COMMISSION OF THE EUROPEAN COMMUNITIES
DIRECTORATE-GENERAL FOR ENERGY – DG XVII

PROMOTION AND DEVELOPMENT OF ENERGY COOPERATION BETWEEN EEC AND CENTRAL AND EAST EUROPEAN COUNTRIES

FINAL REPORT

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VOLUME 1
PROPOSALS FOR COOPERATION

ICE GOPA CMSU

EXECUTIVE SUMMARY

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This report contains an analysis of the energy situation of the Central and East European countries, Bulgaria, Czechoslovakia, German Democratic Republic, Hungary, Poland, Romania and the Soviet Union, and recommendations for cooperation between the Commission of the European Communities and these countries. The analysis is based on desk research and missions performed to all of the above mentioned countries except Romania.

Data on the economic and energy situation in each country are presented in a separate volume. The reports of the missions have been incorporated in the Final Report.

The Central and East European countries have a number of similar characteristics. These similarities are the result of the common energy and industrial policy followed over the last 40 years, which can be summarized as a forced development of heavy (energy-intensive) industries and an extensive exploitation of domestic energy resources. This "stalinist" type of industrial development has led to energy sectors of the Central and East European countries which are producing over world market cost levels and industrial sectors which are structurally and technically energy-intensive. The government-set prices for energy have been too low providing little motivation for efficient use of energy.

Another important aspect of the energy situation of the Central and East European countries is the energy trade between the Soviet Union and the smaller countries. The Soviet Union is the world's largest producer of energy and has provided the smaller countries with energy for decisive periods of time at prices lower than the world market prices. The adjustments now necessary as these countries open up to the West are partly the cost of past benefits enjoyed in trade with the Soviet Union.

The Central and East European countries have another similarity. That is the drive to open up to the rest of the world and to develop western-style political and economic structures. This general trend is, of course, very differently advanced in each of these countries. In most of these countries this process is leading to substantial institutional change which significantly affects the energy sector. Because of these similarities there are a number of recommendations for cooperation which could be implemented multilaterally.

Based on the findings of the field missions to six of the seven countries, the problem areas and needs of each of them were compared and it was recognized that the cooperation proposals for all countries could be subsumed under four general fields:

- energy planning including energy pricing
- energy conservation
- natural gas
- energy and environment.

For each of the countries studied recommendations for cooperation have been developed based on the analysis of the energy sector and identification of problem areas.

Recommendations for cooperation between the EEC and **Bulgaria** which should be given top priority are the following:

Under the general issue of **energy planning** the following subjects need to be addressed:

- Analysis of the energy supply/demand situation

- Price structure problems taking into account the need for gradual adjustments of energy supply as to reflect actual market costs

- Organizational structure and management of the energy sector.

The above tasks can and should be performed through collaboration with the high level technical staff of the Bulgarian enterprises.

Energy conservation measures and their implementation should also be given top priority. The Bulgarian enterprise dealing with energy conservation is very well organized at a central and at a regional level. Cooperation in this field should focus on energy conservation methodologies, energy management techniques as well as technology transfer regarding measuring equipment required for detail energy audits and other energy conservation equipment and devices.

On the energy supply side, the following issues are proposed for cooperation:

- Review of the primary fuel supply options with emphasis on gas imports from the USSR

- Modernization of the fossil fired power plants and the district heating systems especially regarding environmental monitoring and control systems

- Environmental control and safety systems for nuclear power plants.

The cooperation should mostly take the form of transfer of know-how to the existing Bulgarian energy enterprises.

The energy situation in **Czechoslovakia** is characterised by the importance of the lignite production. The decreasing quality of the lignite and the extent of the environmental problems are the major issues of the energy sector. Furthermore, the issue of nuclear safety puts the policy of enhancing nuclear energy as a substitute for coal in jeopardy . This situation will lead to a complete reorientation of the energy policy in which energy conservation and gas become important options.

In the area of **energy planning and policy**, a policy dialogue as well as high level adivsory services are envisaged. A structured approach should involve issues like data collection with emphasis on the energy demand as well as a more systematic effort in energy planning focusing on institution building.

With the reorientation of energy policy, **energy conservation** will play a major role, especially in the industrial sector. As immediate actions, energy audits and especially a model factory as a demonstration project should be realised. To develop a more structured approach, a study on energy conservation in industry is proposed in order to identify the industries to be treated with priority as well as the priority energy conservation programmes and measures to be developed by Czechoslovakia.

Energy conservation in the transport sector should also be included in the cooperation with Czechoslovakia in order to avoid an excessive increase of the fuel consumption resulting from the development on road transport

Energy and environment is a priority area for cooperation. Immediate action is required regarding desulphurisation and the reduction of NO_x emissions from coal fired power plants.

The issue of interfuel substitution (**natural gas**) in industry is proposed as an area for immediate coooperation. The implementation should take into account the high level of know-how and skills of the Czechoslovakian engineers.

As Czechoslovakia has been following a classical stalinist industrial policy its industrial base is composed of heavy industries most of which are overaged. At the same time the Czechoslovakia did not allow most industries to use western technolgies. **Technology transfer** is, therefore, crucial to the modernisation of the industrial and energy sector. The EEC should aim at playing a catalytic role especially in triggering the flow of capital necessary for the introduction of western technologies.

The following proposals for cooperation with the **German Democratic Republic** can be given.

Assistance in setting up a market-oriented **policy framework**, especially with regard to economic incentives and new legal regulations aiming at rational use of energy and protection of the environment is recommended. Technical assistance measures (studies, institutional consultancy etc.) and provision of high-level training for energy experts will be at the forefront in these fields.

The CEC should provide assistance in the rehabilitation/reconstruction of the power stations through the transfer of environmentally acceptable energy technologies and grant financial and technical support to develop rehabilitation concepts for areas suffering from longlasting mining burdens.

In the field of energy conservation assistance is necessary to fully exploit the energy conservation potential by launching energy sector audits, providing information and training. To this end, support of the dissemination of energy saving equipment, the transfer of recycling technologies are required. Thus, training, information and technical assistance are the most appropriate forms/means of cooperation in the field of energy conservation.

Regarding utilization of **natural gas**, the CEC's Proposal for Guidelines on Gas Transit to the energy sector of the GDR should be applied. In this context, financing should be provided first for the improvement/extension of the East German network of gas pipelines, and, secondly, linking the East German with the West European gas network should be studied.

Technical and financial assistance for solving problems regarding **electricity transfer** from the West to the East, and help to substitute lignite-based energy systems is a further recommendation. Adequate means would be the spread of information on the advantages of the non-coal energies, actions towards diversification of the energy supply side (energy price policy, energy technology transfer etc.) and, perhaps, the implementation of demonstration projects.

Studies on the potential and the possible uses of **geothermal energy, wind energy and biomass/biogas** are required together with the set-up of demonstration projects.

Assistance is needed in reassessing the role of **nuclear energy** in the future and in making existing plants more compatible with international safety standards.

The IfE–Institute (Institut für Energetik) in Leipzig might be a very professional potential partner in many of the above mentioned cooperation fields.

The analysis of the energy situation in **Hungary**, led to three important considerations influencing the recommendations for cooperation with Hungary in the energy area, namely:

- the high qualification of the Hungarian experts
- the existing institutional uncertainties
- activities of other coordinated assistance donors.

These considerations result in the requirement to select very carefully the scope and depth of any cooperation scheme to meet the specific needs of the Hungarian energy sector.

In the area of **energy policy**, the responsible ministry would be interested in seminars and studies reflecting the western European adjustment and government policies to cope with the energy crisis. Specifically, there is interest in consultations regarding legal and administrative measures taken, for example, minimum insulation levels for homes, district heating programmes and regarding basic pricing principles for energy intensive industries.

The cooperation with the Energy Efficiency Office (EEO) is considered a good focal point for this type of support. The EEO is adequately staffed and well established, being founded in 1984. It has the necessary institutional support and infrastructure. It is recommended, however, that the level and type of expert services and projects (like seminars) be very critically evaluated by the Commission and that other institutions be involved or allowed to participate. In this way a better spread of know–how can be achieved.

Integration or optimization of the international long–range **gas pipeline network** is an area of cooperation in which the CEC could provide high level experts. However, it should be noted that the World Bank is very active in the oil and gas area in Hungary and that any cooperation in this area should be carefully coordinated with other donors. Also the Central and East European countries are themselves coordinating the efforts in this direction. There is a good possibility to combine these activities and to provide assistance to several of the countries at the same time.

Environmental projects have been defined in the operation PHARE. A possibility for further involvement is in the area of environmental aspects of oil refineries. Information and experience regarding environmental protection measures, investments required, Cost–Benefit–Analysis have been mentioned by Ministry of Industry as possible areas of interest for EC cooperation.

The most appropriate fields and means of cooperation with **Poland** in the short and medium terms are the following.

Energy Conservation is the first priority for the Polish energy and economic system. The cooperation must focus on institutional building of national and regional "Agencies for energy conservation", well integrated in the decision making system. This should involve: training on energy conservation methods with existing institutions (Universities, institutes), support of energy audits and conservation programming by local experts (with special attention to the transport system), organization of the information on efficient end–use equipment.

In the field of energy planning, the price problems (gradual adjustment of energy products prices at consumer level to the actual cost of production) require action. In addition, the organization, management and institutional aspects linked with the reorganization and decentralization of the energy system should be supported. The analysis of energy demand by sectors and energy products and the establishment of energy consumption data bases are further areas for cooperation. Studies on these subjects should be immediately done, or reinforced, by high level technical assistance working in close relation with local experts and institutions on specific and well defined subjects.

On the supply side, two major fields are proposed for cooperation, dealing with "**traditional energies**". The first deals with the modernization of the existing energy system which is based mostly on solid fuels. Cooperation projects for the repowering of power plants, modernization of the distribution system and refurbishing of the district heating sector should be initiated. The second deals with the increase of the share of **natural gas** in the Polish energy system. In this field, the CEC should undertake a joint study to examine the various options for gas imports in the country, in relation with the needs of other countries of the region and examining the opportunity of associating non–European nations in this development effort.

Concerning **renewable energies**, the effort of cooperation would concentrate on feasibility studies on geothermal energy use.

Conservation and rational use of energy should be of first priority for the **Romania**. The cooperation should focus on the following: institutional structure for energy conservation on national and regional level, rational use of electricity in all economic sectors, energy conservation methodologies (management, training, conservation programmes, conservation and environmental protection), fossil fuel substitution with renewable energy sources (biomass, solar, wind, small hydro). The cooperation should involve local experts and staff in all stages.

The restructuring of Romania's energy sector and the **rehabilitation of the existing energy transformation system** require proper organization and planning techniques. The fields of cooperation should be: National energy planning including supply/demand studies with emphasis on the electrical power system, organizational, management and institutional aspects associated with the decentralization of the energy system, energy price policy reforms taking into account the gradual evolution of prices towards actual market values.

Most of the problems associated with the Romanian energy sector are those of the energy supply system at all levels. The following is proposed to be included in the cooperation:

- Reorganization of the energy transformation sector, especially the electrical power system

- Rehabilitation and repowering of power plants

- Introduction of combined heat and power plants utilizing natural gas and new coal combustion technologies which are considered friendly to the environment.

USSR is a "continent" with enormous resources and needs and advanced technology in various fields. Its political, economic and social situation is critical. The case of cooperation with USSR must be treated specifically and with deep analysis of its implications before embarking on specific projects.

The most appropriate ways to initiate a cooperation on energy with the USSR are the following:

- To perform, in cooperation with the Soviets, an analysis of the evolution of the Soviet **energy policy** and of the organization and problems of the energy system in the changing economic and political situation. In particular, increase the knowledge on the energy situation of the various republics, mostly the European ones, with which "bilateral" cooperation in the field of energy might be envisaged. This analysis has to be done on a permanent basis by a group of experts, in dialogue with the Commission of the European Communities.

- A special study has to be done on the research and development activities and programmes in the USSR, in view of structuring the cooperation in the field of **energy and environment**.

- In the short term, cooperation can be initiated on **energy planning** methods, including demand analysis and forecast and investment assessment (for instance, comparison of end-use efficiency programmes, cost and increasing marginal cost of the supply for different forms of energy).

- The economic and environmental constraints on the energy system are such in the USSR that **energy conservation** is the main "energy resource" to be developed in this country for the future. The success of a vigorous energy conservation policy is vital for the USSR and very important for the EC for environmental and strategic reasons. The first cooperation in this field to be proposed by the CEC to the Soviet government would be to help the creation and management of institutions in charge of planning and implementing energy conservation in all sectors of the economy, at national, republic and regional levels.

- If **financial aid** to the USSR from the European Community is envisaged, energy efficiency investments must have high priority in the cooperation programmes.

- **Natural gas** is the main energy resource of the USSR. Furthermore, the natural gas exports from the USSR are very important for the West European countries and for most of the central and east European countries. Cooperation can be promoted on a wide range of technical matters with the Soviet gas industry.

There are a number of further issues related to the **implementation of the cooperation** which are, to a very large extent, common to the Central and East European countries.

Given the objective of fostering the change and promoting the economic and social development in the Central and East European countries and the huge size of the tasks related to these objectives, the Commission of the European Communities should concentrate on playing a **catalytic role** in this process. One of the areas to which this catalytic role has to apply is the investment in new technologies. The **transfer of western technologies** is related to investments - mainly in the modernization, rehabilitation or replacement of industrial equipment and processes as well as power plants

These activities have not only to aim at technology transfer in an abstract way, but especially at joint ventures and other forms of cooperation, which link and transfer western capital to the technology. One of the strategies for the cooperation should therefore be to initiate and facilitate **industrial cooperation** between industries of the EC member states and industries from the Central and East European countries, as these countries are competing for western investments with established markets, i.e. in Asia and Latin America.

The main aim of these activities would be to make available the full scale of European technology and investment potential by speeding up the process of industrial cooperation for small and medium-sized industries as well industries from the smaller member states.

This relates to a second area of recommendations regarding the implementation: the **regional approach**.

The industrial cooperation is an example where an **interregional approach** between the EC and the Central and East European Countries could prove useful.

A further field, where the possibilities of interregional cooperation should be studied, is training where regional training programmes should be designed

Intraregional cooperation is mainly considered beneficial regarding energy policy and planning where the differences in history and approach form a base for a fruitful exchange of experience. In the field of energy supply the decomposition of the Soviet dominated trade structures as well as new energy policies have completely changed the framework. The CEC could try to initiate regional cooperation, e.g. regarding the exchange of experience or in the field of **gas**.

Gas supply serves at the same time as an example for a regional **cooperation** in the **East-South-West** triangle. Given the responsibilities and commitments to both East and South, the EC should try to exploit synergies between the EC and the developing countries on one hand, and the EC and the Central and East European countries on the other hand. The supply of gas from the Maghreb to the Central and East European countries could be studied especially regarding the benefits of economic cooperation as well as the seasonal demand. Industrial cooperation is a further field as east European exports of often subsidized products have to be replaced by the export/transfer of technology.

The **coordination within the EEC and with other donors** for the cooperation activities is a matter of politics as well as of efficiency.

The general strategy towards implementation has to follow a twofold approach. Whereas for political reasons some cooperation activities should be carried out immediately as **immediate actions**, the main cooperation effort should be based on a **structured approach** which results, for example, in programmes which incorporate a package of actions.

This concentration on programmes rather than projects also implies the change from an annual project oriented budget to multiannual frameworks as they are for example used successfully by the Commission for the cooperation with the Mediterranean countries.

The **planning of cooperation** can be differentiated into two phases. In a first phase the structured approach mentioned above has to be programmed and planned. In a second phase the specific cooperation activities or projects have to be planned.

An important feature of the planning of successful cooperation is the role of the counterpart organizations. On a first level the identification of counterpart institutions has to be an explicit part of the development of the **structured approach** to cooperation. On the project level the counterpart institutions have to be involved into the project planning.

The planning of the cooperation activities has one of its main features in the choice of the adequate means and instruments of cooperation in relation to the fields of cooperation chosen.

Regarding the preparation of the cooperation the Commission would probably be well advised to outcontract these activities to experts as it has, for example, been done successfully for the training activities in China. This would leave more room to the planning and **monitoring and evaluation**.

The selection of a qualified and cooperative partner institution is crucial for the success of the cooperation.

In some cases it may also be considered to include the counterpart organization in the evaluation in order to substantially increase the acceptance and support for sensitive or difficult projects.

The **execution** of the cooperation should leave enough room for the executing parties to adapt the activity to the needs occurring. It is probably fair to say that the Commission has so far been getting substantial benefits from this policy.

An important function in the process of execution lies in the support offered by the executing agent as regards the contributions from the counterpart agencies. Even though this may not always be politically easy, the efficiency and success of the cooperation requires that all partners contribute their part. Regarding the Central and East European countries this policy has to be established from the beginning so as to avoid that western cooperation is seen as a substitute for own effort.

Most of the cooperation activities will produce results which deserve to be **disseminated**, which also results from the catalytic function. Workshops on the results of a specific programme or project may be as adequate as the publication and distribution of suitable reports.

The introduction of a **monitoring and evaluation** of cooperation activities is one of the major recommendations for the implementation of the cooperation activities with the Central and East European countries.

The main reason is that the cooperation with the Central and East European countries presents a new field of opportunities. Therefore the first experience has to be monitored and evaluated carefully to optimize the design of future activities. The need for monitoring arises also from the fact that activities and projects have to be adapted during the course of their execution. The monitoring of a project also lays ground for the decisions on the continuation of that activity in principle and allows the optimizing of the project.

Ex–post evaluation is an additional requirement but no substitute for the monitoring. This evaluation has to be carried out independently which means not only by the officials responsible for the execution. Enough resources have to be dedicated to the evaluation as the specific project related circumstances have to be taken into account. For technical assistance, for example, the output and results are often difficult to assess which leads to the a.m. large effort.

CHAPTER 1

Introduction

I. INTRODUCTION

The countries of Central and East Europe, with a total population of 399.2 million (of which 286.4 in the USSR) consume approximately 1,850 MTOE of primary energy per annum. Their specific consumption per GDP unit is more than that in the European Community, while their per capita energy consumption is above the EC level.

A first view of the energy markets of these countries indicates that they face severe disequilibriums between supply and demand. Apart from the USSR which has abundant hydrocarbon resources most of these countries are heavily depending on one form of energy (coal) and of energy imports from USSR (oil, natural gas); their energy policies and planning are absolutely inadequate.

The energy related environmental problems are extremely acute and their impact extends beyond their national borders into the other European States - members or not of the Community.

Under these circumstances, the possibilities of a close cooperation of the EC and the Central and East European countries in the energy sector – beyond energy trade – should have been explored sooner, if the political relations had not stood a decisive obstacle since the foundation of the European Communities.

The change of these relations, starting in 1985, and the almost revolutionary developments of the last months of 1989 not only allow for the cooperation in all – energy included – economic sectors but make such a cooperation an integral part of the EC policy towards these countries. The EC is now leading an international effort to provide coordinated assistance to the Central and East European countries' effort to reform their socioeconomic system.

With this picture in mind the Commission of the European Communities decided to investigate the possibilities for cooperation between the EEC and the Central and Eastern European countries, while at the same time, getting a clear picture of the energy situation in these countries. The results of this investigation would lead to a coherent cooperation in the energy sector and to the necessary instruments for carrying it out.

To this effect the Directorate General for Energy (DG XVII) awarded a contract to a group of consultants consisting of:

- C.M.S.U.: Communications and Management Systems Unit, Athens, Greece
- GOPA: Gesellschaft für Organisation, Planung und Ausbildung mbH, Bad Homburg, Federal Republic of Germany
- I.C.E.: International Consulting on Energy, Paris, France

to conduct a study on the "Promotion and Development of Energy Cooperation between the EC and the East European Countries". GOPA assured coordination during the duration of the study and a consistent presentation of the interim and final reports.

The contract was signed on 15th March, 1990. According to its terms the interim report was submitted to DG XVII on the 18th May and it was presented on the 23rd May, 1990. The final report has been submitted in July and, 1990.

I.1 The Objectives and the Scope of the Study

The objectives of the study were

a. to analyze the energy situation in the seven Central and East European Countries;

b. to identify the major problems encountered by the energy sector in these countries;

c. to define the needs for cooperation with the EEC and the respective priorities; and

d. to formulate proposals and recommendations for the cooperation of the EC and the Central and East European Countries in the energy sector.

The study was expected to provide reference material for each country on:

a. the energy situation (data, problems, policies, etc.);

b. the structure and the organization of the energy sector;

c. energy planning and policy; and

d. the real needs of the energy sector and for cooperation as a function of a, b and c.

Furthermore the actual status of the cooperation between the Commission of the European Communities and each of the seven Central and East European countries was to be assessed.

I.2 The Methodology

In order to meet its objectives the study followed two main directions.

The first one aimed at providing the general information on the development model and the overall energy system of the Central and East European countries; at reviewing and evaluating the experience of the EEC and these countries in international energy cooperation; and at analyzing the evolution of the relations of the potential counterparts with a focus on the recent – and still developing – phase of cooperation in the framework of the extension of coordinated assistance to the countries of Central and East Europe.

The second direction dealt with each of the Central and East European countries separately, along two major axes: the first aimed at producing the individual country reports, while the second at producing an as accurate and as consistent as possible data set for production, the transformation and the consumption of energy in each of these countries.

The information collected on the development model which the Central and East European countries followed for the last four decades, and more specifically its energy components, highlighted aspects common to all the European centrally planned economies and led to the identification of the main trends and issues of their energy sector. The establishment of these common characteristics proved extremely helpful – going from the general to the particular – for the analysis of the energy situation and the specific problems of the energy sector in each of the Central and East European countries.

The review and evaluation of the energy cooperation experience of the EEC and of the countries of Central and East Europe, as well as of international energy cooperation activities in the framework of International Organization, like the World Bank and UNDP, does not have the ambition of recording **all** such cooperation. Its objective has been to review and analyze as completely as possible **all kinds** of cooperation.

In this respect it helped both to highlight basic characteristics of the international conduct and behavior of the Central and East European countries in the energy sector, and to identify energy cooperation experiences which – although interesting – need to be modified before being utilized in the framework of the energy cooperation between the EEC and these countries.

Finally, the analysis of the political framework of the relations between the EEC and the Central and East European countries, especially during its current phase sets the stage on which energy cooperation will develop. It is interesting to realize that cooperation in the energy sector is already part of the coordinated assistance extended to these countries.

The analysis of the energy situation of each of the Central and East European countries was based on the findings and the overall picture created through the preceding analysis and extensive literature research. On this basis the individual countries were "known" before visited, and the objectives of the field surveys were well defined.

All countries of the Central and East Europe were visited, with the exception of Romania. The trip to Romania, although attempted twice, was not finally made due to the prevailing political and natural (the earthquake!) conditions in that country during the whole period until the end of the project. For this reason the Country Report on Romania is based on published literature and intelligence reports as well as on unpublished material available in institutions having general or specific interest in the Romanian energy sector.

The Country Reports have been produced with a view from the general, as formulated in the previous phases of the study, to the specific, leading to country–specific proposals for cooperation. These proposals express the main views of both the consultants and the energy experts and authorities of the countries visited.

The Country Reports were discussed by the consulting group and the priorities for cooperation of the EEC and each country were set in agreement by all partners – consultants.

Finally, the consultants made an intensive effort to produce **generalized policy proposals** for the energy cooperation between the EEC and the Central and East European countries going from the specific back to the general and following a **Structural Approach**. Long discussions led to the conclusion that for a number of serious reasons having to do with the instability in these countries and significant differences between the underlying their energy problems conditions – as explained in the appropriate Chapter of the report – such an approach was very risky to be followed and **policy** proposals could not be presented.

Instead an "immediate action" approach is followed proposing **programmes** (and not projects) for each country, specifying the conditions under which each of this programmes will have specific characteristics as well as general rules that should guide the preparation of the programmes proposed for each country.

In this respect, the main fields for cooperation are identified and the means available for promoting the cooperation in these fields are specified. Finally country–by–country proposals for the implementation of the proposed cooperation are made.

I.3 The Structure of the Final Report

The final report is divided in two volumes.

Volume I includes all the analysis, the country reports and the synthesis leading to the proposals for the energy cooperation of the European Communities with the Central and East European Countries.

Chapter I is this general **introduction** to the whole report.

Chapter II presents the general **Trends and Issues** in the Central and East European countries in the energy sector.

Chapter III analyses the evolution of the **Relations** of the EC and these countries, focussing on their present state, and reviews the **Cooperation** experiences of the EC, of the countries of Central and East Europe, as well as the International Organizations.

Chapter IV presents the **Country Reports** on the energy sector of each of the Central and East countries, which cover: their socioeconomic profile, their energy system; the trends and issues in the energy sector; and the country specific proposals for cooperation of each country will the EC.

Chapter V presents the **Approach and the Proposals** for the cooperation between the EEC and the Central and East European countries in the energy sector. This chapter includes the evaluation of the Cooperation Environment, as defined by the available opportunities and the existing limitations, presents the proposed fields and the means for cooperation and formulates the implementation proposals. Finally recommendations for further investigation on certain aspects and further possibilities for cooperation between the EEC and these countries in the energy sector are made.

Volume II contains the data presenting the structures of the production, of the transformation and of the consumption of energy for each of the Central and East European countries, in the form of Country Reports restricted mainly to hard data and certain "stable in time" information on each country.

This material – with some unavoidable repetition as compared to the Volume I Country Reports for reason of completeness – is presented in a separate volume in the relief that it will retain its value for a much longer period of time, as compared to Volume I which will sooner need updating.

I.4 General Remarks

This study is the product of collective work of the three members of the consulting group, i.e. the Communications and Management Systems Unit (CMSU) of Athens, Greece; GOPA – Gesellschaft für Organisation, Planung und Ausbildung of Bad Homburg, Federal Republic of Germany, and the International Consulting on Energy (ICE) of Paris, France. For this reason all three consultants jointly share the responsibility for the report.

The Research Teams from the three Consultants were:

From the CMSU:

The main Research Team under the Head of the Unit, Prof. J.-E. Samouilidis was formed by:

- Nick G. Yacoumelos,
- Elias Karydoyannis,
- Walter Fissamber

From the GOPA:

- J.-W. Fromme
- J. P. Johnson
- Dr. H.-J. Siegler

From the ICE:

- Bernard Laponche,
- Cathérine Locatelli (IEPE, Grenoble, France).

The country missions were carried out by:

Bulgaria:	Mr. Yacoumelos, CMSU
CSFR:	Mr. Fromme, GOPA
GDR:	Dr. Siegler, GOPA
Hungary:	Mr. Johnson, GOPA
Poland:	Mr. Laponche, ICE
USSR:	Mr. Laponche and Miss Locatelli, ICE

Finally the time-specific character of the study has to be emphasized. The developments in both, the political and economic domain in the Central and East European countries lead to the necessity of a special effort to update this work, since new activities and initiatives already came up during the period covered by this study and will continue to emerge in the near future.

The Final Report is submitted with the understanding that it reflects the situations as it had evolved until **end of May, 1990**, when any further collection of information had to stop in order to synthesize and formulate the proposals for cooperation.

CHAPTER 2

Trends and Issues

2. *TRENDS AND ISSUES*

2.1 The Particularities of Central and East European Countries

East European countries' energy development models show a number of particularities when compared with Western European and American systems – particularities which are worth emphasizing. These exist in the fields of both production and consumption.

2.1.1 High Energy Consumption

East European countries are major energy consumers as can be seen from several general indicators such as energy intensity. The German Democratic Republic and Czechoslovakia have the highest energy intensities within the CMEA – around 100 koe/1000 $80. Hungary has the lowest energy intensity at around 600 koe/1000 $80 (see Annex I). There are some differences in energy intensities according to the indicator chosen (GDP, National Accounting indicator, or Net Material Production (NMP), the socialist national accounting indicator) (see Annex II).

The extent of energy consumption in each country reflects the specificities of their models of economic development. These can be understood in terms of two factors: a policy of autonomy/self–sufficiency and a strategy of "heavy industrialization" (development of steel and metal industries, etc.). These characteristics have affected the energy systems of the CMEA countries.

2.1.2 The Coal Dependency

All CMEA countries are coal–producing countries. As a result, their energy balances are dominated by solid mineral fuels. Coal accounted for 31.5 % of primary consumption in the CMEA countries in 1987 – 80 % in the case of Poland, 70 % for GDR and 60 % for Czechoslovakia (see Annex III). The desire to satisfy energy needs using national resources explains this feature of primary energy consumption. CMEA countries are major coal producers. The GDR is the worlds largest lignite producer (310 million tons in 1988). Poland ranks fourth in world terms for hard coal production (193 million tons in 1988). The only significant hydrocarbon producers are the Soviet Union, Romania and, to a lesser extent, Hungary. The Soviet Union is the world's main oil producer (607 million tons in 1989) and the world's main gas producer (796 billion m^3 in 1989).

In contrast to this, oil plays only a small part, except in Bulgaria, Hungary and, of course, the Soviet Union. Its role has tended to decrease throughout East Europe since the early eighties – benefitting not only coal, but also natural gas.

Such a massive use of solid mineral fuels has been possible because of the size of the industrial sector within the structure of energy consumption. This is one of the particularities of the energy scene in East European countries. Thus the industrial sector accounted for 50 % of final CMEA energy consumption in 1986. In contrast, transport plays a relatively smaller role at only 13.7 % of final energy consumption in 1986. The strategy of rapid "heavy" industrialization based on heavy energy–consuming industries steel and metals, followed by specialization in chemical, petrochemical and refining sectors in the seventies – explains the importance of energy consumption and the importance of the industrial sector. Energy thus has a particular function, that of meeting the constantly growing needs of heavy industry with national sources – irrespective of the costs incurred.

2.1.3 The Increasing Costs of Coal Production

Under such conditions the energy policies are above all supply policies, dominated by the aim of maximizing production. This policy is in line with the directive centralized planning which dominates the management of East countries' economies. But such strategies, especially during the eighties, cannot be implemented without massive investment, in both human and capital terms. Between 1981 and 1985, energy investment accounted for a third of all industrial investment in most East European countries. In Poland, 32.9 % of industrial investment is given over to the energy sector[1]. Worsening production conditions as rich deposits have been exhausted and growing capital needs have weighed heavily on production costs. In addition, the extent of the efforts expended does not in any way exclude falls in production as in the Hungarian and Czech cases. Production of lignite in the GDR reached its high point in 1985. In Czechoslovakia, the objectives for the period up to 2000 are based rather on keeping production at its present level rather than on increasing it[2].

The limits of East European countries' energy development model thus show up clearly in the early years of the 1980s. The logic of "extensive" development based on massive investment in the energy sector becomes less and less tenable given the needs and objectives of modernization of the economy and the capital investment that this implies. East European countries' desire to become part of the world economy implies a certain degree of rationalization and efficiency of industrial systems which is incompatible with the current energy situation.

2.1.4 Environmental Stresses

At the same time, environmental problems linked to the use of coal on a massive scale limit its use. Thus the ecology of Northern Bohemia has suffered major damage. The GDR and Poland are in the same situation: land devastation, air pollution, etc.[3] The Soviet Union for example will spend yearly 8.7 bill. Rbl for environmental projects. In the past, such constraints were offset by resorting to hydrocarbons in the form of imports of oil. There is, however, an increasing awareness for these problems which will have a major impact on the energy policies of those countries as explained in the individual country reports in Chapter 5. For all Central and East European countries it is impossible to separate the energy problem from the environmental issues.

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1 "Profile Poland, part two" – Energy Economist Report, 25 August, 1989, p.11.
2 "Profile Czechoslovakia, part two" – Energy Economist Report, 24 July, 1989, p.7.
3 "Profile Czechoslovakia" op.cit., p.7 and Deutscher Bundestag, 11 Wahlperiode, Bonn. – "Materialien zum Bericht zur Lage der Nation" – Geteiltes Deutschland, 1987.

2.1.5 Hydrocarbons in the Energy Balance

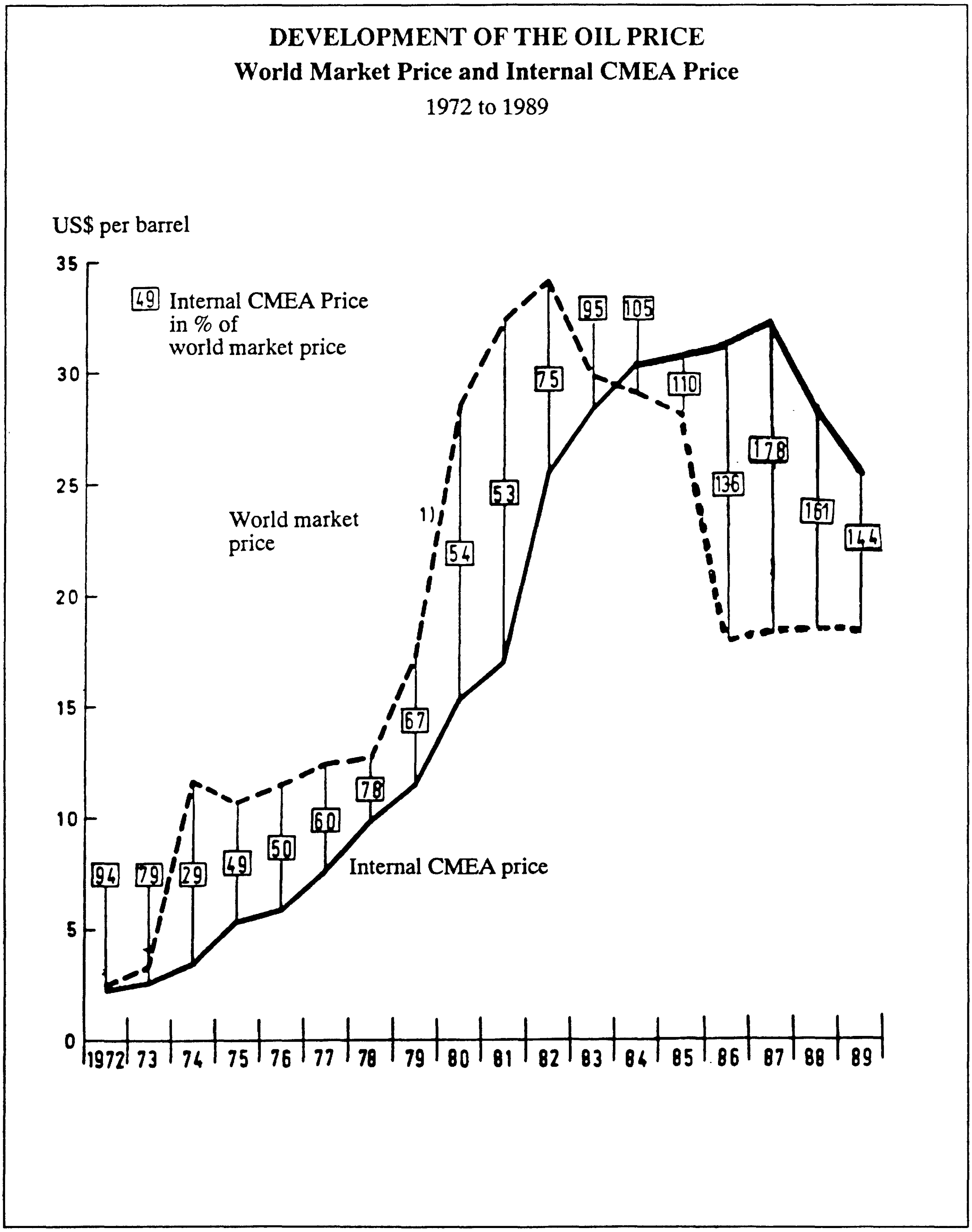
The progress of hydrocarbons within East European countries' energy balance (excepting the Soviet Union) has been slow compared with their penetration in Western Europe. Neither does it assume the same proportions as in Western countries. A few statistics are enough to demonstrate this. Hydrocarbons did not come to play a significant role in East European countries' energy balance until the second half of the 1960s. In 1980, oil accounted for 35.5 % of the CMEA's primary energy consumption, while natural gas accounted for 24.3 %. The degree of penetration varied from country to country according to the various economic and energy strategies adopted. Oil has never accounted for more than 30 % of primary energy consumption in Poland or in the GDR. In Bulgaria, Hungary and the Soviet Union, it exceeds 35 %. The "homogeneous" nature of the region in energy terms is thus somewhat relative. The policy of restructuring the energy balance can be explained by the need to modify their industrial structure and to increase energy efficiency. The GDR, however, has always aimed at energy self–sufficiency, even if it meant using lignite with a low calorific value. In contrast to this, the New Mechanism started in Hungary in 1968 aimed at greater integration within the world market. This inevitably implied greater efficiency possible with oil.

The consequence of the penetration of hydrocarbons has essentially been to involve East European countries in massive import policies, firstly as regards oil, and then in the eighties, natural gas. The region's largest importers are the GDR (22.3 million tons in 1980) and Czechoslovakia (20.2 million tons in 1980) (see Table n° 4). This dependence is all the stronger since it involves the region's only producer – the Soviet Union. The Soviet Union thus supplied over 85 % of all the East European countries' needs in 1980 (with the exception of Romania which differed from its CMEA partners by its high level of oil production and its strategy of oil imports from OPEC countries).

2.1.6 The Oil Price Issue

Internal trade mechanisms within CMEA – payment in transferable roubles (the clearing currency) at annually revised prices based on the previous five years average international oil prices (the "Moscow" rule). The rule also has the effect of polarizing internal–CMEA trade with respect to trade with the Soviet Union – a polarization which has been reinforced by successive oil shocks. This rule meant for the soviet oil exports to the CMEA countries that the decrease in world market prices, which has taken place since 1982, did not affect the recipient countries' oil bill before 1987, as can be seen from the following graph.

Figure 1: Development of the Oil Price



The graph also shows that, during a long period of time, the small CMEA countries have benefitted from this price building mechanism, whereas in recent years this convention turned out to be financially disadvantageous to them. However, considered on the whole, these countries profited from the rule up to now.

Trading conditions allow the countries to continue their past strategy of industrialization based on continued growth in energy consumption without having to borrow massively in foreign currency to obtain hydrocarbons. Although adjustments are only delayed, there is no need to revise existing representations of the energy system or to adopt short-term energy conservation policies. At a macro-economic level, policies based on borrowing make it possible to limit the deterioration in terms of exchange and the worsening of East European countries' balance of payments situation. Economic decision-makers are not interested in imperatives of energy conservation as a result of the disconnection between domestic and international prices – all the more so as traditional priorities continue to dominate i.e. **the fulfilment of production plans**[4].

This strategy has also reached its limits. Since the early eighties, East European countries have had to cope with limited supplies of Soviet oil provided under the **previous conditions.**

1982 marked a major rupture in hydrocarbon supplies to East European countries. The Soviet Union effectively decided to reduce deliveries to CMEA countries by 10 % (though this figure varied slightly from country to country). Faced with the major external constraint imposed by limited supplies of foreign currency, East European countries have been unable to resort to massive imports from OPEC. Their economies have thus had to adapt to a significantly lower level of oil supplies. Thus, in the eighties, substitution policies have emerged in all the East European countries – policies aimed at replacing oil imports with increased national production of coal or nuclear energy. These trends have been accentuated in recent years since Soviet oil deliveries (under previously existing conditions) have been falling regularly since 1986. The Soviet Union, increasingly preoccupied with its own domestic problems has more or less had to reduce its commitment to supply CMEA countries, with the result that they have had to define new energy policies.

2.1.7 A Place for Natural Gas

The structure of the primary energy consumption and the environmental stresses linked to the actual energy system in all Central and East European countries lead to forecast an increasing role for natural gas in their energy systems. This is particularly true for Poland, GDR and Czechoslovakia. All countries, except Romania and, of course USSR, are importing natural gas from USSR. This will change with the opening of the energy market of these countries: natural gas trade at European and Mediterranean level is certainly a main issue for the future.

The trade in energy which had developed in the seventies has led to a situation in which any domestic Soviet difficulty become the entire region's problem. A more detailed study of the situation in the Soviet Union is thus essential if we are to understand energy problems in East European countries.

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4 LOCATELLI (C.) – "Economies planifiées: des systèmes economiques très intensifs en énergie" in "Energie, croissance, développement: Une rétrospective sur le dernier quart de siècle" – Energie Internationale 1989–1990, Economica, pp.252–259.


IRLAND
UDSSR
POLEN
CSSR
ÖSTERREICH
SCHWEIZ
UNGARN
RUMÄNIEN
JUGOSLAWIEN
BULGARIEN
ALBANIEN
GRIECHENLAND
ITALIEN
FRANKREICH
SPANIEN
PORTUGAL
MAROKKO
ALGERIEN
TUNESIEN
GAS SUPPLY SYSTEM
IN EUROPE

2.1.8 Comparative Analysis of Primary Energy Consumption

Primary energy production in all Central and East European countries (excluding the USSR) totalled 438.4 Mtoe in 1987. The respective figure for the Soviet Union was 1366 Mtoe, which is about 312 % of this total. The shares of the various energies were as follows (without USSR):

Oil	19 %
Coal	57 %
Gas	18 %
Nuclear	3 %
Hydroelectricity and others	3 %

For the Soviet Union, the following energy-specific percentages are reported:

Oil	32.3 %
Coal	22.6 %
Gas	38.3 %
Nuclear	3.1 %
Hydroelectricity and others	6.8 %

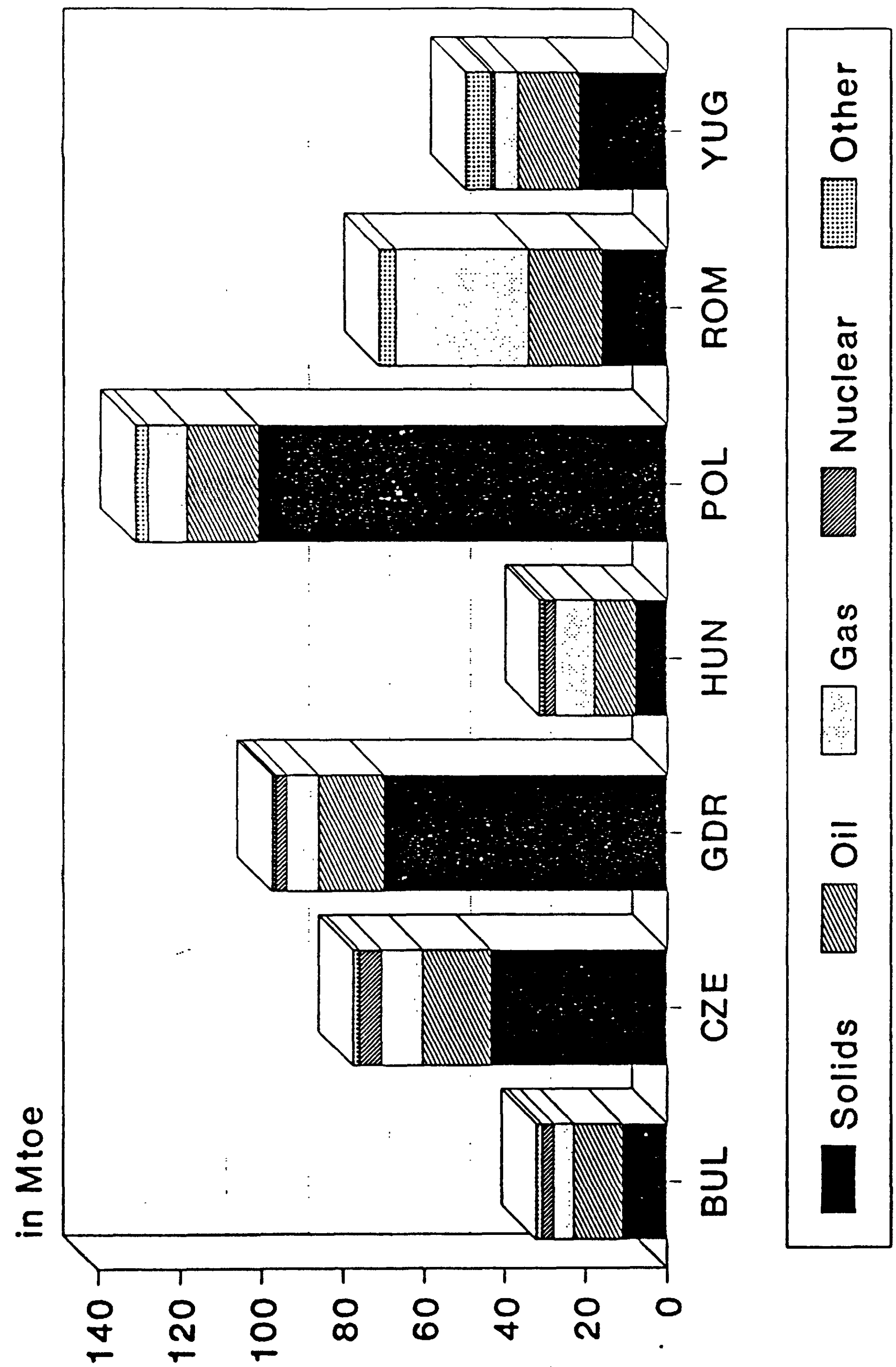
The other country-specific shares are the following (in %):

Countries Energies	BUL	CSFR	GDR	HUN	POL	ROM
Oil	38.5	20.8	13.2	29.0	13.0	19.5
Coal	31.4	56.8	73.5	24.6	78.1	25.0
Gas	14.5	12.3	9.4	27.9	8.2	49.7
Nuclear	10.0	7.5	2.9	9.5	-	-
Hydroelectricity and others	5.6	2.6	1.0	9.0	0.7	5.8

As can be seen from that table, the structure of primary energy consumption is quite different between the countries: Coal is of overwhelming importance in Poland, GDR and CSFR, oil plays a major role in Bulgaria and Hungary, gas is very important in Romania and Hungary, nuclear energy is primarily consumed in Bulgaria, Hungary and CSFR, hydroelectricity is of great importance in Hungary and holds significant shares in Bulgaria and Romania, too.

In the Soviet Union, gas and oil are ranked first, followed by the consumption of coal.

FIGURE
EASTERN EUROPE - 1987
PRIMARY ENERGY CONSUMPTION



2.1.9 Comparative Analysis of Final Energy Consumption

1986	Soviet Union	Central Europe	EEC 12
Industry	58.4	51.8	35.8
Transport (1)	12.3	6.9	25.7
Housing Service	29.3	41.3	38.5
Total	**100.0**	**100.0**	**100.0**

(1) It does not represent all the energy consumption of the transport sector. Some part is in the housing service–agriculture sector.

Source: OCDE–EEC–UNO–ENERDATA

There are big differences in the structure of the final energy consumption between Central and East Europe and the EEC. The former are characterized by the high energy consumption in the industrial sector and by the low energy consumption in the transport sector. For the EEC we can note the high energy consumption in the transport sector. So, the energy balances are very different.

For the EEC countries, the split of primary energy consumption looked as follows in 1987:

Oil	44.9 %
Coal	21.6 %
Gas	18.7 %
Nuclear	12.8 %
Hydroelectricity	2.0 %

Thus, the share of oil and nuclear energy is bigger and the share of coal smaller than in each other case referring to Central and East European countries. Considered on the whole, the consumption level of gas in West Europe is similar to that in East and Central Europe (18.7 % and 18.0 %, respectively).

2.2 Soviet Energy Policy

Without any doubt, two of the main objectives adopted by Soviet energy policy in the 1970s were that of responding to the ever–increasing energy needs of industry (especially the overaged heavy industry) and that of guaranteeing hydrocarbon supplies to CMEA countries. The Soviet Union used a supply–based policy to reconcile these two imperatives.

2.2.1 The Policy of Extensive Energy Resource Management

The sixties and seventies were marked by strong continued growth, firstly in oil production, then in gas production.

This growth was possible because of the existence of Soviet hydrocarbon reserves (its oil reserves are of the order of 60 to 75 million barrels[5], though the exact figure is subject to some controversy, and gas reserves are of the order of 41.1 trillion m^3). This growth has also been due to the extensive resource management policy, linked to the use of taut plans (the constant upward re-evaluation of production objectives). This development logic has led the Soviet Union into major investments which have, however, been essentially production-oriented, to the detriment of exploration. But how could it be otherwise given the production objectives which have been fixed: 480 - 500 million tons in 1975, 630 million tons in 1980! Energy investments thus currently account for 40 % of Soviet industrial investment[6]. It became clear, however, in the second half of the seventies that this development logic carried within itself the seeds of a further crisis. Between 1975 and 1985, there was a clear slowdown in Soviet oil production: 2.1 % per year on average as opposed to 10.2 % per year between 1965 and 1975. This has been, first of all, an expression of problems in oil exploration, particularly in the very rich but still relatively young province of Western Siberia in the Oblast of Tyumen. The number of meters drilled (the Soviet Union's exploration indicator) fell off after 1968.

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5 BEAUCOURT (Ch.) - "L'énergie en URSS en 2010" in Le Courrier des Pays de l'Est, n°337, February, 1989, p.5.

6 KORCHEMKIN (M.B.) - Energy aspects of Perestroika, Rotterdam, Center for International Studies, 1989, P.4.

The same can be said of the discovery of new structures and deposits. By the mid-seventies the plan targets were no longer being reached, in particular in the Oblast of Tyumen[7]. These trends resulted in a real production crisis in 1985. Not only had the 1985 target - 630 million tons - not been achieved, but Soviet oil production actually fell for the first time in 1984 and 1985. The same situation is to be found in 1989. Soviet oil production has fallen by 17 million tons compared with its record level of 624 million tons in 1987. The factors explaining the problems of oil production are already well known and have been largely discussed by the Soviet press and officials. Alongside the specific problem of exploration, the practice of "taut plans" involves the extensive exploitation of deposits (massive injection of water, extraction from the deposits without the proper preparatory operations)[8] The overall modernization of the industry has also been neglected. The problems here are the lack of adequate and effective technology (in particular in the field of computer-aided recuperation technologies) and insufficient plant replacement. To say the least, such a situation is paradoxical if we take into account the amount of energy-related investment within the Soviet economy[9]. In these conditions, the future of Soviet oil production would seem uncertain; this is all the more the case because, for the time being, perestroika is having negative effects on this sector. Some of the difficulties of 1989 were related to the fact that less equipment was being supplied to the sector than initially planned as a result of the partial deregulation within the industrial sector. Within this context the Soviet Union has been led to define a new energy policy, and, as a corollary, a new oil exportation policy.

2.2.2 A New Soviet Energy Policy?

Soviet energy policy is labouring under a substantial constraint, within a context of stagnation or low growth of its oil production. An increasingly tight external constraint is obliging the Soviet Union to pursue, in the more or less short term, an oil exportation policy essentially oriented towards the countries of the OECD, in order to obtain hard currency. Thus its oil exportation strategy is guided by its balance of payments difficulties. These exports accounted for 80 % of the hard currency gains of the Soviet Union (60 % for oil and 20 % for gas). According to O. Bogomolov, the increases in oil prices brought in some 170 billion dollars[10]. The fall in international oil prices has destroyed the balance that the Soviet Union was able to establish between its exports to East Europe (under particular conditions) and its exports to the West. The loss of earnings in convertible currencies as the result of the decline of international oil prices has been evaluated as amounting to 40 billion roubles since 1985. Oil exports now account for less than 50 % of the Soviet Union's gains in hard currency. They are no longer even able to cover the servicing of its debt[11]. Faced with their external debt, a deficit in their trade balance in 1989 and above all their budget deficit, the Soviets have hardly any other choice than increasing their exports towards the West, which has now become a privileged zone for Soviet strategy.

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7 GUSTAFSON (F.) - "The origins of the Soviet oil crisis: 1980-1985" - Soviet Economy, 1(2), 1985, p.103-135.

8 These constraints are mentioned by V.A. DINKOV in October 1988 in an interview published by N. NEFTYANIK n°12, December 1988, and reported in <Review of Soviet Oil>, Petroconsultant, vol. XXIII, n°12, Dec., p.49.

9 KORCHEMKIN (M.B.) - Energy aspects of Perestroika, Rotterdam, Centre for International Studies, 1989, p.4.

10 "Un entretien avec un conseiller économique de M. Gorbachev", Le Monde, 24 November, 1989.

11 Interview with the managers of Concern Gazprom.

It is also becoming clear that the strategy of maximizing energy production, given the amount of investment involved, is increasingly in contradiction with the objectives of perestroika, i.e. the modernization of the economy. These contradictions were clearly brought to light in 1989. Given the need to develop the consumer goods sector, the Soviets seem to have cut investment in the energy sector, in particular in the oil industry. The effects on oil production have turned out to be quite catastrophic. They will continue to be so as long as the present logic of development of the energy sector is maintained. What scope for manoeuvre does the Soviet Union really have? Perestroika and glasnost have largely contributed to opening up the debate on energy which had never really got off the ground in the Soviet Union. This debate now focuses on two key questions: the maintenance of the strategy of maximizing hydrocarbon production and the maintenance of the strategy of oil exportation, especially given the political leverage it provides on the importing countries. Roughly speaking, the following tendencies have emerged. The "reformers" are in favour of limiting production: some say this should essentially affect oil, while others argue that it is valid for hydrocarbons as a whole. There is a vast controversy at the present time about the level that Soviet gas production should reach in the year 2030: some argue that it should amount to 1000 billion m^3, whereas others put forward the target of 1300 billion m^3 [12]. Their positions are less clear-cut concerning oil exports, but then here they have to take into account the external constraint. They are certainly in favour of restricting exports as a whole, while maintaining substantial exports towards the West. An energy conservation policy should make these apparently contradictory objectives compatible with each other. This is at the center of their energy policy.

It should however be pointed out that some far more radical criticisms concerning oil exports have emerged in the Soviet Union. It has undoubtedly been one of the essential effects of perestroika that a debate has now begun on the profitability of these exports: but this of course presupposes some real knowledge of production costs and less arbitrary prices than those applied at present. The underlying question behind this debate concerns the validity of an administered price system which is independent of costs (and this concerns both supply and demand policy).

There is, therefore, not much scope for manoeuvre for the Soviet Union as long as a real energy conservation policy has not been set up. Three variables must be taken into account: the stagnation of production, the need to export to the West in order to obtain hard currency and the need to shift part of energy-related investment towards other sectors. The changes in the conditions of exchange within the CMEA may allow the Soviet Union to transfer these constraints to the other member economies.

12 Interview with the managers of Concern Gazprom.

2.2.3 A Change in the Trade Structure

The political and economic upheavals which have been taking place in East Europe have resulted in the CMEA being called into question, as it is now seen as an obstacle to the integration of these countries into international trade. If we look beyond the divergent interests involved then we can see that there are two guiding principles behind the discussions concerning the reform of the CMEA: trade in convertible currency and at world prices[13]. Even if transitional arrangements cannot be excluded, these changes raise the fundamental question of the compatibility between the present levels of oil imports (but paid in hard currency) and the financial capacities of these countries (the amount of their debt in terms of hard currency). This financial capacity is likely to be, in the years to come, a key variable determining the level of their oil imports and therefore their oil consumption. A great deal is at stake here, as the following simple exercise will illustrate. If we take the levels of oil imports from the Soviet Union and we evaluate them in terms of world prices in dollars, then we obtain the following figures:

1.22 billion dollars for Bulgaria

0.87 billion dollars for Hungary

2.09 billion dollars for the GDR

1.43 billion dollars for Poland

1.74 billion dollars for Czechoslovakia

0.50 billion dollars for Romania[14]

Moreover, past experience has shown that when Soviet oil supplies were decreased in 1982 the East European countries did not turn massively towards OPEC crude oil, with only some notable exceptions, such as the GDR. But even in this case, these imports were above all used to sustain a policy of re-exporting refined products (sometimes even crude!) towards the West in order to obtain convertible currencies as it had already been practised earlier by Bulgaria leading to a reduction in delivery with higher prices from Russia.

Thus all the East European countries are faced with the necessity of developing energy conservation policies. The modernization of their economies is forcing them into giving up the extensive exploitation of their resources, based on ever-increasing investment given their production conditions. Limited financial capacities and the conditions of exchange within the CMEA, which in any case are bound to change, are restricting their possibilities of importing oil. Thus they cannot avoid energy conservation if they do not wish their economic growth to be held up by substantial energy resource-related constraints.

13 Le Monde, 15 December, 1989.

14 LOCATELLI (C.), MERCIER-SUISSA (C.) - "Les échanges d'hydrocarbures intra-CAEM" - Le Courrier des Pays de l'Est, Feb. 1990, Forthcoming.

2.3 Energy Conservation in Central and East Europe

Energy conservation objectives are no new thing in East Europe, since already in the early seventies they were integrated into the energy policies of these countries. Energy conservation policy is part of an industrial policy which aims at moving from "extensive growth" to "intensive growth".

2.3.1 Administered Energy Savings

Energy conservation in East Europe appears above all as a macro-economic issue, within a more general context of deteriorating balance of payments and austerity policies. The idea is to limit oil imports. This cannot be a "preoccupation" of economic agents at a micro-economic level for three reasons: the system of administered prices which has no stimulative role, the actual absence of budget constraints at an enterprise level and the existence of priority production targets, whatever the cost of achieving them may be. In such conditions, the energy conservation programmes which have been adopted are in keeping with the modes of organization and operation of centrally planned economies. With the exception of Hungary, which by 1979 had recognized the role of prices, (and the GDR, at a plant level) **administrative measures** (norms and quotas) are seen as of central importance in this type of energy conservation policy. Energy prices play only a secondary role. Consumption norms are introduced at an enterprise level. These are to be fulfilled as part of the enterprise plan. Such a policy presupposes a multitude of regulations, and frequent adaptations to technical change. However, it is illusory to believe that such a system of norms can be generalized and made to work effectively. For the system assumes implicitly that the enterprises' real energy consumptions can be known, which is not in fact the case[15].

The same applies to the household sector regarding the deficiencies of the knowledge of consumption patterns as well as the impossibility of successfully regulating the behaviour of the consumers.

Within the perspective of "industrial competitiveness" which they have adopted, the industrial sector and oil products are at the very core of the energy conservation policies in the East European countries. An exception should be made for the extreme case of Rumania, where a government decree of the 23rd of December 1983 imposed a reduction of 50 % in energy consumption norms outside industry (changes in the relative weight of the various sectors), the modernization of the production apparatus and energy substitution. The idea is to use oil henceforth essentially for refining, chemicals and petrochemicals and to eliminate it in thermal uses. The underlying organizational logic of this type of economy tends to orientate energy conservation objectives towards the sectors which are (because of their high degree of centralization) most easily identified and controlled by the planner, i.e. electricity, steel and metallurgy.

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15 BETHKENHAGEN (j.) - "The GDR`s energy policy and its implications for the intensification drive" - Studies in Comparative Communism, XX(1), Spring 1987, p.65.

However, improvements in energy efficiency are slow and uncertain in East Europe. The current economic reforms should make it possible to remedy this situation and make energy conservation as much a micro-economic as a macro-economic preoccupation. What is at stake here is the modification of **the behaviour of economic agents** both in terms of energy management (the elimination of wasteful behaviour) and in terms of choice of technology and equipment. This requires proper price signals and better understanding of the structure of energy demand.

2.3.2 Energy Consumption in the Industrial Sector

The industrial structures of the East European countries, and the modernization problems which they are now confronted with, are determining factors of their high level of energy consumption.

The so-called "Stalinist" mode of industrialization, based on the accelerated development of heavy industry, has been a determining factor in the high level of energy consumption in East Europe. This does not however do away with national particularities in the rate and type of industrialization. Thus the Hungarian industrial structure remains marked by the initial importance of light industry.

The eighties have seen the emergence of policies of structural adaptation in most East European countries. These have aimed at developing sectors like electronics, computers, robotics and bio-technologies. However, the process of industrial restructuring has been slower than initially intended, although real progress has been made in certain countries: in Hungary and the GDR, for example. Despite these "new demands" on policy-making, certain "traditional" priorities have been maintained: the development of metallurgy and the heavy chemicals industry, for example. The problems involved in avoiding disequilibria in the trade balance explain why such specializations have been preserved. In such a context progress in energy efficiency is slow.

Moreover, modernization policies have only had a slight impact on energy efficiency, given the insufficient replacement of fixed capital as a result of austerity policies.

The difficulties involved in modernizing the industrial sector in the East European countries.

The ageing of industrial plant in the East European countries, along with the slow diffusion of less energy-consuming technologies, are decisive elements in determining the level of energy consumption. This ageing of the production apparatus has been largely criticized in East Europe.

The evolution of the specific energy consumption of steel production illustrates the difficulties which the East European countries have had to confront in their attempt to improve the energy efficiency of their system. Although a great amount of uncertainty surrounds the trends in this field, in certain cases increases in energy consumption can be observed between 1975 and 1980 (this was the case in Hungary and in the Soviet Union).

These trends have to do with the choice of technologies, the problems of plant renewal and the diffusion of innovations within planned economies. Whereas the Open Hearth process, which is highly energy-consuming, has more or less disappeared from steel production in the Western world, it is still widely used in East Europe.

This problem of industrial modernization explains the high level of the specific energy consumption of steel production (despite the uncertainty of the figures involved). Thus in 1985 consumption levels were as follows:

- in Poland: 0.560 toe/ton
- in Hungary: 0.452 toe/ton
- in the Soviet Union: 0.960 toe/ton16

Another significant example of high specific energy consumptions concerns the cement industry. These were as follows:

- 4.8 GJoules/ton for Hungary in 1983
- 4.51 GJoules/ton for Czechoslovakia in 1983
- 5.13 GJoules/ton for Poland in 1983

whereas the international reference figure was 3.7 GJoules/ton according to the World Bank[17].

These figures do not in any way suggest that the East European countries have not obtained some improvement in their energy efficiency. The case of the Soviet Union, in both electricity and steel production, may prove quite the contrary.

However, these examples do illustrate the limits of the system when it endeavours to set up a real energy conservation policy. Quite evidently, it has been in the electricity sector, with its specific characteristics (highly centralized, and easily controlled by the planners), that the improvements in energy efficiency have been obtained, mainly through the effects of size.

In order to obtain energy savings, the Soviets have been constructing larger and larger plants, even if the savings so realized are increasingly small. The same reasoning has been applied to steel production. Here the Soviets have essentially attempted to improve existing technologies, notably through increasing plant size. Moreover, such a strategy may have other objectives than energy conservation.

This model cannot be applied to all sectors. It also has its limits – illustrated by the still high levels of consumption. Economies of scale are not inexhaustible. Moreover, the model involves high levels of capital investment, which are often unjustifiable in economic terms.

The reforms that are presently being implemented are intended to overcome these obstacles. In particular, they are likely to influence the patterns of energy consumption:

- by making enterprises more sensitive to **production costs** (price reform, financial autonomy). They can give rise to new forms of energy management (in terms of behaviour) as well as modifying the criteria governing the choice of equipment, which has an essential impact on energy consumption;

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16 These calculations were made on the basis of energy balances processed by ENERDATA and the steel production figures published in the Steel Statistical Yearbook 1986 – Brussels, International Iron and Steel Institure, 1986.

17 Energy efficiency in European industry – Ney York, ECE/UNO, 1980, p.139 – (ECE Energy Series n°1), and
Poland: reform, adjustment and growth – Washington D.C., The World Bank, 1987, p.189, vol.2.

- also probably by inducing certain changes in the structure of industry (development of services, consumer goods etc.)

The need for cooperation with the Western countries remains important, however, in as much as certain technologies are not available. Refining is a case in point. But this also concerns equipment for measuring and controlling consumption (thermostats etc.). The lack of the necessary equipment in this field has been a major constraint on energy saving[18].

These examples, although they remain fragmentary, show that the potential for energy saving does exist in the East European countries. However, they should not hide the very real possibility of future increases in energy consumption. The economic reforms, through the increases in living standards they are likely to induce, will lead to new energy requirements. Two sectors will be particularly affected by this: housing and transport.

2.3.3 Energy Consumption in the Transport and Residential Sectors (19*)

When we look at the economic reforms which have been undertaken in East Europe, then we can see that increases in energy consumption are highly likely. Indeed, the success of these reforms, and the corresponding rise in living standards, are likely to lead to an increase in the rate of equipment of households (in household electrical appliances as well as personal vehicles) and improvements in housing (effects on size). From this point of view, we must point to the presently low impact of the transport and residential sectors on overall final energy consumption. These latter, and particularly households, have never been considered as high priorities in the various energy plans in the East European countries, notably in terms of energy conservation. This accounts for the widespread wasteful use of energy. Since energy was considered to be a "basic good" for the population, energy prices long remained very low[20].

The situation is in the process of changing fundamentally as a result of the current reforms. In Hungary and Poland there have been substantial price increases since the beginning of 1990. There are, however, social and political limits to the price increases as the reactions in Poland showed.

18 "Les économies d'énergie dans les pays de l'Est: URSS, Hongrie, RDA, Roumanie, Tchéchoslovaquie" - Le Courrier des Pays de l'Est (289), Nov. 1984, p.28.

19* Our analysis of the transport and residential sectors is largely inspired by the research carried out by V. MERKIN - Petroleum Conservation in East Europe - Delphic Assiciates, 1988, vol.I and II.

20 WILSON (D.) - Soviet Energy to 2000 - The Economist Intelligence Unit, 1986 - (Special Report n°231, p.152).

The transport sector

This sector, which is marked by Soviet–type centralization, can be characterized by the importance of rail transport and the poorly developed stock of private vehicles, with the exception of the GDR.

The policies which have been adopted in this sector have three essential objectives: the dieselisation of the lorry stock, the electrification of the railway network and the decrease in specific diesel oil consumptions, in order to free quantities of oil for other specific purposes (chemicals and petrochemicals). These policies have had some degree of success, in particular concerning the stock of lorries using diesel oil (almost all lorries in the German Democratic Republic and Czechoslovakia) and the number of Km. of electrified railway line (however, the degree of electrification remains lower than in Western Europe, with the exception of Poland). On the other hand, the decrease of specific energy consumptions has turned out to be more problematic[21].

In certain countries (the German Democratic Republic and Hungary) there has undoubtedly been a fall in consumption of oil products in the transport sector (with the exception of private transport). However, only a small part of this can be attributed to improvements in energy efficiency.

"Rationing" in terms of quantity (the case of Poland in 1982) or by means of prices (Poland at the present time, or Hungary) has also made it possible to lower total energy consumption, although, once again, this cannot be said to result from improved energy efficiency.

21 "En Hongrie, de nouvelles et fortes hausses des prix inquiètent la population et mobilisent les syndicats" – Le Monde, 9 January, 1990, p.25.

The housing sector

The housing sector has never be seen as a priority in terms of energy conservation in East Europe. The following factors should be stressed as far as heating is concerned. Centralized heating has been extremely important, notably in those countries which have made massive use of coal and brown coal (the German Democratic Republic and Czechoslovakia). At the same time, highly polluting individual heating equipment can also be found and is a major pollutant (i.e. in the GDR and in the CSFR).

Moreover, the lack of energy-saving equipment or of devices necessary to control and measure energy consumption casts some doubt on an energy efficiency drive in housing, and undermines the effectiveness of defining consumption norms. The poor quality of building material, which has also been criticized in the press, has much the same negative effect[22].

Although transport and housing have relatively little impact on energy consumption, there is nonetheless a great potential for energy conservation. In fact, energy saving is necessary in order to avoid increased consumption in these sectors developing at an "unsustainable rate".

22 MERKIN (V.) - Petroleum conservation in East Europe, Falls Church (Virginia), Delphic Associates, 1988, vol.1, p.22.

2.4 Conclusion

The patterns of energy use in East Europe, characterized by high levels of energy consumption, notably in the industrial sector (coal consumption in particular), seem to have reached their limits. The spread of local energy shortages and the high level of energy-related investment are the indicators of these limits, i.e. for the Soviet Union where this led to a slow-down in oil and gas exploration. Past supply policies - based on massive investment in order to increase domestic production - are no longer viable, given the amount of capital necessary to modernize the economy. The former trade pattern - oil in exchange for manufactured goods - has also been called into question, especially in Hungary. In the future, the financial capacity of the East European countries is likely to be the determining factor concerning oil imports to these countries.

In these conditions, energy conservation in East Europe is of crucial importance if these countries are to continue to develop economically without resource constraints. Of course, the potential for energy conservation is enormous, and not only in the industrial sector. The most flagrantly wasteful behaviour can be eliminated rapidly. However, this assumes that the economic agents will be interested and encouraged to do so, and that they will find some help in resolving the problems that will inevitably crop up.

In this respect, the reforms which have been undertaken, notably concerning prices, are necessary but insufficient. Much energy conservation is only possible if old equipment is replaced and new, more efficient technologies used. These new technologies are often unavailable, and involve a substantial financial effort. It is not enough only to define energy conservation policies. One also has to have the possibility of implementing them, and this means obtaining certain equipment (thermostats, control devices etc.). For this reason, it is important to have sufficient available resources in order to resolve the key problems. In this context, cooperation with the Western countries could be useful, if not indispensable, not only in terms of technology and finance, but also in terms of training.

The Central and East European countries are facing three heavy constraints for their energy situation:

- The coal production reaches its limits, and will probably decrease due to the decrease in the quality and accessibility of mines, high investment requirements and environmental stresses.

- The energy consumption per capita and per unit of GDP is very high compared to Western European standards, leading to an urgent need for vigorous energy conservation policy.

- The future development of nuclear energy remains uncertain and meet growing public opposition in most of the countries, in particular in USSR.

The current political and economic evolutions may lead to deep modifications in the energy system. The main directions of the new energy policies are, for all countries, energy conservation and, for most of them, the increase in the share of natural gas, in particular for electricity generation.

Annex I

Global Indicators:
Energy Intensity
2nd Energy per Capita

Energy Intensity (in koe/1000 $ 80)

	Bulgaria	Hungary	Poland	GDR	Romania	Czechoslovakia
1970	601	524	775	986	744	883
1971	637	530	763	989	698	907
1972	624	525	741	964	698	888
1973	661	532	718	973	738	867
1974	665	532	681	928	706	873
1975	656	532	703	908	732	879
1976	674	559	722	906	715	883
1977	722	418	752	909	713	884
1978	732	572	755	906	725	893
1979	740	587	817	918	704	916
1980	790	563	808	883	748	881
1981	816	542	695	900	749	858
1982	827	566	717	882	747	868
1983	820	568	737	892	760	887
1984	867	609	743	935	835	936
1985	851	621	779	1026	859	950
1986	900	651	828	1055	922	973
1987	929	661	827	1090	882	1008

Energy Per Capita (in koe/hab)

	Bulgaria	Hungary	Poland	GDR	Romania	Czechoslovakia
1970	2157	2065	2634	4227	1890	3930
1971	2347	2174	2751	4336	2000	4155
1972	2398	2193	2846	4375	2110	4190
1973	2626	2331	2937	4570	2286	4204
1974	2703	2380	2919	4584	2288	4348
1975	2875	2420	3130	4670	2451	4469
1976	3030	2537	3262	4772	2628	4556
1977	3198	2006	3425	4939	2662	4705
1978	3307	2805	3527	5010	2805	4794
1979	3468	2879	3727	5223	2798	4922
1980	3583	2785	3562	5130	2906	4819
1981	3606	2658	3235	5126	2901	4697
1982	3540	2670	3367	5039	2833	4650
1983	3574	2701	3298	5004	2866	4677
1984	3662	2810	3206	5098	2957	4815
1985	3696	2930	3323	5425	2997	4851
1986	3717	3002	3428	5495	3033	4854
1987	3862	3014	3488	5592	2924	4973

Annex II

Note on the Calculation of Energy Intensities for Central and East European Countries

NOTE ON THE CALCULATION OF ENERGY INTENSITIES FOR CENTRAL AND EAST EUROPEAN COUNTRIES

Questions surrounding the evolution of energy intensities in East Europe countries are raising considerable controversy at present. On the basis of a rapid overview of the relevant literature, it is difficult to identify the dominant trends because of the contradictory nature of the results. Thus it is equally possible to conclude that the energy intensity has been improving or worsening in East European countries since the sixties. Without making any claims to being exhaustive, it is however possible to identify two main types of analyses. Firstly, those which base their calculations on the Net Material Product (the socialist national accounting indicator) and which conclude in the existence of significant falls in East European countries' energy intensities since 1970 (or even since 1960!). Among these, the most significant are those if the EEC–UNO (New York) of N. Jestin–Fleury and various scientific research studies. Thus a 40% fall in Soviet energy intensity between 1965 and 1980 can be deduced from the diagram produced by A.A. Makarov in contrast, analysed based on Gross Domestic Product (or GNP) show an increase in energy intensity in East European countries (with the exception of several years).

The difference between these two types of study can be explained in large part by the type of macro–economic indicator employed – NMP or GDP. Clearly the calculation of energy intensities using these two different types of macro–economic indicator account for two quite different realities since they are constructed on the basis to two quite different conceptions of national accounting systems. Three points are worthy of note. Production evaluated using the NMP is limited to **material goods and services** which alone are considered to be productive (even though most East European countries have adopted less restrictive definitions). In addition, the NMP refers to **material goods and services excluding capital depreciation.** Write–offs (or the consumption of fixed capital) are excluded from the NMP (except for non–productive sectors where they are treated as a form of final consumption). In contrast, the consumption of capital appears as the gross fixed capital formation in the GDP or the GNP.

J. CESKA has summed up these differences in a single definition as follows: (a)
Intermediate
Consumption
NMP = Intermediate GDP consumption
- material consumption in the non–productive sphere
- non–material consumption in the productive sphere
- housing–related costs
- stock losses related to abnormal phenomena
- official travelling costs

  consumption of fixed capital in the material sphere

One last feature should also be emphasized – the category entitled "**special foreign trade earnings**" – which reflects the differences between the domestic and international price structures.

Apart from the differences in the definitions, albeit important, most of the questions raised concern the method used to calculate the NMP. At the centre of the debate is the price formation mechanism in East European countries. Raising questions about the evolution of energy intensities inevitably means asking what is meant by economic growth, a question which has often been raised concerning the Soviet Union and which remains topical.

To begin with, it appears that the exclusion of certain items such as services or the imperfect method for accounting for all intermediate consumption (as in the case of "non-productive services" by productive sectors) leads to a certain over-evaluation of the rate of economic growth as calculated using the Net Material Product. Thus R. CAMPBELL emphasizes that in the sixties "material production in the Soviet Union rose faster than non-material production" (b). Excluding intermediate consumption of non-productive services has the same effect. Since they are not accounted for as such, they cannot be deducted in any calculation of added value.

The distortions caused by the system of administered prices are without doubt even more fundamental. These prices are not in any way the result of calculating the cost of the various factors involved, if proper account is taken of taxes which can included grand-aid, of the fixing of highly variable profit rates in different sectors, and of the absence of realistic interest rates. Neither do they reflect consumer's preferences, given the imbalances which exist on consumer goods markets. Above all, they raise the problem of how to adequately measure production and added value. They also often lead to further questions regarding the weightings applied to the various sectors of the economy.

These factors are relatively well-known and little-contested. In the other hand, the numerous controversies which have arisen concerning Soviet economic growth have cast doubts on the way in which "inflation" is measured (and hence on the methods used to construct price indices). In recent years evaluations of economic growth in the Soviet Union made by Soviet economists have had only lead to a rekindling of the debate. According to A. AGANBEGUIAN, the use of real prices (excluding inflation) leads to nation income growth rates lower than those given in official statistics (c). And according to M. LAVIGNE, the most critical analyses have been made by V. SELJUNIN and G.K. KHANIN, who have challenged the official figures for economic growth. According to these authors, "o...§ between 1928 and 1985, national income has increased by a factor of 6-7 at a declining annual rate - between 1981 and 1985 it rose by 3%, or 0.6% per annum (but it fell between 1981 and 1984 o...§)" (d). The Soviet Studies journal has reported wide-ranging controversies in the 1980s concerning growth as it appears in Soviet investment statistical series. Here again, Soviet price indices and methods of measuring inflation are at the heart of the debate.

From the studies briefly mentioned here, it can be deduced that one of the major problems is that of the concept which is central to Soviet price indices - that of **comparable prices** as opposed to the **constant prices** used Western national accounting systems. According to the definitions given by F. KUSHNIRSKY, comparable prices are those of a base year, and are theoretically constant until the base is revised. He points out however, that comparable prices vary not only with the introduction of new goods into the price index at their current price (reckoned to be the base year price) but also as a result of the substitution of a definitive price for a temporary price. This method can also be found in the calculation of the wholesale price index and in the price index used for statistical series for investment (f).

This method can also leave the way open to "hidden deflation" or to "hidden inflation" (g) the latter being more in line with Soviet practices. Such inflation thus leads to an over-evaluation of volumes and so of Soviet economic growth. From this point of view, two main factors at least appear in the literature. An crucial factor seems to be that the prices of new goods are overestimated with reference to their characteristics (or as compared with the prices of the goods which they are supposed to replace). At the very least, they are not, in the first instance, an accurate reflection of a price resulting from volume production (h). To these factors should also be added official price increase justified by improvements in the quality of products or technologies, but which are often unrelated to actual improvements (i). Under such conditions, it would be legitimate to ask, as does A. NOVE, what validity can be accorded to the sample used (j).

The thesis of a significant rate of inflation is also supported by other elements which are not refelcted in Soviet price indices. Shortages and non-satisfied purchasing power resulting from a growing disconnection between supply and demand are both manifestations of inflation in an economy based on administered prices.

It should not be concluded that Western estimates of East European countries' economic growth are any less problematic. Their multiplicity and divergences show that the opposite is the case. Evaluation of gross fixed capital formation and of intermediate consumption is not easy. But the assessment of a true rate of inflation is infinitely more complex and formidable task.

(a) CESKA, J. "Comparison of gross domestic product and net material product", in The future of the world economy, IIASA, Vienna, Springer Verlag, 1989, 590 pp.

(b) CAMPBELL, R. The conversion of national income data of the USSR to concepts of the system of national accounts in dollars and estimation of growth rate, Washington DC, World Bank, 1985, 45 pp. (World Bank staff working paper n°777.)

(c) AGANBEGUIAN, A.G. Perestroika: le double défi soviétique, Paris, Economica, 1987, pp. 7–10.

(d) LAVIGNE, M. "L'accélération, la réforme, la transparence: l'économie soviétique en marche vers le changement?", Chroniques d'actualité de la SEDEIS, 36(5), 15th May 1987, 168 pp.

(e) KUSHNIRSKY, F.I. "Methodological aspects in building Soviet price indices", Soviet Studies, XXXVII(4), Oct 1985, pp.505–519.

(f) KONTORVICH, V. "Inflation in the Soviet investment and capital stock", Soviet Studies, XLI(2), April 1989, P.324.

(g) KUSHNIRSKY, F.I. Op. cit., p.517.

(h) MARER, P. Dollar GNPs of the USSR and East Europe, London and Baltimore, John Hopkins University Press, 1986. (World Bank Publication).

(i) This line of argument is emphasized by numerous authors such as P. MARER, B. RUMER and A. NOVE. In particular see, RUMER, B. "Soviet estimates of the rate of inflation", Soviet Studies, XVI(2), April 1989, p.299.

(j) NOVE, A. "A note on growth, investment and prices indices", Soviet Studies, XXXIII(1), Jan 1981, p.142.

Annex III

Structure of the Energy Consumption (in %)

Structure of the Energy Consumption (in %)

	1970						1975					
	Consumption (mtoe)	Coal	Oil	Natural Gas	Electr.*	Total	Consumption (mtoe)	Coal	Oil	Natural Gas	Electr.*	Total
Bulgaria	18.3	47.3	47.4	2.2	3.1	100.0	25.1	36.2	49.7	4.3	9.8	100.0
Hungary	21.4	53.4	27.8	14.4	4.4	100.0	25.5	37	38.6	19.7	4.7	100.0
Poland	86	83.7	9.9	5.9	0.5	100.0	106.5	78.6	14.4	6.6	0.4	100.0
GDR	72.1	86.5	12.6	0.6	0.3	100.0	78.7	74	18.6	6.3	1.1	100.0
Romania	38.5	20.8	26.2	52.7	0.3	100.0	52.1	20.1	25.4	51.1	3.4	100.0
Czechoslo	56.4	74.6	18.3	3.6	3.5	100.0	66.1	66	24.7	5.9	3.4	100.0
CMEA_6	297.2					100.0	354					100.0

	1980						1987					
	Consumption (mtoe)	Coal	Oil	Natural Gas	Electr.*	Total	Consumption (mtoe)	Coal	Oil	Natural Gas	Electr.*	Total
Bulgaria	31.7	29	47.8	11	12.2	100.0	34.9	31.4	38.4	14.6	15.6	100.0
Hungary	29.8	30.2	34.9	27.2	7.7	100.0	32.6	24.7	29	27.9	9.3	100.0
Poland	120.4	76.9	15.3	7.4	0.4	100.0	92.9	78.2	12.9	8.1	0.8	100.0
GDR	85.9	69.9	17.8	8.4	3.9	100.0	132.1	73.6	13.2	9.3	3.9	100.0
Romania	64.5	19.9	28.7	45.7	5.7	100.0	68.4	24.9	19.5	49.7	5.9	100.0
Czechoslo	73.8	61.7	25.2	8.9	4.2	100.0	78.4	57.5	20.4	12.1	10	100.0
CMEA_6	406.1					100.0	439.3					100.0

* Hydro and Nuclear

CHAPTER 3

Relations and Cooperation

3. *RELATIONS AND COOPERATION*

3.1 Introduction

World history during the 20th century has been marked by developments in and considerations related to the energy sector. Energy, due to its strategic nature, has guided the policies of all countries, large and small. International relations between countries and block of countries have been influenced by energy considerations. In this context both antagonisms - sometimes leading to open regional conflicts - and cooperations developed.

The two major Blocks (East and West), into which the world was divided after World War II, never came into a face-to-face confrontation in their strive to secure energy resources or to block the other side's access to such resources. Yet, their antagonism over energy was strong and energy considerations can be clearly identified in the background of the East-West conflict, especially - but not only - during the Cold War period. Therefore, it is no wonder that the energy cooperation - even in the form of trade - between the two Blocks was rather slow to develop. On the contrary such cooperation was intensified - especially after the energy crises of the 70's - within each Block.

Since that time, energy cooperation has become an increasingly important issue of international relations, especially among industrial countries, both East and West. It sprung from the need to cope with the impact of oil price increases on their economies, which provided adequate justification for a more concerted effort to reduce dependency on oil and its derivatives. And to that extent, it seems that industrial countries have succeeded to coordinate their policies with considerable success.

It was soon realized, however, - especially as the international climate improved - that the energy problem can not be solved by the industrial countries alone, working in isolation.

On the one hand, energy policy could no longer be made without taking into account the interrelationships of an increasingly interdependent world economy. Nor, it is a matter, of policy responses to emergency situations in the oil market. There is an established need to develop and use technologies for the production and consumption of energy in the light of exhaustible resources and environmental constraints at a global scale.

On the other hand, energy policy should not be viewed as a means of securing prosperity for industrialized countries to the neglect of the rest. It has to be formulated in a world-wide context in which long-term problems, like population growth and the need to feed the people, have to be taken into account. In this perspective, energy cooperation has developed between the industrialized countries of both Blocks with the countries of the Third World, some of which possess extensive energy resources; and to that extent, developing countries of the Third World participate in a dialogue, which helps - at least - to avoid economic disruption and political conflicts.

On these grounds, in the recent years cooperation practices have witnessed remarkable development and diversification, concerning specific fields and forms, number and status of participants, institutional settings and type of engagement.

International cooperation in the energy sector, though, has not developed equally among the different countries or among the different supranational groups. This is natural, to the extend that neither the international relations are determined solely by energy considerations nor the potential for cooperation in different sectors of the economy, like the energy sector, is independent of the relations between the different countries or groups of countries.

It is, therefore, understandable that the energy cooperation between the EEC and the Central and East European countries have lagged behind, been influenced by the overall relations between them. It is equally true that, as their overall improved, their cooperation in the energy sector developed.

The recent developments in the countries of Central and East Europe, though, open new horizons for their cooperation with the EEC. And this for two reasons:

First, because the political changes and the socioeconomic reforms that are under-way in Central and East Europe open the way for improved relations of these countries with the EEC; therefore for further development of their cooperation in all sectors, energy included.

Second, the economic conditions in the Central and East European countries and their needs for carrying out the reform of their social and economic system makes the cooperation with the EEC in all sectors of the economy, originally in the form of aid and at a second stage in the form of technical and economic support, absolutely necessary.

Therefore, any effort to formulate proposals for the cooperation in the energy sector between the EEC and the Central and East European countries should be based on the analysis of the evolution of the relations between the two sides and of their experience in cooperation between themselves or with third parties.

This Chapter attempts an analysis of the history of the relations between the EEC and the Central and East European countries, focussing mainly on the recent developments, and reviews the main cooperation experiences of the EEC and these countries in the energy sector. Some interesting experiences of International Organizations are also presented, in an effort to examine an as wide as possible spectrum of activities and enrich the ideas from which cooperation proposals can emanate.

3.2 The Relations of the EEC with the Central & East European Countries

The EEC Member States and the Central and East European Countries have a long history of coexistence on the oldest of all continents. They share World History and a common culture. It is, therefore, no wonder that the European Communities expressed, from almost their formation, the wish to normalize their relations with the Central and East European Countries and to overcome the suspicions created during the Cold War period.

3.2.1 The EEC and the CMEA Relations

3.2.1.1 The Phase of Refusal

It was as early as 1963 that an aide-memoire was addressed by the Communities to the Soviet Union to this effect. Yet, the Central and East European Countries, at that time members of the Council for Mutual Economic Assistance (CMEA)[1], known also as COMECON, remained hostile to the EEC. Their position towards the Community was determined by 17 studies of the Institute of Economics and International Relations of the Academy of Sciences of the USSR published in 1957 labelling it "the economic arm of NATO" and "the holy alliance against Communism and the workers".

Based on these ideological positions the CMEA countries refused to have dealings with the EEC and made all possible efforts to impede the accession of the Community to international conventions and its participation in multinational organisations. The period until 1971 has been named "the phase of refusal"*.

This holds true beside the fact that in 1962 a new series of studies was published under the title "32 Theses on the Imperialist Integration in West Europe" which, despite their exact wording, draw significantly more realistic political lines against the EEC. In effect Moscow in the "32 theses" admits that a "pragmatic and limited", policy of cooperation cannot be a priori excluded.

3.2.1.2 The Phase of Realism

A second phase of EEC-CMEA relations - called "phase of realism"[2] - opened with Brezhnev's statement of 1972, in which he spoke of the possibility of relations between the CMEA and the EEC. Brezhnev actually overruled the "32 Theses", by recognizing that the Community is not a "transitional phenomenon" dependent to the USA, but "a permanent reality in evolution".

The reasons behind Brezhnev's initiative should be searched for not only in the climate of detente emerging at that time, but in the sphere of the economy as well. Some of the CMEA European countries were beginning to feel the effects of Community policies, and particularly of the Common Agricultural Policy, on their trade with West Europe, and thus finding themselves under pressure, in their own interests, to enter into arrangements with the EEC in the first instance in the agricultural field. Furthermore, the Soviets wished at that time to strengthen the CMEA both internally and externally.

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1 **The CMEA was formed in January 1949, as a response to the Marshal Plan, by USSR, Bulgaria, Czechoslovakia, Hungary, Poland and Romania. Albania joined in Feb. 1949 to withdraw in 1961- The GDR became a member in 1950 and Mongolia in 1962. Cuba and Viet Nam joined later in 1972. The CMEA, unlike the EEC, had no supranational powers. It acted as coordinator and broker for its member countries. Its task has been to coordinate the national plans of its members, to produce technical and scientific standards and norms and has played an important role in industrial specialization and internal division of labour distributing production tasks to its members in order to avoid duplication. With the exception of Finland, CMEA has not signed trade agreements with major trading partners.**

2 **Maslen, John: "The European Community's relations with the state-trading countries 1981-83", Yearbook of Euroean Law - 1983, p. 323-346, Clarendon Press, Oxford, 1984**

The first CMEA approaches to the Community, in 1973 and the first half of 1974, were addressed to the Governments (Danish and German respectively) which held the Presidency of the EEC Council. It was not until the Presidency had repeatedly indicated that such enquiries should be addressed to the Commission that the then Secretary of the CMEA, Mr Faddeyev, finally wrote in September 1974 to the President of the Commission, Mr Ortoli, inviting him to Moscow to discuss relations between the two organizations. Although the invitation was accepted, Mr Ortoli's visit never took place. A meeting between officials of the Commission of the EEC and the CMEA Secretariat was held in Moscow in February 1975, with the aim of preparing for this visit. This meeting examined and compared various activities of the two organizations and identified a number of areas in which an exchange of information could be of mutual interest, but the Commission's proposal to hold a second preparatory meeting of the same kind was never taken up. Instead, the CMEA put forward, in February 1976, the draft of an agreement to be concluded between the EEC and its Member States on one side, the CMEA and its member countries on the other.

The draft agreement, beside articles on possible areas and forms of co-operation between the CMEA and the EEC as organisations, included a section laying down the "principles" on which trade between CMEA and EEC countries should be based. Notably, most-favoured-nation treatment and non- discrimination provisions, together with the granting of tariff preferences to CMEA countries at "an appropriate level of development".

The objectives of the draft may be summed up as follows: basic guidelines for trade would be laid down in the agreement between the organisations; Community agreements with individual East European countries would be limited to technical matters and subject to supervision by the CMEA and its member countries collectively.

This concept was unacceptable to the Community, as it becomes clear from the counter-draft which the Community put forward in November 1976. This draft agreement dealt only with working relations between the two organisations, while trade questions were to be dealt with in bilateral agreements between the Community and each of the CMEA countries. This remained the Community's position throughout the negotiations which followed.

Negotiations continued until October 1980, when they were suspended by mutual consent, the positions of the two sides being irreconcilable. Basically, the East European side would not relinquish, and the Community would not accept, the concept of the CMEA becoming a kind of intermediary between the EEC and individual CMEA countries with power, through the EEC-CMEA agreement, not only to lay down guidelines for trade policy but also to supervise the content and execution of Community agreements with the individual countries.

The Community's opposition to this idea was based on both legal and political arguments. On the one hand, it wished to negotiate on trade matters with those responsible for trade policy and wielding the instruments of this policy - i.e. in practice, the Governments of CMEA countries. On the other hand, the Community did not have any particular wish to see an extension of the CMEA's powers and activities in the trade field, limited traditionally to the co-ordination of intra-CMEA trade plans. Certain CMEA member countries, while officially supporting the CMEA negotiators, let it be known informally that they, too, were not enthusiastic about such a strengthening of the CMEA's role.

3.2.1.3 The Phase of Recognition

It is difficult to set an exact date for the beginning of the third period, called "phase of recognition" of the relations between the Community and the Central and East European Countries. In 1983, both Hungary and Czechoslovakia began exploratory conversations with the Commission aimed at extending the range of their trade agreements with the Community, limited till then to certain sectors, while 1984 brought clear signs of an interest on the East European side in renewing the EEC-CMEA dialogue. In the final communique of the CMEA Summit Meeting in June of that year, the CMEA countries confirmed their readiness to conclude "an appropriate agreement" between the CMEA and the EEC, with a view to promoting trade and economic relations between member countries of the two organisations.

The first formal step in the resumption of the EEC-CMEA dialogue took the form of a letter from the then new Secretary of the CMEA, Mr Sytchov, which was handed to President Delors on 14 June 1985. This letter proposed that official relations should be established between the CMEA and the EEC by the adoption, at high level, of a Joint Declaration. The CMEA draft for the Joint Declaration contained provisions of a general nature, of which only two are of substance: the CMEA and the EEC, the only parties to the agreement, were to establish official relations with each other by the adoption of this Declaration; in subsequent meetings, representatives of the two sides were to discuss what the forms and methods of these relations would be and what areas they are to cover.

Based on the Community's main strategy for the normalization of relations between the EEC and the Central and East European countries, treating each of these individually according to its particular circumstances – the nature of its economy, its links with the Community, its legal situation (member of GATT or not) etc. – the EEC decided to adopt a parallel approach – i.e. seek to develop the Community's relations with CMEA member countries simultaneously with its relations with the CMEA as an organization.

In September 1985, the CMEA accepted the idea of the "parallel approach" by indicating that each CMEA member country would decide for itself whether to conclude agreements with the Community. Furthermore, the replies of the individual countries to the EEC proposition indicated that they were willing and would be allowed to establish formal relations with the Community and to conclude agreements with it, and that trade matters would be negotiated with the Community by each CMEA country. The earlier insistence on using the CMEA as an intermediary between the Community and individual Central and East European countries had apparently been dropped, and the role of CMEA-EEC relations reduced to that of cooperation between the two organisations as such, within the limits of their respective interests and competences.

The negotiations, at experts level, started in September 1986 aiming at the approval of a Joint Declaration rather than at concluding an agreement scripto sensu. Yet, even in this limited framework a major obstacle was identified in including the "territorial clause" – typical to all EEC agreements with third countries – referring to West Berlin.

Finally the obstacle was overcome in May 1988, and the Joint EEC-CMEA Declaration was signed in Luxembourg on the 25th of June 1988 by Hans Dietrich Genscher, Foreign Minister of the Presidency and Willy De Clercq, External Relations Commissioner of the EEC, on the one side and Rudolf Rohlicek, Chairman of the CMEA Executive Committee, and Ventcheslav Sytchov, Secretary of the CMEA, on the other side.

The Joint Declaration restores diplomatic relations between the Community and the CMEA and states that the two parties are engaged in developing cooperation "in the domains relevant to their respective competences to their common interests". These domains as well as the forms and methods of cooperation were to be determined through contacts and negotiations. In this respect, talks between the EEC and the CMEA started to help exchange information on the powers and the working methods of the two organisations. In addition more detailed work began on four areas of common interest: the Environment, economic forecasting, technical standards and statistics.

The Joint Declaration opened also the way to establishing diplomatic relations between the EEC and the CMEA member states, as well as for bilateral agreements with each of them. This is of extreme importance, because it lead to the recognition by the Central and East European Countries of the fact that the EEC, as such, represents something more than the "total" of its twelve Member-States.

The Declaration marked the official reversal of the CMEA policy towards the EEC and constituted an important step towards the normalization of the relations of the CMEA Member States with the Community. It also facilitated the recognition of the right of the Community to participate as an independent entity in all international organizations and to be accepted as a signatory to multilateral conventions according to its competences and procedures.

3.2.2. The EEC Policy Towards the Central and East European Countries

3.2.2.1 The Rhodes Declaration

The mutual recognition between the EEC and the CMEA created a totally new international environment, in which the Community had to determine and find a new role. Towards this direction the Council issued at its 40th Meeting in Rhodes on Dec. 4, 1988 a declaration on the international role of the EEC referring to the East-West relations as well. The "Rhodes Declaration" gave a positive political push to the improvement of the relations between the Community and the Central and East European countries.

Having in mind, that the Central and East European countries were interested to develop their relations with the EEC, the Council reaffirmed its will to come to agreements of economic cooperation with each of them, taking into consideration the specific conditions of each country, in order to take advantage of the existing opportunities in a mutually advantageous way.

At the same time the Council reaffirmed its determination to take the appropriate actions in order to overcome the division of the European Continent and promote the principles and values shared by the EEC Member States.

To this effect, the Community declared that it would try to achieve:

a) the strict respect of the provisions of the Final Act of Helsinki, as well as new progress through the procedures of the Conference for Security and Cooperation in Europe, including a satisfactory and rapid conclusion of the Vienna Conference for the Denuclearization of Europe;

b) the establishment of a stable and secure equilibrium of the conventional forces in Europe at a lower level, the reinforcement of mutual confidence and of the military transparency as well as the complete and verifiable ban of chemical weapons;

c) the promotion of the human rights and the basic freedoms, of the free movement of people and ideas, the establishment of more open societies, the promotion of human and cultural exchanges between East and West.

d) the development of the political dialogue of the Community and its East neighbours.

After this Council Declaration, Jacques Delors, in his speech in front of the European Parliament on Jan. 17, 1989 pointed out that the EEC, although it is the first commercial power in the World, cannot develop the Single Market of 1992 in isolation. On this basis, he proposed to the non-EEC European countries to look together for a framework of cooperation appropriate for each specific case. And, referring to Mikhail Gorbatchev's idea of the "Common European House", he counter proposed the idea of the "European Village", one of the houses of which would be the Community of the 12.

The Commission's policies at that time were based on the realization that:

- a positive development of the reforms already under way in the Central and East European countries and an improvement of their economies were in the interest of the Community, thus the EEC ought to give a positive, yet prudent, answer to the openings of these countries;

- the economic situation in the Central and East European countries was in bad share and could not be improved unless the reforms bring results; thus the EEC should contribute to this by responding in a coherent and efficient way the initiatives of these countries and by coordinating the relevant policies of its Member States;

- bilateral agreements - existing or under negotiation - should play a significant role by offering new possibilities of exchanges, by improving the access to markets by creating business relationships based on the economic operations of the EEC in these countries, by developing economic cooperation in fields of common interest (such as the Environment, energy, standardization, etc), and finally by opening the way for the creation of joint ventures, if certain necessary conditions were met;

- cooperation in the fields of science and technology could also be envisaged, although security reasons set some limits of prudence.

3.2.2.2 The "Global Concept"

By mid April 1989 new progress was achieved in the East-West relations. Actually, since the Summit of Rhodes the Commission had indicated that the Community ought to have a unanimous opinion regarding the problems of the Central and East European countries and that the Twelve ought to form a global concept for their relations with them. This "global concept" of the Twelve ought to be coherent and coordinated and to be expressed by a number of plans.

The cooperation between the EEC and the Central and East European countries ought to be complementary to the cooperation between these countries and the EEC Member States, adding a new dimension while reassuring a better coordination to these policies. The necessary higher degree of coherence between the policies of the Community and these of the Member States as well as a higher level of efficiency in the implementation of such policies and a further reinforcement of procedures relative to national agreements of cooperation was achieved in the framework of the European Political Cooperation.

Finally, an interconnection between initiatives stemming from the European Political Cooperation and those of the economic domain, which lie within the responsibilities of the Council, has been established.

The coordination of the relations of the twelve member states with the Central and East European countries, as proposed by the Commission, should be based on a higher transparency of the policies especially with regards to the export credits towards these countries, in order to avoid a destructive competition between the Twelve.

3.2.3 A New Europe Emerges

The 1989 developments, though, proved "revolutionary" rather than evolutionary. The economic conditions in the Central and East European countries were deteriorating with a pace much faster than anticipated. The political impacts of the economic situation were threatening both the "traditional" conservative regimes – which they finally helped to overthrow – and the ones under reform – which were faced with major setbacks.

By July 1989 the situation was becoming critical, although some humanitarian aid was forwarded to the countries under reform. That was not enough though, specially for Poland and Hungary. The need for direct economic intervention to support these economies was becoming urgent while the roadblock was political rather than economic.

Mr. Gorbatchev gave the way out when, on July 15, 1989, he addressed the Arche Summit of the World's most industrialized nations meeting in Paris with a letter that made the necessary political opening. The reaction of the Summit was immediate. The leaders of the U.S.A., Canada, France, Italy, Japan, the UK and the F.R.G. together with President J. Delors decided, using the principles of the Global Concept for the relations with the Central and East European countries developed by the EEC, to move quickly with a coordinated aid programme, which was to become known as the Operation PHARE (Pologne et Hongrie: Assistance pour Reconstruction Economique). Twenty four Western countries were to participate in the Operation, the management of which was entrusted to the Commission of the European Communities.

3.2.3.1 Operation PHARE

Operation PHARE was conditional upon progress of the reforms underway on both the political and economic fields. The conditionalities referred, more specifically, to:

a) the declaration of the firm commitment of the recipient countries to introduce as soon as possible, and continue with, substantial reforms in their current economic systems towards the development of a market-oriented economy;

b) the establishment of a lasting partnership linking the recipient countries to those which are undertaking to provide the aid;

c) the opening up of the political system of the recipient countries directed towards establishing the rule of law, the respect for human rights, the introduction of multi-party system and the holding of free and fair elections.

On the other hand, the Arche Summit decided that:

a) the aid which is being added to that already committed or promised by the participating countries would be additional to the PHARE operation; and

b) the burden consented to by the participating countries would be shared, since they all have an interest in what is politically and economically at stake.

On their side Poland and Hungary clearly indicated that the restructuring of their economies requires budgetary monetary and exchange rate reforms, the elimination of subsidies as well as the clear separation of government and enterprise.

The EEC committed to Operation PHARE 500 MECU from the 1990 General Budget and, based on the first estimates of the needs per finances, indications, revised the Interinstitutional Agreement on Budgetary Discipline of June 29, 1988 to adjust the Financial Perspective for the years 1991 and 1992 accordingly. The adjustment raised the ceiling of Heading 4 (Other Policies) by 200 MECU in 1990, 1175 MECU in 1991 and 1628 MECU in 1992. Under the new ceilings the financial flows to the Central and East European countries will be 500 MECU for 1990, 850 MECU for 1991 and 100 MECU for 1992.

A set of "special (informal) instruments" was established to govern Operation PHARE. At the top of the pyramid is the Council of Foreign Ministers of the 24 participating countries. They meet every six months and they have the supreme political responsibility and authority for the Operation. Their first meeting took place on Dec 13, 1989 and their second meeting is scheduled for July 3, 1990.

Under the Ministers, a group of high level officials – known as Group–24 or G–24 – meets once every two months to prepare the ministerial meetings and monitors the implementation of their decisions.

The Brussels Network and a number of specialized working groups, meeting on a weekly basis are preparing the G–24 meetings and provide the technical support necessary for the Operation. Members of the Permanent Representations of the 24 participating in Operation PHARE countries in Brussels form the Brussels Network, which operates and is equivalent to the COREPER, in EEC terms. This way the effective and efficient coordination of the operation and the participating countries is secured.

By September 1989 the first Action Plan of the Operation PHARE was presented by the Commission in accordance with the mandate conferred by the Arche Summit, as confirmed by the 24 countries at their Ministerial meeting of August 1, 1989.

The Action Plan include measures for the two countries in the following fields:

a) Agriculture: supplies and restructuring, including the supply of agricultural products, as a form of emergency aid the proceeds of the sales of which is to be used to finance restructuring and training programmes, and the supply of means of agricultural production (pesticides and machineries).

b) Access to markets, including such measures as accelerated abolition of quantitative restrictions, improved agricultural concessions by the Community, possible tariff concessions, and extension of the benefits of the system of generalized preferences as from 1990.

c) Investment, including eligibility to ECSC and EIB loans and guarantees, risk-capital financing, and export credit guarantees, investment guarantees, and promotion of investment protection agreements.

d) Vocational training, including programmes both for the support of the restructuring effort and for the vocational reorientation of displaced manpower.

e) the Environment, including programmes relating both to the physical and to the cultural environment.

In submitting the Action Plan, the Commission proposed the necessary financing that led to the revision of the Financial Perspective, as presented in previous paragraphs and suggested that this outlay, which could be only one out of many available instruments, should be supplemented by a contribution of 100 MECU from the EEC Members States out of their national budgets and 300 MECU from the rest (non-EEC) of the 24 countries.

As soon as the Action Plan was approved by the Ministers of the 24, the Commission started soliciting ideas in order to formulate the appropriate programmes and contributions for its implementation, As of May 1990, the following eight major programmes were in progress:

a) Poland: environmental protection programme;

b) Hungary: environmental protection programme;

c) Regional: Environment Centre in Budapest;

d) Poland: programme of basic technical assistance for the privatization of the economy;

e) Hungary: programme for the modernization of the financial system;

f) Poland & Hungary: programme for the cooperation in the field of economics;

g) Poland & Hungary: technical assistance programme for the implementation of the Trans - European Mobility Programme for University Studies (TEMPUS); and

h) Poland: sectoral import programme for animal feeds and animal feed additives.

Details of these programmes are given in Annex A.

Also by May 1990 the financial and aid commitments (in grants and loans) made by the 24 countries within the PHARE were of the order of 12,000 MECU, for one to three years, as summarized in Table 1 (for details see Annex B).

This figure should be compared to the real needs of the effort to support the economies of the Central and East European countries, as estimated by the Commission. In his speech before the European Parliament on Jan 1, 1990, President Jacques Delors said that "the necessary financial solidarity to the six Central and East European countries (referring to the forthcoming expansion of PHARE) to overcome their development problems will require an increase of the EEC budget by approximately 14,000 MECU annually while the European Investment Bank will require another 5,000 MECU annually to extend the necessary financing to these countries. These funds represent only the EEC (and not the "24") contribution and they will be needed for a period of 5-10 years, according to Mr. Delors.

Table 1: PHARE Financial and Aid Commitments: Grants & Loans (as of May 14, 1990)

		MECU equivalent
I	**Poland**	
1.	Food Supplies	380.590
2.	Technical Assistance to Agriculture	46.963
3.	Vocational Training	211.680
4.	Investment, Joint Ventures and Industrial Development Credit	735.750
5.	Environment	198.100
6.	Energy	27.000
7.	Other	74.470
8.	Export Credit Guarantee Ceilings	2593.000
9.	Project Financing	1297.000
10.	EEC Action Plan	300.000
11.	Polish Stabilization Fund (PSF)	915.696
12.	Polish Balance of Payment Support	644.000
13.	Debt Reduction	665.000
Total I		**8449.249**
II	**Hungary**	
1.	Technical Assistance to Agriculture*	----
2.	Vocational Training**	38.500
3.	Investments – Joint Ventures	26.700
4.	Environment**	23.000
5.	Energy*	----
6.	Others	146.130
7.	Export Credit Guarantee Ceilings	1064.200
8.	Project Financing**	50.000
9.	Economic Development Financing	1955.000
10.	EEC Action Plan	
Total II		**3303.550**
Other Financing Indicated & Donors		**519.150**
Grand Total		**12271.949**

* Commitments for Hungary included under respective entries for Poland
** Commitments for Hungary are partially included in respective entries for Poland (see Annex II for details)

3.2.3.2 The Extension of Operation PHARE

Operation PHARE, as expected after the historic changes in the Central and East European countries that occurred in the last two months of 1989, attracted the interest of the rest of them, as they are reforming their social economic and political systems. At the Ministerial Meeting of the "24" in Brussels on Dec. 13, 1989 the decision was taken in principle to extend coordination aid to Bulgaria, Czechoslovakia the GDR and Yugoslavia, provided that they carry out the requisite political and economic reforms. On Feb. 16, 1990 a (high level) Group-24 meeting extended this decision to Romania.

These five countries thereafter submitted memoranda to the G-24 outlining the objectives of their reform programmes and requesting specific forms of assistance. In March 1990 the Commission sent fact finding missions to all the countries concerned to obtain supplementary information and to examine progress achieved in the reform programmes outlined in the memoranda.

These missions ascertained that during the first half of 1990 most of the countries concerned will have put in place the basic legislation needed to meet the political and economic conditionalities of the PHARE Operation.

The five countries memoranda, the legislative programmes on which they have embarked and the commitments which they have assumed, notably within the framework of the Conference on Security and Cooperation in Europe, confirm their determination to move towards competitive market - oriented economies. With this end in view, they have identified specific goals including:

- sustained non-inflationary growth;
- market pricing;
- reorientation of exports towards hard currency markets;
- external currency convertibility;
- balance of payments equilibrium;
- overcoming of the debt problem;
- a better environment;
- a shift to cleaner energy sources;
- increased productivity in industry and agriculture;
- the creation of modern services, especially financial services;
- establishment of normal property rights;
- the setting up of modern taxation system; and
- privatization and the breaking up of monopolies.

The sequencing of policies designed to attain these goals, their rapidity and the particular ways and means chosen vary according to the characteristics of each country and the results of its authorities' discussions with the competent international institutions.

Based on these considerations the Commission has identified the priorities for coordinated assistance to support the efforts of each country to achieve the objectives of its economic reforms. These priorities take fully into account the country's economic situation, particular requirements and absorptive capacity.

These priorities generally cover the following fields:

a) improved access to Western markets;

b) food supply;

c) training;

d) the Environment; and

e) investment and economic restructuring.

The above priorities are applicable according to the Commission and to the wishes of the national Authorities of the recipient countries in the following way:

a) Bulgaria

- agriculture and agro-food industry;
- the Environment;
- investment, mainly in transport and telecommunications;
- training, mainly in management and financial services;
- industrial restructuring, mainly in chemical and light industries;
- tourism;
- improved access to markets; and
- energy, mainly conservation

b) Czechoslovakia

- industrial restructuring;
- the Environment, mainly pollution control, industrial waste and nuclear safety;
- energy
- training and youth exchanges;
- investment, mainly in transport and telecommunications;

- scientific and technical cooperation; and
- improved access to markets.

c) German Democratic Republic

- food industry, mainly slaughter–houses, dairy sector and sugar;
- the Environment, mainly water, air and industrial pollution as well as protection of the cultural heritage;
- investments, especially transport and telecommunications;
- training;
- energy, mainly conservation; and
- improved access to markets.

d) Romania

- agriculture and food industry, mainly research, production technology and joint ventures;
- the Environment;
- investment, mainly transport, tourism and small enterprises;
- training, mainly in management, banking, tourism, communications and agro–industry;
- energy, and
- improved access to markets.

e) Yugoslavia

- agriculture
- the Environment, and mainly river, basin and coastal pollution;
- investment;
- restructuring of the banking and the industrial sectors;
- training, mainly in management, banking and taxation;
- structural adjustment, including the social sector, and
- improved access to markets.

The Action Plan for the extension of coordination assistance along the lines of Operation PHARE to the other five Central and East European countries, as drafted by the Commission, is expected to be approved at the upcoming Ministerial Meeting of Group–24 on July 3, 1990, after having being discussed at the (high level) G–24 over the last months and finalized at their sixth meeting in Brussels on May 22, 1990.

3.2.3.3 From Cooperation to Association

While the "24" were preparing to extend coordinated assistance to all Central and East European countries, the Community has been negotiating with them trade and cooperation agreements. By the end of May 1989 the network of "first generation" trade and cooperation agreements with these countries was completed, allowing for the normal development of commercial and economic relations. At the same time the process of the German reunification was moving fast leading to the immediate economic and monetary union and the "integration of the territory of the German Democratic Republic"[3] into the Community, through the Federal Republic of Germany by the end of the year.

While these first steps towards the common European House or the common European Village were just taking effect, the wish for "closer association" was gaining grounds on both sides. The Central and East European countries are already looking beyond the normalization, which was almost unthinkable only five years ago, to a special type of relationship reflecting geographic proximity, shared values and increased interdependence. They view the Community as an essential partner, links with which can assist then to "rejoin Europe", ending artificial divisions of past decades. They have noted the promising developments in relations between the EEC and the European Free Trade Association (EFTA) and have indicated their willingness to be more directly involved in this process as the economies of the Community and the EFTA become more closely integrated.

The Community, in response, decided to "start forthwith" discussions in the Council, on the basis of the Commission's communication,. on Association Agreements with each of the countries of Central and East Europe, which include an institutional framework for political dialogue. The Community will work to complete association negotiations with these countries as soon as possible on the understanding that the basis conditions with regard to democratic principles and transition towards a market economy are fulfilled"[4].

These agreements, leading from Cooperation to Association, were given the name "Europe Agreements".

A problem still remains with the content of the relations of the EEC with the USSR, mainly due to the size of its economy and the particular features of its reform process. The Community is seeking to obtain the highest possible level of reciprocal benefits from the new trade and cooperation agreement. In particular, the EEC encourages the USSR to play a fuller part in the open international economic system.

3 This exact expression was used in the Conclusions of the Presidency after the Special Summit of Dublin, on April 28, 1980 to signify that the GDR will de facto join the EEC without following any of the procedures for enlargement

4 Conclusions of the Presidency, Special Summit of Dublin, April 28, 1990

3.2.3.4 First Experiences from Operation PHARE

Before closing the presentation of the Community initiatives which form a completely new set of relations in Europe it is worth making note of two more points.

First, the Council asked, at the Special Summit of Dublin on April 28, 1990 the Commission "to study the implementation of the most appropriate accompanying", to transfers of private capital and investments towards the Central and East European countries, "measures (e.g. reassurance, granting of guarantees)".

This means that the Council recognizes that the major bottleneck in any effort to restructure and develop the economies of these countries is the size of their foreign debt. With such a high indebtedness it is impossible for them to buy the technology required for industrial restructuring and for increasing the extremely low overall productivity of their economies. The only way to surpass this bottle-neck is to attract foreign investment, which carries with it technology and know-how.

This fact should be born in mind during any exercise of developing the cooperation with the Central and East European countries in any sector, energy included.

Second, the Group-24 has recognized the need of Operation PHARE to "strengthen the co-ordination" of its different components (measures projects and actions) "further to achieve synergy and complementarity"*.

This means that the G-24 realize that the "immediate action" approach employed in the first phases of Operation PHARE - and rightly so, due to the emergency character of the situation in 1989 and early 1990 - ought to be replaced by a "structured approach", which guarantees - if properly applied - the maximization of the effectiveness and the total efficiency of the efforts to support the social and economic reforms in Central and East Europe.

3.2.3.5 The European Bank for Reconstruction and Development

Since the very beginning of the Operation PHARE, and especially in view of the extension of coordinated aid to all Central and East European countries, it as realized that significant amounts of capital and investment finances would be required. The estimates of President Delors have been mentioned previously. Such financing capacity could not become easily available through the existing financial institutions. A new institution was badly needed.

The idea of creating an European Bank for Reconstruction and Development (EBRD) was first presented by President Mitterand when addressing the European Parliament on 25 October 1989 as President in exercise of the European Council.

The proposal was discussed at the informal Paris Summit held in November 1989 and the European Council on 8 and 9 December in Strasbourg endorsed the idea, indicating that the Bank's purpose would be to promote productive and competitive investments in the Central and East European countries, to facilitate the transition towards a market-oriented economy and to accelerate the required structural adjustments. The Bank's main task would be to develop the competitive productive sector. The European Council called for negotiations to open in January 1990.

The intergovernmental constitutive conference, in which both the Community as such, represented by the Commission, and the EIB were invited to attend as future shareholders of the Bank, reached agreement by 9 April 1990, except for the location of the Bank's principal office, which finally was agreed to be in London.

According to the Agreement establishing the Bank, the EBRD has been established to help supply the finances required for implementation of the political and economic reforms in the Central and East European countries, with a wide shareholding associating both potential recipient countries and non-Community countries in its capital.

It will operate by making or guaranteeing loans to, and by making or underwriting equity investments in, private sector enterprises for the most part, but also infrastructures and state owned enterprises which are being privatized or operating in a competitive market manner.

Although the bank will not be able to use its own funds for offering concessional finance it will be able to accept and administer special funds provided by shareholders and others.

The Bank's 10 billion ECU capital will be provided initially by forty-two shareholders, i.e. forty countries together with the European Economic Community, as such, and the European Investment Bank, as shown in Table 2. Beside the funds provided by the 30% of the capital which will be paid in, the bank will also be able to make loans or equity investments out of funds borrowed on the capital markets.

The Agreement for the establishment of the EBRD was approved at the Ministerial Meeting of the 42 participating countries on May 29, 1990. Its principal offices of the EBRD was agreed to be in London, UK and Mr. J. Attali was been elected as its first President for a four-year term (for details on the structure and the functions for the EBRD see ANNEX C).

The EBRD operates on a transitional basis, pending the ratification of the Agreement by the competent bodies of the participating countries. The official operation of the Bank is not expected to begin before October 1990.

Table 2: Initial Subscriptions to the Authorities' Capital Stock for Perspective Members of the European Bank for Reconstruction and Development (EBRD)

Countries	Number of Shares (MECU)	Capital Subscription (%)	Percentage of Shareholding
I. EEC Member States			**45.00**
Belgium	22800	228.00	
Denmark	12000	120.00	
France	85175	851.75	
Federal Republic of Germany	85175	851.75	
Greece	6500	65.00	
Ireland	3000	30.00	
Italy 85175	851.75		
Luxembourg	2000	20.00	
Netherlands	24800	248.00	
Portugal	4200	42.00	
Spain34000	340.00		
United Kingdom	85175	851.75	
IIa EEC	**30000**	**300.00**	**3.00**
IIb EEC	**30000**	**300.00**	**3.00**
III Other European Countries			**11.37**
Austria	22800	228.00	
Cyprus	1000	10.00	
Finland	12500	125.00	
Ireland	1000	10.00	
Israel 6500	65.00		
Liechtenstein	200	2.00	
Malta100	1.00		
Norway	12500	125.00	
Sweden	22800	228.00	
Switzerland	22800	228.00	
Turkey	11500	115.00	
IV Receipients Countries			**13.45**
Bulgaria	7900	79.00	
Czechoslovakia	12800	128.00	
German Democratic Republic	15500	155.00	
Hungary	7900	79.00	
Poland	12800	128.00	
Romania	4800	48.00	
USSR	60000	600.00	
Yugoslavia	12800	128.00	

to be continued on next page

Contd.

V Non–European Countries			**24.17**
Australia	10000	100.00	
Canada	34000	340.00	
Egypt	1000	10.00	
Japan85175	851.75		
Korea, Republic of Mexico	6500	65.00	
Morocco	3000	30.00	
New Zealand	1000	10.00	
United States of America	1000	10.00	
100000	10.00		
	1000.00		
VI Non Allocated Shares	**125**	**1.25**	**.01**
Total	**100000**	**10000.00**	**100.00**

The Commission, in the meanwhile, takes the appropriate steps to have the EBRD classed as a "multilateral development bank" under the Solvency Ratio Directive for Credit Institutions. This will facilitate the work of the Bank in borrowing funds by reducing the costs to banks subject to the Directive of investing on obligations issued by the Bank.

3.2.4 Energy in the Emerging Europe

The development of the last twelve months have changed not only the political environment but they have created new grounds for activities in practically all sectors. In fact a number of sectoral programmes and projects are already launched, sometimes without the knowledge of the institutionally competent authorities or services.

It is also true that – since the "immediate action approach" has been followed instead of a more "structured" approach in the development of the ongoing programmes– opportunities for interventions from a number of sectors are not well or widely enough known.

An exercise in the direction of highlighting activities related or offering opportunities to the energy sector is due.

As presented in previous paragraphs Operation PHARE has developed programmes for:

- Environmental protection (for both Hungary and Poland);
- The Regional Environmental Centres in Budapest;
- Basic technical assistance for privatization (for Poland);
- The financial system (for Hungary);
- The cooperation in the field of economics (for both countries);
- Technical assistance for the implementation of TEMPUS (for both countries); and
- Imports for animal feeds and feed additives (for Poland).

In addition, the fields of probable activities in the forthcoming extension of coordinated aid to the rest of the Central and East European countries have been specified to be, according to the proposed Action Plan, in the areas of:

- access to markets;
- food supply;
- training;
- environment; and
- investment and economic restructuring.

The energy sector is already present in programmes that have entered the implementation phase, and it is pretty obvious that will be present in the ones that will be formulated in the near future. It is also obvious that the energy sector has ample opportunities to participate in a number of programmes having a more general character, e.g. in training or technical assistance.

3.2.4.1 The Environmental Protection Programmes

Environmental Protection Programmes have been approved for both Hungary and Poland.

The Environmental Protection programme for Hungary is composed of 22 projects or actions (Table 3) of a total budget of 21.0 MECU with duration until the end of 1991. Out of these 22 projects four refer to the sector of energy with a total budget of 5.88 MECU, while the project for the Thermal Water Resources Study with a budget of 0.4 MECU is also of extreme interest for the energy sector.

Table 3: List of Environmental Projects of PHARE Programme for Hungary

GENERAL	**Million ECU**
Establishment of a Regional Integrating Monitoring (RIM) System	0.11
Protection of Caves and Springs of Budapest	1.00
Establishment of Ferto Lake National Park	1.40
Wetlands and Grasslands Protection Study	0.15
Environmental Education and Training Study	0.25
Environmental Education and Training Exchange Programme	0.25
Sub-total	**3.16**
AIR	
Modernization of the Emission Monitoring Network	1.90
Modernization of the Air Quality Monitoring Network	1.90
Modernization of the Network Registering Background Air Pollution	0.50
Catalyzer Programme	0.50
Sub-total	**4.80**
WATER	
Koros Oxbow Rehabilitation	0.82
Silt Dredging and Reed Harvesting at Lake Batalon & Lake Valence	0.82
Identification and Measurements of Micropollutants	0.82
Modernization of the Hydrological Monitoring System	0.50
Groundwater Pollution Study	0.50
Thermal Water Resources Study	0.40
Sub-total	**3.86**

to be continued on next page

Contd.

WASTE	
Val-Vertesacsa Industrial Ewaste Disposal Project	2.00
Inventory of Groundwater Pollution Sources	1.30
Sub-total	**3.30**
ENERGY	
Study for SO_2 Emission Reduction at 3 Power Stations	0.20
Fluidized Bed Installations at Ajka and Dorog Power Stations	1.35
Geothermal Pilot Project	3.20
Taurus Rubber Energy Savings Project	1.13
Sub-total	**5.88**
TOTAL	21.00

Exchange rates used: ECU 1 = HUF 75.5; US$ 1 = HUF 62; ECU 1 = US$ 1.22

The Environmental Protection Programme for Poland is composed of 11 projects with a total budget of 19.0 MECU. Out of these projects 5 are not ready to be financed and funding is provided for further technical assessment and preparations. The major three projects of the programme, with a total budget of 8.0 MECU are in the energy sector (Table 4).

Table 4: List of Environmental Projects of PHARE Programme for Poland

AIR PROTECTION	Million ECU
Serialized production of flue gas desulphurization for coal fired	1.8
Set-up production of circulating fluidized bed boilers	6.2
Air pollution monitoring	5.0
Sub-total	**13.0**
WATER PROTECTION	
Mine water desalination plant in the Czeczott hard coal mine	--
Cracow waste water treatment plant*	--
"Czaika" Warsaw waste water treatment plant*	--
Sub-total	**2.0**
WASTE MANAGEMENT	
Incineration plant for toxic chemical waste	1.1
Municipal waste incineration, Warsaw*	0.5
Sub-total	**1.6**
NATURE CONSERVATION	
Foundation for the great Mazarian Lakes region	1.8
Warta river foundation*	0.2
Sub-total	**2.0**
Environmental Education and Training	0.4
TOTAL	19.0

* Projects are not included in 1990 programme. Funds shown are provided for technical assessment and project preparation

The specific energy related projects are summarized in the following paragraphs, and detailed information on these projects is presented in Annex A.

a) Hungary: Study for SO_2 Emission Reduction at three Power Stations

The objective of the study is to determine the most appropriate technical and economic manner in which the SO_2 emissions can be effectively reduced, and how the necessary equipment can be best internationally tendered.

The Hungarian Electricity Board (MVMT) is the responsible for the study local organization, under the monitoring of the Ministry of Industry.

The total cost of the study is 0.2 Mecu and it will be financed in total by Operation PHARE on a grant basis.

b) Hungary: Fluidized Bed Installations at Ajka and Dorog Power Stations

The objective of the project is to reduce SO_2 and, to a more limited extend, also NO_X emissions at the two power plants, without reducing their steam generating capacity.

The Electric Power Industry (VEIKI), which has developed the fluidized bed technology, will be the main contractor.

The total cost of the project is 3.7 Mecu, the foreign component of which (1.35 Mecu) will be financed by Operation PHARE on a partial grant basis.

c) Hungary: Geothermal Pilot Project

The objective of the pilot project is to demonstrate the technical feasibility as well as the financial and economic viability of making environmentally sound use of the geothermal water potential of Hungary.

The firm Geo–Thermal Cooperative of Budapest, specializing in this field, has prepared the project and would be responsible for its implementation and long–term monitoring.

The total cost of the project will be 3.20 Mecu, and will be financed by Operation PHARE on a partial grant basis.

d) Hungary: Taurus Rubber Energy Savings Project

The objective of the project is to reduce the specific energy consumption at Taurus' Szeged and Budapest plants. This serves the overall objectives of decreasing air pollution reducing unit costs and thus increasing the competitiveness for the company's products, improving the energy balance of the country and demonstrating that improved energy management applying up–to–date technology is a feasible and economic undertaking.

The project has been prepared and will be implemented by Taurus, and will be monitored by the Ministry of Industry.

The total cost of the project will be 1.93 Mecu, the foreign exchange component of which – amounting to 1.13 Mecu – is included in Operation PHARE on a loan basis.

e) Hungary: Thermal Water Resources Study

The objective of the study is to undertake an assessment of the thermal water potential of the country in order to gain a better understanding of the characteristics of this resource. It serves the general objective of defining the necessary policies and methods for making sustained and environmentally sound use of the country's thermal water.

Execution of the study will be the responsibility of the Research Centre for Water Resources Development (VITUKI), which will also involve in the study those organizations that are presently utilizing thermal waters or are undertaking research and development work. The study will be supervised by the Department of Water Management of the Ministry for the Environment and Water Management (KVW).

Of the total cost of the study of 0.6 Mecu, 0.2 Mecu will be financed by local sources and 0.4 Mecu are included in Operation PHARE on a grant basis.

f) Poland: Serialized Production of Flue Gas Desulphurisation (FGD) Installations for Coal Fired Electrical Power Stations

The objective of the project is to alleviate the SO_2 problem by facilitating the introduction of FGS technology in existing large coal fired stations, which are the main emission sources. The project aims at transferring FGD technology from an EC firm to a Polish firm.

The Polish contractor has not been selected yet.

The total cost of the project is estimated to be 1.80 Mecu. Operation PHARE will finance the foreign component of the project in a grant form and the local expenses in the form of a loan to the Polish manufacturer, repayable in local currency. Local costs will be supported by the Polish manufacturer.

g) Poland: Set Up Production of Circulating Fluidized Bed Boilers (CFBC)

The objective of the project is to reduce SO_2 emissions in Poland by introducing to a Polish firm, with a capacity of 50–350 MWe, the Fluidized Bed Boiler technology for industrial production and the implementation of this technology in medium-scale power stations.

The RAFAKO boiler manufacturer has been selected to be the contractor. Overall responsibility and monitoring of the project will be with the Ministry of Environment, Air Pollution Department.

Operation PHARE will finance the foreign component of the total cost of 6.2 Mecu by a grant and will provide a loan for the local expenses to the Polish manufacturer, repayable in local currency.

h) Poland: Construction of Mine Water Desalination Plant in the CZECZOTT Hard Coal Mine

The objective is to build a desalination plant having a final capacity of 30,000 m^3/day high salt content mine water, based on brine concentration and by evaporation and/or reverse osmosis techniques.

Since no operational solution is available it was decided to carry out a comprehensive study to examine the different options.

A number of bilateral donors to Operation PHARE have already expressed interest. Co-financing may be done either by a direct contribution to Operation PHARE, in which case EEC procedures will have to be followed, or in the form of parallel financing, in which case the donor will be financing a specific object or part of a project, according to its own procedures.

3.2.4.2 The Regional Environment Centre for Central and East Europe in Budapest

The establishment of a Regional Environmental Centre located in Budapest was propose by the President of the USA as a potential major contribution to the improvement of the environmental situation in the region. From the start, the Centre has been presented as a possible multinational venture.

Given the close relationship and interaction existing between environmental issues over Europe, the close relationship of the Budapest Centre and the proposed future Community environmental agency is of interest.

According to the draft charter, established in January 1990 by the US and the Hungarian authorities, the Centre is to be an independent, non-advocacy, non-profit making organization. The Centre may engage in, support and encourage activities in the following areas:

- Data Collection and Dissemination;
- Development of institutional Capability;
- Education; and
- Clearing house: for matching resources from a variety of sources.

According to the draft Charter, the Centre will enter its operation phase by July 1990, and its financing will be based on a tripartite basis according to which the 1/3 of the total estimated cost for the three-year period 1990-1992 of 12.0 Mecu (US$ 15 million) will be provided by the US, 1/3 by Hungary and the remaining 1/3 by other potential donors. The Charter of the Centre, though, is still under negotiation and both the timetable and the financing scheme proposed in the Draft might change.

3.2.4.3 Other Coordinated Aid Activities

Beside the environmental programmes, the Energy Sector has opportunities to become active in programmes of a more general character that have already been launched. Three such cases can be sited at this point.

a) The technical assistance programme for the implementation of the Trans - European Mobility Programme for University Studies (TEMPUS) sets priorities, among others, in the fields of:

   - management;
   - applied economics;
   - applied sciences, technology and engineering; and
   - environmental protection;

   All these fields have strong interconnections to the energy sector. Personnel specialized in these fields is absolutely necessary for restructuring the energy industry and tackling energy problems.

   The programme, within a perspective of five years, will have an initial pilot phase of three years commencing on July 1, 1990 with a total budget higher than 20 MECU.

b. The programme for the cooperation in the field of economics, also, offers possibilities to the energy sector. This is more so given the inadequacy of the energy economists in the Central and East European countries experienced in and capable to deal with the problems of the market-oriented economy.

   The cooperation between economists from these countries and Western energy experts will become necessary if appropriate energy planning practices and policies are to be effectively introduced in the Central and East European countries and if energy is to be considered a critical factor of production in macro, as well as, in micro economic planning.

c. Finally, the USA has pledged 27 MECU equivalent for cooperation in the energy sector and many other members of Group 24 have indicated their interest to finance coordinated aid programmes in various fields related to industry (see Annex B). Thus, it becomes evident that in the framework of Group-24 financing can be solicited, if interesting ideas and programmes are formulated. And, this is a challenge for the European energy sector.

3.2.4.4 The Activities of the Directorate for Energy of the CEC (DG XVII)

The Directorate for Energy of the Commission of the European Communities has become active in the common effort towards the emerging New Europe. The commissioning of this very study is a proof of the concern and the interest of DG XVII in the energy related problems of the new European and International order. It is also a proof of its will to formulate a well structured policy for tackling these new problems, based on coherent, effective, efficient and integrated programmes.

While this study has been prepared, DG XVII established contacts with the energy authorities of the Central and East European countries and exchanged views on their problems and the existing or foreseeable cooperation possibilities. To this effect, high ranking officials of the Directorate for Energy have already visited all these countries, and energy experts and government officials from the Central and East European countries have been invited to Brussels for discussions with the staff of the Directorate.

These contacts seem to have been more advanced with Hungary, for which four areas of potential cooperation have already been identified. They are:

a) the establishment of market-oriented energy policy;

b) the assessment of "third party financing" activities in Hungary;

c) the conduct of energy audits in a number of Hungarian food industries; and

d) the organization of seminars and other training activities.

The first consultations with the Hungarian authorities proved that the cooperation in the field of energy audits for certain food industries could be put immediately in effect, pending the formulation of a global framework of bilateral cooperation between the EEC and Hungary. On these grounds DG XVII tendered a survey on the energy use in four sectors of the Hungarian food industry, in cooperation with the Energy Efficiency Office (EEO) of Budapest. These four sectors are:

- meat processing;
- poultry processing;
- brewery; and
- food preservation.

For each of these priority sectors an energy audit will be carried out in two or three different representative industries selected in agreement with the EEO. The audits include also a training and technology transfer component, according to which a number of Hungarian will be introduced to EEC new technologies and their use in EEC factories.

The Directorate for Energy is also extremely active in the negotiations, both in the framework of the Group 24 and with the Hungarian authorities, for the establishment of the Regional Environmental Centre in Budapest, and especially with reference to its part related to energy.

The consultations with the Polish authorities on possible cooperation are also quite advanced, while discussions have already started with Yugoslavia, the German Democratic Republic and Czechoslovakia, in view of the extension of Operation PHARE to the rest Central and East European countries.

The CMEA was formed in January 1949, as a response to the Marshal Plan, by USSR, Bulgaria, Czechoslovakia, Hungary, Poland and Romania. Albania joined in Feb. 1949 to withdraw in 1961. The GDR became a member in 1950 and Mongolia in 1962. Cuba and Viet-Nam joined later in 1972. The CMEA, unlike the EEC, had no supranational powers. It acted as coordinator and broker for its members countries. Its task has been to coordinate the national plans of its members, to produce technical and scientific standards and norms and has played an important role in industrial specialization and internal division of labour distributing production tasks to its members in order to avoid duplication. With the exception of Finland, CMEA has not signed trade agreements with major trading partners

3.3 The Cooperation Experiences of the Central & East European Countries

The experiences of the Central and East European countries, with the exception of the USSR, in international energy cooperation have developed mainly in the framework of their membership to the CMEA. It is only during the last decade or two that their presence in the broader international scene has become visible. Even the trade of energy products has been largely limited to within the CMEA.

3.3.1 The Cooperation Among the Central and East European Countries

The cooperation among the Central and East European countries has been to a large extend restricted to the trade of primary and final energy products. Few activities in the areas of energy resource exploration and technology transfer are reported.

3.3.1.1 Oil Trade

The USSR is the main oil producer of the Central and East European countries and one of the major oil producers in the world. With the exception of Romania, all the rest of these countries rely heavily on Soviet oil (Table 1). Romania, being a major oil producer, has been the least dependent; but since 1986 it was permitted to increase its imports from the Soviet Union. Therefore, all of the Central and East European countries now meet at least 84 % of their needs with either indigenous or Soviet oil (Table 5).

Table 5: Oil Imports of the East European Countries from the Soviet Union (mt)

	1984	1985	1986	1986 % Soviet oil in imports	1986 % cover of needs with Soviet oil plus indigenous production
Bulgaria	13.4	13.9	13.6	70	84
Czechoslovakia	16.4	16.4	16.4	91	102
GDR	17.3	17.3	17.4	75	102
Hungary	8.2	8.0	8.3	92	120
Poland	15.2	15.0	15.1	85	87
Romania	1.0	2.4	6.3	31	93

Source: PlanEcon

Almost half Soviet oil exports are oriented towards the other Central and East European countries (Table 6). They are based on either preferential or barter basis. Crude export prices to these countries are based on a "sliding scale system" calculated on a "moving five year price average", which was established to protect those countries against major fluctuations/increases in the world oil prices. This has been useful for them to keep a better balanced trade relationship with the Soviet Union. However, with the present low oil prices the "sliding scale system" has proved disadvantageous for the oil bills of the East European countries, as for a certain period it incorporated the higher oil prices of previous periods. Yugoslavia pays world market prices, but on a barter or transferable rouble basis.

Table 6: 1986 Soviet Oil Trade (mt)

Trading Partner	Crude Exports	Products Exports	Crude Imports	Products Imports	Net Exports
Six Central & East European countries	70.8	6.2	--	0.4	79.6
OECD	42.9	33.1	--	0.7	75.3
Other CPEs	14.2	8.7	--	--	22.9
LDCs	7.2	2.3	20.3	--	-10.8
	135.1	50.3	20.3	1.1	164.0

Source: PlanEcon

Romania became a net oil importer in 1975. Owing to its historically more distant relationship with the Soviet Union and its relatively large domestic oil base, Romania has a more diversified mix of crude suppliers than other Central and East European countries. Crude imports from the Soviet Union have declined from 6.3 Mmt in 1986 to 4.7 Mmt in 1987. A large part has to be paid for on the basis of world market prices and in hard currency.

The German Democratic Republic is almost 100 % dependent on foreign oil. In 1987 the country imported 22 mt of crude oil and used only 17 mt at best. The Soviet Union, as the prime crude oil source (in 1987 78 % of supplies) has cut back her deliveries from 19 mt in 1980 to 17.1 mt for all years after 1983 and up to 1990. Over the long run further reductions are likely. Most of the Soviet crude oil comes through the Friendship pipeline. It was built in the early 1960s and runs over 5000 km from Western Siberia to the GDR–Polish border and from there directly into the two refineries at Schwedt and Leuna.

Additional crude oil supply comes from unspecified sources (probably Iran, Iraq, Libya, Syria and–indirectly–the Federal Republic of Germany), and has been declining slowly since 1985. The amounts correspond closely to the size of the product exports.

Czechoslovakia's oil imports come almost exclusively from the Soviet Union. They reached a peak of 19.3 million tons in 1980 and since then have gradually declined – to 17.8 mt in 1986. In concert with Soviet oil and gas exports plans, Czechoslovakia's oil imports are optimistically planned to come down to 14 mt by 1990. If this were achieved at current prices for oil this would mean a saving of 7.2 billion crowns in payments to the USSR. On the other hand, the smaller planned quantity of additional but cheaper gas purchases would only cost 4.1 billion crowns. Therefore if plans materialized under relatively stable oil and gas prices, the chronic balance of payments deficit which Czechoslovakia runs with the Soviet Union (3.8 billion crowns in 1986) could largely disappear. But substantial achievement of the goal of reduced oil imports would also force a reduction in hard currency earnings from refined product exports, and also prevent gas from substituting instead for high–cost indigenous coal.

Poland relies heavily on the Soviet Union for its energy import needs, which are mainly oil. Poland's high dependence on Soviet oil is balanced in part on a bilateral basis by Polish coal exports to the Soviet Union. This reduces the amount of foreign currency it can earn for its coal exports, and which is needed for its imports of foodstuffs and technology from the West. The lack of foreign exchange in turn aggravates its debt situation, which remains one of the main reasons for its economic difficulties.

Poland imports of crude oil from the Soviet Union have since 1977 averaged 12.9 million tons per annum, and meet over 90 % of its crude import needs. The Soviet Union also supplies about two–thirds of Polish product imports.

3.3.1.2 Natural Gas Trade

In the gas sector the USSR is again the main producer and exporter to the rest Central and Eastern countries. Soviet gas exports to these countries are constantly increasing. The increase was of the order of 10 % – 15 % in volume between 1986 and 1987 (Table 7). It is interesting that the ruble price is higher for these countries as compared to prices of exports to the West, although some of the former participated in the cost of the gas pipelines from Siberia to the western border of the USSR. In the 70's part of the gas exported by the USSR was of Iranian origin.

In total Soviet gas exports to the Central and East European countries covers almost 7 % of their TPER, with Bulgaria (12 %), Hungary and Czechoslovakia (11 %) at the top.

Table 7: Volumes & Prices of Soviet Gas Exports

Country	1986 Volume (bcm)	1986 Price (fob) (R/th cbm)	1987 Volume (bcm)	1987 Price (fob) (R/th cbm)
Bulgaria	5.1	120.1	6.1	108.9
Hungary	4.1	116.8	4.8	106.1
Romania	2.5	120.4	3.3	109.4
Poland	7.1	120.0	7.5	110.5
CSFR	10.2	124.3	10.6	110.6
GDR	7.0	119.9	7.0	109.9
Total Central and East European Countries	37.2	--	39.3	--
FRG	15.0	83.0	16.9	47.8
Italy	8.0	51.0	8.6	39.0

Source: IEA

Romania, traditionally self–sufficient in natural gas, became dependent since 1987 on Soviet gas imports. These imports have been continuously increasing as the domestic production declined. It is for this reason, and on the basis of the anticipated increase of the demand of Soviet natural gas for Greece and Turkey by 1992, that Romania participated in the construction of the new trunk lines, in exchange for natural gas at concessionary prices.

The German Democratic Republic is importing Soviet gas via the 5000 km Brotherhood pipeline from Western Siberia and the 2750 km Union pipeline from Orenburg in the Urals. Between 1980 and 1986 the imports have only risen from 6.4 bcm per year to 7 bcm or 9 % (implying little RFO substitution). Soviet gas exports to the Central and East European countries have increased during the same period from 30 bcm to 40 bcm or by 33 % and exports to the West from 25 bcm to 42 bcm or by 68 %. The imports may increase more rapidly once the new Progress Pipeline is finished in 1989. During the 1980–85 5–year–plan the six Central and East European countries had the obligation to build 2600 km of gas pipeline including 55 compressor stations from Western Siberia to the western border of the Soviet Union. The total cost is estimated to be 3 billion rubles. The GDR has participated with a share of 855 million rubles (29 %).

Czechoslovakia covers 93 % of its consumption requirements in natural gas from Soviet imports, that are expected to increase by 40 %, from about 9 bcm in 1985 to an expected 12.6 bcm for 1990.

Since 1973 Czechoslovakia has served as a transit country for Soviet gas deliveries to West European countries. One trunk line crosses its Austrian border and another one is going to cross its German border. The latter (from the Soviet border town of Ushgorod to the German border town of Waidhaus) has become operational in 1989. The first 56 inch pipeline runs over 867 km of Czech territory. Both systems together are designed to cope with 73 bcm of annual throughput.

At the same time, Czech construction teams have completed their share of the 4600 km Progress pipeline on Soviet territory, which is supplying extra gas to East Europe as of 1989. The Czech share of 360 km is estimated to have costed about 895 million convertible rubles, including ancillary technical equipment and compressor stations.

Poland is importing almost 50 % of its consumption requirements in gas from the USSR. The planned increase in gas imports will come mainly from the Soviet Union, as the new pipeline, connecting Warsaw to the main natural gas network (Siyanie Severa) of the Soviet Union, has become operational. It has a capacity of 4 bcm/yr and the gas supplied through it is utilized mainly for fertilizer feedstocks and households. It is foreseen that Poland will also receive better terms for its increased imports through the technical assistance it is providing for the construction of gas pipelines in the Soviet Union. To enable seasonal demand peaks to be met, an underground reservoir near Lodz, at the south west of Warsaw, will be utilized.

3.3.1.3 Coal Trade

The USSR is a major coal exporter. Although specific data on the coal trade between the Central and East European countries are not available, almost 75 % of the Soviet coal exports are directed to them.

The German Democratic Republic is one of the main Soviet coal importer since the end of the 70's, when it stopped mining domestic hard coal. The coking coal and coke needed for domestic steel plants are imported from the Soviet Union, Poland and Czechoslovakia. These imports have risen from 5.4 mt in 1984 to an estimated 10 mt in 1987. Some of the extra amounts may have been used in power plants to cover the shortfall in domestic brown coal production. Although coal imports represent only about 10 % the of total coal consumption in terms of heat value, they along with additional Soviet gas are expected to be balancing fuels as the gap between energy production and demand widens in the future.

Romanian coal imports mainly from the USSR and other Central and East European countries have increased significantly since 1975 (from the USSR 1975: 635 thmt, 1987:2448 thmt; in total: 1875: 2420 thmt, 1987: 7850 thmt). Most of these imports consisted of coking coal for the steel industry.

3.3.1.4 Electricity Trade

The electricity networks of the Central and East European countries are to a considerable extent interconnected with the trade of electricity is small in volume due to the rigidities of their transformation capacity.

Electricity exports from the USSR amount for only 20 % of its total production. Hungary imports 30 % of these exports. Romania imports of Soviet electricity have more than doubled in the period 1985 (2000 GWh) to 1987 (4294 GWh) as against approximately 5000 GWh of total Romanian imports. Relatively limited exports of electricity are directed to Poland through a link across its southern border. This connection also extends over 750 kms to a 4000 MW Soviet nuclear power plant under construction in Khmelnitskii in the Western Ukraine. Imports from the Soviet Union are expected to increase by about 1000 MWh upon completion of this plant, which is being constructed with Polish technical assistance.

3.3.1.5 Technical Cooperation

Technology for exploration and exploitation of energy resources remains a bottle–neck in the energy system of the Central and East European countries, including the USSR. In view of high prices, currency constraints and strategic barriers for obtaining western technology they have developed specialization in different medium technology sectors and subsectors and have supplied equipment, know–how, training and skilled manpower for energy projects. After all, as explained in the previous chapter, the "industrial specialization" and the internal "division of labour" have been two of the major responsibilities of the CMEA, to which they have been members for the last four decades. Thus, although, these projects cannot be considered "joint ventures", they are a form of cooperation specific to the state controlled economies.

In this category of technical cooperation fall a number of projects such as:

a) the construction of the major Soviet gas trunk pipelines;

b) offshore exploration projects in the Black Sea (with Bulgaria and Romania) and in the Baltic Sea (with GDR and Poland);

c) the construction of nuclear power plants using Soviet Technology (Bulgaria)

d) the construction of a hydropower station on the Danube, the Gabcikovo–Nagymaros project (Hungarian participation with Austrian financial help);

e) the offshore oil production operations in the Baltic Sea by a Polish–Soviet–East German consortium; and

f) thermal power plant equipment supply from USSR, GDR, Czechoslovakia and Poland.

3.3.2 The Cooperation between the Central and East European Countries and the EEC Member States

The CMEA and its Member States, as presented previously, have only recently recognized formally the European Communities. For this reason there have been no relationships between them. Yet, the Member States of the two Organizations have had extensive trade relations that were intensifying as the political climate was relaxing in the last decades. In recent years the cooperation between East and West expanded into the domain of technology and know-how transfer as well as the trade of equipment, although with certain constraints of strategic nature.

The major part of the cooperation between EEC and Central and East European countries, whether for trade or technology, was on the western side conducted through the private sector (oil and gas companies and construction or consulting firms), within the framework of bilateral cooperation protocols. On the other side the counterparts were State Services or Committees and state controlled companies.

3.3.2.1 Oil Trade

The USSR is one of the main oil producing and exporting countries of the world. About one third of the Soviet crude and approximately half of product exports go the western (OECD) countries.

The FRG is the principal importer of naphtha, (with 2089 thmt in 1986), followed by the Netherlands, (with 1263 thmt). The Netherlands are the principal importers of diesel and residual fuel oil (4629 thmt and 2424 thmt respectively in 1986), followed by the FRG (3080 thmt and 1492 thmt, respectively). Finally, Italy is the principal importer of refinery feedstocks, and crude natural gas liquids (with imports of 3202 thmt, and 10030 thmt respectively in 1986). These three countries are also the principal importers of total Soviet oil in the EEC, which in 1986 reached 56150 thmt.

Table 8 summarizes the dependency of the EEC Member States on Soviet oil and oil products, from which it is can be observed that the dependency of:

- the Netherlands and U.K. for diesel; and
- Belgium and Denmark for refinery feedstocks

on imports from the USSR exceeds the 40 % level.

Table 8: Dependency of the EEC Member States on Soviet Oil and Oil Product Exports (1986) (percentages)

Country	Diesel	Total Oil Products	Oil Refinery Feed-stocks	Crude NGL, and Feed-stocks	Total Oil
Belgium	20.2	7.9	77.1	17.5	14.4
Denmark	7.7	3.4	87.8	17.2	9.7
France	14.0	11.3	17.2	8.7	9.3
FRG	11.9	12.6	0.0	5.7	8.8
Greece	14.8	10.4	14.1	14.5	14.0
Ireland	5.7	2.0	0.0	0.0	1.4
Italy	11.7	5.2	31.1	12.2	11.1
Luxembourg	0.0	0.0	0.0	0.0	0.0
Netherlands	35.9	23.5	0.0	2.0	11.9
Portugal	0.0	0.0	00.0	2.3	1.9
Spain	18.3	11.2	7.7	0.8	1.6
United Kingdom	44.6	13.5	16.8	8.7	9.7

Source: OECD

All USSR oil exports to the EEC countries are at world market prices, and constitute a major portion of the hard currency earnings of the Soviet Union.

Romania has stopped, since 1980, its export refining programme in an all out effort to increase its hard currency earnings which led to the almost full repayment of its foreign debt. This programme made Romania particularly active in the Western refined products markets, with total exports of oil products rising from 4.8 Mmt in 1975 to 8.7 Mmt in 1988, while only 16 Mmt of refinery output was consumed in the country (1987). Principal importer of Romanian oil products among the EEC Member States is Italy.

The German Democratic Republic is also exporting refined oil products. Its export refining activity has two goals: first to earn hard currency; and, second, to dispose of heavy products which the domestic refineries can not avoid producing. The Federal Republic of Germany is, with about 2.5 mt, the major client for the product exports, of which the major portion goes to West Berlin, in the effort of the Federal Republic of Germany to find an economically efficient way of supplying West Berlin by making sufficient crude available to the GDR for processing (apparently Soviet crude).

Bulgaria has also been reported to export oil products to EEC member countries, mainly to the FRG. This export activity is again related to, its efforts to earn hard currency, yet exact data are not available.

3.3.2.2 Gas Trade

The USSR is the main natural gas supplier of the EEC Member States. Its proven recoverable gas reserves are estimated at about 38.000 bcm. The production of Soviet gas reached 727 bcm (as 588 mtoe) in 1987, 83.1 bcm of which was exported. Almost half (34.4 bcm) of these exports go to EEC Member States.

The Soviet policy of oil substitution by gas in its domestic market is closely related to its effort to increase gas exports to the Western markets. The Progress pipeline which is built in conjunction with other Central and East European countries links the West Sibirian gas fields directly with the East and the Western export markets. Another export pipeline to south-eastern Europe is also under construction. Through this pipeline exports to Turkey will reach 3.2 bcm/year by 1990, while the leg to Greece – which is planned to be completed by 1992 – is expected to lead to additional exports of 2.0 bcm/year in 2002 starting from 1.0 bcm/year in 1993.

3.3.2.3 Coal Trade

Coal deliveries from the USSR to EEC countries has always been limited. A slight rise in recent years (coking coal from 0.1 mt in 1981 to 0.9 mt in 1986 and steam coal from 0.1 mt in 1981 to 0.5 Mt in 1986) can be attributed to the pricing policies in the Soviet Union, which set prices at about 10 % below world market prices for comparable qualities.

Poland is the fourth coal producing country in the world, while it is the third major coal exporter. Almost 22 % of Polish hard coal is exported, 58 % of which to Western countries. France, the FRG and Italy are the first EEC importers, with approximately 2 mt each annually. The previous Polish regime has been speeding up coal production, since the 1981 sharp decrease of production and exports, in its effort to increase the foreign currency earnings.

The only other Central and East European country reported to export coal to the West in recent nears is Czechoslovakia. Its total exporting activity, through, is very small ranging from 0,2 to 1.2 mt per annum.

3.3.2.4 Electricity Trade

The electricity grids of the Central and East European countries are not connected to the Western grids. Thus, until now there have not been any trade exchanges for electricity. Even West Berlin has been meeting its total electric power demand with local production, based mainly on coal.

Cooperation though in this field is expected to begin in the very near future. The first step has been made by the 1987 agreement between the two Germanies to link their power systems by 1990/91. Through a 380 kV line the Western company Preussen Elektra will provide some 1 TWh yearly to West Berlin and the German Democratic Republic. Of course, the reunification of the two Germanies will speed up the process.

3.3.2.5 Technical Cooperation

Until 1985 the cooperation between the Central and East European and the Western countries in the overall energy sector was, for all practical purposes, limited to trade exchanges. No direct technical and financial cooperation had developed, with the exception of the cooperation in the framework of International Organizations, which will be discussed in following paragraphs.

Mr. Gorbachev, making an important change from the policies of his predecessors, has been trying for the last five years to open up the Soviet energy industry to some foreign technological and financial cooperation through joint ventures, risk and profit – sharing arrangements etc. However, despite some western willingness to participate, in financial, technological, and management etc. aspects of Soviet energy projects, "joint ventures" still remain a concept requiring further exploration and negotiation. Especially since Western companies see their purpose as exploiting and selling Soviet energy resources wherever it is profitable (inside or outside the Soviet Union), whereas the Soviets regard the "joint ventures" as investments within their territory gauged to exports that will bring in hard currency. The Soviets' attitude to offshore oil drilling activities, however, appears to be more akin to "western style" joint ventures, as their technology in this field is much less sophisticated as compared to their onshore oil activities. This has resulted in several arrangements with the Nordic countries for acquiring offshore drilling vessels and equipment for use in the Barents Sea. Similarly, some US companies have also shown interest in joint ventures with the Soviets in their northern offshore areas. The Occidental Petroleum Corp. received in early 1987 a joint venture proposal from the Soviets for developing an oil field in the Soviet Arctic Territory in Arkhangelsk. The proposed arrangements provide for know-how, equipment and technology from the Occidental side, under a Soviet joint venture law which was established in 1986 giving foreign companies the right to own up to a 49 % share in the joint venture, while the rest stays with the Soviet government.

Since the Soviet legislation on joint ventures was promulgated in 1986, 14 contracts have been signed in energy related manufacturing and service sectors with EEC companies or consortia in which EEC companies participate. This type of cooperation has developed for the biggest energy ventures of all i.e. the petrochemical complex being built by Occidental, Montedison, Enichem and Marubeni near the Tengniz oil field. It is considered that the energy sector offers good long term prospects for joint ventures, because it is a capital intensive sector, where western partners are not obliged to battle with stifling Soviet labour laws and management styles. However this will not happen over night. In the period up to 1990 the total outlays for joint ventures is not expected to exceed 2 billion dollars.

These contracts are:

a) in the oil, gas and petrochemicals subsectors

- the petrochemical complex "Tenghiz Polymer" near the new Tenghiz oil and gas field by the Caspian, by a Western Consortium, in which two Italian companies participate;

- the corrosion monitoring system for the Tenghiz gas field development, awarded to a British concern;

- the construction of a polypropylene plant in Budnovsk, by a British company;

- an ethylene glycol and ethylene oxide plant, by a Western German company;

- the construction of a new refinery near the Tenghiz oil field, by a consortium in which companies from France and the FRG participate;
- the upgrading of the Omsk refinery, by a French company;
- the upgrading of the Ufa refinery, by a French company; and
- the construction of an MTBE plant for gasoline blending components in Lithuania, by an Italian Company.

b) in the coal subsector

- technical information exchange on development of underground and open cast coal mining technology, in cooperation with a French concern; and
- coal slurry feasibility study for 1800 km^2 in Siberia, conducted by an Italian company.

c) in the nuclear energy subsector

- technical cooperation on fast breeders technology, with France;
- nuclear technology cooperation, with the Federal Republic of Germany; and
- two high temperature nuclear reactor technology cooperation agreements, with the FRG, for stations of 100 MW and 200–250 MW, respectively.

Beside technical cooperation projects of EEC concerns on Soviet soil, the Soviets have signed a contract for the construction of an extension of the Bulgarian gas trunk pipeline in Greece. The pipeline, 700 km long, is expected to be operational by 1993, with a capacity of 2 bcm/year.

3.3.2.6 Cooperation in Environmental Energy Issues

The fact that most of the Central and East European countries share borders with EEC Member States has made them share environmental concerns related to energy. The priority given to such issues, by the EEC created a new field in which cooperation could be established.

It has to be observed, though, that the Central and East European countries were very slow in responding to pressures from the Western Countries concerning the Environment. The lack of sensitivity of the Eastern regimes to popular pressures and their preoccupation with economic, social and political difficulties during the last decade, gave rather low priority to the environmental problem. It is characteristic that their first positive response to pressures concerning the Environment were made in the framework of their participation in international organizations, rather than as a response to repeated invitations from bordering countries.

This is why in 1987, two years after the 1985 UN/ECE Helsinki resolution for the reduction of the 1980 sulfurdioxide emissions by 30 % by 1993, the German Democratic Republic concluded a bilateral agreement with the Federal Republic of Germany on environmental cooperation. It provides an agenda of expert meetings on technical questions and experiences.

The same year the Federal Republic of Germany managed to sign another environmental agreement with Czechoslovakia, whose air pollution is considered to be one of the major sources of acid rain imported into the FRG. It provided for cooperation for the reduction of emissions from power stations. Under its present form the activities included in the agreement are limited to exchange of information on national experiences and data and to the development of recommendations in this area.

3.3.3 The Cooperation of the Central and East European Countries with other Countries

Energy being of strategic importance, has been a sector of economic and technical activity closely related to foreign policy. The Central and East European countries – and especially, but not only, the Soviet Union – have dealt with energy in their foreign relations aiming both at increasing their sphere of influence and at blocking or making difficult the access of their antagonists to the world energy resources. In this context and within the range of their technological and financial capabilities the Central and East European countries developed cooperation in the energy sector with a number of Third World Countries, whether in the form of aid or in the domain of trade.

In recent years, though, as the international tensions relaxed and their technological distance from the other industrialized nations increased, the Central and East European countries realized that they had to develop closer cooperation with the technologically advanced countries, such as the U.S.A. and Japan, as well.

3.3.3.1 Trade of Energy Products with Third World Countries

The Central and East European countries possess significant energy resources; yet they are not self-sufficient in energy. For this reason they have developed extensive trade relations with oil producing Third World Countries. Furthermore, they are exporting energy products to other Third World countries, in order to expand or consolidate their sphere of influence.

Not all energy trade agreements signed by Eastern countries become known; nor the details of the known are public. Most of them are long term and – if not exclusively – they contain counter-trade provisions. Typical examples are:

- the 20-year cooperation agreement between Bulgaria and Iran for imports of 1 bcm/year Iranian gas (through the reopening of the Irano-soviet gas pipeline, at least part of which will be repaid by Bulgarian chemicals and oil and gas processing equipment and know-how);

- the oil trading contracts between Bulgaria and the Soviet Union for imports from Iran, Iraq, Libya and Algeria;

- the long term contracts for the supply of 2-4 bcm of Iranian gas per year to Czechoslovakia; and

- the Soviet oil imports mainly from Libya, Iraq and Saudi Arabia, as well as from Algeria, Iran and Syria for smaller quantities.

Many of these trade agreements are cleared on an oil or gas for armaments basis. Officially some of these deals may be declared to be crude for product swaps. This was the case for an agreement of the USSR with Iran to import 0.1 mbd of crude. This type of trade has been a significant element in maintaining Soviet export earnings from oil, as the Middle East crude which has been acquired is normally reexported to European markets without ever touching Soviet soil.

In the period 1978–1986 the Soviet oil imports from Third World countries more than doubled, reaching the 3.3 % of total oil domestic production (Table 9).

Table 9: Soviet Oil Imports from Developing Countries (.000 barrels per day)

	1978	1979	1980	1981	1982	1983	1984	1985	1986
Total	168	135	76	86	153	245	290	261	406
Middle East	128	76	36	0	2	46	77	65	85
Iraq	31	59	34	34	119	118	125	96	180
Libya	0	0	0	45	18	44	25	15	2
Iran	0	0	0	0	0	21	38	48	56
Saudi Arabia	0	1	5	6	14	15	10	9	19
Algeria	0	0	1	1	0	0	15	29	64

Source: IEA

Occasional contacts are also maintained between the Central and East European countries (mainly the USSR) and OPEC. During the last years (1986 on) OPEC has repeatedly asked the USSR to reduce its oil exports to Western Europe, so that OPEC agreements on oil prices are supported.

The Soviet Union has been importing natural gas from Afghanistan since the 1960s, and from Iran from 1970 to 1980. The Afghani supply, of about 2.4 bcm annually, exceeded the 80 % of the total Afghani production. The Iranian supply of associated natural gas was delivered through the 42–inch 1120 km IGAT–1 line, which had a total capacity of 16.5 bcm annually, ten bcm of which were designated for exports to the Soviet Union. The Soviet Union used Iranian gas to supply its southern republics, in order to be able to switch Soviet gas for export to Western and East Europe. Iranian exports were halved in 1979, and the contract was suspended in April 1980 over the Iranian demand for higher prices.

Imports of 17 bcm annually of non–associated gas from Iran were also planned through the 56–inch IGAT–2 pipeline system. In exchange for this the Soviet Union planned to export 14.6 bcm of Iranian gas to Western and East Europe. This plan was cancelled after the Iranian revolution; however Iran did complete the 588 km southern leg of the pipeline for internal sales purposes.

Negotiations between Iran and the Soviet Union reopened in early 1986 regarding the possible resumption of gas deliveries, either through IGAT–1 or by completing the northern leg of IGAT–2, in an effort of the USSR to reverse the trends of gas import decline since 1977 (Table 10), and to promote its policy to substitute for oil. There has also been talk of converting IGAT–1 to an oil pipeline, which proved infeasible as the bulk of it is in use for internal gas sales. It is probable that Iran, with the second biggest gas reserves in the world after the Soviet Union, will eventually wish to expand its gas exports too. Exports to the Soviet Union, for possible re–export to third parties, will be a part of the Soviet attempts to strengthen its policy to substitute for oil.

Table 10: Soviet Gas Imports (bcm)

	1970	1975	1977	1978	1979	1980	1983	1986
from:								
Afghanistan	2.59	2.85	2.37	2.45	2.45	2.74	2.28	2.40
Iran	0.97	9.56	9.26	7.25	4.36	0.22	--	--
Total	**3.56**	**12.41**	**11.63**	**9.70**	**6.81**	**2.96**	**2.28**	**2.40**

Source: IEA

Soviet exports of oil and oil products to Third World Countries are generally billed on a barter basis for commodities imported in return. Most of these exports are directed to countries in Africa, Central and South America, and India.

Soviet exports to Yugoslavia are mainly crude oil, constituting a significant part of that country's energy requirements, which rely heavily on petroleum imports. Soviet oil exports to Yugoslavia have increased considerably during recent years due to hard currency difficulties of the latter. Soviet oil exports by Yugoslavia which were at a range of 5 mt in the early 1980's now appear to have risen to 7 mt. It is most probable that they largely comprise of re-exports of Middle East (e.g. Iraqi) oil obtained by the Soviet Union.

There are also some minor Soviet electricity exports to Finland and Turkey. Finland has been being electric power for some time in the past. In 1988, in the hope of consolidating electricity trade, the Soviets have offered long term contracts to the Finish at very attractive prices (starting at 0.10 - 0.20 marka/kWh or $ 0.025 - 0.05/KWh and rising with time to almost double in a ten years period). Turkey has already contracted 600 GWh/year for the next 10 years at prices indexed to international energy cost indices.

Oil imports from Third World Countries are part of the trade of almost all other Central and East European countries, either for domestic use or for re-exportation of refined products. Romania's oil imports, mainly from Iran and Iraq, almost tripled between 1975 (4.5 mt) and 1987 (14.5 mt). Bulgaria imports only 2.2 mt from the Middle East. This amounts to 16 % of its total oil imports, which covers its exports to the West.

3.3.3.2 Technical Cooperation with and Aid to the Third World Countries

The non-trade cooperation of the Central and East European countries and the Third World Countries has mainly the form of Development Aid.

The volume of development aid from these countries in 1988 was estimated to be of the order of $ 4.7 billion, with the USSR providing almost 90 % of it ($ 4.2 billion). The GDR, Czechoslovakia and Bulgaria provided the remaining 10 % or $ 0.5 billion. The aid figures given by these countries in various UN fora are much higher, due to the fact that they include forms of cooperation that are difficult to quantify. Growing budget deficits, combined with changing internal priorities relating to the restructuring of their economies have limited over the last couple of years the resources available for international aid.

On the other hand the new Soviet approach to international economic and political relations increased the attention paid by the USSR to regional cooperation and organizations. In order to integrate more closely its economy into the international system and to enhance the efficiency of its aid programme, the Soviet Union has started showing greater interest in and support for multilateral organizations and aid coordination (as opposed to its clear previous preference to bilateral agreements). As an example of this change in attitude, the USSR participated for the first time in May 1989 in a joint World Bank–UNDP chaired meeting of aid donors to Guinea Bissau, a recipient of direct Soviet aid until then. The USSR officially stated its intention to attend similar meetings in the future and to participate in local aid coordination while it might envisage cofinancing arrangements with the World Bank and other bilateral donors. These developments mark an impressive change of attitude of the USSR and the other Central and East European countries towards the cooperation with Third World Countries in development aid, which includes cooperation in the energy sector.

A large amount of aid from the Central and East European countries is directed to non–European countries with planned economies. In most cases large trade deficits of the aid recipient countries are converted to long–term low–interest credit and are eventually written off altogether.

More specific to the energy sector, the USSR has pledged before the recent elections to continue providing 60 % of Nicaragua's needs for oil and oil products in the form of aid. India, being the largest recipient of Soviet aid, received in 1988 a large frame of credit ($ 5.2 billion) at relatively soft terms (53 % grant element) for the construction of two nuclear power stations and a thermal power station. Egypt received Rb 1.5 billion of aid out of which $ 140 million were earmarked for a power plant. Mozambique, received a $ 28 million loan for the purchase of petroleum products.

Recipients of Soviet aid have also been, on the old style bilateral basis, many other Third World Countries like Angola, Ethiopia, Yemen, A.R. Zambia, Afghanistan, Peru, Tanzania, Morocco, Cuba, Mongolia, Viet Nam, North Korea, Laos, China, Brazil, Guinea Bissau, and Mali. The credits extended to these countries included – in most cases – energy products or was used to cover imports of Soviet energy products (mainly oil) at concessionary prices.

The Soviets have developed limited technical cooperation with Third World Countries either as part of the development aid extended to these countries or on a contractual basis with unknown financial arrangements. Such cooperation is established mainly with African, Asian and Central American countries. Oil exploration activities in Angola and Cuba depend heavily on Soviet know–how, expertise and equipment, rather on an aid basis.

Oil exploration contracts have been signed with Yemen and Iran, most probably on oil exchange basis.

Soviet mining know–how and equipment for the Heilong Jiang and four 300 MW thermal power stations were built on credit in Yinkon and Nanjing, in the People's Republic of China.

It should be, finally, noticed that certain Soviet energy exports to Third World countries have to be considered as indirect aid to the recipients. Some 80.000 bd of crude and products exported in 1986 to Mongolia and Viet Nam on a long term credit basis, can be sited as an example. Some oil exports to Cuba on a sugar for oil barter basis are sold in Western European markets on behalf of the Cubans to provide them with hard currency.

From the other Central and East European countries, the German Democratic Republic, Czechoslovakia, Bulgaria and Poland (up until recently) have been active in cooperation with Third World countries in the form of aid programmes of concessionary counter-trade agreements.

Poland is reported to have exported coal preparation plants. Seventeen such plants have been established with Polish equipment, supervision and know how in countries like India, Nigeria, the People's Republic of China, Argentina, Vietnam and Yugoslavia.

Bulgaria has set up a committee for cooperation with Ecuador in economic, scientific and technical matters. The Committee's functions are to administer counter-trade agreements according to which Bulgaria provides power stations in exchange for tropical products and, probably, crude oil. A similar agreement has been signed with the Arab Yemen Republic by which power generation and electrification projects are exchanged, most probably for oil.

Since 1989 the policy of the USSR and other Central and East European Countries in the field of cooperation with Third World Countries shifts away from the concessional aid form. New forms of economic cooperation are put into operation which mainly consist of joint ventures, the financing of specific projects, the provision of labour for the development of remote areas, mainly in the USSR. A large number of students and trainees from Third World Countries who have studied in the Central and East European countries (mainly the USSR, the GDR and Czechoslovakia) are working for about two years after termination of their training in the host country, reimbursing their scholarship.

3.3.3.3 Cooperation with Major Industrialized Nations

As discussed in para 2.2.5 above, the need of the Central and East European countries for technology and financial resources has opened their energy markets to the West. This change in policy - although still incomplete - has attracted the interest not only of EEC concerns but of American and Japanese enterprises, as well.

Until 1988 a number of contracts has been signed between the USSR and companies from major industrial countries outside the EEC in the energy sector. Typical examples are:

a) the petrochemical complex "Tenghiz Polymer" near the new Tenghiz oil and gas field by the Caspian, contracted to a Western consortium in which two American and one Japanese concerns participate;

b) the manufacturing of process control equipment for the oil refinery and Petchem industry, by an American company;

c) the participation of a Canadian company for the welding and laying on land of the JV09 gas trunk pipeline;

d) the development of gas and oil fields on the Sakhalin peninsula, by a Japanese company;

e) the production of mining equipment, by an American contractor; and

f) the Soviet-Japanese joint venture and trade agreement for the exploitation of the East Siberian coal field of Neryungri to provide high quality coking coal for the Japanese steel industry. Despite reductions of the original contract quantities the Soviet Union delivered 4.4 mt of coking coal and 0.9 mt of steam coal to Japan in 1986.

g) the huge nuclear power project in Cernavolda, Romania, which originally included five 700 MW units of Canadian design. (The over 15 years delay of the project constitutes an interesting negative experience on energy cooperation).

There is no published information of similar cooperation between other Central and East European countries and non-EEC industrialized countries in the energy sector, with the exception of a financing agreement between Romania and a Canadian corporation for the construction of nuclear power stations worth $ 1.0 billion in Romania. The progress of the project is not known.

3.3.4 The Cooperation of the Central and East European Countries in the International Organizations

The Central and East European countries have not been, until 1985, members of International Organizations being active in the energy sector, with the exception of the UN and its agencies. Since 1985 Hungary, Poland and Romania joined the World Bank and the International Monetary Fund while Bulgaria and Czechoslovakia are ready to participate soon.

The USSR, in the framework of its new approach to international economic and political relations, started since 1988 participating in activities of the International Organizations (such as the World Bank) and other Regional Organizations which aim at promoting international cooperation for the development of the Third World countries. In 1989 the USSR attended, as an observer, the annual meeting of the Asian Development Bank for the third consecutive time and is seeking to become a member of this institution.

3.3.4.1 Cooperation in Activities of the UN and its Agencies

The Central and East European countries have always been active in the UN and its Agencies.

In the Food and Agriculture Organization (FAO) all East countries participated in European Information Networks and Pilot projects aiming at improving energy efficiency in agriculture.

Czechoslovakia, Poland, Hungary, Romania, the USSR (Biellorussia) and Bulgaria have participated, together with Yugoslavia, Portugal and Cyprus in a UNDP-UNIDO programme for energy conservation in industry. The programme aimed, mainly at establishing an information network for different industrial sectors.

In the framework of the UN Economic Commission for Europe (ECE) the Central and East European countries have signed the 1985 Agreement for the reduction by 1993 of the sulfurdioxide emissions at the 70 % level of 1980. Thereafter, Czechoslovakia, GDR and Bulgaria have signed bilateral agreements on the basis of the 1985 UN/ECE Agreement.

To this effect Czechoslovakia put in effect a comprehensive environmental protection programme for the period 1987-90 that calls for new investment of 14 billion crowns and for another 3.2 billion crowns for the completion of projects of the 1981-85 Plan. All projects contemplated for starting up by the year 2000 are evaluated at about 50 billion crowns or roughly 1 % of the annual Net Material Product of Czechoslovakia. It is unknown whether these cost estimates include the construction of new nuclear power stations on the grounds that one 1000 MW such facility replaces coal fired facilities that would emit 0.2 million tons of sulfurdioxide per annum.

3.3.4.2 Cooperation in Activities of the World Bank and its Agencies

The major contribution of the World Bank and its Agencies – the International Bank for Reconstruction and Development (IBRD), the International Development Association (IDA) and the International Finance Corporation (IFC) – to the three Central and East European countries that have become members since 1985 is related to the support for the improvement of their overall economic situation.

This support is offered through the implementation of sectoral reform programmes designed in cooperation with the recipient country and through financing provided by or through the appropriate agency. Such programmes are running for the reform of the financial sector (Hungary), the restructuring of the public sector (Poland), the pricing policies (Hungary), the tax system (Hungary), the liberalization of trade (Poland), the foreign debt restructuring, in cooperation with the Paris Club and/or commercial banks (Poland and Romania). Most of these programmes which are financed through policy-based lending by the World Bank, affect the energy sector, either by providing funds for specific subsectoral energy projects or by promoting special technical assistance subprogrammes.

In 1985 the IBRD provided Romania 33 loans for a total of $2184.3 million, but no further financing was made available since, Hungary, on the contrary, shows a steady progress in absorbing IBRD loans at a rate of $320 to 350 million yearly. One of the six loans received in the two last years by Hungary was directed to energy programmes for conservation and the development of the oil and gas sectors. Poland has not yet received any financing from the World bank. The World Bank programmes in Poland are aiming at economic and institutional reforms that will attract direct foreign investment and promote joint ventures.

Hungary and Poland have been very active in the Technical Assistance Programmes and especially in the World Bank – UNDP project for Energy Planning for Europe and Arab states.

The UNDP– World Bank project for energy planning, initiated in 1987, was designed as to:

a) provide specialized training, through periodic courses and workshops;

b) expose its participants to current thinking on selected issues;

c) enhance planning skills; and

d) promote the exchange of views and information.

Its objectives were to:

a) transfer a set of widely used energy planning techniques and methodologies to the participating countries;

b) provide, within the framework of the modular approach, the development of country level case studies prepared by national teams and covering specialized aspects of energy planning;

c) provide a forum for inter–regional training and information dissemination; and

d) exchange views on a wide range of contemporary issues of concern to the energy planners of all participating countries.

Thirteen European and Arab countries divided into three groups participated: The Maghreb group (Algeria, Morocco, and Tunisia), the Middle East, group (Bahrain, Egypt, Iraq, Jordan and Kuwait) and the European group (Cyprus, Hungary, Poland, Portugal and Yugoslavia).

The first phase (1987–89) focussed on energy demand, power investment and long–run marginal cost, energy price impact, macro–economic and energy sector linkages, planning of hydro–thermal systems and energy conservation. The second phase (1990–91) will be policy oriented and the groups will be gradually transformed into well structured and organized networks. The objectives for the second phase are:

a at the "macro" level

- to re–enforce in–country cooperation between various sectoral entities;
- to enhance the capabilities of the planning organizations;
- to re–enforce the development of cooperation between countries; and

b at the "micro" level

- to continue the identification of different energy issues;
- to systematize the information sharing on available techniques;
- to improve the cooperation between energy planning specialists and decision makers; and
- to achieve larger exchange of experience among energy planners of different countries through networks

In the framework of this project Hungary participated in a large number of activities, which would be carried out through a working group from the Electricity Utility (MVMT) and the Institute for Electric Power Research (VIK). Following the preparation of the LRMC study under phase 1, MVMT will start upon a work programme geared to the design of electricity tariffs. In addition a price impact study will be carried out jointly by MVMT and VIK; and the two Hungarian organizations together with Poland will launch studies on environment and on risk and uncertainly. The environment study will mainly be a pilot project involving a cost–benefit analysis to present a framework to assess pollution standards. The risk and uncertainly study is designed to test the efficacy of the various methodologies currently under review in a World Bank led research project.

Poland will embark on a LRMC study and will cooperate with Hungary on the pilot studies on environmental issues and on risk and uncertainty. In addition due to the high quality of the work performed in Poland during phase 1 Polish experts will be used in phase 2 to provide technical assistance and consultancy services of the pricing impact studies to Portugal and Cyprus.

Experts from Hungary send Poland will also participate in workshops and training courses on energy planning, energy data bases, energy conservation and will assist other countries in their work programme.

A seminar on institutional and financial aspects of energy conservation is scheduled to be help in Warsaw, Poland next October, as part of the activities of this programme.

3.3.4.3 Cooperation with the International Energy Agency (IEA)

The IEA was established in 1974 by the OECD Member States, right after the first energy crisis. The Central and East European countries obviously are not participating in its activities. Yet, one of the objectives set for the IEA is "to maintain cooperative relations with non-members countries and international organizations".

In pursue of this objective the IEA has undertaken lately a number of activities with a view to provide direct assistance to various non-member countries. Last April (1990) the first official contact of the IEA with a Central and East European country – Poland – took place in Copenhagen, in order to exchange views and to start closer cooperation.

The IEA, regardless of not having up to now official relations with the East European countries, has always been interested in their situation and has been publishing periodic country reviews. This makes it easier for the IEA to start direct cooperation with them, as the international climate has radically changed.

3.4. The Cooperation Experiences of the EEC and Other International Organizations

International cooperation in the energy sector is not of course limited to the experience of the Central and East European countries in this field. As stated previously, the countries of planned economies were rather isolated until recently, and their international cooperations in all fields of economic activity – energy included – was restricted mainly between themselves. For this reason it is interesting to review the experience in energy cooperation accumulated, especially since the early '70s, by other countries.

The European Communities, having relatively early realized the importance of international cooperation in the energy sector, have made significant efforts both to coordinate the energy policies of their Member States and to develop close cooperation with countries that are not members of the EEC, especially the ACP and the Third (non–EEC) Mediterranean Countries.

International Organizations, such as the UN and other regional organizations, have also tried to promote the cooperation among their members in the energy sector with varied success.

Activities in the framework of these organizations are reviewed in order to enrich the background against which opportunities for the cooperation of the EEC with Central and East European countries will be searched for.

3.4.1 The Energy Cooperation within the EEC

The European Communities do not have a formally and institutionally established a Common Energy Policy. The activities in the energy sector are mainly coordinated by the Directorate General for Energy (DG XVII), while in the coal and nuclear subsectors significant role is played by the ECSC and EURATOM. Interventions and programmes directly or indirectly related to energy are also part of the activities of other Directorates General (mainly DG XI for the Environment, DG XII for Research DG XVI for Regional Policy and the ERDF, DG VI for Agriculture and, especially after the Single European Act, DG III for the Internal Market and DG IV for Competition).

3.4.1.1 The Common Energy Objectives and other Energy Policies

In their effort to cope with the acute problems faced by the EEC during the first energy crisis, especially in the absence of a Common Energy Policy, a set of Common Energy Objectives has been adopted by the Member States. The original Common Energy Objectives of 1974 have been reviewed in 1986 and cover the period up to 1995. The Directorate General for Energy is monitoring and coordinating their national energy policies for achieving the goals set in a number of horizontal and vertical subsectors.

The horizontal objectives cover the Internal Market, energy pricing, security of supplies, external relations, protection of the Environment, regional development and promotion of technological innovation. The sectoral objectives cover the sectors of efficient use of energy, oil, natural gas, solid fuels, electricity generation, and new and renewable sources of energy.

Beyond the Common Energy Objectives, in a number of energy fields, such as energy efficiency, pricing, international energy relations the CEC produces documents, evaluations and recommendations for the Council, which lead to conclusions, Council Recommendations or Resolutions ensuring measures of common action by the Member States. Examples of such Council Recommendations can be sited in the areas of gas and electricity pricing principles and of the use of coal and other solid fuels.

The ECSC and EURATOME Treaties also lay down specific rules on coal and nuclear energy, while the Community adopts from time to time Regulations and Directives which extend the legal framework for the EEC energy policy. The rules on oil stocks or on sharing the oil supplies in emergency situations, as well as the norms and standards for the efficiency of energy consuming equipment can be sited as examples.

3.4.1.2 The Programmes of the Commission

The centrally run by the Commission programmes in the energy technology field and the financial support for new investment and modernization of the energy infrastructure constitute the direct interventions of the EEC in the energy sector.

The Community Programmes supplement and prevent the duplication of the efforts of the Member States in energy. At the same time these programmes require and promote the cooperation between them, although practice has shown that most of the interventions funded were addressed to one only country.

Three major Community Programmes can be sited:

a. the programme for the Support for Technological Development in the Oil and Gas Sector, (1978–89);

b. The Energy Demonstration Programme, (1978–89); and

c. The THERMIE: Programme for the Promotion of Energy Technologies, (1990–95)

All three were funded through Chapter 70 of the General Budget.

The Programme for the support for Technological Development in the Oil and Gas Sector is concerned with the promotion of the technological development directly related to activities in exploration, production, transportation and storage of oil and gas, which are likely to improve the security of Community oil and gas supplies.

The programme was designed as:

- to contribute to the Community's security of supply (through major technical achievements);

- to significantly speed up the technical advancement in the oil and gas subsectors (especially at a time when the USA's oil related industry was in a decline); and

- to foster a Community identity in the oil and gas prospecting and production industry (by pooling efforts throughout the community).

As the Programme ended in 1989, the DG XVII gives consideration to further action in the same direction, in order to:

- safeguard the security of oil and gas supplies for the Community;
- create a sound industrial base for the oil-related sector; and
- establish the community in the leading position in the world oil-related industry.

The Energy Demonstration programme aimed at stimulating the innovative initiatives in the fields of alternative energies, energy saving, substitution of hydrocarbons, liquefaction and gasification.

The programme proved to be extremely successful, since it led to the development of alternative technologies in all above fields. Some of the innovations had a considerable impact on the diversification and security of the Community's energy supplies and on strengthening the Community's industrial base in the respective area.

The DG XVII is considering further action in the same direction aiming at

- strengthening of the Community's trade and industry in these fields, in the framework of the Internal Market;
- helping to consolidate economic and social cohesion within the Community;
- the protection and cleaning up of the Environment; and
- the dissemination and promotion of successful demonstration projects throughout the Community.

The THERMIE Programme for the promotion of energy technologies is just starting and places its emphasis on the dissemination of the energy technologies in the Community. In this sense it succeeds the previous two programmes, aiming at:

- the encouragement of investment in successfully demonstrated technologies in other regions of the Community; and
- publicizing the results of the successful projects.

It will cover the following issues:

a. energy efficiency (in buildings, industry, transport and urban infrastructure, electricity and heat);

b. renewable energy sources (solar, biomass, geothermal, hydroelectric and wind);

c. clean use of coal; and

d. Oil and gas exploration and development.

The programme will be coordinated with other Community Programmes, namely: JOULE & ECLAIR (for R & D) and SPRINT (for Innovation & Technology) and it will give priority to:

- joint ventures originating from at least two different Member States;
- proposals of Small and Medium-sized enterprises; and
- activities in the less prosperous Regions of the Community.

The Research and Development Programmes, funded though Chapter 73 of the General Budget, namely:

a. The joint Programme of Direct Action of the JRC;

b. The Supplementary Programme of Direct Action of the JRC; and

c. The cost-sharing Programme

include significant activities in the energy sector. The level of funding for energy is of the order of 400 MECUs in recent years. These programmes offer plentiful opportunities for the cooperation of the European research community, although the Member States are not directly involved.

3.4.1.3 The Structural Funds

The Structural Funds and more so the Regional Fund (ERDF), as well as the European Investment Bank and the other financing institutions (NICs), are both directly and indirectly involved in energy and energy related fields. Most infrastructures of the energy sector are eligible for financing through them. Programmes such as:

a. the quota or non-quota financing of the Regional (until 1989) Programmes of the Member States by the ERDF,

b. the Integrated Mediterranean Programmes (IMPs),

c. the Structural Funds interventions according to the new institutional framework based on the Regional Development Plans and the Community Support Framework (since 1989)

contain significant energy oriented subprogrammes.

Yet, most of these programmes were, and still are, national in character and they did not promote the cooperation between the Member-States. Only indirectly - through bilateral coordination or thanks to the catalytic intervention of the Commission - certain Member States included in their proposals infrastructures of common interest, as e.g. The case has been with the proposal for the interconnection of the Italian and Greek electricity grids by an undersea cable.

The new Regulations governing the operation of the Structural Funds, though, provide that the Commission can use 15% of the totally available financial resources for "Community Interest" projects. Although the initiative for these projects is reserved for the Commission, the Member States can promote ideas, which in order to qualify as of "Community interest" should be of cooperative nature.
Beside the general ERDF programmes, the Fund has been active by direct specific or general action in the energy sector. The programmes for the Diversification of Energy Sources in the

Mezzogiorno (Italy) and in the Aegean islands (Greece) are examples of the former, while the VALOREN Programme falls in the latter category.

The VALOREN Programme aimed at realizing the interconnection between energy and local development. All less-favoured regions of the Community were eligible in the Programme, which had three main axes:

a. the exploitation of specific energy sources (renewables, peat and lignite);

b. the rational use of energy or the improvement of energy efficiency; and

c. the promotion at local and regional level of better exploitation of indigenous energy potential.

Specific regions of Ireland, Italy and Greece participate in the programme, with considerable success. The VALOREN Programme did not require cooperation between the participating Member-States. Yet, it offered the opportunity for the exchange of information and ideas, which in fact is one of the most valuable forms of cooperation.

3.4.1.4 ECSC and EURATOM Activities

The ECSC is responsible for important activities and interventions in the coal subsectors. Under its capacity the ECSC is financing programmes for:

a. the stabilization of production and promotion of consumption of Community coal;

b. research on coal;

c. the re-employment of steel and coal workers; and

d. the intra-Community trade in coking coal.

EURATOM, according to its Treaty, is providing loans for nuclear power generation and for fuel-cycle installations projects.

Finally, the New Community Instruments (NICs) offer loans for energy saving projects, projects for the development of alternative energy sources, the application of new technologies and innovation in the energy sector, rational use of energy programmes and other energy related projects.

None of the ECSC and the EURATOM activities and the NIC financing interventions require cooperation between the Member States. The comment made previously, referring to activities of the ERDF, can be repeated in this case, as well.

The major asset, through, of the Community for the promotion of established and experimentation on new forms of cooperation between its Member States in the energy – as well as in any other– sector can be identified in the everyday functions of its Directorate General for Energy. Through them consciously or – and more importantly – subconsciously experience, information and ideas travel all over the Community territory. Thus through DG XVII cooperation between the Member States materializes continuously both in a formal and in a "grass–roots" fashion.

3.4.2 The Energy Cooperation of the EEC with Third Countries

The EEC Countries have long standing good relations with almost all other countries, both on a bilateral basis and within the framework of other International Organizations. Beyond that, the European Communities, in order to play their role in the World and to fulfil their obligations as a major and leading international power, have developed special relations with individual countries or groups of such countries. These relations are fostered by the cooperation in different fields of economic and technological activity, energy included.

For two specific groups of countries the Mediterranean non–EEC countries and those from the areas of Africa, the Caribbean and the Pacific (ACP) that have entered the Lome Agreements, the EEC has developed special programmes aiming at their development.

3.4.2.1 Energy Cooperation with the Third Mediterranean Countries

The relations of the EEC with almost all the Third (non–EEC) Mediterranean Countries (TMC) are of utmost interest for the Community. This is for a number of reasons. First, some of the EEC Member States have with certain TMC very old an close ties, creating something like an "acquis national", for the latter; second, the EEC and the TMC share the Mediterranean as a "common resource"; and, finally, the traditional close relations between the two groups of countries at the social and economic levels renders a certain transferability of the problems of the TMC to the EEC countries and vice versa.

For all these reasons the Community has a feeling of special responsibility towards the TMC, which is expressed by a special and specific to them policy, the Mediterranean Policy (Med Policy).

The main objectives of the Med Policy are to contribute to the economic development and to the social and political stability of the TMC. To serve this policy the EEC has concluded individually with each of the TMC (with the exception of Albania and Libya) agreements of association or cooperation according to which:

a. the EEC market is open to their industrial products;

b. their agricultural production enjoys preferential status in the Community;

c. financial resources, in the form of grants or EIB loans are made available to them for economic development projects;

d. economic and technical cooperation is promoted between each of them and the EEC or its Member States; and

e. an institutional framework for dialogue is established.

The Med Policy is implemented through financial protocols between each TMC and the EEC. Projects of the energy sector, with the exception of investments for oil refineries, are eligible for funding within these protocols. The specific projects are proposed mainly by the recipient countries. Not all TMC developed cooperation in the energy sector, the main reason being that they are interested in projects that are in most cases of subregional, rather than of national scale, and their economic size is disproportionally large, compared to the resources available through each protocol.

Thus the experiences of the contribution of the energy sector in the EEC Med Policy and of the cooperation between the Community and the TMC are limited compared to the existing potential and to the needs that are there, although not disappointing. This cooperation was actually exhausted in consulting missions, seminars and a few technical assistance and training programmes.

The Directorate General for Energy is reconsidering the energy components of the Med Policy in an effort to bring closer the needs of the TMC, the objectives of this policy, and the EEC energy objectives. New forms of cooperation are searched for, on the basis of:

a. past experience and experience from other cooperations;

b. the realization that the advancing integration within the EEC might hurt the interests of the TMC; and

c. the fear that the current developments in Central and East Europe might abstract the European interest away from the Mediterranean.

3.4.2.2 Energy Cooperation with the Third World Countries

The European Community's cooperation with Third World Countries in energy matters was formally initiated late in 1979. The need for this cooperation rose from the realization that:

a. only through cooperation the impacts of the energy crises on the economies of both developed and less developed countries could be minimized;

b. the growing energy demand – all energies taken together – was coming essentially from countries of the Third World, and this situation is most likely to continue; and

c. energy is a most critical factor for the development of the less developed countries.

On these grounds the interests of the EEC and of the Third World countries are converging; and this convergence offers lots of opportunities for cooperation either between North and South, or of the South–South type in which the EEC could play the role of catalyst and provide technical assistance.

The main field of cooperation that developed is in energy planning. Energy planning was selected – and the choice proved successful – because:

a. it is an instrument of global importance and a field in which countries of different levels of development can cooperate; and

b. it is field which could bring to the surface the convergence of interest of the participants and could help define their limits.

Yet, the cooperation between the industrialized EEC and the Third World countries, even in the energy planning, would not have succeeded if the Commission Services had not realized early enough that:

a. the problem of underdevelopment and the absence of planning in all aspects, energy included, are interrelated and parts of one and the same vicious circle;

b. the regional differences in the Third World, both in terms of magnitude and in geographic terms are of extraordinary size;

c. a reproduction of the European patterns of evolution in all respects, including energy issues, is impossible in the now developing countries; and

d. the regional concept in the Third World, both at the intra- and the international levels varies over a very wide spectrum.

The EEC cooperation with Third World countries for energy planning had three main objectives:

a. to achieve a certain degree of structural uniformity at the presentation level of energy data and to account for all energy forms and activities;

b. to adapt the available instruments to the reality of the developing countries;

c. to develop a sensitive enough diagnostic system in order to be able to forecast changes; and

d. to build or reinforce the local energy planning institutes, through emphasis in training and technical assistance aiming at defining locally adjusted methodologies and routines.

Six years after its initiation the programme succeeded to:

a. develop and apply energy planning methods for the Third World countries;

b. establish new and/or reinforce existing energy planning institutes in all participating countries;

c. train some 2000 energy planners; and

d. establish the framework for the continuous cooperation and exchange of information and data between European and Third World experts and administrators.

Some projects of the Programme, like the ones in Argentina, Brazil and the People's Republic of China, involved the practical application of the EEC energy planning network with most of the know-how drawn from the EEC network of energy planning institutes.

Others, like the ones in Ecuador and Jordan, aimed at setting up and strengthening regional energy institutes with strong technical support from the Community.

Finally, there were projects, like the one in Thailand, that involved a mixture of both approaches mentioned above, i.e. both apply the EEC method and provide European technical assistance.

All projects, though, brought valuable experience to Europe. Certain classical assumptions are reviewed and new questions are asked on the basis of the experience gained in the Third World Countries. This will lead to improving the reliability and the sensitivity of the European energy planning tools and methods.

Beside the energy cooperation of the EEC with Third World countries, its Member States have their own strategies and cooperation programmes with the rest of the World. Such strategies develop either on a bilateral basis between any EEC Member State and its counterpart Third World country, or in the framework of their participation in International Organizations and fora.

With respect to most of the Third World countries the cooperation, beyond the trade of energy products, takes the form of financial aid (loans, credits, guarantees or subsidies) accompanied or not by technical assistance and transfer of technology or know-how. This type of cooperation in the energy field concerns mainly infrastructure and power production projects.

Table 11: ODA by EEC Member States DAC Donors (in $ million)

	1970-71	1980-81	1987-88
Belgium	134	590	654
Denmark	61	455	927
France	1135	4407	6925
FRG	766	4226	5249
Italy	230	713	2939
Netherlands	209	1613	2275
U.K.	629	2232	2390

Source: OECD

From the EEC Member States France, the Federal Republic of Germany, Italy, the United Kingdom, the Netherlands, as well as Belgium and Denmark are active in providing aid to Third World countries (Table 11). The exact size of the energy component of such aid is not known, since energy projects are generally classified under economic infrastructure, but energy or energy related activities are also included in other use classifications such as social and administrative infrastructure, industry and other production, or even agriculture (Table 12).

Table 12: Major Aid Uses by DAC Donors, 1986-87 (% of total commitments)

	Social and Administrative Infrastructures	Economic Infrastructures	Agriculture	Industry and Production	Food aid	Program Assistance
Belgium	44.1	12.9	14.9	5.8	2.0	20.3
Denmark	21.2	20.1	11.8	11.2	0.6	27.0
France	41.6	17.7	9.7	6.1	0.8	24.1
FRG	32.8	22.3	10.5	7.7	3.1	23.6
Italy	20.6	23.6	17.1	8.7	5.8	24.2
Netherlands	23.7	14.8	22.9	3.8	2.0	32.8
U.K.	22.5	18.9	8.8	14.4	1.2	34.2

Source: OECD

3.4.2.3 Energy Cooperation in the Framework of International Organizations

Since the beginning of the 80s energy problems attracted the interest of International Organizations like UN agencies, the World Bank and other Regional Organizations. The EEC itself has indicated its interest in the activities of these organizations and participates in one of them.

The UNDP-World Bank Project for Energy Planning, described in paragraph 2.4.2 previously is one example of the initiatives taken by International Organizations in energy matters. The Energy Sector Assessment Programme of the same Organizations, launched in November 1980, is a second example.

The UNDP-World Bank Assessment Programme was designed to provide a rapid diagnosis of the major energy problems faced by the developing countries and to evaluate the options for solving them. These assessments analyze the policies that could encourage greater production from indigenous energy sources and greater efficiency in the use of energy. They judge the investment priorities in the energy sector and provide the framework for multilateral and bilateral technical assistance in the sector.

This programme initially covered 60 developing countries. The response to the Assessment Programme has been strong and requests have been received from more governments than those originally envisaged. Governments have made extensive use of the advice and have requested further assistance, either for the more detailed analysis of specific policy or preinvestment options, or, more generally, to improve the management and institutional framework for the sector.

For this reason the UNDP and the Bank have launched a programme for the Management of the energy sector (ESMAP), designed to provide assistance to the governments of developing countries in implementing the policy, planning and institutional recommendations of the Assessment or in carrying out prefeasibility studies for energy investment identified in these reports.

The Energy Sector Management Programme can finance:

a. assistance to improve a government's ability to manage its energy sector, by defining staffing and work programmes, evaluating information needs, identifying sources of public and private finance and developing a medium-term investment plan;

b. prefeasibility work on priority investment plans, especially those which will provide enough affordable energy to rural areas; and

c. providing specific short-term assistance in institutional and manpower development.

A number of other activities and specific programmes have also been undertaken by the World Bank, for:

- the promotion of oil and gas exploration;
- the development of coal policies and projects;
- improving the efficiency of operating power systems; and
- reducing losses in power distribution.

From a quantitative point of view, however, the most important Bank operations related to the energy sector are by far its lending operations.

The World Bank is the largest and most diverse multinational lender for energy. Its commitments have reached in 1989 the level of $ 43560 million, representing almost 20% of its total lending operations. The regional allocation of the loans (Table 13) indicates that its main interests lie away from Europe.

Table 13: Regional Allocation of World Bank Commitments for Energy (1989)

	Amounts ($ million)	**%**
Africa	3039	6.95
Asia	21052	48.33
Europe, Middle East and North Africa	7791	17.89
Latin America and Caribbean	11687	26.83
Total	43559	100.00

Source: World Bank

The lending operations of the World Bank cover a wide range of activities from transfer of technology in petroleum lending to refinery conversions and electricity power stations.

The European Community has established long standing cooperation with the UNDP and other International Organizations (ESCAP, IDB, IAEA, etc.) that co-finance an Energy Planning Programme for Developing Countries and for Europe.

The programme is now running its third phase (1988-91). The previous two phases (1980-83 and 1984-87) have offered the opportunity to accumulate significant experience both on specific energy issues and on different forms of international cooperation.

The main objectives of this programme are:

- improve the data on energy demand, supply, resources, etc;

- reinforce energy planning institutes and their capacity to design energy policies;

- promote contacts and exchange of experience between energy suppliers and energy consumers;

- promote the transfer of European energy technologies, investments and products;

- support research on the demand side of the energy sector, mainly with respect to changing patterns due to innovative technologies;

- promote the rational use of energy;

- support a more systematic development and exploitation of regional or local energy resources;

- improve the energy situation in less developed areas and regions as well as within the Community;

- analyze the role of energy for economic and social development; and

- promote the regional and international cooperation in energy.

Under this programme the Commission exchanged experts, disseminated know-how, supported publications and cooperation, re-enforced existing administrative institutions, undertook evaluation studies and supported financially and scientifically methodological and other studies, training programmes and seminars in the developing countries. Concerning the European countries the Commission supported energy plans and specific energy studies (diagnosis of energy situation, feasibility studies, energy supply concepts, evaluation etc.).

This Community action is within the policy objectives of the Directorates General XVII (Energy), I (Foreign Relations) and VIII (Development) to the degree that it promotes the development of energy plans, it supports energy institutions and it conducts studies and training programmes in developing countries. The total amount spend in this programme by the Community was 10 MECU for the 1st phase (1980-83) and 20 MECU for the 2nd phase (1984-87), out of a total of 70 MECU initially engaged for both phases.

ANNEX A

OPERATIONS AND PROGRAMMES OF OPERATION PHARE
(as of May 16, 1990)

As part of the programme to support the economic and social reform underway in Poland and Hungary, the Commission has taken a number of financing decisions on projects in the priority sectors, namely agriculture, investment, the Environment, and training. Taking into consideration earlier programmes, the amount of financing from the Community General Budget now stands at 142 MECU, out of the 300 MECU earmarked for direct aid to these two countries, on top of the EIB and ECSC loans and the counterpart funds raised in Poland from the local sale of food aid. These programmes are:

- The Environmental Protection programmes for both Hungary and Poland;
- The Regional Environmental Centre in Budapest;
- The basic technical assistance programme for privatization for Poland;
- The programme for the modernization of the financial system for Hungary;
- The programme for the cooperation in the field of economics for both Hungary and Poland;
- The technical assistance programme for the implementation of the Trans–European Mobility Programme for University Studies (TEMPUS), for both Hungary and Poland; and
- The programme for imports of animal feeds and feed additives for Poland.

Most projects of the programmes listed above will be put out for tender and open for all firms of the Community and the recipient countries.

These operations are part of the Operation PHARE, which is described in the main report. This Annex gives more detailed information on their technical characteristics and their status, as of May 16, 1990.

1. THE ENVIRONMENTAL PROTECTION PROGRAMME FOR POLAND

The short-term aim of the Environmental Protection Programme is to help Poland develop its environmental monitoring capacity and finance projects designed to reduce emission of pollutants, improve water quality and nature protection, and treat waste.

This initial programme will establish an overall strategy, an environmental protection policy, and, through feasibility studies for new projects, pave the way for future programmes.

The programme will involve:

(a) the setting-up of a fund to finance projects concerning air and water pollution, treatment of waste and the protection of natural sites: the financing will cover the cost of equipment, technical assistance and expenses incurred in implementing the project;

(b) participation in the Project Implementation Unit set up by the World Bank in the Ministry concerned.

The Environmental Protection Programme for Poland is composed of 11 projects with a total budget of 19.0 MECU. Out of these projects 5 are not ready to be financed and funding is provided for further technical assessment and preparations. The major three projects of the programme, with a total budget of 8.0 MECU are in the energy sector (Table 1).

For all the projects of the environmental protection programme for Poland it has bee decided to create Programme Management (or Implementation) Units, which are to be financed by Operation PHARE and to use external experts.

A number of bilateral donors have already established extensive links with the responsible Ministries and announced their decision to assist in this area.

Table 1: List of Environmental Projects of PHARE Programme for Poland

AIR PROTETION	**Million ECU**
Serialized Production of flue gas desulphurization for coal fired	1.8
Set-up production of circulating fluidized bed boilers	6.2
Air pollution monitoring	5.0
Sub-total	**13.0**
WATER PROTECTION	
Mine water desalination plant in the Czeczott hard coal mine*	-
Cracow waste water treatment plant*	-
"Czaika" Warsaw waste water treatment plant*	-
Sub-total	2.0
WASTE MANAGEMENT	
Incineration plant for toxic chemical waste	1.1
Municipal waste incineration, Warsaw*	0.5
Sub-total	1.6
NATURE CONSERVATION	
Foundation for the great Mazarian Lakes region	1.8
Warta river foundation*	0.2
Sub-total	2.0
Environmental Education and Training	0.4
TOTAL	19.0

* Projects are not included in 1990 programme. Funds shown are provided for technical assessment and project preparation.

Cofinancing may be done in two ways. The first is a direct contribution to the fund, in which case donor finance will be subject to the same implementation procedures as Community funds. The second is parallel financing, involving the donor financing a specific object or part of a project, according to its own procedures. The selection of cofinancing operations in this case will be undertaken on a case-by-case basis, in agreement between the donor, the Ministry and the Commission, and the assistance of the Project Implementation Unit.

1.1 Air Pollution

The main air pollutant is sulphur dioxide, which is present in great quantities as a result of high lignite consumption and the fact that emissions controls and environmental protection measures are inadequate. The economic crisis has also fuelled lignite consumption and reduced that of more costly energy sources.

Sulphur dioxide (SO_2) is one of the major causes of acid rain, which affects large forested areas in Europe. SO_2 is also a major health hazard at the concentration level prevailing in Poland. Some severe respiratory diseases have indeed been reported.

The highest SO_2 concentration in air is found in the "three borders" region (Poland, East Germany, Czechoslovakia) and in upper Silesia, where sulfur dioxide deposits exceed 100 tons/km^2.

In Poland exploratory and very limited measurements made during 1988 lead to an estimation of global SO_2 emissions of 4.2 million tons/year.

Preliminary figures indicated that in Poland 50 % of the SO_2 emissions are generated in large power stations, running 7000 hours/year or more. Most of these units are only equipped with dust control systems, while they use local high sulphur content coal (up to 5 % sulphur) or brown coal as a fuel.

From a strategic point of view, it makes sense to tackle the largest contributions to air pollution by SO_2 first.

The Polish authorities intend to adopt and enforce the most stringent norms for flue gas composition (based on the FRG TA Luft values) in the very near future and to take drastic actions when needed. The "polluter pays principle" will be accepted as the rule.

The combination of a strict law, an efficient control and drastic actions in case of infraction are the basic conditions for achieving a substantial reduction of air pollution levels in Poland.

A key factor is thus to organize and train an environmental control inspectorate – which is being established in Poland – and to give it the tools for measuring, on site, the levels of emissions generated by pollution sources.

The reduction of SO_2 emissions may be limited:

- by beneficiating (cleaning) the coal;
- by contacting the flue gases with a SO_2 fixation–absorption medium, (scrubbing);
- a solution or a suspension of lime, sulphite, or carbonate (wet methods);

- the same products under powder form (dry methods);
- selm-wet-methods.
- by combusting the coal in an fluidized bed boiler.

Coal beneficiation is uneconomical at the present stage of development and in the context of present energy prices.

For existing boilers, or for very large units, the wet scrubbing technique is the best choice. Desulphurization ratios of more than 90 % are commonly obtained with this technique.

When focusing on medium scale new units, fluidized bed combustion is considered as the optimal solution for high sulphur-high ash content coals. These units operate at about 850 C, generating a minimum of NO_x compounds and allowing optimum SOx (capture also about 90 %) by adding crushed limestone which is chemically converted to gypsum. The bed material consists mainly of ash and spent sorbent.

Domestic heating in the form of individual coal fires is also damaging to the environment, especially since this type of emission is difficult and costly to control. Vehicle exhaust gases are also a subject of concern, though to a lesser degree.

Generally speaking, the monitoring of air pollution, whether of domestic or industrial origin, is inadequate.

1.2 Water Pollution

No significant progress has been made in combating water pollution, mainly because the right technology for treating waste water and residues is not available and the industry lacks capital.

Vast quantities of industrial waste are emptied into the rivers and the Baltic Sea. Not surprisingly, pollution levels are very high; one third of Polish river waters are polluted even for industrial use.

The main sources of water pollution are: industrial and domestic waste water, industrial waste, water salinity caused by the coal industry and seepage of chemicals used in agriculture.

The demand for waste-water treatment is enormous since treatment facilities exist in only half the centres of population. The technology requirements are correspondingly enormous.

1.3 Solid Waste

Solid waste is put in open-air dumps without the slightest control. Indeed, waste management, industrial and domestic, is one of the biggest environmental problems facing Poland at present. The disposal of toxic waste, especially chemical waste, in the principal water courses and the use of the sludge as fertilizer are also cause for concern.

1.4 Natural Sites

An overall strategy is needed for the protection of the natural sites of Poland, many of which are in danger. The most urgent need for site protection exists in the Mazury lakes. Help is also required for setting-up and managing the new institutions responsible for establishing appropriate policies and taking the suitable measures.

1.5 The Energy-Related Projects of the Environmental Protection Programme for Poland

The specifics energy related projects of the Environmental Protection Programme for Poland are presented in the following paragraphs.

1.5.1 Serialized Production of Flue Desulphurisation (FGD) Installations for Coal Fired Electrical Power Stations

The objective of the project is to alleviate the SO_2 problem by facilitating the introduction of FGS technology in existing large coal fired stations, which are the main emission sources.

The project comprises the transfer of FGD technology from an EEC firm to a Polish firm, which will then be able to develop a serialized production for power stations (OPOLE and BELGHATOW have been selected as priority plants for implementation).

Since the RAFAKO boiler manufacturer (Racidorz) – the Polish company selected at first – is no more the candidate firm to develop this technology, the selection of a suitable Polish company has to be made on technical grounds, amongst the 12 companies identified by the authorities.

Following the call for tenders, the technology will then be transferred to the Polish firm, where production methods and engineering practice will need adaptation, including the development of a cost and price accounting system.

The selected Polish firm will assume the role contractor. Overall responsibility and monitoring of the project will be with the Ministry of Environment (Project Implementation Unit – PIU – and Air Pollution Department), in close cooperation with the Board of Energy and Brown Coal Board.

The Project is already underway and it is expected to be completed by April 1991.

The cost of the programme includes:

i	Evaluation of the Polish firms and selection Specifications, preparation of tender – Final selection	0.10 MECU
ii	Licensing agreement, negotiation, licence fee, hardware and software supply, technology adaptation, expertise for cost calculation	1.55 MECU
	Total	1.65 MECU
	Contingencies	0.15 MECU
	Grand Total	1.80 MECU

The precise cost breakdown of the different components in (ii) will be part of the specifications.

The Fund will finance (i) in the form of a grant and (ii) expenses in the form of a loan to the Polish manufacturer, repayable in local currency. Local costs will be supported by the Polish manufacturer.

The Project is justified on the grounds that the FGD technology is very well adapted to the Polish power stations and much more economical than other technologies.

1.5.2 Set Up Production of Circulating Fluidized Bed Boilers (CFBC)

The objective of the project is to reduce emissions in Poland by introducing in a Polish firm the Fluidized Bed Boiler technology (capacity 50–350 MWe) for industrial production and implementation in medium-scale power stations.

The project aims at transferring of the circulating fluidized bed boilers technology (CFBC) from an EEC firm to the RAFAKO boiler manufacturer, the Polish firm already selected as the most suitable for setting up of the industrial production capability of RAFAKO.

RAFAKO will be the contractor. Overall responsibility and monitoring of the project will be with the Ministry of Environment, Air Pollution Department, and the Project Implementation Unit (PIU).

The contract will be awarded and the licensing agreement will be completed by September 1990. The equipment are expected to be delivered by January 1990, and the training of Polish engineers and technicians to advanced design and construction techniques for the setting up of industrial production will be finished by May 1990.

The cost of the project includes:

i	Preparation of specifications and call for tenders	0.20 MECU
ii	Licensing agreement, negotiation, licence fee, CAD–CAM and additional equipment, including training and expertise for cost calculation	5.40 MECU
	Contingencies	0.60 MECU
	Total cost	6.20 MECU

The precise cost breakdown of the different components in (ii) will be part of the specifications.

The fund will finance (i) in the form of a grant and (ii) expenses in the form of a loan to the Polish manufacturer, repayable in local currency. The Polish manufacturer will support local costs.

The project is justified on the grounds that the use of the CFBC technology means a reduction of about 15 % of the total cost when compared to a classical pulverized fuel boiler equipped with a SO_2 scrubbing system.

Moreover it is well adapted to the Polish coal type (with high sulphur and high ashes content). The CFBC technology is more suitable for the power range to be developed in Poland, compared to the atmospheric fluidized bed system (AFBC).

1.5.3 Construction of Mine Water Desalination Plant in the CZECZOTT Hard Coal Mine

The CZECZOTT colliery is one of the most recent, modern and economic hard coal mines in Poland, with a production of 7 mt in 1989 (15 mt in 1994).

Due to geological reasons, the mine "produces" 30,000 m^3/day of water with a salt content of 50–60 mg/l, which corresponds to a quantity of 1,500–1,600 tons of NaCl daily discharged into the already heavily polluted Wistula river. The management of the mine is therefore confronted with the problem either to find a technical solution or to close the mine.

The objective is to build a desalination plant having a final capacity of 30,000 m^3/day mine water, based on brine concentration and by evaporation and/or reserve osmosis techniques.

The G–24 fact–finding mission on the project concluded that the figures on the NaCl content of the water are not very accurate, the proposed technology was somewhat complicated, all alternatives (pipeline, injection in rocks, lagooning, etc.) did not seem to have been carefully examined, and the cost (originally estimated at 80 MECU) was extremely high.

On the basis of these findings the project was considered not ready for financing in 1990, and it was agreed that, before any decision is taken, a detailed study of all options was required. Accordingly, a comprehensive study should be carried out to examine the different options.

2. *THE ENVIRONMENTAL PROTECTION PROGRAMME FOR HUNGARY*

The short-term objective is to improve Hungary's capacity to monitor the quality of air and water and to give immediate financing for measures to improve waste disposal, regenerate the ecosystems of lakes, reduce emissions of pollutants and support training in environmental protection. The medium-term objective is to help the authorities responsible for the Environment to draw up long-term environmental protection strategies and policies, boaster institutional capacity and lay the foundations for the Community's participation in environmental protection projects by preparing financing programmes.

The programme provides for:

(a) a fund to finance projects in the areas referred to above, which would cover the cost of equipment, technical assistance and other expenses incurred in implementing the programme;

(b) the setting-up of a unit within the Ministry to administer the programme, which it would include three outside experts to help implement the programme and achieve its objectives.

The Environmental Protection programme for Hungary is composed of 22 projects or actions (Table 2) of a total budget of 21.0 MECU with duration until the end of 1991. Ont of these 22 projects four refer to the sector of energy with a total budget of 5.88 MECU, while the project for the Thermal Water Resources Study with a budget of 0.4 MECU is also of extreme interest for the energy sector.

Table 2: List of Environmental Projects of PHARE Programme for Hungary

GENERAL	Million ECU
Establishment of a Regional Integrating Monitoring (RIM) System	0.11
Protection of Caves and Springs of Budapest	1.00
Establishment of Ferto Lake National Park	1.40
Wetlands and Grasslands Protection Study	0.15
Environmental Education and Training Study	0.25
Environmental Education and Training Exchange Programme	0.25
Sub-total	**3.16**
AIR	
Modernization of the Emission Monitoring Network	1.90
Modernization of the Air Quality Monitoring Network	1.90
Modernization of the Network Registering Background Air Pollution	0.50
Catalyzer Programme	0.50
Sub-total	**4.80**
WATER	
Koros Oxbow Rehabilitation	0.82
Silt Dredging and Reed Harvesting at Lake Batalon and Lake Valence	0.82
Identification and Measurement sof Micropollutants	0.82
Modernization of the Hydrological Monitoring System	0.50
Groundwater Pollution Study	0.50
Thermal Water Resources Study	0.40
Sub-total	**3.86**

to be continued on next page

Contd.

WASTE	
Val-Vertesacsa Industrial Waste Disposal Project	2.00
Inventory of Groundwater Pollution Sources	1.30
Sub-total	**3.30**
ENERGY	
Study for SO_2 Emission Reduction at 3 Power Stations	0.20
Fluidized Bed Installations at Ajka and Dorog Power Stations	1.35
Geothermal Pilot Project	3.20
Taurus Rubber Energy Savings Project	1.13
Sub-total	**5.88**
TOTAL	21.00

2.1 Air Pollution

Decades of economic development based on heavy industry and intensive agriculture, and the lack of any environmental protection policy, have caused alarming levels of pollution in Hungary. Nearly 45 % of the population live in areas where air pollution is over the internationally agreed limits and causes a high incidence of respiratory diseases, anaemia, bone abnormalities in children and lung cancer. Sulphur dioxide is one of the main source of pollution (45 % exported and 10 tons/km^2 amount of nitrous oxide in towns.

2.2 Water Pollution

Water pollution, brought from neighbouring countries by rivers or generated domestically, is reaching worrying levels. Only half the population is linked to a system for evacuating waste water, and the water distributed to nearly 800 towns and villages has been qualified unfit for human consumption. Surface water and the tributaries of the main rivers are seriously contaminated with mercury, lead and bacteriological agents and there is a great deal of seepage of nitrates into underground water (115000 tons a year).

2.3 Soil Pollution

No reliable date is available on the soil but the improper use of fertilizers, atmospheric fallout and waste deposits have pushed the acidity level over the critical threshold of 4.5 pH in some places. Salinity has reached worrying levels over 100000 Ha in a region where the rise of underground water is threatening other irrigated areas. About 30 % of forests are affected, 12 % of which seriously.

2.4 Solid and Chemical Waste

Waste disposal is a real problem in Hungary. The some 17 million cubic meters of waste produced each year are put in 2600 dumps, of which only 58 % are deemed to be adequately protected.

Hungary, also, imports hazardous waste which it is not adequately equipped to stock.

2.5 The Energy-Related Projects of the Environmental Protection Programme for Hungary

The specifics energy related projects of the Environmental Protection Programme for Hungary are presented in the following paragraphs.

2.5.1 Study for SO_2 Emission Reduction at three Power Stations

The Hungarian Electricity Board (MVMT) committed itself to the national environmental programme by, inter alia, pledging to reduce SO_2 emissions from its thermal power generation stations. For this purpose, the three plants of Pecs, Oroszlany and Gagarin have been selected as they have high SO_2 emissions. For the plant at Pecs, a preliminary assessment of the most suitable technology or reducing SO_2 emissions.

The objective will investigate the specific technical problems and characteristics of each one of the three plants, especially with respect to the type of coal fired. Based on this and an assessment of the internationally existing technologies available for SO_2 reduction, the study will determine the most appropriate technology in terms of effectiveness and costs. For the plant at Pecs, technical assistance will be provided to MVMT to prepare tender documents, for tendering and bid evaluation.

The three plants are subsidiaries of MVMT. From the government's side, the study would be monitored by the Ministry of Industry on behalf of the Project Management Unit (PMU) at the Ministry for Environment and Water Management.
The terms of reference of the study will be prepared by 30 June 1990, and the study will be completed by 31 March 1991.

The total cost of the study is estimated at 0.20 MECU, all of which is included in the PHARE programme for financing on a grant basis.

Without undertaking the study, there is a danger of less than optimal decisions being made concerning the most appropriate technology and equipment. The benefits of the study lie in the reduction of such less than optimal decisions and their associated high costs.

The study is justified on the grounds that its cost is very small in relation to the investment requirements for reducing SO_2 emissions at the three plants, while the potential benefit of achieving considerable cost savings is substantial.

2.5.2 Fluidized Bed Installations at Ajka and Dorog Power Stations

The Hungarian Electricity Board (MVMT) has been analyzing possible technical solutions for the cost-effective reduction of its coal fired power plants. For this purpose it developed its own technology of combining fluidized bed firing with the conventional process of pulverized coal burning. A pilot project has been operating for three years with excellent results. MVMT therefore now plans to apply the technology to the boilers of the two power plants at Ajka and Dorog.

The objective comprises the conversion of two boilers of 100 t/h of steam generating capacity at Ajka and one boiler of 50 t/h capacity at Dorog. Since the coal at Dorog has a low calcium content and thus a limited capacity to bind the sulphur in the ash, additives have to be added to the coal and for this an appropriate system is included in the project.

For the Ajka power plant installation the research Institute for the Electric Power Industry (VEIKI), which developed the fluidized bed technology, has assumed the role of the main contractor. For the conversion of the boiler at Dorog, the Energy Management Institute (EMI) will assume this role, as the capacity of VEIKI is limited to undertaking the work at Ajka. Monitoring of the project will be done by the Ministry of Industry on behalf of the Project Management Unit (PMU) at the Ministry for Environment and Water Management (KVM).

The first boiler at Ajka will be completed by 15 August 1990 and the installations are expected to be completed by 15 August 1991.

The capital cost and the financing plan of the project is as follows:

Capital Costs (MECU)

Item	Foreign	Local	Total
First boiler Ajka	0.42	0.80	1.22
Second boiler Ajka	0.42	0.80	1.22
First boiler Dorog	0.40	0.51	0.91
Base costs (as of January 1990)	1.24	2.11	3.35
Physical and price contingencies	0.11	0.24	0.35
Total costs	**1.35**	**2.35**	**3.70**

Financing of the foreign exchange requirements amounting to 1.35 MECU is included in the PHARE programme. The possibility for providing the financing partly as a grant is being considered. The local costs will be covered by the government.

The operation of the converted boilers will result in a reduction of SO_2 emissions totalling 4,900 t/year and of NO_x of 310 t/year. In relative terms, the SO_2 and NO_x emissions will be reduced by about 50 and 35 % respectively.

The project is justified on the grounds that the Hungarian technology is, for the relative reduction of emissions to a level of 70 %, the lowest cost technology available and thus highly cost-effective.

2.5.3 Geothermal Pilot Project

Hungary imports about 80 % of her energy requirements, while she is one of the richest countries in Europe regarding geothermal energy. However, as the thermal waters are highly saline and contaminated by hydrocarbons, their discharge into surface waters after utilizing their energy, as practiced now, causes considerable damage to the Environment. Another constraint stems from the fact that replenishment in many of the thermal water sources is very slow so that production pressure and yields decrease with increasing abstraction. The only technical solution to these problems is the reinjection of the used water into the ground. Limited experience is available for this technology in Hungary as well as in other countries.

The objective of the pilot project is to demonstrate the technical feasibility as well as the financial and economic viability of making environmentally sound use of the geothermal water potential of Hungary.

The pilot project comprises: (1) drilling and commissioning two thermal water reinjection wells at the Felso Varos housing estate (12,000 inhabitants) in the town of Szeged, where thermal waters are now utilized for heating purposes and discharged into surface waters; (2) drilling and commissioning of two thermal water production and reinjection wells for providing another housing estate in Szeged with heating water, replacing a gas fired boiler system, and (3) a long–term monitoring and evaluation programme, ensuring that the results of the pilot project are properly analyzed and used for the further exploitation of the geothermal water potential.
The firm Geo–Thermal Cooperative of Budapest is specializing in this field, has prepared the project and would be responsible for its implementation and long–term monitoring. All construction work will be tendered on a turnkey basis. Operation of the wells and heat exchange system will be the responsibility of the city council of Szeged. The project would be supervised by the Ministry of Industry on behalf of the PHARE Project Management Unit of the Ministry for Environment and Water Management.

The project has already started. The contracts are expected to be awarded by October 31, 1990 and the project to be completed by the end of 1991.

The Capital costs and the financing plan of the project is as follows:

Capital Costs (MECU)

Item	Foreign	Local	Total
Reinjection wells at Felso Varos	0.18	0.90	1.08
Production and reinjection wells at Eszak	0.26	1.46	1.72
Base costs (as of January 1990)	0.44	2.36	2.80
Physical and price contingencies	0.07	0.33	0.40
Total costs	**0.51**	**2.69**	**3.20**

The cost of the long-term monitoring and evaluation programme is not included in the capital costs, as these activities will only be carried out after 1991. As no local funds are available for this pilot project, the total amount of 3.20 MECU is included in the PHARE programme for financing. Considering the pilot character of this otherwise revenue earning project, part of the financing is foreseen on a grant basis.

Most importantly, the project will demonstrate the feasibility of utilizing thermal waters in an environmentally sound manner. In addition, the pilot project will save 5.3 million m^3 of natural gas per year and stop the pollution now caused by the discharge of the used thermal waters.

According to calculations made by Geo-Thermal, the investment will be recovered within six years and is therefore already justified on economic grounds alone.

2.5.4 Taurus Rubber Energy Savings Project

Know-how and technological development for saving energy in industrial processes through modern, computer based energy management systems, are not well developed in Hungary. The Taurus Hungarian Rubber Works is one of the industrial enterprises in the country with high energy throughout. For two of three factories, the one in Szeged processing rubber for industrial use and the other in Budapest producing tyres, Taurus the potential for energy savings through improved energy management has been analyzed in detail and corresponding project prepared.

The objective of the project is to reduce the specific energy consumption at Taurus' Szeged and Budapest plants. This serves the overall objectives of decreasing air pollution reducing unit costs and thus increasing the competitiveness for the company's products, improving the energy balance of the country and demonstrating that improved energy management applying up-to-date technology is a feasible and economic undertaking.

The project comprises the procurement, development, installation and commissioning of computer based energy management systems for the plants at Szeged and Budapest, including the associated hard- and software, data collection systems, actuators, interfaces to other computer equipment, etc.

The project has been prepared and will be implemented by Taurus, with Mrs K. Bekes, chief of the company's energy department, assuming project management responsibility. The project will be monitored by the Ministry of Industry on behalf of the Project Management Unit (PMU) of the Ministry for Environment and Water Management (KVM).

The technical specifications have been completed, and the systems are expected to be operational by 31 August 1991.

The capital cost and financing plan of the project is as follows:

Capital Costs (MECU)

Item	Foreign	Local	Total
Szeged system	0.20	0.12	0.32
Budapest system	0.78	0.57	1.35
Base costs (as of January 1990)	0.98	0.69	1.67
Physical and price contingencies	0.15	0.11	0.40
Total costs	**1.13**	**0.80**	**1.93**

The foreign exchange cost of the project amounting to 1.13 MECU is included in the PHARE programme on a loan basis with terms and conditions to be determined. The local costs will be financed by Taurus.

The projected energy savings are estimated at 210 TJ/year, valued at 0.64 MECU (HUF 48.3 million).
The project is justified on the basis of financial and economic internal rates of return of 30 and 38 % respectively.

2.5.5 Thermal Water Resources Study

The thermal waters of Hungary constitute some of the most valuable resources of the country. The thermal water is exploited for both heating and medical purposes. At present about 500,000 m^3/day of thermal water is used from the natural springs as well as the about 1100 drilled wells. Abstraction of water from the confined thermal acquires has resulted in many cases in substantial loss of pressure and volume and there is the fear that the tapped resources are over-exploited. Despite the long tradition in Hungary of making use of these resources, relatively little is known about their characteristics.

The objective of the study is to undertake an assessment of the thermal water potential of the country in order to gain a better understanding of the characteristics of this resource. It serves the general objective of defining the necessary policies and methods for making sustained and environmentally sound use of the country's thermal water.

The study constitutes the first phase of a longer term programme and comprises:

a) a basic survey of all wells and springs;

b) procurement of equipment for the instrumental survey of wells and springs;

c) a detailed survey of the 200 most important wells and springs;

d) establishment of a theoretical model for assessing thermal water resources; and

e) study tours.

Execution of the study would be the responsibility of the Research Centre for Water Resources Development (VITUKI), with Mr.B.Ferenc being the study coordinator. VITUKI would also involve those organizations in the study that are presently utilizing thermal waters or are undertaking research and development work. The study will be supervised by the Department of Water Management of the Ministry for Environment and Water Management (KVW).

The procurement of the required equipment will be completed by 30 September 1990. The survey will last from September 1990 to December 1991 and the water modelling work will be completed by the end of 1991.

The capital costs and financing plan of the project is as follows:

Capital Costs (MECU)

Item	Foreign	Local	Total
Basic survey of wells and springs	-	0.05	0.05
Equipment	0.13	0.02	0.15
Survey of 200 wells	-	0.28	0.28
Water modelling	-	0.02	0.02
Study tours etc.	0.03	0.01	0.04
Base costs (as of January 1990)	0.16	0.38	0.54
Physical and price contingencies	0.02	0.04	0.06
Total costs	**0.18**	**0.42**	**0.60**

Of the total estimated cost of the study of 0.6 MECU, 0.2 MECU will be financed by local sources and 0.4 MECU are included in the PHARE programme on a grant basis.

Undertaking the study will provide the basis for better decision making with respect to the most appropriate use of the country's thermal water resources. The benefits of the study thus will be the avoidance of misinvestments and environmental damage that could result from the continuation of the present practices.

The study is justified on the grounds that its costs are small in relation to the benefits that could result from a rational and environmentally sound exploitation of the thermal water resources potential of the country.

3. *THE REGIONAL ENVIRONMENTAL CENTRE FOR CENTRAL AND EASTERN EUROPE IN BUDAPEST*

In July 1989, as a follow up to the initiative to help the Central and Eastern European countries overcome their environmental problems, the President of the USA proposed the establishment of a Regional Environmental Centre located in Budapest, as a potential major contribution to the improvement of the environmental situation in the region linked with the ongoing process of economics reforms. From the start, the Centre has been presented as a possible multinational venture.

The interest G-24 could have in the establishment relates not only to the support it could bring to improving environmental action in the region, but also because of the close relationship and interaction existing between environmental issues over Europe. In this respect a close relationship with the proposed future Community environmental agency is of interest.

According to the draft charter established in January 1990 by the US and Hungarian authorities, the Centre is to be an independent, non-advocacy, non-profit making organization. Recognizing that local and regional actions are essential to resolving global environment problems, and responding to growing private and public concern for the environment in the region, the Centre is established to address environmental challenges generally common to Central and Eastern Europe. The Centre will be a source of information and assistance for citizens of the region regarding critical or persistent local, national and regional problems. These purposes are served best by the active participation of non-governmental organizations (NGOs, business and non-profit organizations) from Hungary, the United States and elsewhere in the organization and operation of the Centre.

The Centre will act as a catalyst for the support of individuals and organizations that advocate or implement solutions to the environmental problems in this region. It will promote interaction and cooperation among diverse interests. The Centre may engage in, support and encourage activities in the following areas:

- Data Collection and Dissemination;

- Development of institutional Capability;

- Education; and

- Clearing house for matching resources from a variety of sources.

The Centre will sponsor and support seminars, workshops, exhibitions, training courses, exchanges, fellowships, studies, professionals, maintains and publicize a collection of environmental information. The Centre may develop formal of informal ties to other organizations with related interests. Participation by government agencies and non-governmental groups, international organizations, citizen's groups, academia and industry is encouraged.

The Centre is to be governed by a Board of Trustees, with 10 to 15 members. Membership should be broadly representative. The Chairman shall be elected for a term of 3 years. The Board shall appoint an Executive Director to manage the day-to-day affairs of the Centre. According to the charter drafted by the USA and Hungarian authorities, the first Executive Director shall be a Hungarian citizen supported by a Programme Manager who is a US Citizen.

It is expected that this proposed structure will be subject to modification after discussion with other potential participants. The Commission has indicated its intend, within this context, to obtain a significant role for the European Community and its Member States in the Centre's structures, corresponding to their financial and substantive commitment to its aims.

The following timetable has been set by the USA and Hungary:

March – April 1990	Develop and refine the programme description, financial plan etc.
April – May 1990	Form the Board of Trustees and select the Executive Director and Programme Manager.
May – June 1990	Finish the Charter and set priorities for the initial activities of the Centre – Formulate and publish the programme announcement.
July 1990	Start Operation

The timetable could be influenced by negotiation with other possible participation. The Centre will be a permanent organization.

According to the draft charter, the Centre is initially established with funds provided by the Government of the United States, the Government of the Republic of Hungary and by other sources. The hypothesis under which the USA and Hungary appear to have agreed is a tripartite financing scheme (1/3 USA, 1/3 Hungary, 1/3 others participants) for a total estimated cost of 12 MECU (US$ 15 Million) over 3 years (1990 –1992).

Accordingly the original purpose of the USA was to devote US$ 5 million for 3 years to cover 1/3 of the Centre's expenditure, assuming that one year's expenditure would reach US$ 5 million, part of which going to the endowment fund.

The Commission has expressed the view that financing should be spilt in four equal parts: Hungary, USA, European Community and other potential participants. According to its view the Commission proposed that the EEC's participation from the 1990 budget, be a significant contribution for the year 1990 and 1991, i.e. 2 MECU (= 1/4 of the total cost), the USA would contribute 2 MECU, the Hungarian authorities 2 MECU or equivalent and from other sources a contribution of another 2 MECU are expected.

The Centre is to be served by two types of financial arrangements.

The first is an operating account, from which disbursements are made to support projects and activities authorized by the Board of Trustees. The second account is the endowment fund from which withdrawals are made by Board resolution. An international accounting firm with offices in Budapest shall be retained to audit bank with offices in Budapest.

Whether or in which proportion the EEC contribution would be allocated to the operating account or the endowment fund is to be decided, considering the total financing available from the different participants and its modalities. Possible later contributions and their modalities will have to be considered in the light of the achievements of the Centre. Its future programmes, and its financial situation.

4. PROGRAMME FOR BASIC TECHNICAL ASSISTANCE TO POLAND FOR THE PRIVATIZATION AGENCY

The cornerstone of the liberalization and economic reform process is the break-up and privatization of the estimated 6000 plus Polish state-held companies. A privatization agency will have the job of drawing up legislation and establishing the necessary procedures and conditions for an orderly and equitable privatization of these state-held companies. The agency will have a double role - preparations for privatization and privatization itself, and creation of a securities market. This will finance technical assistance, training abroad and outside institutional support. The first stage of the project will be implemented in close liaison with the international Finance Corporation.

5. MODERNIZATION OF THE FINANCIAL SYSTEM OF HUNGARY

The Hungarian Government is engaged in sweeping reforms of policies, institutions and financial instruments, which are in integral part of general process of economic liberalization. Financial reform is seen as a key element of economic restructuring.

Hungary's national bank is negotiating with the World Bank for a loan of some US$ 66 million for the modernization and strengthening of the financial system.

The Community will finance part of the technical assistance and institutional support needed for the modernization programme. The programme will be implemented by the national bank in close cooperation with the World Bank and the Hungarian banking association.

6. COOPERATION IN THE FIELD OF ECONOMICS FOR POLAND AND HUNGARY

The aim of this cooperation is to promote an exchange of scientific knowledge and expertise in specific economic fields between professional and academic economists of Poland, Hungary and the Community.

The specific fields will concern the process of reform and economic integration, including an analysis of the macroeconomic situation and ways of tackling macroeconomic imbalances, and questions relating to liberalization, integration and microeconomic reform.

Community aid will mainly take the form of grants for research and teaching, research networks and projects and advanced training course.

7. TECHNICAL ASSISTANCE FOR THE IMPLEMENTATION OF THE TRANS-EUROPEAN MOBILITY PROGRAMME FOR UNIVERSITY STUDIES (TEMPUS) FOR POLAND AND HUNGARY

The aim of the programme is to create a technical assistance instrument for the start-up and initial implementation phase of the TEMPUS programme, starting on 1 May for a period of nine months.

It is planned to establish a central coordinating office to help set up TEMPUS offices in Poland and Hungary, develop administrative procedures for the administration of TEMPUS grants, select projects for this year and establish proper coordination with the relevant authorities within the Community and other countries of the Group of 24.

8. SECTORAL IMPORT PROGRAMME FOR ANIMAL FEEDS AND ANIMAL-FEED ADDITIVES FOR POLAND

This is the second operation to aid Polish agriculture. Under the programme, 40000 tons of animal feed (for pigs and poultry) and various additives to the value of ECU 4 million will be sold to private-sector farmers, who will thus have an opportunity to obtain good quality products at a low price. This will help improve the financial situation of private-sector farmers and boost production of good quality meat.

Technical assistance will be given to help improve the food and health situation and to impart appropriate technology for the animal-feed industry. A study will be carried out to lay down a coherent and effective strategy for the meat sector and food stocks.

Annex B

Operation Phare

Indicative Financial and Aid Commitments (as of May 14, 1990)

OPERATION PHARE

INDICATIVE FINANCIAL AND AID COMMITMENTS
(as of May 14, 1990)

POLAND

	Amount actually committed or envisaged (MECU equivalent)	Comments[1]
1. FUNDS ALLOCATED TO THE ORIGINAL PRIORITIES OF THE G-24		
A. Food supplies	Total 380.590	All G-FC
Australia	3.500	
Austria	2.800	
Canada	9.200	
EC	12.500	A new tranche is being prepared (300.000 t. wheat)
Finland	7.000	
Iceland	0.300	
Italy	8.000	
Japan	22.500	
Norway	6.600	
Switzerland	2.800	
Turkey	0.920	
USA	7.370	FY 89
	112.60	FY 90

1 G: Grant
L: Loan
FC: Firm Committment
PC: Possible Committment

B. Technical assistance to Agriculture

Austria	0.700	Both countries
Germany	2.500	G-FC; aid to the Polish Church to promote the private agricultural sector (2 in FY 89 and 3 in FY 90).
	5.000	G-PC: delivery of second-hand agricultural machinery to Poland.
	0.500	G.PC: technical assistance to Polish Ministry of Agriculture.
Netherlands	0.650	G.FC: cooperation actions
New Zealand	0.260	Technical assistance development fund: both countries: also for environment
	0.053	Assisting NZ companies to develop links to both countries: also for environment.
Switzerland	16.800	
United Kingdom	20.500	
Ireland	118.900	

C. Vocational training (Training and retraining, Management training)

Austria	2.100	Both countries.
	14.700	Cultural, agricultural and scientific cooperation (three year programme)
Canada	7.700	Both countries
Denmark	2.000	FY 90 - FC-G (both countries)
	4.000	FY91-92 PC-G (both countries)
Finland	0.400	Both countries

Finland	0.400	Both countries
France	14.400	G-FC: research, training and cooperation programme in the food industry
Germany	1.600	Special training programme in the fields of management, economics, science and law (scholarships included).
Italy	1.330	Both countries
Japan	22.500	GFC-Both countries (covering vocational training and environment)
Netherlands	0.650	
New Zealand	0.130	Agricultural education programme
Norway	1.230	GFC
Spain	1.000	Both countries
Switzerland	16.800	PC-G Both countries (includes cultural cooperation)
Turkey	0.540	Both countries: additional contribution by Turkish Banks association
United Kingdom	7.100	"know-how fund" (G-FC)
USA	28.000	Cultural/scientific exchanges. Both countries
	21.600	Support for democratic institutions. Both countries

D. Investments, joint ventures, industrial development credits

Denmark	37.500	Both countries: three year funding for investment + grants for projects (F-C)
	125.000	Investment guarantee arrangement
Finland		Investment guarantee scheme
France	144.000	Investment guarantee scheme
Germany	1.500	Bank credits for craftwork production (L-FC)
Italy	33.250	Both countries; public corporation to finance joint ventures and to extend support to small businesses. (L-FC) Concessionary terms (1,75%, 20 years loans, with a 5 year grace period)
Norway	19.800	Export credit guarantee for investment and export of capital goods (FC).
USA	216.200	"Enterprise fund" to help promote the private sector (G-FC). Both countries
	5.400	Trade development Telephone system modernisation
Switzerland	86.600	PC-G/L

E. Environment

Denmark	62.500	FY 91-95, PC-G (both countries)
Finland	18.400	Over three years
Japan		(see under Vocational Training)

New Zealand		(see under Agriculture)
Norway	1.300	G-FC
Sweden	42.500	Over three years
Switzerland	16.800	PC-G Both countries
USA	13.800	G-FC for Krakow (sulphur dioxide emissions, water quality and supply, air quality)
Nordic countries	42.800	Both countries Finance corporation for the purpose of Nordic participation
<u>F. Energy</u>		
USA	27.000	Both countries
<u>G. Others</u>		
Belgium	3.000	Both countries
Germany	1.100	FC for supporting measures in the social political field
	5.000	FC: promotion of social & economic development (1990): Both countries
	22.500	PC: further commitments for promoting social & economic development (1991-1993) Both countries
Germany	15.000	FC: reduction of postal fees for parcels sent to Poland
Ireland	0.840	General Economic Aid (details to be decided); Both countries
	0.130	Trust Fund to the World Bank for Poland
Italy	7.000	Medical aid (G-FC)

Japan		Formulation and implementation of projects in Poland to be supported by the World Bank and financed as grant by Japan Special Fund established with World Bank
Luxemburg	0.500	Unspecified projects
Netherlands	4.400	Medical supplies
	6.500	General Credit for Cooperation both countries
USA	4.900	Science and technology exchanges
	3.600	Medical supplies, hospital equipment and medical training

2. RECENT DEVELOPMENTS OUTSIDE THE SCOPE OF THE ORIGINAL EXERCISE

A. Export Credit Guarantee Ceilings

Austria	69.000	City of Vienna
	51.750	Federal Government short term credit scheme (PC)
Belgium	69.200	PC
Canada	15.400	PC Revolving Fund which would be available for additional commitments as reimbursed
Finland		Open without ceiling
France	480.000	
Germany	1.250	FC, 1990-1992
Italy	363.600	
Japan	322.000	FC- over two years. Subject to clearance of arrears of guarantied commercial credits and in accordance with the developments of structural adjustment programme agreed with IMF.
Luxemburg		Supplementary ceilings under examination
New Zealand	50.000	Both countries
Norway	19.800	Guarantee scheme for capital goods and investments (FC)
Spain	44.000	FC On a case by case basis. Amount could be increased
Turkey	90.000	FC
USA	180.000	Both countries

B. Project financing

EIB	1.000	Over three years for both countries: principle approved by Council of Ministers: EC budget guarantee
IBRD	276.000	For information only Two projects are ready; they should be followed by another $300 M project loan and then perhaps by a $500M SAL; total commitments could reach $1bn by the end of 1990 (PC)
Japan	450.00	Over 3 years - united loans of EXIM Bank (including co-financing with international development financing institutions- subject to clearance areas due to EXIM Bank and in accordance with the developments of structural adjustment programme agreed with IMF
Spain		Case by case commitment
United Kingdom	21.000	Agricultural projects

C. EEC Action plan

EEC	300.000	G-FC (both countries) for various fields

D. Contributions to the Polish Stabilisation Fund (PSF)

As the PSF will be managed in dollars at the New York Federal Reserve bank, the figures given under this heading are all in American currency (000.000)

	in millions of dollars	
Australia	0.760	
Austria	20.000	G-FC (in schillings)
Canada	25.000	G-FC
Denmark	7.700	
Finland	5.100	FC (in Finnish marks)
France	100.000	L-FC (in French francs)
Germany	250.000	L-FC - credit line in DM (not deposited at the NYFRB)
Iceland	0.330	FC
Italy	100.000	L-FC (in lira)
Japan	150.000	L-FC (yen loan)
Portugal	2.500	L-FV (order of magnitude)
Spain	14.000	L-FC (order of magnitude)
Sweden	10.550	L-FC
Switzerland	30.000	L-FC
Turkey	1.500	0.75 local currency
United Kingdom	100.000	G-FC (in sterling)
United States	200.000	G-FC
TOTAL	1017.440	

Two other countries have expressed an interest in contributing to this Fund Norway and Luxemburg: the possible figures have not been specified.

E. Balance of payments support

IMP	644.000	For information only PC-L (for the time-being, a request by Poland)

F. Debt reduction (other than in the Paris Club framework)

Germany	380.000	Cancellation of arrears on a DM 1bn loan of 1975 Conversion of future payments on DM 1bn loan of 1975 into local currency to be used for German-Polish projects (PC-G)

HUNGARY

	Amount actually committed or envisaged (MECU equivalent)	Comments[1]

1. FUNDS ALLOCATED TO THE ORIGINAL PRIORITIES OF THE G-24

A. Technical assistance to Agriculture

Austria		See under Poland
New Zealand		See under Poland

B. Vocational training (training, retraining, management training)

Austria		See under Poland
Canada		See under Poland
Denmark		See under Poland
Finland		Management training Energy saving, te lecommunications, food processing See under Poland
Germany	1.600	Special training programme in the fields of management, economics, science and law (scholarships included)
Italy		See under Poland
Ireland	0.100	Fellowship scheme for management, language and other human resource training
Japan		See under Poland

1 G: Grant
L: Loan
FC: Firm Committment
PC: Possible Committment

Netherlands	1.300	For all fields
Spain		See under Poland
Turkey		See under Poland
United Kingdom	35.600	C-PC ("know-how fund")
Switzerland		See under Poland
USA		See under Poland

Note: Other countries are already involved in this field with firm commitments for unspecified amounts (Norway, Japan, France, Luxemburg and yet another group is studying the possibility of entering into commitments (Australia, Greece, New Zealand, Belgium).

C. Investment (joint ventures)

Denmark		See under Poland
Italy		See under Poland
Switzerland		PC-G investment promotion activity
USA	0.920	PC (would cover a three year period) (see also under Poland)
	23.000	G-PC (enterprise fund to promote the private sector)

Note: Belgium, France and the Netherlands are also involved in this field with firm commitments for unspecified amounts. Germany extends government guarantees for investment in Hungary (DM 43 m so far). Canada is looking into the possibility of entering into commitments.
Japan considering overseas investment credits of EXIM Bank following discussions between IMF and Hungary.

D. Environment

Denmark		See under Poland
Japan		See under Poland
New Zealand		See under Poland
Nordic countries		See under Poland
USA	4.600	G-FC creation of a Regional
	18.400	Environmental Centre in Budapest

Note: Finland, Austria, Germany, the Netherlands and Spain are also involved in this field with firm commitments for unspecified amounts. Austria has a working programme on the basis of bilateral agreements.

E. Energy

USA		See under Poland

F. Others

Belgium		See under Poland
Canada	11.700	Credit to the Hungarian national bank for the purchase of Canadian goods (FC-L)
Germany	1.100	FC: supporting measures in the social and political field * see under Poland
Ireland		See under Poland
	0.100	Trust Fund to the World Bank for Hungary
Italy	133.000	
Japan		Formulation and implementation of projects in Hungary to be supported by the World Bank and will be financed as grant by Japan Special Fund established with the World Bank by Japanese contributions
Netherlands		See under Poland
Turkey	0.230	(G) Medium term facility

2. RECENT DEVELOPMENTS OUTSIDE THE SCOPE OF THE ORIGINAL EXERCISE

A. Export credit guarantees

Belgium	69.700	PC
Finland		Open without ceiling
Germany	420.000	Current exposure; no restrictions on further cover
Japan	357.000	FC- over two years
New Zealand		See under Poland
Spain		Open without ceiling
Sweden	127.500	FC- Above guarantee commitments already made
Switzerland		Open without ceiling
Turkey	90.000	FC
USA		See under Poland

B. Project financing

Austria		See under Poland
EIB		L-FC (as much as 1.0 bn Ecus could be extended as EIB loans to both Hungary and Poland, with Community budget guarantee)
Italy	50.000	L-FC - Concessionary terms (1,75%, 20 years loan, with a 5 years grace period)
Japan approx.	450.000 (overseas investments included) credit	Over 3 years untied loan of EXIM Bank including co-financing with the international financing institutions following discussions between IMF and Hungary

C. Economic Development Financing

EEC	870.000	PC- Proposal for a loan up to max. 1.0 bn ECUs for structural adjustments.
Finland	85.000	Structural adjustment credit
Germany	500.000	FC: untied loan in 1987, guarantied by the federal government.
	250.000	FC: increase of 1987 federal government-guarantied loan (1989)
	250.000	FC: bank loans, partially guarantied by Lander - governments of Bavaria, Baden - Wurttemberg (1989)

D. EEC Action Plan

See under Poland

OTHER FINANCING INDICATED BY DONORS

	Amount actually committed or envisaged (MECU equivalent)	Comments[1]
Australia	3.150	Training programme for Eastern Europe
Austria	345.000	East-West fund to promote investment in Eastern Europe
Sweden	96.000	For Eastern Europe over a three year period
United Kingdom	75.000	Know-How Fund for Eastern Europe over a period of 5 years

1 G: Grant
L: Loan
FC: Firm Committment
PC: Possible Committment

Annex C

The Organizational Structure and the Functions of the European Bank for Reconstruction and Development

THE ORGANIZATIONAL STRUCTURE AND THE FUNCTIONS OF THE EUROPEAN BANK FOR RECONSTRUCTION AND DEVELOPMENT

The idea for creating a European Bank for Reconstruction and Development was first presented by President Mitterand in his address to the European Parliament as President in exercise of the Council, on October 25, 1989.

According to its Establishing Agreement, which was approved by the Ministerial Meeting of the forty-two participating countries in Paris on May 29, 1990, the Bank will have a Board of Governors, a Board of Directors, a President and one or more Vice-Presidents. Each Member country shall be represented on the Board of Governors and shall appoint one Governor and one Alternate Governor. The Commission will appoint the Governor and the Alternate Governor on behalf of the Community.

The Board of Directors will be composed of 23 members, 11 of which shall be elected by the Governors representing the 12 EEC Member-States, the EEC, as such, and the EIB, 4 shall be elected by the Governors representing the Central and East European countries, 4 shall be elected by the Governors representing the rest of the European countries and the remaining 4 shall be elected by the Governors representing the non-European countries.

The President of the Bank will be elected for a four-year term by the majority of the total number of Governors representing, no less than a majority of the total voting power of the members. Mr. J. Attali has been elected as the first President of the EBRD.

The Bank will carry out its operations in any or all of the following ways:

i by making or cofinancing together with multilateral institutions, commercial banks or other interested sources, or participating in loans to private sector enterprises, loans to any state-owned enterprise operating competitively and moving to participation in the market-oriented economy, and loans to any state-owned enterprise to facilitate its transition to private ownership and control; in particular to facilitate or enhance the participation of private and/or foreign capital in such enterprises;

ii a. by investment in the equity capital of private sector enterprises;

b. by investment in the equity capital of any state-owned enterprise operating competitively and moving to participation in the market oriented economy, and investment in the equity capital of any state-owned enterprise to facilitate its transition to private ownership and control; in particular to facilitate or enhance the participation of private and/or foreign capital in such enterprises; and

c. by underwriting, where other means of financing are not appropriate, the equity issue of securities by both private sector enterprises and such state-owned enterprises referred to in (b) above for the ends mentioned in that subparagraph;

iii by facilitating access to domestic and international capital markets by private sector enterprises or by other enterprises referred to in subparagraph (i) of this paragraph for the ends mentioned in that subparagraph, through the provision of guarantees, where other means of financing are not appropriate, and through financial advice and other forms of assistance;

iv by deploying Special Fund resources in accordance with the agreements determining their use; and

v by making or participating in loans and providing technical assistance for the reconstruction or development of infrastructure, including environmental programmes, necessary for private sector development and the transition to a market-oriented economy.

In this respect, a state-owned enterprise shall not be regarded as operating competitively unless it operates autonomously in a competitive market environment and unless it is subject to bankruptcy laws.

More specifically the functions of the EBRD include:

i the promotion through private and other interested investors of the establishment, improvement and expansion of productive, competitive and private sector activity, in particular small and medium sized enterprises;

ii the mobilization of domestic and foreign capital and experienced management to the end described in (i);

iii the fostering of productive investment, including in the service and financial sectors, and in related infrastructure, where that is necessary to support private and entrepreneurial initiative, thereby assisting in making a competitive environment and raising productivity, the standard of living and conditions of labour;

iv the provisions of technical assistance for the preparation, financing and implementation of relevant projects, whether individual or in the context of specific investment programmes;

v the stimulation and encouragement of the development of capital markets;

vi the support to sound and economically viable projects involving more than one recipient member country;

vii the promotion in the full range of its activities of environmentally sound and sustainable development; and

viii the undertaking of such other activities and the provisions of such other services as may further these functions.

CHAPTER 4

Country Reports

4.1 Bulgaria

Bulgaria

A Survey of Energy Issues
and a Proposal for Cooperation with the
Commission of the European Communities

CONTENTS

CONTENTS

1. SOCIOECONOMIC PROFILE

1.1 General Background

Bulgaria is located in the middle East Balkans with a total country area of 110.912 km². Its neighbouring countries are: north-Romania, south-Greece and Turkey west-Yugoslavia, where the East part of the country is open to the Black Sea.

The climate of Bulgaria is considered to be continental, with July as the hottest month of the year (16-27°C) and January as the coldest (-4 to -2°C). The driest month is February with an average rainfall of 28 mm and the correspondent wettest month May with an average rainfall of 87 mm.

Based on the 1985 census the population of Bulgaria totalled at 8.942.976. The average annual population growth rate for the 1980's was situated in the order of 0.23 %. The urbanization of the population after World War II was rapid, in 1946 only 24.7 % of the population was urban where in 1986 the correspondent figure was 65.5 %. It should be mentioned that for the same year nearly 13 % of the country's total population lived in the capital, Sofia. Population distribution for the largest cities and towns are presented in table 1.0.

In the past (before 1945) the economy of the country was strictly agricultural with only minor development of other sectors, such as food industry, light industry and limited lignite mining. After World War II the economic structure of the country was completely reformed towards heavy industry while at the same time mechanization of agriculture increased productivity of this sector. Since then (1945) considerable success has been achieved in the industrial and the agricultural sectors.

1.2 Overall Economic Profile

Following an official increase of just over 5 % in each of the two preceding years, the real growth of national product in 1988 accelerated to 6.2 % (plan: 6.1 %), according to the plan fulfilment report. The growth of the economy was supported by a relatively mild winter, improved supplies of fuels and electricity and by vigorous increases in imports from non-socialist countries- at the price of a drastic worsening of the regional balance of trade. On the other hand, however, with the continued improvement in the terms of trade there must have been a real outflow of resources to the Soviet Union.

Whereas the growth of industrial production accelerated as planned to 5.1 % (1987: 3.8 %), agriculture showed a further drop in production in 1988 of 0.7 % (1987: -5.1 %); the plan had foreseen a growth of at least 5.5 %.

Concerning real per capita income, an increase according to plan of 3.4 % (1987: 4 %) is reported; yet, the slower development in the standard of living was accompanied by a worsening in the supply situation. The growing disequilibrium in the consumer goods markets was reflected in the increase of average nominal wages (246 leva per month) by 5.1 % as opposed to only 3.4 % for retail trade turnover at current prices. The worsening of the supply situation in spite of a number of measures to counteract this was demonstrated in the form of a growing list of scarce goods and in growing queues and, duke partly to production shortfalls in agriculture, even hit basic foodstuffs.

Gross fixed capital formation (10.4 billion leva at current prices) increased, with a growth rate of 3.6 % somewhat more slowly than planned. The share of modernization investment increased to 26 % and the share of investment in machinery and equipment to 44 %. Thanks to the growth of exports of 4 % and the fall in imports of 1.8 % the balance of trade in 1988 turned around to show a surplus of altogether 533 million valuta leva. This improvement was due to the trade with the socialist countries, including the USSR. The balance of trade deficit with the non-socialist countries multiplied itself by three: the drastic shrinking of the surplus with the developing countries played a decisive role here. Bulgaria's hard currency debts rose in 1988 by US$ 1.2 billion to an estimated US$ 7.1 billion gross of US$ 5.9 billion net by the end of the year, whereby the revaluation of the US dollar in relation to other Western currencies had a dampening effect.

The reform package, which took effect at the beginning of the year, was followed in the course of the year by isolated measures only, and the reform discussion concentrated on the fields of science, culture, education and health, and agriculture. At the beginning of 1989 a new round of extensive economic reforms was, rather surprisingly, decided upon. The legal form of a Decree by the state council ("ukaz" no. 56 for economic activity) which was chosen this time is higher in rank than a Cabinet Order, which was the usual form until then - The Decree lays down a new framework, putting the Order which had been passed only a year before, and which was to be valid until the end of 1990, out of force earlier than planned.

According to the Decree, economic activity in Bulgaria is to be based on a combination of state planning and regulation with the independence of the "firms" and the functioning of the market mechanism in accordance with the law, and it has to take account of environmental protection requirements.

1.3 Current Economic Situation

The main developments are for the moment limited to the political sphere. In December 1989 it was formally decided to hold multiparty elections in June 1990, which will be preceded by a new electoral law. The preparation of an economic stabilization programme and of a new legislation on property rights was also announced. A new constitution is to be drafted and approved before the end of 1990.

Official data on the economic performance in 1989 has not yet been released, but according to declarations and speeches by the new leaders, Bulgaria is affected by a major economic crisis. In fact, the economic situation is characterized by an increasing budget deficit and foreign debt. Around a quarter of government expenditure, i.e. Leva 7 bn, is spent on subsidies; public debt has reached Leva 10 bn. An immediate price liberalization - mainly linked to the necessity to reduce producer and consumer subsidies - will lead to a three digit price inflation rate. A 40 % increase in prices has actually taken place during the last ten years, as opposed to the marginal increase (0.3-3 % per annum) claimed by the officials statistics.

The country is affected by a massive monetary overhang, signalled by a rapid increase in the savings of the population, which are now totalling Leva 25 bn, and are roughly equal to one year's consumer purchases. The economy is also suffering from labour shortages, especially in agriculture, in part due to the recent surge in emigration of the population of Turkish origin.

In 1989 Bulgaria's non socialist trade has deteriorated. In particular, a persistent deficit characterizes Bulgarian trade with the EC: the accumulated deficit for 1981–1988 is over US $ 6 bn. It is estimated that the country's gross debt at the end of 1989 exceeded US $ 10 bn, with a sharp increase from the early 1980's when the debt totalled no more than 2 bn, and by far above preceding officially-reported figures. Hard-currency reserves total only $1.3 bn, while a large part of credit and loans due to be repaid by other countries to Bulgaria – about $ 1.5 bn – are extended to LDCs, and thus quite difficult to recover. Over the next six years the country will have to repay on interest alone more than US $ 4–4.5 bn, and debt service may cost as much as 184 % of Bulgaria's hard-currency trade.

Table 1.0: Population Distribution for the Largest Cities and Towns (1986)

City or Town	Population (10^3)
Sofia	1119
Plovdiv	349
Varna	303
Ruse	186
Burgas	186
Stara Zagora	154
Pleven	132
Tolbukhin	110
Sliven	104
Shumen	103

2. *THE ENERGY SYSTEM*

The development of the energy sector in Bulgaria during the last 20 years has been strongly influenced by the tendency towards concentration of energy resources production, conversion and centralization of distribution. Thus, the following functional energy systems have been set up: electric energy, heat energy, coal mining, nuclear energy and oil processing.

2.1 Institutional Structure of the Energy Sector

The energy sector of Bulgaria is administrated now by the Economics Ministry, where according to the recent reforms started in 1988 the Former Energy Ministry was abolished. The energy sector at this time is still under revision (May 1990) incorporating restructuring economic factors which have recently evolved. The present organizational structure of the energy sector has the following hierarchy:

A.	**Economics Ministry**	
B.	**Committee of Energy**	
C.	**Type 'A' Organizations**	**Type 'B' Organizations**
	- R & D - Engineering - Construction - Management	- Exploitation - Economic control - Maintenance

The most important role in the country's energy sector is held by the Committee of Energy. The Committee is responsible for the overall energy sector supervision and for the drafting of the general development guidelines and the energy policies along with the future goals on the country's energy supply and demand system. Under the Committee of Energy there are two types of organizations, 'A' and 'B'. These organizations are responsible for the development and the rational exploitation of the energy sector respectively. In detail, the type 'A' organizations undertake the tasks of energy planning, R & D for most of the energy systems, along with power plant design and construction responsibilities. Type 'B' organizations are responsible for the exploitation of the energy resources, the operation and maintenance of the energy systems and the power plants. Although, these enterprises are under the supervision of the Committee of Energy recent reforms have given them certain degree of freedom in the context of the upcoming economic market system.

The enterprises which belong to the type 'A' group, along with their associated specific responsibilities are the following:

ENERGOPROEKT:	R & D of energy systems, national and power utility energy planning, design of electric power stations (thermal, hydro), industrial heating plants, power transmission lines and substations, urban electric networks and district heating systems.
ENERGOISGRAGDANE:	Detail engineering work on construction, modernization and maintenance of power transmission lines and substations.

MINSTROY:	Construction of open and underground coal pits and other minerals, manufacturing of spare parts for pit support and custom made equipment for mines.
ENERGOREMON:	Repair of main and auxiliary equipment in all thermal and hydro power plants, production of spare parts and custom made units, reconstruction and modernization of power equipment.
PROMISHLENA ENERGETIKA:	Research, investigation, design, implementation and production activities in industry, agricultural and domestic energy sectors, concentrating on tasks for the rationalization on energy end use and conservation of energy.
TECHENERGO:	Research, design, production in the field of rationalization, automation and modernization of technological processes in the energy sector, the development of new equipment for the exploitation of low grade fuels.
NIMPROEKT:	Research, design and engineering in the field of coal mining, dressing and briquetting, development of complex mechanization schemes and integrated systems for process flow management.
ENERGOKIBERNETIKA:	Research, design, engineering and manufacturing in the field of energy information systems, electronics and automation systems.
ENERGOIMPEX:	Foreign energy trade, imports and exports of coal, electricity and other energy carriers, imports of machinery and equipment for the power industry.

The predominant role for the development of the overall energy system is undertaken by the ENERGOPROEKT enterprise which directly reports to the Committee of Energy. Also, it should be noted that a number of the above enterprises carry out work outside Bulgaria. The largest work volume abroad is performed by ENERGOPROEKT in the field of power plant design and construction management.

The enterprises of the 'B' group type are those dealing with the exploitation the operation and the economic control of all the energy transformation systems as follows:

- Lignite and hard coal mines
- Fossil thermal power plants
- Nuclear power plants
- Hydro power plants
- Electrical transmission and distribution networks

- Industrial thermal power plants
- District heating systems

It should be emphasized that the above institutional structure of the energy sector is being revised at present where its final form will probably take place after the national elections in June of this year. According to Committee of Energy officials major changes are not anticipated, especially within the type 'A' enterprises which are of interest to this study.

2.2 Primary Energy Profile

Bulgaria's energy system depends heavily on imported fuels. About 60 % of the total energy consumption has to be imported, the highest rate in East Europe. Main primary fuel imports are oil and natural gas from the Soviet Union, almost 100 % of the imported supply needs. The country has large deposits of brown coal and lignite which is considered to be of low heating value and quality, and small amounts of bituminous coal and anthracite. The annual production of domestic coal amounts to 71 % of the solid fuel needs. Electricity demand is mainly satisfied by nuclear power plant production, almost 29 %, fossil fired thermal power plants and a small share from hydroelectric power plants.

2.2.1 National Energy Resources

The main drawback feature on Bulgaria's energy sector development is its limited indigenous energy sources. Indicative, the available fossil fuels resource per capita is in the order of 139 toe as compared to world's average of over 1390 toe. The main energy resource of the country is coal with an estimated stock of 4.4 billions of tons, 80 % of which have already been investigated since 1956. The coal stocks are distributed among 34 solid fuel deposits, most of them being rather small in size and not economic or technically feasible for exploitation. The types of coal available and their associated contribution with respect to the total stock are:

–	Lignite	85 %	of all coal deposits
–	Subbituminous coal	6 %	of all coal deposits
–	Bituminous coal	6 %	of all coal deposits
–	Anthracites	3 %	of all coal deposits

Lignites have the largest share of Bulgaria's coal stocks. This fuel is characterized by its low heating value of 4.0 to 8.0 MJ/kg, its high ash content of 11.5 % to 32.0 % (dry ash basis) and its moderate to high sulfur content in the range of 1.1 % to 3.9 %. Subbituminous coal has a heating value of 8.0 to 17.0 MJ/kg, very high ash content between 18.2 % and 50.2 % and a moisture content of 13.5 % to 35 %.

The country's coal resource centre is located at Maritza–East with a lignite field area of 240 sq.Km. The fuel seams are situated at depths of 20 m to 90 m and have a thickness of 3 to 22 m. Thus, open–pit mining is possible and feasible. However, at a smaller field in Maritza–West (nearby Dimitrougrad) coal can be found up to 200 m below the surface in seams with a thickness of 1.7 to 3.0 m, where partial underground mining is necessary.

Bituminous coal stocks are small and can be found in the Eastern part of the Balkan mountains, approximately between Gabrovo and Sliven. The heating value of this coal is in the order of 17.0 MJ/kg which is considered quite poor in comparison to international convention with heating values of at least 23.0 MJ/kg. Anthracites may be found north of Sofia in small amounts. During the seventies bituminous coal deposits were also identified 30 km north of Varna. It is estimated that this coal has a high heating value averaging at 34 MJ/kg. The coal is situated in depths of 1200 m up to 2000 m in seams with thickness of 0.2 to 14 m. The particular depth of this mine along with the geological conditions render exploitation extremely unfavorable.

High grade indigenous energy carriers such as crude oil and natural gas are very small and they meet less than 1/2 % of the nation's primary energy demand. Demand needs for oil products and natural gas are mostly satisfied with imports from the Soviet Union.

The economically and technically feasible hydroelectric potential is estimated at about 14 TWh p.a. including the river Danube's share. At present only 1/3 of the above resource has been utilized.

The renewable energy resources may be limited to geothermal and low head hydro power. The reserves of geothermal waters identified up to now have an annual energy potential equivalent to 240 – 260 Ktoe. Small and low head hydro power potential is in the order of 0.8 TWh of annual possible production. Solar and wind energy are of limited potential due to the country's climatological conditions.

It is clear from the preceding figures that the most important indigenous energy source comes from low grade lignite. Bulgaria has developed its own technology for the exploitation and the transformation of the fuel on site with quite success, although environmental problems associated with lignite combustion have not been dealt with.

2.2.2 Primary Energy Supply

The energy sector of Bulgaria's economy is mostly import dependent, the highest in East Europe. The main primary energy sources utilized are:

- Coal
- Oil
- Gas
- Electricity (hydro, and nuclear)

The country's 1981–1985 five year energy plan aimed towards a reduction in energy import dependence through intensification of national energy primary fuel exploitation and resource transformation production. Unfortunately the goals set in the plan have come across some difficulties during the implementation stage, namely:

- Delays in mining equipment manufacturing
- Fall back and delays in the nuclear program
- Low production of hydro plants due to bad hydrology years and delays in construction and equipment manufacturing

The basic characteristics of the four basic primary energy sources in Bulgaria are outlined herein along with their associated domestic production import and exports for the years 1970 to 1987.

Coal Sector

Domestic production of solid fuels constitutes 87 % of the indigenous energy supply and 18 % of the overall national consumption for 1987. Imported solid fuels cover 13 % of the annual consumption contributing 31 % towards the primary energy needs for the same year.

According to the 1981–1985 energy plan, indigenous coal production should have been intensified from 30 million tons in 1980 to 45 million tons in 1985. Also, the long term expectations for coal production should have been raised to annual levels of 60 million tons by the end of the eighties. These goals have not been achieved as it can clearly be seen in table 2.1. The level of production in 1985 has remained the same as of 1980 while the following two years it increased only by 6.7 million tons, far from the original goals. Recent production goals are more moderate aiming at production levels up to 39 billion tons for 1990. Despite these goals, documented figures for 1987 and 1988 show 36.8 and 35.7 million tons respectively.

About 75 % of Bulgaria's coal production comes from the mining field of Maritza East. This particular site has favourable exploitation conditions with the following fuel characteristics: 4.6 - 6.7 MJ/kg, 29 % ash, 55–64 % moisture, and 1–3.5 % sulphur content. Selected lignites from this Maritza East mine with significant heating value are processed in a nearby briquetting factory and the rest is converted to electricity in 12 thermal power plants with a total capacity of 1020 MWe.

Most of the hard coal needs are met by imports from the Soviet Union. As it is shown in table 2.2 hard coal imports peaked in 1985 to 8.8 millions of tons but since then have dropped due to consumption decreases in the industrial sector. It should be noted that since 1980, coal has substituted oil fuels in power stations, namely in 1980 33 % of the primary fossil fuel needs while in 1987 it rose to 37 %.

Exports of hard coal were limited to low levels in the early eighties, as shown in table 2.3. At present there is no available coal to be exported while the tendency is to abolish energy export policies due to recent scarcities in the energy supply system.

Oil Sector

The 1984 oil reserves of Bulgaria were at a low level of 2 million tons. The current production level of 0.3 million tons will diminish the reserves by 1991 in case no new oil discoveries take place.

Primary oil needs are in the order of 38 % of the total consumption for the year 1987 where 98 % of the oil needs are imported mainly from the Soviet Union. After a moderate oil import decrease, attributed to Soviet cuts in 1982, imports have remained constant at a level of 12.6 million tons on an annual basis, as shown in table 2.2. Minor re–exports of oil were maintained by the mid eighties although at present they have been abolished.

Bulgaria has a refining capacity in the order of 15 million tons as of 1988. There are three refineries, at Burgas, Pleven and Rouse being the first in capacity (10 million tons.)

Gas Sector

Natural gas indigenous production has experienced a slow-down from 0.5 billion m^3 in 1970 to just 0.02 billion m^3 in 1987 with limited reserves left to be exploited. Thus, all of the primary natural gas needs are imported from the Soviet Union as shown in table 2.2. The gas imports show a gradual increase in the order of 5 % on an annual basis. Natural gas constitutes 15 % to the total primary energy needs. Gas imports have replaced gradually oil imports, since 1980 where changes in fuel patterns took place in all major sectors.

Primary Electricity Sector

Primary electricity is supplied by hydroelectric and nuclear power plants. Hydroelectric energy can be considered indigenous. There is some discrepancy as far as the characterization of nuclear energy due to the fact that considerable effort is undertaken by the ENERGOPROEKT enterprise. For all practical purposes of this study nuclear energy will be considered as primary imported supply.

Hydroelectric generation has declined the last five years, from 3.5 TWh in 1983 down to 2.5 TWh in 1987. As shown in Table 2.1 it covers only 2 % of the total primary energy country needs. The total installed hydro capacity was 1975 MW in 1987 with an average annual utilization factor of 1266 hours.

Nuclear production, about 13 TWh, covers 10 % of the country's primary energy needs and almost 30 % of the electricity needs. The total installed nuclear capacity was 2760 MWe in 1987.

Bulgaria imports considerable amounts of electricity, mainly from the Soviet Union (5.8 TWh in 1985 and 1.6 TWh from other countries). Recently (1988) electricity imports have declined down to 4.5 TWh while exports have been limited to low levels of less than 1 TWh.

Renewable Energy Sources

Renewable energy sources are of low importance, from their associated energy potential, and economic point of view with the exception of the small hydro resource. In brief the main characteristics of these sources are:

- Geothermal energy is characterized as low enthalpy, thus it is only adequate for limited applications in the agricultural sector. Most of the geothermal wells have very high salt content creating technical problems in several specific utilization applications. The potential is estimated to be in order of 240–260 Ktoe.

- The small hydro potential could be exploited with simple hydro turbine units. It has been estimated that the total potential of small hydro resources is in the range of 800 GWh.

- Biomass fuels present several problems and difficulties during the collection process. Such fuels are used on a small scale and have little impact on the national energy balance. At present wood and other biomass waste account 5 % of the total primary energy supply.

- Wind resource sites exist only at the northern part of the country on the mountains where ice deposit problems restrict the operation of wind turbines.

- Solar radiation on Bulgaria is relatively low, thus, solar thermal systems are not justified from both the energy and the economic point of view.

2.3 Energy Transformation

The production structure of the national energy transformation is of quite complex character. With respect to the convertible energy contained in the energy resources used, four major production stages may be differentiated:

- Production of primary fuel and energy resources (fossil fuels, nuclear fuel, hydro power)
- Dressing and processing of primary fuel and energy resources (briquetting, coking, and fuel oil distillation)
- Production of energy in an altered form (electricity and heat energy)
- End–use of energy for production in the national economy, industrial branches and the domestic and tertiary sectors.

The main end utilization purposes of the transformed energy resources are the following:

- Production of mechanical energy for power processes
- Heat production for high, medium and low temperature processes
- Lighting
- Energy resources used as feedstock for non–energy production

The energy transformation sectors in Bulgaria which are of great interest are the electricity generation and the heat generation ones along with the centralized heat supply.

2.3.1 Electricity Sector

Electricity in Bulgaria is mainly generated by fossil fired and nuclear power plants. The overall system is served by 400 KV and 220 KV transmission networks. The basic characteristics of the generation and the transmission network are presented below.

Power Plants

Bulgaria's electrical power generation system is constituted by two types of power plants; electric utility owned and industrial owned. In 1988 the total installed capacity was 11.309 MWe comprised by 44 thermal stations out of which 18 are utility owned and 26 industrial owned, 88 hydro power stations and 1 nuclear power station. The power capacity mix break down is as follows:

Type	**Capacity Mix (1988)**	
	(MWe)	**%**
Nuclear	2760	24
Thermal		
-utility	5508	49
-industrial	1066	9
-total	6574	
Hydro	1975	18
Total	**11309**	**100**

Thermal power plants constitute 58 % of the total capacity. The utility fossil fired power plants are mainly lignite fired as shown below.

Fuel Type	**Utility Thermal Plants**	
	(MWe)	**%**
Indigenous coal	3340	61
Imported coal	1664	30
Residential fuel oil and natural gas	504	9
Total	**5508**	**100**

The largest share of the indigenous lignite fired power plants are situated at the Maritza East coal field with a total capacity of 2360 MWe (21 % of total capacity). The technology used for the direct combustion of the lignite has been developed in Bulgaria and has shown good technical and economic characteristics. In 1988, 31 % of the total electricity was generated at the Maritza East site.

The nuclear power plant site is located at Kozloduy near the north west border with Romania. There are 5 units in operation.

- 4 VVER–440 reactors, 1760 MWe

- 1 VVER–1000 reactor, 1000 MWe

One more VVER–1000 MW reactor is near completion and is planned to come into operation by the end of 1990. In 1988 nuclear generation contributed 36 % (16 TWh) to the total electricity production. All of the nuclear units are river water cooled.

The hydro power plant in Bulgaria are considered to be multi–purpose units for both electricity production and water utilization. The largest units are the Belmeken–Sestrimo (755 MW) and the Dospat–Vacha (410 MW). The estimated annual production, considering average hydrology conditions, is in the order of 4.6 TWh, although in 1988 only 2.6 TWh were produced (dry year). A pump storage hydro unit of 864 MW at Chaira is nearing completion. Its main task will be to serve as short–time back–up to the relatively large nuclear capacity and it should also serve to control the system transmission voltage levels.

Transmission Network

Bulgaria's electrical transmission network consists of 400 KV and 220 KV networks. Also, 110 KV and 20 KV networks are used for distribution of electrical power. The national network is interconnected to the systems of:

- USSR with 750 KV and 400 KV lines
- Romania with 2–400 KV and 1–220 KV lines
- Yugoslavia with a 400 KV line for parallel operation and 3–110 KV lines for regional operation
- Turkey with a 400 KV line
- Greece with a 400 KV line and a 220 KV line

Based on the present transmission network characteristics it is considered that the existing national voltage levels should be adequate for the next 20 to 25 years, beyond this time period 750 KV networks may also be considered.

2.3.2 Heat Generation and Centralized Heat Supply

Bulgaria incorporates and utilizes high levels of thermal energy, in 1988 about 14.6 PJ. The total installed heating capacity is in the order of 13153 MW and it is constituted as follows:

System Type	**Thermal Capacity**	
	(MW)	**%**
District heating	7760	59
Industrial heating	3025	23
Hot water boilers	2368	18
Total	**13153**	**100**

The fuel types used by these central heating stations are:

Fuel Type	Thermal Capacity (MW)	%
Lignite	1066	8.1
Sub-bituminous coal	314	2.4
Imported Coal	1197	9.1
Residual fuel oil and natural gas	10576	80.4
Total	**13153**	**100.0**

Industrial heating loads are supplied mainly (about 60 %) by centralized heating systems. Centralized heating for the domestic and the tertiary sector has progressively penetrated the energy market covering 27 % of the total heat demand of these sectors. Almost 16 % of the total population of the country is supplied by district heating networks. Centralized heat supply systems have been installed in 30 of the biggest cities and towns in Bulgaria.

2.4 End Use Consumption

The end-use of energy demand share of the main sectors on Bulgaria's national economy have remained relatively constant within the last years. The total consumption for 1987 was in the order of 22.5 million toe. The particular energy demand share characteristics are the following:

Sector	Energy Consumption (1987) (Mtoe)	%
Industry & Construction	13.6	60.4
Domestic & Tertiary	6.0	26.7
Agriculture & Forestry	1.1	4.9
Transportation & Communication	1.8	8.0
Total	**22.5**	**100.0**

2.4.1 Industry and Construction Sector

The biggest energy consumer in Bulgaria is the industrial and the construction sector, about 60 % of the total consumption of the major economic branches. The predominant energy sources used are liquid and gas fuels, electricity and heat energy with a correspondent share of 41.1 %, 13.7 % and 36.0 % respectively as shown in tables 2.4 and 2.5

Energy consumption of this sector is characterized by its relatively high utilization losses and a consequent high specific energy consumption. As shown in table 2.6, the iron and steel industry, the chemical and rubber industries, the building material industry and the glass and china industry are the most energy consuming ones. Also, it should be noted that western industrialized countries utilize 1/2 to 1/3 of the energy for the same work volume produced by the Bulgarian industrial plants.

2.4.2 Domestic & Tertiary Sector

The domestic and the tertiary sector is the second largest from the energy consumption point of view, with a 26. % share of the total demand as shown in tables 2.4 and 2.5. The primary energy sources are liquid and gas fuels (45.2 %), electricity (20.4 %) and heat energy (13.0 %). At rural areas, other more traditional fuels are used such as wood covering about 5 % of the total demand.

2.4.3 Agriculture and Forestry Sector

The agriculture and forestry sector is the least energy consuming one with only a 4.9 % share of the total demand with liquid and gas fuels predominating the consumption with about 75 %.

2.4.4 Transportation and Communications sector

The transportation and communications sector holds a 8.2 % share of the total consumption. Most of the energy used comes from liquid and gas fuels about 90 %. It should be noted that this sector burdens the total consumption with imported fuels by almost 48 % as presented in TABLE 2.5.

2.5 Energy Balance System

Bulgaria's energy system is called upon to satisfy the energy needs of the four basic economic sectors, namely:

- Industry and construction
- Domestic and tertiary
- Agriculture and forestry
- Transportation and communication

The main energy processes which have to be supplied are:

- Power and specific electricity use
- High temperature
- Medium and low temperature

2.5.1 Energy System Utilization Characteristics

The present structural energy resource utilization along with its associated energy losses is presented in figure 2.1. Based on the above structure, 60 % of Bulgaria's primary energy is transformed and processed while only 40 % is consumed directly. The conversion losses are in the order of 34 % of the total primary energy resources. Thus, only 66 % of the primary energy is made available for final end use processes.

The structure of the final energy consumption by process type has the following approximate distribution:

- 25 % of final energy resources are used for production of mechanical energy for power processes, or about 16 % of the primary fuel and energy resources used
- The relative share of the high temperature processes is also about 16 %
- The relative share of the medium and low temperature processes amounts to about 50 % of the supplied final end–use resource, or about 34 % of the primary fuel and energy resources.

According to ENERGOPROEKT estimates the associated losses of the above processes are in the order of 11 %, 5 % and 10 % of the primary energy resources, for power, high temperature, medium and low temperature processes respectively. Thus, the end use energy amounts to about 36 % of the primary energy supply. It is clear that this low utilization factor results in a high energy intensity of the national income. Also, it should be noted that many industrialized countries use the same amount of energy to produce twice the industrial output.

2.5.2 Energy Balance for the Year 1987

The primary fuels and energy sources supplied to satisfy the 1987 energy needs are presented in the table below. The total consumption is in the order of 32.8 million toe, out of which 60 % are transformed to electricity, heat energy and transportable fuels. As it can be seen in this table, 91.2 % of the solid fuels are converted into electricity and heat, while only 34.1 % of the liquid and gaseous fuels are converted mainly into heat energy.

Fuel Consumption & Energy Resource Transformation 1987

Source Type	Consumption (Ktoe)	Transformation (%)
A. Primary Fuels & Energy Resources	32782	60.0
- Solid fuels	11182	91.2
- liquid and gaseous fuels	17155	34.1
- others (hydro, nuclear solid)	4445	81.8
B. Fuels and Energy after Transformation	13734	100.0
- electricity	3714	27.0
- heat energy	8679	63.2
- briquettes	633	4.6
- coke	708	5.2

The electricity generation, as presented in the table below, is mainly comprised of almost 60 % from thermal power plant production, 26 % from nuclear and 5 % from hydroelectric. Also, 9 % of the generation needs had to be imported, although 800 GWh had to be exported at the same time (15.5 % of the imports).

Electricity Energy Balance 1987
Transformation 1987

	(GWh)	(%)
Demand	47804	100.0
Generation		
. thermal	28481	59.6
. nuclear	12436	26.0
. hydro	2538	5.3
Total	**43455**	
Imports	5149	
Exports	800	
Net Imports	4349	9.1

The final energy balance for the year 1987 is presented in the table below. The energy balance is supplied by 79 % of imports and 21 % of domestic production. The energy transformation losses appear to be in the order of 31.2 %. It should be noted that the final end-use resource allocation for the four economic sectors do not include the associated process losses.

Energy Balance of Bulgaria's Demand/Supply System for 1987

Supply	Ktoe
Domestic output	6994
Imports	25788
Total resources	32782
Exports	68
Transformation losses	10231
Final end use available	22551
Demand	
Industry & Construction	13599
Domestic & Tertiary	5990
Agriculture & Forestry	1116
Transportation & Communication	

Table 2.1: Primary Fuel Energy Production

Year	Lignite (Mton)	Hard coal (Mton)	Oil (Mton)	Gas (Gm3)	Hydro (TWh)	Total (PJ)
1970	28.9	0.4	0.3	0.5	2.2	291
1975	27.5	0.3	0.1	0.1	2.5	261
1980	29.9	0.2	0.3	0.2	3.7	285
1981	29.9	0.2	0.3	0.1	3.6	276
1982	32.0	0.2	0.3	0.1	3.0	289
1983	32.1	0.2	0.3	0.1	3.5	295
1984	32.1	0.2	0.3	0.0	3.3	291
1985	30.7	0.2	0.3	0.0	2.12	267
1986	35.0	0.2	0.3	0.0	2.3	299
1987	36.6	0.2	0.3	0.0	2.5	313
			in PJ			
1970	228	7	14	17	25	291
1975	218	6	5	4	29	261
1980	219	5	11	7	44	285
1981	212	4	12	5	42	276
1982	234	4	12	3	36	289
1983	236	4	12	2	41	295
1984	235	4	11	2	38	291
1985	225	4	11	1	26	267
1986	257	4	11	1	27	299
1987	268	3	11	1	30	313

Table 2.2: Primary Fuel Imports

Year	Hard coal (Mton)	Coke (Mton)	Oil (Mton)	Gas (Gm3)	Electricity (TWh)	Nuclear (TWh)	Total (PJ)
1970	5.0	0.5	8.6	0.0	0.2	0.0	489
1975	6.4	0.4	12.3	1.2	4.1	2.6	791
1980	6.7	0.4	14.9	4.0	4.9	6.2	1059
1981	7.1	0.4	14.0	4.5	4.7	9.1	1079
1982	7.2	0.5	12.6	4.8	5.5	11.0	1068
1983	7.1	0.5	12.6	4.9	5.3	12.0	1079
1984	7.2	0.5	12.6	5.5	5.9	13.3	1125
1985	8.1	0.7	12.8	5.5	7.5	13.1	1170
1986	7.3	0.5	12.8	5.8	5.4	12.1	1125
1987	7.9	0.2	13.1	6.1	5.3	12.4	1155
				in PJ			
1970	114	13	359	0	3	0	489
1975	146	10	516	41	48	30	791
1980	153	12	625	140	57	72	1059
1981	161	11	587	157	56	107	1079
1982	165	13	528	169	64	129	1068
1983	162	14	528	172	62	141	1079
1984	164	15	536	193	69	156	1125
1985	184	19	536	190	87	154	1170
1986	167	14	536	202	64	142	1125
1987	181	6	549	212	61	146	1155

Table 2.3: Primary Fuel Exports

Year	Hardcoal (Mton)	Oil (Mton)	Electricity (TWh)	Total (PJ)
1970	0.0	0.3	0.3	14.7
1975	0.0	0.0	0.4	4.1
1980	0.2	0.0	1.0	16.9
1981	0.0	0.0	1.3	15.0
1982	0.2	0.0	2.7	37.4
1983	0.2	0.0	2.8	38.8
1984	0.3	0.0	3.3	45.6
1985	0.5	0.1	3.0	50.9
1986	0.3	0.0	1.5	24.2
1987	0.0	0.0	0.8	9.6
		in PJ		
1970	0.0	11.0	3.7	14.7
1975	0.0	0.0	4.1	4.1
1980	5.6	0.0	11.3	16.9
1981	0.3	0.0	14.7	15.0
1982	5.6	0.0	31.8	37.4
1983	5.1	0.8	32.9	38.8
1984	6.6	0.0	39.1	45.6
1985	12.1	4.2	34.7	50.9
1986	7.0	0.0	17.2	24.2
1987	0.0	0.0	9.6	9.6

Table 2.4: End-Use Energy Demand by Economic Sector and Energy Form 1987 (ktoe)

Year	Industry & Construction	Domestic & Tertiary	Agriculture & Forestry	Transportation & Communications	Total
Briquettes	---	633	---	---	633
Sub-bituminous coal	135	304	8	6	453
Coke	899	---	---	---	899
Other solid fuels	206	336	22	10	574
Liquid and gas fuels	5594	2709	833	1666	10802
Electricity	1859	1221	98	123	3301
Heat energy	4898	777	145	41	5861
New energy sources	8	10	10	---	28
Total	**13599**	**5990**	**1116**	**1846**	**22551**

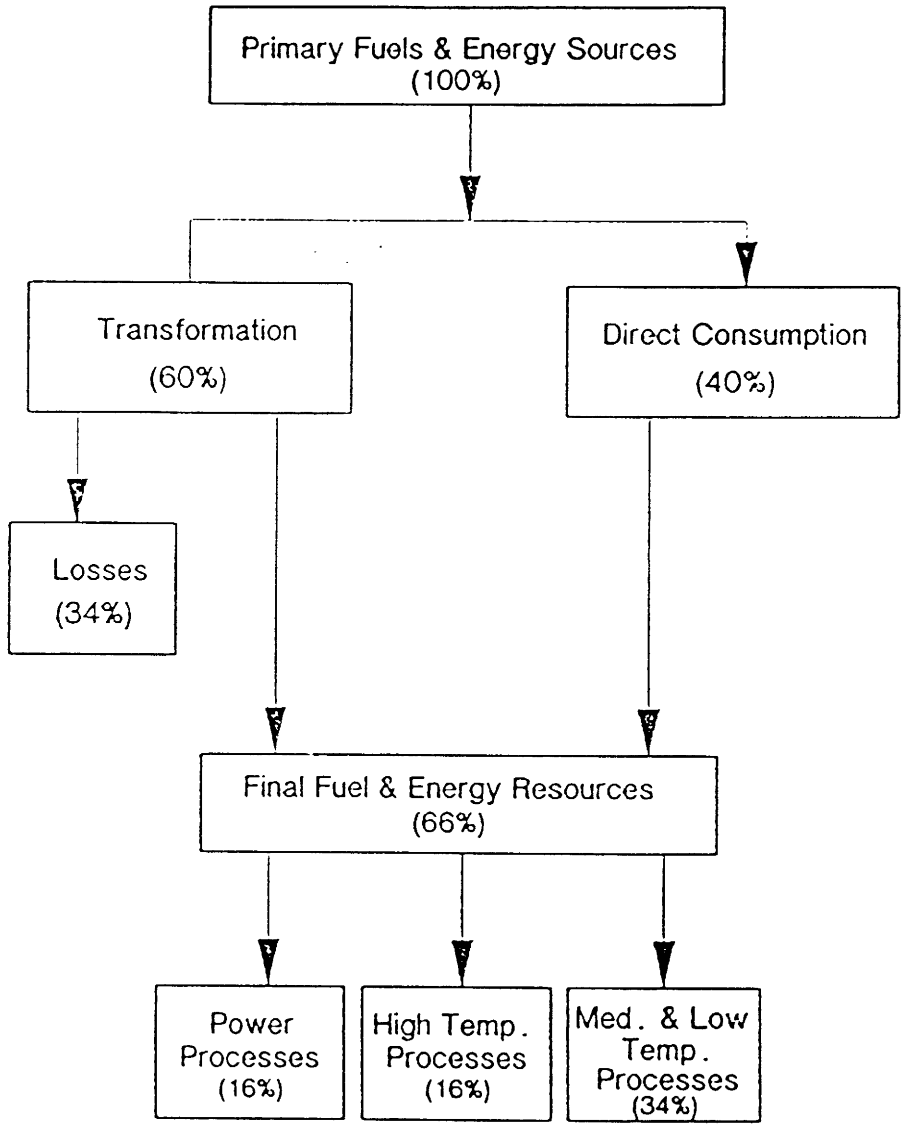
Table 2.5: End-Use Energy Demand by Economic Sector and Energy Form 1987 (%)

Year	Industry & Construction	Domestic & Tertiary	Agriculture & Forestry	Transportation & Communications	Total
Briquettes	--	10.5	--	-	2.8
Sub-bituminous coal	1.0	5.1	0.7	0.3	2.0
Coke	6.6	--	--	--	4.0
Other solid fuels	1.5	5.6	2.0	0.5	2.5
Liquid and gas fuels	41.1	45.2	74.6	90.2	47.9
Electricity	13.7	20.4	8.8	6.7	14.6
Heat energy	36.0	13.0	13.0	2.3	26.1
New energy sources	0.1	0.2	0.9	--	0.1
Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**
Sector Total	**60.1**	**26.6**	**4.9**		

Table 2.6: Energy Consumption of Major Economic Branches

Industry	**(Ktoe)**	**(%)**
Electricity and heat production	14936	67.9
Coal mining and oil processing	78	0.4
Iron and steel	1248	5.6
Machine building and electricity	2358	10.6
Chemical and rubber	815	3.7
Building materials	4409	19.8
Timber and woodworking	961	4.3
Paper	251	1.1
Glass and china	370	1.7
Textile and knitwear	336	1.5
Clothing	349	1.6
Leather and shoes	16	0.1
Polygraphic	51	0.2
Food	7	0.03
Other	1083	4.9
Construction	2604	11.7
Agriculture	821	3.7
Transportation	1084	4.9
Domestic & Tertiary	3668	16.5
Total	**22252**	**100.0**

Figure 2.1: Utilization of Primary Fuels and Energy Resources



3. *TRENDS AND ISSUES*

Since the only domestic energy source in Bulgaria is coal, where its corresponding reserves are estimated to be over 100 years of the current production rates, it dominates the present energy balance while it dictates the energy planning for the next years. Also, gradual emphasis has been given towards intensive natural gas and electricity utilization. The energy balance system is burdened with large amounts of district heat production from oil and gas fired boilers where retrofitting to coal fired is not technically or environmentally feasible. Thus, limited imported fuel substitutions exist in this sector.

Energy consumption in all economic sectors is considered to be high at extremely low efficiency levels. In specific, the industrial sector is the most energy intensive one creating numerous problems to the energy supply system. At present, minor energy conservation measures are in place aiming to improve the industrial energy balance deficiencies.

Environmental pollution is one of the main topics that will have to be dealt with in the foreseen years. Cleaning up of the flue gases of the existing fossil fired power plants will certainly be the main environmental protection issue in future development plans. Also, nuclear power plant safety is reexamined and system design and operational philosophy will have to undergo major revisions.

Specific annual demand of primary energy resources in Bulgaria amounts to 3.5 toe per capita. However, restructuring of the energy sector in the seventies has decreased the energy intensity and the demand growth rate.

The main objectives and policies of the energy sector evolution and development in Bulgaria, with respect to the overall energy supply/demand balance system, are the following:

- Reduce energy imports to the absolute minimum
- Intensify and improve exploration of domestic low grade coals
- Review the nuclear expansion option taking into account the increasing cost of plant safety, security of environmental control and reliability
- Promote energy conservation measures in the industrial and the domestic sectors

The above objectives arise from the need to rationalize the energy balance system which up to now has evolved reflecting only on past energy policies and economic trends.

3.1 Energy Policy Issues

The evolution prospects and plans for the energy sector in Bulgaria have to be reviewed, although firm development plans are not expected to be discussed prior to the national elections in June 1990. The result presented herein are based on current energy policies, possibilities and probable prospects up to the year 2010.

Bulgaria's current energy policies aim toward the overall rationalization of the energy supply/demand system. The present energy policies and development plans could be implemented and materialized based on the following overall goals and targets.

- Increase the extraction of indigenous coals to maximum possible levels.
- Improve coal distribution among consumers such that non justifiable transportation cost will be abolished.
- Intensify hydroelectric resource exploitation.
- Environmental protection.
- Priority is given to thermal power plants and to a larger percentage of combined electricity and heat production based on imported and indigenous fuels.
- Stricter control on nuclear power plant safety.
- Retrofit, overhaul or shut down of obsolete fossil fired thermal power plants.
- Conservation measures in all economic sectors.

3.2 National Energy Plan 1990-2010 Forecasts

Based on the energy policies, goals and targets the following primary energy consumption may evolve according to ENERGOPROEKT.

Overall Consumption (Mtoe)

Year	Minimum	Maximum
1990	35	36
1995	38	42
2000	42	49
2005	45	54
2010	49	60

The ENERGOPROEKT energy demand forecasts envisage a balanced and mutually bound pattern of energy resources as a function of national economy under the assumption that energy intensity of the overall national income will decrease at an annual average rate no less than 1.5 %.

3.3 Energy and Environmental Issues

The main environmental issues associated with Bulgaria's energy sector are mainly concentrated in the energy transformation branch. In specific, during the combustion process of fossil fuels in thermal power stations, the nuclear power plant operation, siting of new hydro power stations and minor problems with high voltage transmission lines.

3.3.1 Thermal Power Plants

As it has already been mentioned in section 2.3, a large percentage of electricity and heat energy needed is generated by thermal power plants utilizing indigenous low quality coals. These coals are characterized by their high ash and sulfur contents of 55 % and up to 4 % respectively. The logical consequence of these natural characteristics dictate the scale of the ecological deterioration problems and the overall environmental control complexity in the context of modern requirements.

The major environmental problem associated with Bulgaria's lignite fired and hard coal fired power plants are the following:

- relatively high emissions of SO_2
- high emissions of fly-ash

NOx emissions are considered to be of secondary order as far as the lignite plants are concerned. These emissions are of high ranking order at sites where natural gas fired plants are situated.

Environmental problems associated with heavy oil fired thermal plants are of low priority due to their relative low annual utilization factor.

Environmental monitoring and control equipment is currently provided by the Soviet Union and Poland, the operation of which has presented several problems.

Bulgaria is considering a number of measures to improve the air quality of the country, such measures include the following:

- Development of local technology for the clean up of flue gases from SO_2 and fly ash for the lignite fired thermal plants. This effort has not yield much success. Recently contracts have been drawn with Western European countries to examine the feasibility of flue gas cleaning technologies.

- Consideration of constructing new lignite fired power plants incorporating fluidized bed combustion boilers.

Environmental control improvements associated with the indigenous fuel fired power plants are of great importance to the country's energy expansion if present utilization and development growth rates are to continue.

3.3.2 Nuclear Power Plants

Bulgaria lacks nuclear fuel production or fuel reprocessing facilities, thus environmental problems are only related to the electric power generation from the nuclear power plants. The problems may be differentiated in two basic categories:

- Effects on the environment through normal plant operation

- Effects on the environment during a radiation accident in a nuclear plant.

During normal operation of the nuclear power plants (existing and the ones under construction) the following environmental problem arise:

- Thermal pollution of the water source supplied to the power plant cooling system due to the fact that all stations are of the open one way type. The temperature rise is in the order of 8 to 10°C.

- Possible radioactive gas/aerosole emissions

- Possible discharge of radioactive water

- Problems associated with radioactive waste disposal such as soil deterioration.

Major nuclear accidents have a small possibility of occurrence but can not be avoided altogether. The possibility of such accidents may be diminished incorporating effective monitoring and prognosis systems. Also, containment vessels could be incorporated in order to confine the emissions. Such systems need substantial funds to be implemented in the existing nuclear power plants of Bulgaria.

3.3.3 Hydro Power Plants

Environmental problems and impacts associated with the construction of hydro power plants in Bulgaria are considerable and diverse. The main impacts are related to the ecological conservation of rivers and valleys or their conversion into water basins. Also, relocation of local settlements has adverse impacts on hydraulic exploitation.

At present, more funds are constantly provided for activities related to environmental protection. For example, the additional investments associated with environmental design features of two new hydro power plants in Bulgaria were estimated to be 13 % and 18 % of the total budget respectively.

3.4 Energy System Development Problems

The major development problems faced within Bulgaria's energy sector are of broad and diverse nature. Due to socioeconomic reforms and changes underway, current practices within the energy sector may not continue in the future. Modifications of the existing energy supply systems are necessary taking into consideration modern technologies in the field of energy efficiency, safety, environmental control and system protection. Also, current legislative and financial practices must be reexamined and revised accordingly. Current major problems associated with the operation and the expansion of Bulgaria's energy sector may be summarized as follows:

- Utilization of the indigenous low grade coal stocks in an efficient and environmentally benignapproach

- Improvements of nuclear power plant safety, operational practises and environmental control and diagnosis

- Environmental considerations associated with hydroelectric expansion plans

- Energy efficiency improvements aiming towards major decreases in energy intensity in the industrial and the domestic energy sectors.

Specific problems associated with each energy sector in need of immediate attention along with current practises are categorized within the following sections

3.4.1 Environmental Control Problems

The environmental issues associated with Bulgaria's energy supply system, already discussed in Section 3.3, are mainly concerned with specific problems as follows:

- Thermal fossil fired power plant emissions
- Nuclear power plants operations
- Hydroelectric resource expansion.

Since current energy policy and plans call for fossil fired power plant to continue contributing large shares of electricity and heat energy to the energy supply system it is mandatory that the following environmental problems need immediate attention and solution.

- Clean up of flue gases from $S0_2$ and fly ash emissions from combustion in indigenous lignite fired power plants especially those at the Maritza East lignite mine field.
- Improve environmental monitoring and control equipment performance.
- Storage and disposal problems related to large amounts of gypsum produced from limestone S02 clean-up operation; it should be noted that Bulgaria's cement industry cannot consume the entire production.

Efforts made up to now addressing the above problems have not resulted in major improvements, mainly due to lack of technological know how and appropriate financial support schemes.

Nuclear power generation plays a decisive role in the future expansion of Bulgaria's energy supply system. Also, it should be mentioned that according to the official position on the subject, nuclear power is probably the only energy source which could contribute toward energy independence from the scarce imported fossil fuels. Thus, in order for future nuclear power expansion to take place the following specific problems will have to be given immediate attention.

- Radioactive fuel waste treatment and storage
- Containment vessel addition
- Improve the inadequate monitoring and prognosis of environmental control system
- Change the cooling system of the existing plants to the close circuit type in order to avoid thermal pollution of the water source utilized
- Training of power plant operations and maintenance personnel in order to minimize possible operational human error.

Environmental issues associated with hydroelectric expansion plans need to be reexamined due to the fact that hydro power is an indigenous energy form and only a relative small share of the technically feasible potential has been exploited. The specific problems to be addressed concentrate on the siting process of new hydraulic projects incorporating environmental features in the design schemes.

3.4.2 System Efficiency Problems

According to the energy balance system analysis of the Bulgarian energy supply and transformation system along with the energy utilization and intensity characteristics of the basic economic sectors it is mandatory that energy efficiency improvements are of absolute necessity. Efficiency improvements on the supply side of the energy sector are needed for the following plant types:

- Old fossil fired power plants

- Several old hydroelectric power plants

Efforts on energy conservation should be increased due to the present high energy intensity of most of the economic sectors. The specific energy consumption of the industrial sector is very high mainly due to the obsolete technology utilized. Also, it should be noted that in past decades energy conservation was not an issue because of the almost abundant primary energy supply from the Soviet Union.

Energy conservation measures, sound project implementation and policy aspects are needed in the following subjects:

- Energy conservation programmes for most of the industrial branches; immediate attention must be given to their building material, the chemical, the metallurgy and the glass industries.

- Conservation measures for the domestic and the tertiary economic sectors with immediate attention paid to the rational end use of district heating and electricity.

- Address basic energy policy questions and issues on energy conservation programmes.

- Public awareness and persuasion to put into effect energy efficiency and conservation measures

3.4.3 Technology Know-How, Organizational and Financial Problems

The present status of the technological, organizational and financial structure of the country is under constant reform taking into consideration the current changes in the socioeconomic evolution. Although, Bulgaria has in the past progressed in several technological fields, present needs and problems are such that the existing technological and organizational substructure is not capable in dealing with current high technological needs.

The basic technological problems and their associated organizational and financial aspects concentrate on the following areas:

- Modern energy planning and organizational techniques
- Technology know-how on nuclear power plant safety
- Modern environmental equipment manufacturing
- Technology know-how on monitoring and control systems and equipment
- Design tools for nuclear energy systems (power plant subsystems and environmental analysis)
- Low productivity hydraulic tunnel drilling equipment
- Low efficiency industrial equipment such as heavy duty boiler burners etc.
- Low quality of the industrial monitoring and control equipment.

Efforts are made at present to overcome the above technological problems along with their associated organizational and financial needs. It is anticipated that the outcome of the organizational restructuring under evaluation will address the above issues. Also, reorganization of the energy sector towards a more flexible structure on management, operations and finance will contribute towards the depletion of these technological problems.

4. PROPOSALS FOR COOPERATION

Bulgaria's technological expertise is limited to conventional construction, manufacturing and process industries emphasizing and concentrating on the production volume necessary to satisfying the domestic needs and some minor export activities. Present socioeconomic reforms consider shift in direction towards an overall national productivity and energy efficiency improvements while environmental issues and criteria are incorporated in the decision process. Implementation of these general goals require expertise and a technological know-how not included within the existing country capabilities. Thus, cooperation between EEC and Bulgaria in the energy fields is due and necessary at this point in time. The forms and areas of cooperation in the energy field are presented herein. The specific proposals arise from the overall analysis of the national energy supply/demand system as presented in section 2, and on the technological issues discussed and categorized in collaboration and in agreement with the country officials and energy experts during the CMSU field trip in Bulgaria.

4.1 Priority Needs for Cooperation

The basic needs for cooperation between the EEC and Bulgaria arise from the analysis presented in section 3.0 and the associated specific problems of the energy sector outlined in section 3.4. The main areas of cooperation given top priority and considered herein include the following:

a. Information network exchange

b. Energy planning

c. Energy conservation assessment studies

d. Environmental control technology know-how transfer.

The proposed cooperation needs presented herein do not reflect only current and immediate prospects but keep in mind future expansion perspectives of the overall energy system with respect to the national economy.

a. Information Network Exchange

Adaptation of modern energy technologies to the existing Bulgarian energy system requires the support and promotion of professional knowledge and experiences through an extensive information exchange network. The main areas of interest are the following:

- Energy sector structure and management

- Experience in financing energy projects and budget control

- Organization and management of energy related engineering and consulting activities

- Scientific and production practices in the energy sector

- Training seminars in specific fields (nuclear power, energy conservation etc.)

- Exchange of software and computer services
- Western European legislative structure and legal information relevant to the energy sector.

The main Bulgarian collaborating partner for this task should be the ENERGOPROECT enterprise and its associated information and documentation center.

b. Energy Planning

National and power utility energy planning in Bulgaria is the responsibility of the ENERGOPROECT enterprise. At present planning efforts aim towards overall efficiency improvements of the energy sector taking into account the prospects and the conditions of the international energy market and economy. In order to proper plan the country's demand and supply needs satisfying the above goals, cooperation is needed for expertise and technical assistance on the following subjects:

- Methodologies and computer model transfer for national energy demand forecast and energy supply system selection.
- National energy planning supply/demand studies.
- Regional energy assessment studies.
- Energy conservation planning and implementation methods
- Feasibility studies on new energy technologies utilizing indigenous and imported fuels.
- Energy pricing policies impact analysis

c. Energy Conservation Assessment Studies

Energy conservation measures and sound implementation projects should be given top priority within an integrated EEC/Bulgarian collaboration programme for the energy sector. Assessment studies are needed for most of the energy branches, although emphasis and priority must be given to the following:

- Building material industry
- Chemical industry
- Metallurgy industry
- Glass industry
- Food industry
- District heating systems (distribution and end use).

Work in this field could be outlined and performed in collaboration with the Bulgarian PROMISHLENA ENERGETICA enterprise. Efforts should concentrate on the following:

- Energy conservation methodologies
- Energy audits

- Energy management techniques
- Energy equipment retrofits
- Conservation equipment additions such as heat recovery systems etc.

d. Environmental Control Technology Know-How Transfer

Technology know-how is needed in almost every energy sector for both the supply and the end consumption side of the system. Current goals and plans for modernization of Bulgaria's energy system may be implemented through modern technology know how transfer of crucial energy equipment and systems such as environmental control equipment to the country's manufacturing facilities. The transfer could take place through licences, documentation, etc. in collaboration with the ENERGOPROECT enterprise. Know-how is needed for the following energy technologies for environmental control.

- Fossil fired thermal power plants:
  . flue gas SO_2 and fly ash clean up equipment
  . storage methods of gypsum from lime stone SO_2 clean up
  . environmental monitoring and control equipment
  . power plant control equipment and automatic generation control equipment

- Nuclear power plants:
  . plant safety
  . environmental monitoring, control and prognosis equipment
  . radioactive waste treatment technology
  . nuclear power plant computer software design tools and practises.

4.2 Future Cooperation Possibilities

Apart form the cooperation priorities outlined in section 4.1 there are numerous opportunities for future collaboration between EEC and Bulgarian energy enterprises. The areas of interest described herein were discussed with Bulgarian officials during the country field visit as follows:

Organizational and Financial Support

Organizational issues of Bulgaria's energy sector undergo revision in conjunction with the recent socioeconomic reforms. Specific organizational issues associated with new energy projects need also to be reexamined. The new organizational structure should incorporate flexible project management and financial schemes. Also, proper training of personnel has high priority within the reorganization effort. Support in this field of expertise is needed in almost all of the energy sectors and branches.

Engineering Feasibility Studies

Engineering feasibility studies are obligatory as part of the decisions process on new technologies to be implemented and for other energy related specific problems. Areas of interest by energy type which have to be studied in the near future are the following:

- Fossil fired thermal power plants:
  . lignite fired power plant retrofitting incorporating environmental control features
  . lignite fired fluidized bed combustion boilers
  . lignite gasification and combined cycle combustion

- Nuclear power plants:
  . environmental impacts
  . spreading of radioactive waste diffusion into soil and underground water after waste burial

- Energy conservation systems:
  . modern technology switchover on energy intensive industry branches

Energy Technology Know How

- Energy conservation systems
  . modern production processes for the most energy intensive industries
  . industrial monitoring and control equipment
  . software, hardware and practises on energy audits (energy bus)
  . heavy duty boilers and burners (capacity of fuel burnt greater than 700 kg/h)
  . industrial environmental control equipment
  . industrial size fluidized bed combustion boilers

- District heating systems
  . monitoring and control equipment

- Hydroelectric power plants:
  . high productivity tunnel drilling equipment
  . hydraulic, electrical and control equipment
  . small scale hydro standardized package units
  . remote control systems

- Electrical networks
  . high voltage substation equipment.

EEC/Bulgarian Enterprises

Besides the need for cooperation in specific technological areas collaboration between the EEC and Bulgarian enterprises for the undertaking of joint projects in Bulgaria, EEC countries or third countries is possible in following areas:

- Establishing joint teams for engineering consulting services

- Establishing consortiums for joint construction projects on a turn-key base.

From the above cooperation needs priority should be given to the following:

- Information network exchange

- Energy planning and pricing structures

- Environmental technology know-how transfer

- Energy conservation programmes.

Beyond the above cooperation issues there are other possibilities as they are described in this section which may be considered within a long range plan.

4.3 Forms of Cooperation

Future collaboration between EEC and Bulgarian energy enterprises may be achieved through a generic framework. The particular approach could be applied here in such a way that the forms of cooperation will be in a structured fashion with predefined priority objectives. The parameters which will describe the overall effort can be prescribed as follows:

- The forms of cooperation
- The partners
- The issues
- The sector in which cooperation will develop

The overview as well as the specific issues and the level of the cooperation forms are presented in table 4.1. The general issues addressed reflect the need for cooperation of the energy sector of Bulgaria. As shown, priority is given to energy planning, information exchange, technological know-how and software transfer. Feasibility studies, on the subjects discussed herein, are also of high priority. Product and equipment licensing agreements could also take place in collaboration with Bulgaria's manufacturing facilities. Common energy projects may also be undertaken by counterpart consortium establishment and could prove to be a major effort since Bulgarian energy enterprises have a high level of experience in this field.

Recent socioeconomic reforms and restructuring of Bulgaria's energy industry has granted enterprises responsible for the development of the energy sector with a considerable degree of freedom. Thus, cooperation between the EEC and the energy enterprises presented herein is not anticipated to come across major difficulties.

Considering the possible forms of cooperation, the specific issues and the particular energy sectors in need and Bulgaria's energy enterprise capabilities, the collaborating counterparts for the specific issues could be those presented in table 4.2. Official contact points and names for the Bulgarian energy sector are presented in table 4.3

Table 4.1: Levels and Forms of Cooperation

FIELDS OF COOPERATION	DG. XVII	DG. XVII & CONTRACTORS	EUROPEAN ENERGY PRODUCTS INDUSTRY & EUROP. FINANC. INSTITUTIONS	EUROPEAN ENERGY TECHNOLOGY INDUSTRY & EUROP. FINANC. INSTITUTIONS	EUROPEAN FINANCING INSTITUTIONS & ENERGY INDUSTRY	EUROPEAN INDUSTRY (IN GENERAL) & FINANCING INSTITUTIONS	TIME-RANGE OF COOPERATION
INVESTMENT + FINANCING + CONSTRUCTION + TRADING + TECH. TRANSFER + CONSULTING						• New Industrial Technology Change over	LONG RANGE
FINANCING + CONSTRUCTION + TECH. TRANSFER + CONSULTING				• Consortiums New Power Projects • Product Manufacturing	• Consortiums Interconnections • Major Energy Projects		MEDIUM RANGE
CONSTRUCTION + TECH. TRANSFER + CONSULTING				• Energy Projects • Retrofiting			MEDIUM RANGE
TRADING OF FINAL ENER. PRODUCTS + TECH. TRANSFER + CONSULTING			• Product Licencing • Feasibility				MEDIUM RANGE
TECHNOLOGY TRANSFER + CONSULTING		• Know-How • Software • Feasibility • Training					MEDIUM RANGE
CONSULTING	• Info Networks • Software • Pricing Policies • Planning	• Info Networks • Training • Planning					SHORT RANGE

EUROPEAN PARTNERS

Table 4.2: Bulgarian Collaborating Partners

Issues	Bulgarian Enterprise
Energy Planning Pricing	ENERGOPROEJT
Info Network	ENERGOPROEKT
Training	ENERGOPROEKT
PROMISHLENA ENERGETIKA	
Feasibility Studies	ENERGOPROEKT
. Utility	PROMISHLENA
. Industry (conservation)	ENERGETIKA
Technology Transfer	ENERGOPROEKT
. thermal power	TECHENERGO
. nuclear power	ENERGOPROEKT
. hydro power	ENERGOPROEKT
. electrical network	ENERGOISGRAGDANE
. district heating	ENERGOPROEKT
. conservation	PROMISHLENA ENERGETIKA
ENERGOKIBERNETIKA	
. monitoring and control	
Organizational & Financial Support	ENERGOPROEKT
EEC/Bulgaria Consortiums	ENERGOPROEKT

Table 4.3: Bulgarian Energy Sector Contact Points

1. Committee of Energy
   Sofia 1000
   8 Triaditza
   At Georgiew, Director of R&D

2. ENERGOPROEKT
   Sofia 1407
   51 Anton Ivanov Blvd
   A. Krastev, General Director
   S. Stoykov, Head of International Relations

3. PROMISHLENA ENERGETICA
   Sofia 1407
   5 Philip Koutev str.
   P. Ivanov, General Director
   L. Banchev, Vice Director

4.2 Czechoslovakia

Czechoslovakia

A Survey of Energy Issues
and a Proposal for Cooperation with the
Commission of the European
Communities

CONTENTS

FOREWORD

In view of the recent developments in Eastern Europe the Commission of the European Communities is enhancing its cooperation with Czechoslovakia. GOPA-Consultants has been entrusted by the Commission of the European Communities with a study on the energy situation of the CSFR and the identification of cooperation possibilities.

Environmental issues are of great concern to the population and Government of the CSFR. Energy is one of the major producers of environmental pollution (i.e. air pollution) in the CSFR. Therefore a number of cooperation ideas related to environmental issues have emerged. These ideas are regarded as important for the further development of the energy sector in the CSFR and are presented in this report although they may be outside of the programme areas for which recommendations are expected by the CEC.

At the end of February 1990 the consultant visited Czechoslovakia. This tour included discussions at the ministerial level as well as with research organizations, energy producers and consumers. The list of institutions visited is included in Annex I.

The dynamic of the development in the CSFR - especially after the elections - implies a certain level of insecurity regarding the future developments. This refers especially to energy prices and energy policy and planning as well as to a lesser degree to the institutional setting.

The mission was carried out with Dr. J. Jansky of the German engineering firm BTB Jansky and the report was prepared with his assistance.

4.2.1 General Economic situation

The CSFR extends over a surface of 127,900 km^2 and has a population of 15.7 million which results in a population density of 122 inhabitants per km^2.

The CSFR is regarded as the second strongest economy in East Europe behind the GDR. Depending on the definition applied this corresponds to a GDP per capita of about 7,600 US$ (in current prices).

The resource base is mainly provided by coal, iron ore, uranium and other minerals. The CSFR also has a strong agricultural base.

The industrial basis is mainly provided by traditional heavy industry like steel and machinery, which are to a large extent exported to the USSR.

The industrial sector contributes 67% to the GDP, whereas the share of agriculture amounts only to 8%. This is the highest share of the industrial sector in all East European countries.

The importance of the heavy industry is also reflected in the fact that 55 % of the total exports of US$ 23 bill. in 1987 relate to machinery and electric equipment.

The balance of trade has nearly been in equilibrium with imports of US$ 23.3 bill., 27.8 % of which have to be spent for energy products.

The loosening of the trade ties within the COMECON have, however, led to a decrease in imports by 17.2 % in the first quarter of 1990, whereas exports increased by 9 %.

The development of the economy in 1989 was very modest with an estimated growth of 1.7 % after 2.8 % in 1988. The first quarter of 1990 resulted in a negative growth of - 1.6 %.

The foreign debt of the CSFR amounts to US$ 7 bill., which is less than in other East European countries. To this debt, a substantial part of the borrowing to Third World countries has, however, to be added, which has to be written off. It is estimated that this write-off will not be less than another US$ 7 bill.

The structural problems of the Czechoslovakian economy are sometimes called *'internal debt'*, which makes reference to the fact that far too little reinvestments have been made and the economy has been drawing from the substance which the CSFR had – especially before World War II. In fact, only 16.5 % of all investments have been foreseen for reinvestments. This low level of industrial (re)investments leads to a stock of industrial installations, which is to a large extent overaged, outdated and inefficient. Especially in the traditional sectors a substantial part of the machinery dates from the forties and fifties.

The political reforms at the end of 1989 are followed by economic reforms which have been carried out with determination regarding the liberalization towards a social market economy but with ample political care. This applies especially to the liberalization of prices which is postponed and will be gradual in order to avoid the *'shock therapy'* of the Polish type.

Whereas the liquidation of the central plan is more a formal act, the economic reform is structured in four parts:

- financial, fiscal and currency policy
- reform of property
- reform of prices, exchange rates, wages and interest rates
- foreign trade.

The privatization of the large state-owned enterprises is a further priority for the Czechoslovakian Government. This leads to a substantial amount of insecurity with management and labour, even if in a first phase only a national distribution of the shares is envisaged.

The reintegration the CSFR in the IMF/World Bank system presents a further important aspect of the reforms, which is pursued with vigor so that the membership can be decided in September 1990.

A recent trade agreement with the EC also reflects the orientation of the CSFR towards Western Europe.

4.2.2 Energy System

4.2.2.1 Institutional Background

The implementation of national energy policy regarding its effectiveness and efficiency depends to a large extent on the framework set by the economic system for the actors in the energy sector. This refers to the institutional mechanisms as well as to the energy planning procedures.

Czechoslovakia has been a "classical" centrally planned economy. The process of economic reforms to liberalization will also affect the energy sector even though probably more regarding the planning than the institutional structure. The Federation of the Czechoslovakian and the Slovak Republic present a special feature reflected e.g. in the existence of two electric utilities.

These electric utilities report to the **Ministry of Fuel and Energy** which can be regarded as the heart of the energy sector. The main responsibilities of this Ministry are reflected in its departments:

- Gas and Electricity (responsible for the utilities)
- Coal
- Nuclear Power
- First Deputy Minister, who is responsible for planning, cooperation and the coordination of the efforts regarding energy conservation.
  (further details are illustrated in the organigram).

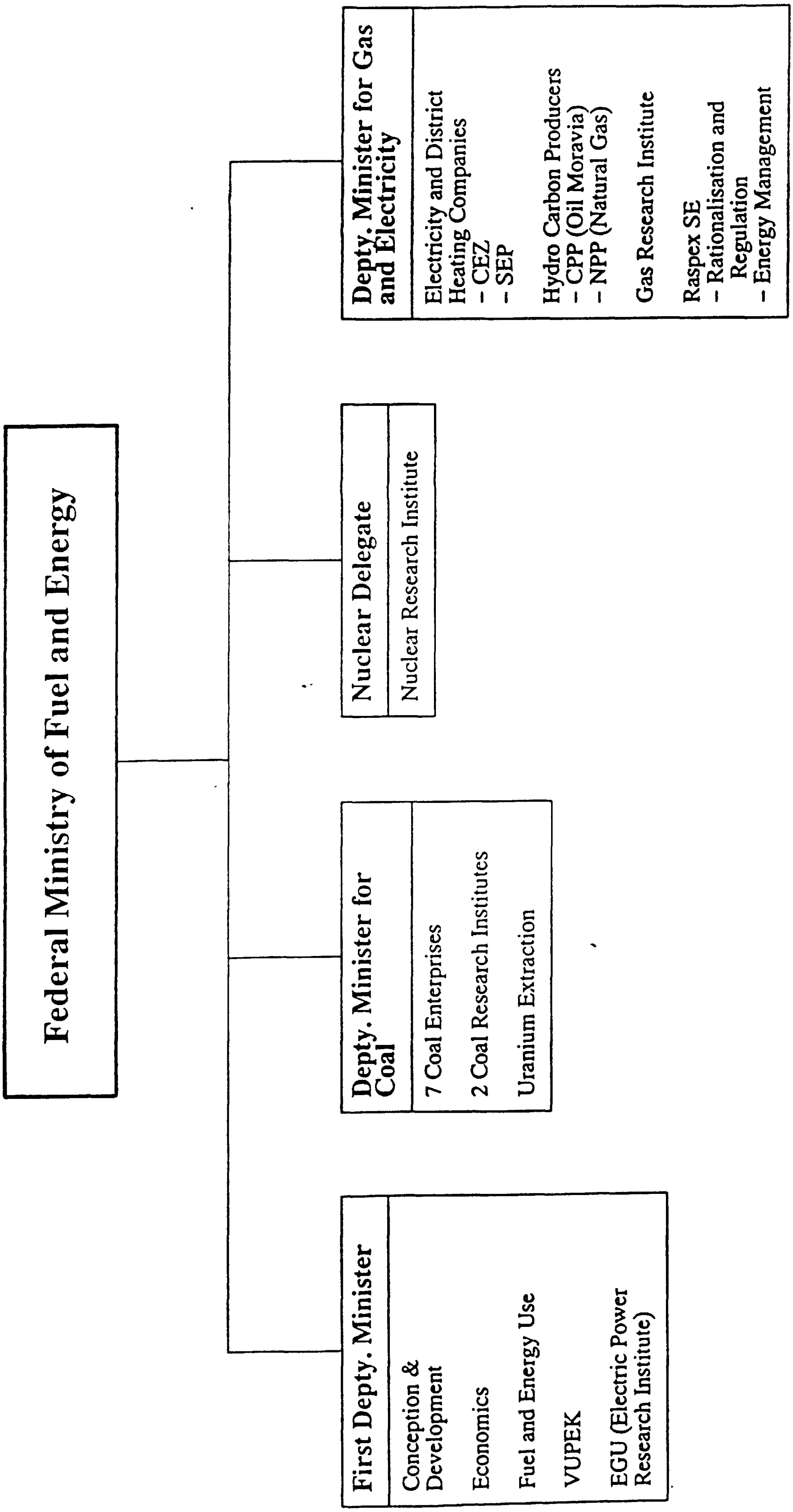
  Furthermore, the planning and research institute VUPEK falls in this branch of the Ministry of Fuel and Energy. VUPEK employs about 370 persons, 200 of which in Prague and the rest in two other places. VUPEK is active in the research regarding energy technologies and energy planning.

One particularity of the institutional setting is the fact that the oil sector falls under the responsibility of the Ministry of Industry.

For the future developments of the energy sector the **Ministry of Environment** will increasingly become important. This Ministry has been newly established in February 1990 and operates in four departments:

- Ecological Policy
- Water and Air Cleanness
- Environmental Development and Land Use Planning (including Waste Management)
- Protection of Nature

Regarding the **qualification** of the Czechoslovakian professionals a detailed assessment is not possible within the context of this study. However, the general impression is that the level of knowledge and expertise in the engineering field is quite strong. Limits are set by the lack of information and experience on modern western technologies (i.e. control and electronics).


Federal Ministry of Fuel and Energy
First Depty. Minister
Conception & Development
Economics
Fuel and Energy Use
VUPEK
EGU (Electric Power Research Institute)
Depty. Minister for Coal
7 Coal Enterprises
2 Coal Research Institutes
Uranium Extraction
Nuclear Delegate
Nuclear Research Institute
Depty. Minister for Gas and Electricity
Electricity and District Heating Companies
- CEZ
- SEP
Hydro Carbon Producers
- CPP (Oil Moravia)
- NPP (Natural Gas)
Gas Research Institute
Raspex SE
- Rationalisation and Regulation
- Energy Management

The main deficit seems to lie in the management and economics of western type. This refers to the level of individual firms where managers have to learn the responsible profit-oriented management of resources – which plays, for example, a major role in energy management.

On the economic level pricing and policy making (e.g with incentive schemes) as well as the energy economy interaction on the demand side are major areas where the qualification could be improved.

The change of the CSFR to western democracy will lead to far reaching reforms of the economic system towards a West-European *'social market economy'*. The final shape of the future Czechoslovakian system, however, is currently as little known as the timing.

A discussion is already underway, regarding the possibilities of privatization for the energy producers. No immediate change is, however, expected regarding the energy sector institutions.

Regarding the cooperation between Czechoslovakian authorities and the EC these institutions will therefore most probably remain important partners.

Furthermore, industries which are not risking to be closed down are potential partners for cooperation. Such a cooperation with the EC would put them in a better position regarding the attraction of foreign partners.

The design of the future cooperation between the EC (Commissions as well as member states) has to take into account that there is no history and experience of technical cooperation. Therefore, the initial cooperation activities have to be well prepared and carefully monitored.

In the following the ideas for cooperation which have been developed based on the analysis of the energy situation and taking into account the Czechoslovakian situation and needs as perceived by the officials contacted (see Annex I) are discussed.

4.2.2.2 Resources, Production and Primary Energy

The most notable characteristic of Czechoslovakia's energy sector is the **large lignite and coal resources**. The lignite reserves amount to 8.4 bill. tons of which only about half is economically exploitable. The most important resource is the lignite of the North Bohemian region. Even though the resource amounts to 6 bill. tons, the current level of production could only be maintained for 30 years. Furthermore, the **lignite quality is decreasing** in terms of the ash content, the sulfur content, mining and exploitation conditions, etc. The heating value is only around 10 MJ/kg in North Bohemia and varies between 9 and 15 MJ/kg in Slovakia. The sulfur content varies for the different basins from 0.9 % in Sokolov to 1.7 % in the largest lignite basin of North Bohemia.

Hard coal resources are concentrated in the area around Ostrava and are estimated at 1 bill. tons. This translates into a life span of about 40 years. Most of the coal 90 % comes from the Ostrava region, where mining takes place at 650 m and the coal has a heating value of 24.6 MJ. The sulfur content of Czechoslovakian hard coal is given at 0.7 %.

Whereas oil discoveries remained negligible, gas was discovered in Slovakia (4 bill. m^3) which brings the gas resources to a level of 15-20 bill. m^3. Hydropower resources are estimated at 3,000 MW and will be increasingly exploited (currently 1,600 MW), mainly in the form of small hydropower.

Uranium deposits are located in Central and North Bohemia at unspecified quantities.

The **wind energy potential** is not yet assessed. The general perspectives seem, however, to be rather limited given, for example, the information available on the GDR, where a worthwhile potential is only in the coastal areas.

PRODUCTION AND IMPORTS

Primary energy production stagnated in the eighties. However, domestic production still covers about 60% of energy consumption.

Production of lignite peaked at 103 mill. tons in 1984 and dropped down to 94 mill. tons in 1990. Output is expected to continue to decrease. A similar trend can be observed for hard coal production which is presently more or less constant at about 25 mill. tons.

Table 1: Coal and Lignite Resources and Production

	Resources Mill. to	Production (Mill. to) 1980	1984	1988
Lignite	8,400	94.9	103.0	100.4
Coal	ca. 10,000	28.5	26.4	25.7

The decreasing lignite production resulted in an **increasing dependence on oil imports** which increased from 25 % of total primary energy consumption in 1980 to 40 % in 1987. The oil is imported in the form of crude oil from the Soviet Union. These imports amount to about 18 mill. tons per year – a small part of which is reexported as refined products (see table 2).

Gas production is relatively low (0.7 bill. m^3 in 1987) and stagnating. Only about 6% of domestic consumption can be provided from domestic sources. **Gas imports have increased constantly** over the last 20 years to 14 mill. m^3 in 1989.

The positive prospects for gas are also determined by the fact that the main gas pipeline for the Russian gas exports to Germany and other parts of Europe cross the CSFR as can be seen from the map.

Table 2: Oil Supply of Czechoslovakia (mt)

		(+)	(+)	(-)	(-)	(=)
	Domestic Crude Production	Crude Imports	Product Imports	Crude Exports	Product Exports	Domestic Supply
1970	0.2	9.8	1.1	0.1	0.8	10.2
1975	0.1	15.8	1.1	0.0	0.7	16.3
1980	0.1	19.3	0.9	0.3	1.3	18.7
1981	0.1	18.5	0.9	0.2	1.0	18.3
1982	0.1	17.3	0.8	0.5	0.9	16.8
1983	0.1	17.1	0.8	0.4	1.2	16.4
1984	0.1	17.2	0.8	0.0	1.1	17.0
1985	0.1	16.9	0.7	0.0	1.4	16.3
1986	0.1	17.8	0.6	0.0	2.0	16.5
1987	0.1	17.6	0.6	0.0	1.5	16.8

Of the total primary energy the shares of the end energies are structured as follows:

Table 3: Structure of Primary Energy Consumption (1987)

	PJ	MTOE	%
Lignite	1,212.0	29.0	37.6
Coal	619.8	14.8	19.2
Oil	669.9	16.0	20.18
Gas	397.8	9.5	12.3
Electricity	82.6	2.0	2.6
Nuclear	241.8	5.8	7.5
Total	3,223.9	77.1	100.0

The share of lignite and coal were increased during the seventies until mid eighties in order to substitute oil imports. This development has come to a halt due to the a.m. decrease in lignite production.

Electricity is also being imported increasingly (1987: 2.2 mill. kWh). Czechoslovakian deliveries to the nuclear power plant at Chmelnizki provide the basis for the supply of 3.6 mill. kWh p.a. from the Soviet Union in the next years.

4.2.2.3 Transformation Sector

The promotion of nuclear energy has been a second pillar of the Czechoslovakian oil import substitution policy. This policy translated in an increasing share of nuclear power.

The main share of the electricity production is however still lignite, which accounts for 63% of the electricity generated. Nuclear energy already contributes 27.2%, whereas hydro energy represents only 5%.

Table 4: Electricity Capacity and Generation in 1987

	Capacity MW	%	Generation GWH	%
Coal	11,800*)	54.6	51.5	63.0
Oil			2.8	3.5
Gas			5.2	6.4
Nuclear	3,200	16.2	22.2	27.2
Hydro	1,600	7.9	4.1	5.0
Total	21,900		85.8	

*) of which 10,800 MW for lignite

The above mentioned increase of nuclear power has been considerable from 15.4% in 1985 to 27.2% in 1987. The contribution of oil to electricity production could be further reduced from 10.1 % in 1985 to 3.5 % in 1987.

The expansion of nuclear power is an important feature for the future development of the energy sector as it was planned in 1989/beginning of 1990. 15 % of the total plan investments for the industrial sector were foreseen for nuclear power plants. This should result in a planned installed capacity of 11,300 MW in the year 2000 (as opposed to MW 35,001 in 1989). This would represent an increase of the nuclear share of electricity generation to more than 50 % and to 73 % in the year 2020.

The main actual project is the 4 x 1000 MW Temelin nuclear power plant.

Nuclear power shall also be increasingly used to provide heat which is today mainly procured as cogenerated district heating from coal-fired power plants.

The oil sector is characterized by re-exports of oil products which have been leveling at probably 1-2 mill. tons/y. The future prospects of these re-exports are open given the apparent decrease of these re-exports and the changing trade patterns.

4.2.2.4 Energy Consumption

The growth of primary energy demand has been picking up again after a zero growth period from 1979 to 1987. From 1983 to 1987 primary energy consumption grew at a rate of 3 % per year whereas the national income grew by 3.7 % p.a.

It is interesting to see that the official plans 1986–1990 foresee growths rates of 0.5 % p.a. related to an economic growth of 3.5 %. In the first two years, however, energy consumption grew by 3.1% whereas economic growth did not reach the projected level.

The level of primary energy demand per capita amounts to 206 GJ which is second in Eastern Europe behind the GDR and is higher than in the Federal Republic of Germany.

Electricity demand has been growing steadily and electricity consumption per capita is second in Eastern Europe with 5,787 kWh/capita, which is mainly due to a high consumption in the industrial sector.

Final energy is mainly consumed by the industrial sector (51 %). The residential and transport sectors follow with 14 % and 11 % respectively. This is a pattern which is quite similar with other countries of Eastern Europe. The strong base of energy-intensive industries and the relatively limited standard of living lead to the high share of the industrial sector.

Low Efficiency in Transformation and End-use

The low efficiency is an important feature in both the transformation sector and especially in the conversion from final to useful energy at the consumer level.

Three major reasons can be identified for the low end use efficiency:

- Firstly, as in many other countries, **low energy prices** lead to a distortion in the resource allocation by encouraging waste (see also section 3). The artificially low level of prices also prevented the development and introduction of modern and efficient technologies.

- Secondly, the industrial policy of the CSFR has followed the Soviet model of heavy industrialization. Structural changes to light and modern industries occurred only in a very limited way. The heavy industries integrated in the CMEA trading system did not face the pressure of world-wide competition and thus did not modernize their production lines. The economic system of a centrally planned economy, which allocated quantities of energy inputs, did not prove to be the most efficient.

- Thirdly, as in the transformation sector, the capital stock in industry is extremely old. In many factories the production equipment dates from the forties and fifties. An example is the Skoda works visited during the mission. There is a power plant still in operation which dates from 1890 (for further details see Annex II).

The potential for the improvement in the efficiency of industrial energy consumption is enormous. The Skoda steel works, for example, operate at a specific energy consumption of about 50 % above the world average.

The problem regarding the improvement of energy efficiency in industry lies in the fact that substantial achievements could be made by "no cost" and "low cost" measures. The modernization of the production processes requires a huge amount of capital. In this respect, the situation in the CSFR is comparable to that in the GDR, where estimates see 70 % of the industries are evaluated internationally not competitive.

4.2.3. Trends and Issues

4.2.3.1 Energy and the Environment

The environmental issues have become the main driving force of the energy policy debate in the CSFR.

The situation in the CSFR is characterized by the fact that the quality of the environment is perceived as very bad and unsatisfactory. People expect an improvement of the **air quality** whereas at the same time the quality of the lignite is decreasing continuously - especially regarding its ash content. The burden of the pollution caused by the burning of 125 mill. tons of coal of which 80 % is lignite, has only partially been assessed. Whereas the estimates for the SO_2 emission vary between 0.8 and 2.5 mill. tons, exports and imports of emission lead to net immissions which are estimated to be even higher. For the dust immission no estimates are available but witness of the effect in coal areas shows a considerable awareness of the population for the burden and health hazard presented by coal dusts.

There is a chain of reasons which can be made responsible for the high level of emissions:

- low coal quality
- old, inefficient and partially inadequate power plants
- location of plants close to urban areas (district heating)
- absence of pollution abatement
- high energy demand through inefficient end use
- unknown but important quantities of coal stoves for heating with low combustion efficiency.

The CSFR has also committed itself to reduce the level of SO_2 emissions by 30 % until 1993 within the framework of an ECE (UN Economic Commission for Europe) agreement and developed a subsequent policy.

The improvement of this situation through the introduction of pollution abatement technologies is planned. The progress of the planned investments is, however, very slow.

Only two power plants are currently equipped with desulphurization. In Tusimice, Soviet magnesit technology is being tested and apparently faces problems, so that the planned use in the Prunerovz plant is open. In Tisova, a dry desulphurization system (which had to be replaced in a plant in the Federal Republic of Germany) was installed and is partially operational. However, SO_2 emissions in that plant remain at 1,000 - 3,000 mg/m^3.

The environmental issues are however not limited to air pollution. The debate on **nuclear safety** has also to be considered environmental. The discussion about nuclear energy has been intensifying with the recently gained liberties. Besides Chernobyl the news about the safety of the East German reactors (i.e. in Greifswald) has caused substantial concern and resistance regarding the nuclear energy in general and especially against Soviet technology. Furthermore, international pressure is amounting as the nuclear plants are partially located close to the Austrian border.

The nuclear debate already caused delays in the nuclear program. This applies especially to the Temelin plant for which the choice of the technology has now become a major issue. Besides the options of Soviet or western technology a compromise is discussed which would result in Soviet reactor technology with western control and safety technology.

To complete the picture it shall be mentioned that hydropower also faces environmental problems. The mini-hydroplants which are under consideration are located in the mountainous regions (i.e. Tatra) and environmentalists oppose to the related deforestation and dam building.

It becomes evident that the environmental issues make decisions on large infrastructure projects like power plants very difficult and time consuming in the newly emerging democracy in the CSFR.

Given the environmental perspectives energy production and thus consumption should be reduced or increasingly be provided by oil or gas.

4.2.3.2 Energy Economics

Energy represents an important sector of the Czechoslovakian economy for a number of reasons.

Even though oil imports have been reduced the total import dependence of the energy sectors is high with 47 % of the primary energy imported. This is reflected in the fact that energy accounts for 27 % of the Czechoslovakian imports.

The investment level in the energy sector is high due to the capital intensity of the programmed nuclear plants. Probably about 25 % of the total investments have to be allocated to the energy sector. The investment is further increased by the pollution abatement programme (i.e. desulphurization) which is foreseen. If the nuclear program continues it will probably be based on western control and security technology which further increases the level of investments.

Investments are also the key issue in energy conservation in industry where old process technology has to be replaced or modernized.

The role of energy for the economy is aggravated by the fact that the industrial base of the CSFR is to a large extent consisting of energy-intensive industries.

Energy prices which reflect costs at international level - not even speaking of the internalization of the environmental costs - would cause substantial problems for these industries.

The level of energy prices in the CSFR is low; in the order of 25-35 % of costs as can be seen from the examples in table 5.

Energy prices have not been able to fulfil their role as control instrument for resource allocation, not only because of their wrong level, but also because of the way in which the economic system functioned. This does not only apply to the level of national planning and allocation of energy quantities, but also to the industrial level.

The structure of industrial electricity tariffs, electricity and power component for example is in some cases absorbed by the large industrial consumers and not carried on to the industrial plants which no longer pay for the power component but only an average price per kWh. This leads, of course, to the complete ignorance of the maximum load and load management issue.

Table 5: Energy Prices in the CSFR

		KCS	DM	ECU	Prices/Cost in %
Large Industrial Consumers					
Water	per qm	3.4	0.36	0.17	
Electricity	per kWh	0.52	0.05	0.03	
Households					
Tariff 1	per kW	1.8	0.19	0.09	
	per kWh	1.05	0.11	0.05	
Tariff 2	lump sum per month	25	2.63	1.28	
	per kWh	0.45	0.05	0.02	
Heat Tariffs	per GJ	21	2.21	1.08	36.2
Cost of Heat Generation					
from lignite	per GJ	58	6.09	2.97	
from gas		80	8.40	4.10	
Coal					
Price		200	21.01	10.25	33.3
Cost		600	63.03	29.72	
Exchange rate in spring 1990: 100 KCS = 9.52 DM					

The awareness for low energy prices and for the need to increase prices is already considerable. Problems lie, on the one hand, in the political process which currently foresees a very careful and gradual approach to price increases. On the other hand, there is a need for further understanding of the details and practicability of cost related pricing. This applies especially to marginal cost pricing for electricity as well as for the practical details of contracting.

4.2.3.3 Energy Policy and Planning

Regarding the Czechoslovakian energy policy as defined in the past years the above mentioned expansion of nuclear energy translates into a nuclear share of 37 % of the primary energy in the year 2005. Furthermore, the contribution of gas was foreseen to increase to 24 %. This gas objective will most probably be increased given the environmental debate.

At the same time hydropower is planned to be expanded by 50 % from currently 1,600 MW to 2,400 MW in the year 2000. This plan is also subject to the environmental debate.

Energy planning process was a function and a part of the socialist planning system with production plans and allocation of energy quantities. This national energy planning is complemented by some planning functions on the district level which applies especially to the planning of district heating which has been promoted quite effectively.

The district heating systems limit, however, the flexibility of the change in the energy system as coal plants in polluted regions cannot just be closed down without assuring alternative heat supply.

This is related to the slow progress on the environmental projects which are currently only amounting to 2% of the total investments.

The actual situation in the energy sector in the CSFR is dominated by a substantial level of insecurity at all levels regarding environmental policy where plant directors fear their plants will be closed down or consumers who fear high price levels.

The change in the economic structure of the CSFR will, however, affect the energy sector especially at the consumer level. The restructuring of the Czechoslovakian industry is only a matter of time. This restructuring will see some of the energy-intensive industries as *'sun set industries'* and modern less energy-intensive industries as *'sun rise industries'*. Energy prices could and should be functional in this process to promote energy conservation.

A further important change in the end use will be the expected explosion of individual transport. Whereas the **transport sector** has been responsible for a modest share of the final energy in the past, the increase of private passenger transport will put a new burden on the energy system. The Czechoslovakian railway system provides 67 bill. ton/km of transport which is surpassed in Eastern and Western Europe only by Poland. Given the rolling stock this seems to be executed more efficiently than in other East European countries. Regarding passenger transport the railway system is also providing an excellent basis for the future development. Important policy decisions have to be taken regarding the speed and scope of the changes in the transport system which should take into account the western experience and aim at a limitation in the energy intensity of the transport sector.

Regarding future options the use of gas and energy conservation emerge as the most promising contributions to the solutions of the Czechoslovakian energy problems.

Gas has already been mentioned as a clean fuel. the conversion potential, i.e. of industrial plants, has to be examined in detail. The technological problems of gas are limited. The draw-back of the gas option lies in the important dependence and price risk associated with gas. In this respect, the CSFR would, however, join a club of western countries (e.g. Germany) which would neutralize the effect on the international competitiveness.

Energy conservation was an aim of energy policy in the seventies and early eighties, when central targets for a reduction of fuel and electricity consumption were established but continuously lowered. Given the centrally planned economic system and this half-hearted approach, only limited progress has been achieved. Energy conservation investments have in the past failed to find finance. The appreciation of the potential for energy conservation is very limited due to the artificially low price levels.

Energy conservation has to be promoted by a consistent energy policy which translates into a programme of measures which relate on information on suitable western technologies until the subsidies for certain energy conservation investments, e.g. in the household sector.

The situation of the energy sector is further characterized by the immense need for new technologies and thus capital. This applies to the transformation sector as well as to the end use sector. The transfer of technology and capital (i.e. direct investments) from other parts of Europe is therefore an important prerequisite for the restructuring of the Czechoslovakian energy and economy systems.

4.2.4. Proposals for Cooperation

4.2.4.1 Principles of Cooperation with the EC

The CSFR has been a prospering industrial nation – one of the wealthiest in Europe before the Second World War. The strong industrial basis and especially the related technical know–how is available. The transformation into a modern economy integrated into the world markets requires substantial changes, however.

The fast absorption of western technology and the definition of a position within the world economy with its international division of labor has to be achieved.

According to the consultants' judgment – as indicated above – the major features which should guide the development of the cooperation of Czechoslovakia with the EC are:

- a changing economic policy, which should be supported by adjustments in the energy policy (e.g. policy dialogue or pricing studies) and efficient energy planning
- a huge demand for energy conservation and pollution abatement technology requiring substantial investments at the level of energy producers as well as consumers. The introduction of the change and i.e. of the new technologies has to be facilitated by all means.
- related to the above, the need for the transfer of energy efficient technology i.e. by means of industrial cooperation (i.e. joint ventures) emerges.

The following proposals for cooperation and for specific projects are structured into four main areas:

- Energy planning and pricing
- Energy conservation
- Environmental production
- Gas supply.

The technical know–how base in the CSFR is quite strong which has to be taken into account while designing cooperation projects. In all of these areas the transfer of economic know–how on the national as well as on the managerial level is, however, important to speed–up the process of economic change.

4.2.4.2 Energy Planning and Pricing

The changing of the Czechoslovakian economy from a centrally planned system towards a market economy will affect the energy sector and energy planning. Cooperation with the EC would be very useful in areas like data collection (i.e. on energy end–use), the transfer of planning techniques and institutional strengthening. The design and execution of regional energy plans or energy conservation programs can be mentioned as examples in this area.

Regarding planning, policy and institutions, the energy sector will be increasingly integrated into the economic reforms. This process could be assisted by a cooperation with the EC (e.g. policy dialogue, transfer of experience in energy planning and programming).

In order to change the attitude of the consumers to energy and to initiate significant and sustained energy conservation efforts, energy prices will have to be increased. The need for price increases is seen in the CSFR. Thus, a pricing study is proposed which could provide the economic analysis of energy pricing focusing on marginal cost prices. The development of suitable electricity tariffs would be an important part of such a study (further details are developed in Annex II).

4.2.4.3 Energy Conservation

Whereas a stronger increase in the use of gas would be an environmentally sound solution, this option is limited by the foreign exchange problems. This leads to energy conservation as a very important solution to the energy and environmental problems.

Regarding energy conservation, a dual approach is proposed. In order to assure an impact in the long run, an assessment of the energy conservation potential and obstacles in the different industrial branches should be performed. Such a sectorial study on industrial energy conservation (see Annex II) will lead to the development of a national energy conservation programme.

In order to motivate consumers and investors, case studies should demonstrate the impact of energy demand management programme on the plant level. A model factory should be analyzed in one of the energy intensive industries which have a chance to survive in a restructured economy (see Annex II).

The flow of the large amount of finance required in the area of energy conservation should be facilitated by the CEC. Innovative financing schemes should be developed and associated with the transfer of European technology. The experience of Hungary, where such finance facilities are only reluctantly used, should however be taken into account.

Furthermore, a training programme should not only introduce European energy conservation technologies, but especially concentrate on the management part of energy conservation activities (i.e. selection of new technologies, contracting, license agreements, etc.).

4.2.4.4 Environmental Protection

The reduction of emissions caused by coal-fired power plants clearly presents one of the major challenges for the energy and environmental policy of the CSFR. Again a dual approach which combines the analysis on the sector level with the demonstration project seems is suggested.

On the sector level, the technologies needed for desulphurization and reduction of Nox emissions (DENOX) shall be screened. In this context it is important to identify the conditions which justify the installation of those pollution abatement technologies in old plants. Furthermore, the strategies for technology transfer should be examined.

The most suitable desulphurization technology should be identified for a demonstration plant, the installation of this technology being used for training. Monitoring to the reduction of the level of emissions should demonstrate the impact and speed up the dissemination of this type of technology.

There are a number of other important issues in the area of energy and environment in CSFR. These refer to waste management and incineration (see Annex II) as well as to the transport sector, i. e. vehicle emission control. The overall pollution control policies need to be based on a nationwide immission monitoring system which also warrants priority.

Furthermore the cleaning of the gases in a chemical plant, the emission control in a waste incineration plant and the monitoring of river water quality are proposed.

4.2.4.5 Gas Supply

The further introduction of natural gas would allow for a clean solution in the conflict between coal and nuclear energy. There are, however, a number of obstacles for the increased use of gas. Areas of cooperation should focus on the issues of fuel substitution, especially in industry. Interfuel substitution is related to the modernization of and energy conservation measures in large industries, energy pricing, etc. and these issues must be treated together.

A separate issue is the transfer of the know-how on gas contracting which is required due to the change from the CMEA system to the commercial (western) system of energy trade (see Annex II).

4.3 Other

Depending on the political developments of the Czechoslovakian energy policy there are a number of further issues which may become important areas of cooperation.

In the **conventional energy system** the issue of the modernization and rehabilitation of the power plants will become a major concern. It has to be further analyzed up to which extent.

The question of rehabilitation/refurbishment will be studied by the Czechoslovakian authorities if a CEC cooperation could prove instrumental to avoid over-investment in new plants.

In the area of **renewable energies** an assessment of the wind energy potential should be undertaken. This assessment could in a phased approach be kept fairly general to decide if it is worthwhile to elaborate a detailed 'wind atlas'.

For the recommendations regarding the implementation see also section 5.6.3 of this report.

ANNEX I

LIST OF INSTITUTIONS IN THE ENERGY SECTOR AND INSTITUTIONS VISITED

Institutions in the Energy Sector and Institutions Visited

Ministry of Environment

Minister : Moldan
Ing. Raab *

Departments :
- Ecological Policy
- Water and Air Quality
- Environmental Development (spatial planning, waste management etc.)
- Protection of the Nature

Hydrometeorological Institute

State/Government Inspection for Air Quality

Research Institute for Water

Technical Economic Center for Cleanness of Air and Climatic Development

Furthermore:

Research Institute for Air Technology
with the Ministry for Machinery and Electric Machines

Department of Vehicle Inspection
with Federal Ministry of Interior

Federal Ministry of Fuel and Energy

J. Boucka*
Kucera*
(Kensky) Viceminister

Departments:
- Energy
- Gas and Bitumen
- Mining
- Uranium

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* **Visited**

Under the Department of Energy two utilities:

- Czechoslovakian Electric Utility
- Slowakian Electric Utility

VUPEK

Director: Cizek
Mr. Bohal*
Mrs. Tykvová*

State/Governmental Energy Inspection (Czech and Slowakian)

Forschungsanstalt für die Energie
(Research Institute for Energy)

German Embassy, Prague

Mr.Klopsch*

SKODA*

Mr. F. Korbel, General Manager
Dr. V. Krátky
Dr. Kratochvíl, Director
Ing. Ulc, Power Supply
Dipl.-Ing. Horn

LACHEMA*

Dr. Kukla
Ing. Horák

Waste Incineration Plant, Brünn*

Dir. Musil
Mr. Hanacék

Tisova Power Plant

Mr. Streda, Director

* **Visited**

ANNEX II

PROJECT PROPOSALS

PROJECT PROPOSALS

1. ENERGY CONSERVATION

1.1 Energy Conservation in a Steel Plant as a Model Factory

Regarding the promotion of energy conservation, the industrial sector clearly presents the largest potential. The approach suggested is twofold. Based on a model factory one project is to quickly show the energy conservation potential in a case study and to move to implementation of modern – partially western – technology as a show case. The Skoda steel works represent a good case study for the Czech industry.

Outline of the Study

Phase I: Auditing/Identification of Energy saving measures

1) Analysis of Energy consumption and production

. Analysis of available recorded data
. Specification of measuring campaign
. Measurements
. Auditing/identification of problem areas
. Evaluation
  - energy balance of the company
  - Specific consumption figures
  - Emissions and waste treatment

. Analysis of Energy Costs
  - financial analysis (company level)
  - economic analysis

2) Development of Production

Scenario 1:	Status quo
Scenario 2:	Siemens Martin Furnaces
Scenario 3:	Modernization
Scenario 4:	Changes of Product lines

3) Measures to lower Energy Demand

Phase II: Demonstration Project

1. Implementing No Cost and Low Cost Measures
2. Feasibility Study for measures requiring larger investments
3. Implementation of the demonstration equipment

1.2 Sector Study on Energy Conservation in Industry

The second energy conservation project is a sectorial study on energy conservation. The various industrial branches shall be screened by the EC energy indicators methodology. On this basis, priorities shall be set. The obstacles for the improvement of energy conservation are identified and the various means of governmental intervention will be discussed. A national programme for energy conservation in industry shall emerge from this study with an emphasis on the financing of the huge investments required.

Introduction

Energy conservation in industry is one of the major untapped energy sources in the CSFR. Given the high level of industrialization and the age of the majority of the equipment, the potential for energy conservation is estimated to be very high.

In order to define this energy conservation potential and strategies to tap it, a study shall be undertaken based on the energy indicators developed for the EC. This study shall analyze and compare the energy conservation potential in the major energy intensive industries. Based on the findings an energy conservation programme shall define the Government policy towards energy conservation.

Objectives

The study on energy conservation in industry aims at :
- identifying the energy efficiency in Czech industries
- analyzing the energy conservation potential for various intervention strategies
- developing an energy conservation programme
- determine the need for investment

Structure of the Study

Screening of Czech industries by statistical analysis

Analysis of major industries (including selected preliminary audits)

Development of an energy conservation programme

Estimation of the investment need

Cost benefit analysis of the energy conservation programme

Development of innovative finance model for energy conservation investments.

2. ENVIRONMENT

2.1 Desulphurization / Rehabilitation of the Tisova Coal Power Plant

In the environmental field the desulphurization of the coal-fired power plants is a central issue. The choice and transfer of western technology is regarded as the priority in this area. The same question is applicable for DENOX. For example, the power plant Tisova could be substituted by modern clean coal power plants (CFBC, desulphurization, DENOX etc.).

2.2 Evaluation of the Desulphurization of the Tusimice Coal-Fired Power Plant

The coal-fired power plants in Tusimice were the first to be equipped with pollution abatement technology. Soviet desulphurization technology which consists of a wet process is apparently not working to full satisfaction. Evaluation of the Tusimice experience should be undertaken.

2.3 Study on DENOX of Coal Power Plants

Besides the sulphur emissions the emission of nitrate is one of the major environmental problems associated with coal combustion.

As the CSFR will continue to use large quantities of lignite and coal, the strategies of the introduction of DENOX have to be studied.

The prerequisites for an efficient transfer of DENOX technology from Europe will be a main focus of this study.

2.4 Waste Control

The waste problem is of major concern to Czech authorities. On one hand, improved waste management is required i.e. the separate collection of recyclable materials. On the other hand, regarding waste incineration the environmental problems are to be solved. Environmental impact assessments will be required to overcome local resistance against waste incineration plants. The choice and transfer of clean technologies is again a major field for cooperation.

2.5 Environmental Design of Industrial Waste Incineration Plant in Brno Area

In the Brno area a substantial number of industries are located. Some of these industries are chemical industries or other industries which produce waste which has to be dealt with carefully.

A project is planned to build a waste incineration plant, especially for this industrial waste. The project idea is linked to a potential site.

The environmental soundness of the site and the overall concept have to be analyzed in order to make the project acceptable.

The study shall analyze the proposed concept for the industrial waste incineration plant. Alternatives for an environmentally optimized concept shall be proposed and evaluated.

Objectives

The study shall analyze the proposed concept for the industrial waste incineration plant. Alternatives for an environmentally optimized concept shall be proposed and evaluated.

Activities

- Analysis of the existing plans
- Evaluation of the proposed technology and the expected emissions into air (dioxine) and water
- Evaluation of expected effects on local air and water quality
- Development of improved environmental design, based on European technologies
- Cost benefits of improved environmental design

Structure of the Report

1. Summary
2. Introduction and Task Description
3. Description of the plant site; site plan
4. Determination of quality and quantity of input material (chemical Analysis, heating value)
5. Recommendations for sorting
6. Recommendation for the combustion process and flue gas cleaning
7. Recommendation for the use of solid components
8. Recommendation for disposal
9. Price Determination
10. Cost-Benefit-Analysis
11. Conclusions

2.6 Air Pollution Control for Brno Waste Incineration Plant

Introduction and Description of the Objectives

The existing Waste Incineration Plant in Brno is equipped with mechanical filters on the flue gas side. Electrical filter are located behind the mechanical filters. There is little information about the flue gas quality, as only limited flue gas analysis is practiced (O_2 etc.).

Emissions of pollutants, such as:

* fly ash
* HCL
* HF
* SO_2
* CO
* NO_x

are not measured as required, for example, by the West German regulations (TA-LUFT).

For this reason, there can be no judgment about the influence of different waste input on the flue gas quality. Measuring apparatus must be selected and installed.

The second step is the selection of the flue gas cleaning equipment.

Finally, it is necessary to optimize the measured flue gas values of the installed flue gas cleaning equipment by trying different combinations of waste input. A period of approximately 6 months is required which includes both winter and summer months.

Structure of the report

1. Summary
2. Introduction and Objectives
3. Description of Existing Plant
4. Description of the Waste (chemical composition, quantities)
5. Measurements and Description of the flue gas quality over a period of one year
6. Determination of the requirements to be fulfilled by the second cleaning stage
7. Comparison of the requirements with similar plants in the FRG
8. Listing of the available equipment supply
9. Cost Comparison
10. Conclusions

2.7 Air Pollution Control in Lachema Pharmaceutical Plant

Exhaust air form drying processes at the Lachema Pharmaceutical plant, Brünn is to be cleaned before emission to the atmosphere

A comparison of similar chemical plants in the FRG is to be conducted in order to determine a standard for the Brünn plant.

The equipment necessary for the improvements should be selected from the same suppliers as for comparable German plants.

Structure of the Report

1. Summary
2. Introduction and Objectives
3. Process and site plan of the plant
4. Production and exhaust air quantities
5. Existing Measures for cleaning exhaust air
6. Comparison with West German Plants (Schering, Merz)
7. Recommendations
8. Cost–Benefit Analysis
9. Conclusions

2.8 Management Strategies for Industrial and Household Waste

Introduction of an Environmental Impact Assessment Methodology

In many areas in the CSFR the environmental quality has been seriously affected by pollution from industry and from energy producers (i.e. SO_2 emissions from lignite power plants).

The opening of the coal society has brought up an intensive discussion on the environment which leads to resistance against new industrial and energy projects.

The introduction of environmental impact assessments in the planning stage of those projects would help to put these discussions on technical grounds.

Based on the European experience with the guideline for environmental impact assessment impact assessment an adapted methodology shall be developed and disseminated for the CSFR.

Objectives

Based on the European experience with the guideline for environmental impact assessment an adapted methodology shall be developed and disseminated for the CSFR.

Activities

- Review of the Czech process of decision-making and planning in which the environmental impact assessment has to be integrated
- Review of the European experience with environmental impact assessment (EIA)
- Development of an adapted EIA

- Development of procedures to integrate EIA in project planning
- Execution of one EIA as a case study (e.g. for a coal power plant)
- Dissemination of EIA methodology in a seminar

2.9 Study on the Introduction of a Nationwide Immission Monitoring System

Air pollution is a serious problem in many industrial areas in the CSFR and the Government is undertaking strong efforts to tackle this problem.

Measurement of air pollution is taking place at some places, but there is no global systematic monitoring of the development of air quality.

A nationwide immission measurement system shall be developed which provides a network of standardized measurements which allows to further analyze and research the development and origins of air pollution.

Based on these policies and programmes to control air pollution can be developed and targeted efficiently.

Objective

A nationwide immission control system shall be developed which provides a network of standardized measurements which allows to further analyze and research the development and origins of air pollution.

Based on these policies, programmes to control air pollution can be developed and targeted efficiently.

Activities

- Review of the existing air quality measurement activities
- Definition of a standardized measurement methodology and technology
- Design of a network of additional measurement stations (in phases)
- Preparation of tender documents for the purchase measurement instruments
- Design of a central monitoring and evaluation procedure
- Design of an analysis procedure for the air quality data and a research programme

2.10 Study on the Introduction of a National Vehicle Emission Control

The high age of the Czech vehicle fleet (i.e. trucks) and the expected increase in individual traffic will lead to a further increase in the level of emissions of vehicles.

The level of emissions can to some extent be controlled by proper maintenance. In this context, the control of emissions of vehicles becomes an important means to force vehicle owners to limit emissions to the technical minimum.

The objective of this study is to analyze the feasibility of a nationwide vehicle emission control system by designing such a system and by assessing the cost and benefits associated with it.

Objectives

The objective of this study is to analyze the feasibility of a nationwide vehicle emission control system by designing such a system and by assessing the cost and benefits associated with it.

Activities

- Definition of vehicle park and transport activities as well as most important sources of emission
- Definition of measurement concepts
- Design of an institutional and organizational framework for a vehicle emission control
- Development of tender documents for measurement equipment
- Analysis of the costs and benefits of the system
- Elaboration of an implementation plant

2.11 Monitoring of Water Quality of Main Rivers

Introduction and Objectives

Emission of waste water from industrial plants in the CSFR underlies only a limited regulation.

In order to arrive at a quick global overview of the wastes introduced into Czech rivers, water analyses at certain intervals along the rivers should be performed.

The collection of samples should be done over a period of several months in order to identify seasonal variations

As a result of these samples, the areas of greatest concentration of pollutants can be identified and the sources of origin of the wastes more easily identified.

The study will result in the suggestion of methods and priorities for waste water treatment and further activities in this area will be defined.

Structure of the Report

1. Summary
2. Introduction and Objectives
3. Selection of Rivers to be Monitored
4. Sample Selection Plan
5. Performance of Water Analysis
6. Determination of Critical Concentrations
7. Determination of the Source of Origin
8. Conclusions

3. GAS

3.1 Know-how Transfer on Gas Contracting

The changes under way in the Comecon trading system will introduce international contracting and pricing procedures.

This will result in major changes in the current structure of gas imports from the USSR.

The objectives of this activity are to transfer the European know-how in the negotiation and elaboration of gas contracts so as to put the Czech authorities in the position to efficiently contract future gas imports.

Objectives

The objectives of this activity are to transfer the European know-how in the negotiation and elaboration of gas contracts so as to put the Czech authorities in the position to efficiently contract future gas imports.

Activities

- Review of existing gas contracts
- Elaboration of handbook on main principles of gas contracting and pricing including model contracts (take or buy etc.)
- Dissemination of gas contracting knowledge by means of a seminar
- Courses on contract negotiating

4.3 German Democratic Republic

GDR

A Survey of Energy Issues
and a Proposal for Cooperation with the
Commission of the European
Communities

CONTENTS

0. INTRODUCTION

During June 5th and June 8th, 1990, a mission to the German Democratic Republic was undertaken by GOPA-Consultants' staff member Dr. H.-J. Siegler in order to collect information on the current situation in the East German energy sector and to discuss the possibilities for an EEC-GDR energy cooperation scheme with representatives from energy sector institutions.

The following persons/institutions have been contacted:

Dr. H.-H. Ziegler,	VEB Kraftwerksanlagenbau, DDR - 1017 Berlin, Hans-Beimler-Straße 91-94, Tel.: 4 38 55 62, Telex: 011 4736 kkab dd
Dr. Löffler,	Department of Energy within the Ministry of Environment, Natural Resources, Energy and Reactor Safety, Schiffbauerdamm 15, 1040 Berlin
H. Patzig, Dr. A. Eckart, G. Piske, Dr. K. Pysall	VE Braunkohlenkombinat Senftenberg, DDR - 7849 Senftenberg, Tel.: Senftenberg 7241, Telex: 0178854/0178830
Prof. Dr. K.-D. Bilkenroth,	VE Braunkohlenkombinat Bitterfeld, Am Kreuzeck, Postfach 61, Bitterfeld - DDR - 4400, Tel.: 640, Telex: 47 63 31 bkk bi
Dr. D. Merten,	Institut für Energetik, Torgauer Straße 114, 7024 Leipzig, DDR, Tel. 2 39 30, Telex: 051 501

All of these experts provided useful information on a variety of specific energy issues in the GDR in a very open-minded manner. Special thanks has to be given to Mr. Eckart who organized the mission and the various visits very efficiently. Given the current situation of rapid changes and turbulences in this country, his help was indispensable.

1. THE MACROECONOMIC FRAMEWORK[1]

In 1988, the growth prospects of the GDR, in comparison to 1987, did not improve. The growth curve continued to flatten out, and the plan figures have not been achieved in wide areas of the economy. For 1989, fourth quarter, national income was 3 % below its previous year's level, industrial production achieved a growth rate of only 2.5 % instead of the planned 4.2 % and output in the construction sector stagnated. In 1990, the national producted is expected to decrease by 4–5 %.

Whereas at the beginning of the eighties developments in the GDR were marked by unforeseeable external events (the reduction of Soviet oil supplies, drastic changes in the credit policy of Western banks, the high level of interest rates), in recent years problems were caused by domestic difficulties, among others the deficiencies of the planning and management system. The central planning authorities did not take realistic account of domestic economic frictions and scarcities in their short and medium term plan targets. The application of key technologies did not take place to the necessary extent and intensity. Innovation problems – largely immanent to the system – have not been overcome. The potential labour supply is exhausted, plant is obsolete, energy and materials are in scarce supply.

The 1988 growth rate was only about 2.6 %. With the exception of the crisis year 1982, this was the lowest growth rate since the beginning of the sixties. Industry did not achieve its plan target in 1988. The industrial production of goods (gross production) in the centrally directed units, with a growth of 3.7 % remained 0.4 percentage points below the target figure, and the net production of the centrally directed units, with an increase of 7 %, was a full percentage point below the target. The frictions and scarcities mentioned above thus influenced negatively important sectors of the economy. The weak points in the economy's development are particularly noticeable here. The figures for the economy as a whole have been influenced especially by trends in agricultural production. The contribution of agriculture and forestry to national income in 1988 was 8 % less than that in 1987. Cereals production showed a drop of 11.3 % compared to 1987 and was 8 % short of the plan target. This result is largely due to adverse weather, e.g. a winter which was too mild and too wet.

Regarding national income, the strong expansion of investment is conspicuous. The volume of investment in the first half of the eighties was clearly too low to allow the structural adjustments necessary for the stabilization of growth. Following years of stagnation, the investment ratio is now rising. The investment strategy followed in the last five year plan has been renounced.

Private consumption, measured by retail trade turnover, increased in 1988 nominally by 3.9 %, almost in line with plan targets. Retail trade turnover and net money income of the population again increased in parallel. Reports about repeated supply bottlenecks indicate, however, that the standard of living of the population has not yet increased to the desirable extent. Besides this, inflationary tendencies have been officially published for the first time in history (+ 2 %). The same holds true for unemployment which is estimated at 130,000 by Labour Union representatives. Of course, actual figures will be much higher in the future.

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1 Sources: Hamburg Institute for Economic Research (HWWA), Economic Developments in Eastern Europe, in: INTERECONOMICS, July/August 1989, and Die wirtschaftliche Entwicklung in den sozialistischen Ländern Osteuropas zur Jahreswende 1988/89, Hamburg 1989
also: Frankfurter Allgemeine Zeitung, 9th March 1990: In der DDR verschlechtert sich die Wirtschaftslage erheblich

The plan was also not fulfilled in the foreign trade sector. Turnover (exports plus imports) more or less stagnated and the surplus on the balance of trade in 1988 was 3 billion valuta marks.

The national economic plan for 1989 exhibited signs of a certain change in trend. The growth rate for the economy as a whole has been reduced slightly compared to the plan figure for the previous year. The gap between disposable income and the supply of goods, which widened considerably in 1986 and 1987, led to a considerable surplus in purchasing power. In 1989 the supply of goods probably grew at an average rate of 4 %, whereas the planned rate of growth of the net money income of the population has been reduced (+ 3.5 %). International trade in goods is again planned to have a surplus whereby the increase in turnover (+ 3.6 %) as well as the expansion of both exports (+ 4.3 %) and imports (+ 2.9 %) seems very ambitious. Trends in energy prices show that a stagnation in intra-bloc trade is to be expected, so that trade with the non-socialist economies must expand accordingly. Given the recent political development in the GDR, its foreseeable unification with the FRG, however, will bring about an integration in the Western economies.

The position/importance of the energy sector within the economy may be depicted by the following indicators:

Number of industrial plants in the energy and fuel sector

Year	**1980**	**1985**	**1988**
Energy Sector	51	49	50
Industry	5031	3526	3408

Number of employees in the energy and fuel sector

Year	**1980**	**1985**	**1988**	**1989**
Energy Sector	210000	225000	229000	229000
Industry	3153000	3262000	3240000	3219000

Index of industrial production in the energy and fuel sector

Year	**1970**	**1980**	**1985**	**1987**	**1988**
Energy Sector	100	144	173	181	183
Average	100	173	211	226	233

Government receipts and expenditures from the energy sector

Year	**1980**	**1985**	**1986**	**1987**	**1988**
Receipts	5995,1	13134,8	14070,4	12474,7	13760,1
Expenditures	1156,0	4810,3	5756,0	5541,3	5327,2
Difference	4839,1	8324,5	8314,4	6933,4	8432,9
Diff./Budget Volume	3 %	3,5 %	3,4 %	2,7 %	3,1 %

German Democratic Republic

Selected Economic Indicators (1988)

– GDP per capita (PPP–concept, 1980 prices) (EEC range: 4810 to 12040 US$)	5100 US$
– Population and Employment	
. Resident Population	16.675 mill.
earning a livelihood (men 15–65 years, women 15–60 years, plus 40 % of the children aged 14 to 15 years)	65 %
. Population Density (Persons per km²)	154
. Growth of Population	0.07 %
. Workers and Employees (without apprentices)	8.594 mill.
. Employment Ratio	51.5 %
Men	55.1 %
Women	48.3 %
. Sectoral Employment Shares	
Industry (without energy sector)	37.4 %
Energy Sector	2.6 %
Handicraft	3.1 %
Construction	6.6 %
Transport, Post, Communication	7.4 %
Trade	10.3 %
Agriculture and Forestry	10.8 %
Other Productive Sectors	3.0 %
Non–productive Sectors	21.4 %
– Sectoral Output Shares (1987)	
. Agriculture	13.4 %
. Industry	44.6 %
. Productive Services	23.3 %
. Non–productive Services	18.7 %
– Natural Resources and Raw Materials Production	
. Potash Dung	3.510 x 10^3 t
. Raw Steel	8.131.2 x 10^3 t

2. *MAIN FEATURES OF THE ENERGY SECTOR*

2.1 Organizational and Institutional Set-up

The energy supply system of the GDR is structured across two levels: On the one hand are the producers, which comprise the combinates for lignite-based power stations and for nuclear energy based power stations as well as the combinate for network operation, on the other hand are the 15 energy combinates for the 15 districts of the territory[2]. These energy combinates are responsible for the regional and local supply with electricity, gas, district heat and coal. In January 1990, the combinates have founded an association of energy suppliers (WEV).

With regard to coal supply, the following structure has been implemented: Lignite producers (mainly BKK Senftenberg and BKK Bitterfeld) deliver directly to the big power stations, the coal processing plants, the big combinates in the industrial sector and to the chemical industry, whereas the end-user in the private sector is supplied via the Governmental coal supply agency in Berlin, which cooperates with the above mentioned 15 energy combinates, each of which in turn cooperates with one commercial coal company.

Of course, the recent political and economic reforms are affecting the organizational structure of the energy sector as well: The tendency towards decentralization most certainly will bring about public utilities at the community level, and the former combinates are being reorganized in the form of corporations or companies with limited liability, whereby their financial basis and technical know-how will be enriched substantially. Thus, these companies will be run according to West European business principles in the very near future.

At the ministerial level, rapid organizational changes have taken place during the last months: In the Honecker era, the energy sector was represented by the Ministry of Coal and Energy, under the Modrow regime the number of industry sector related ministries was reduced by aggregating them, thus ending up with the Ministries of Heavy Industry, Machinery and Light Industry. After the March election the energy sector representatives were absorbed by the Ministry of Economy and the Ministry of Environmental Protection and Water, the latter one being restructured some weeks later as Ministry of Environmental Protection, Natural Resources, Energy and Reactor Safety, which has the following departments: Basic Principles, Emissions and Health Protection, Solid and Liquid Waste, Natural Resources, Energy, and Reactor Safety. Each department is further divided into sub-departments and special units.

After the forthcoming elections for the Länder Parliaments in Thüringen, Sachsen, Sachsen-Anhalt, Brandenburg and Mecklenburg, which are scheduled for December 1990, a decentralization process on the energy policy level will take place most probably, so that some of the central ministry's functions will be transferred to analogous bodies in the Länder.

2 These are the energy combinates in Berlin, Cottbus, Dresden, Erfurt, Frankfurt/Oder, Gera, Halle, Chemnitz, Leipzig, Magdeburg, Neubrandenburg, Potsdam, Rostock, Schwerin and Suhl

2.2 Primary Energy Production[3]

In the early eighties, the East German Government decided to increase the output of brown coal. This was mainly due to the expected increase in energy prices in general, and increasing oil prices in particular. During the plan period 1981–1985, this goal could be fully achieved. On the average, the yearly growth rate of primary energy production amounted to 4 %. The next 5-Year-Plan (1986–1990), therefore, postulated even more ambitious production goals, which up to now could not be completely fulfilled, as can be seen from the following table:

Brown Coal Output (in million tons)

Year	1986	1987	1988	1989	1990
Plan	314	319	317	317	335
Production	311	309	310	304	n.a.

Of course, the expansion of brown coal output created serious environmental problems, first of all with regard to SO_2 emissions, which are about 5 million tons per year.

Given these problems, the plan to further extend brown coal output increasingly met some scepticism. In the context of the general reform of the political and economic system, a significant reduction of brown coal production is aimed at, with plan targets of about 200 million tons by the year 2000. Such a decrease could be compensated for in the following ways:

- Imports of gas
- Imports of hard coal
- Use of nuclear energy.

Besides the domestic brown coal, which in 1988 accounted for 65 % of total primary energy supply, only about 50,000 tons of crude oil are domestically supplied as well as approx. 12 billion m^3 of gas and some nuclear energy.

2.3 Exports and Imports of Energy[4]

In the eighties, the Government of the German Democratic Republic proclaimed the reduction of the energy imports as a major energy policy goal. During the period 1980–1985 the energy imports were reduced by 67 PJ, although domestic energy consumption increased by 150 PJ. To close the gap between supply and consumption, but also to export more energy, brown coal production was increased substantially (in the magnitude of 500 PJ). It is worthwhile to mention that this increase in brown coal output partially led to a reexportation of oil, which had been imported but was going to be replaced by brown coal. Thus, energy export figures nearly doubled between 1980 and 1985 (351 PJ versus 605 PJ). In doing so, the GDR earned foreign currency, which was heavily needed to lower its debt burden.

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3 Source: DIW, Die Energiewirtschaft in den kleineren Mitgliedstaaten des Rates für Gegenseitige Wirtschaftshilfe - Entwicklungstendenzen in den achtziger Jahren, Berlin, November 1989

4 Source: DIW, Die Energiewirtschaft in den kleineren Mitgliedstaaten des Rates für Gegenseitige Wirtschaftshilfe - Entwicklungstendenzen in den achtziger Jahren, Berlin, November 1989

Brown coal being the only important domestic energy resource, hard coal and large quantities of oil and gas have to be imported, first of all from the USSR. For instance, the Soviet Union's share of gas imports is 100 %. With regard to oil and coal the shares are 75 % and 60 %, respectively. The strong dependence of the GDR on the oil imports from the USSR is the main reason why the country joined the transmission and distribution grid, which comes across Poland to the city of Schwedt, from where especially East Berlin is supplied with oil.

In 1986 – 1988 the country's dependence on energy imports grew once again, with gross energy imports from the USSR accounting for 30 % of total consumption. However, the GDR is still in a position to satisfy the lion's share of its primary energy requirements by means of own energy resources, i.e. brown coal.

In 1987, energy export and import figures looked as follows:

1987	**Brown Coal**	**Hard Coal**	**Oil**	**Gas**	**Electric.**	**Nuclear Energy**	**Total**
	mill.t	**mill.t**	**mill.t**	**bill.m³**	**bill. kWh**	**bill.kWh**	**PJ**
Exports	3.1	0.3	8.5	–	3.7	–	455.2
Imports	–	9.0	21.0	7.0	7.5	11.2	1498

According to the yearbook on energy statistics for 1988, and according to internal sources export and import figures for 1988 and 1989 were the following (import figures in brackets):

1988	**1989**
Brown coal (Briquettes): 3.4 mill. t (./.)	3.1 mill. t (./.)
Hard coal: ./. (5.8 mill. t)	./. (4.6 mill. t)
Oil: ./. (17.1 mill. t)	./. (20.5 mill. t)
Gas: ./. (6.9 billion m³)	./. (7.9 bill. m³)
Electricity: 4.1 bill. kWh (5.8 bill. kWh)	4.8 bill. kWh (5.6 bill. kWh)
Nuclear Energy: n.a.	n.a.
Total: 324.0 PJ (1204.0 PJ)	

2.4 Primary Energy Consumption

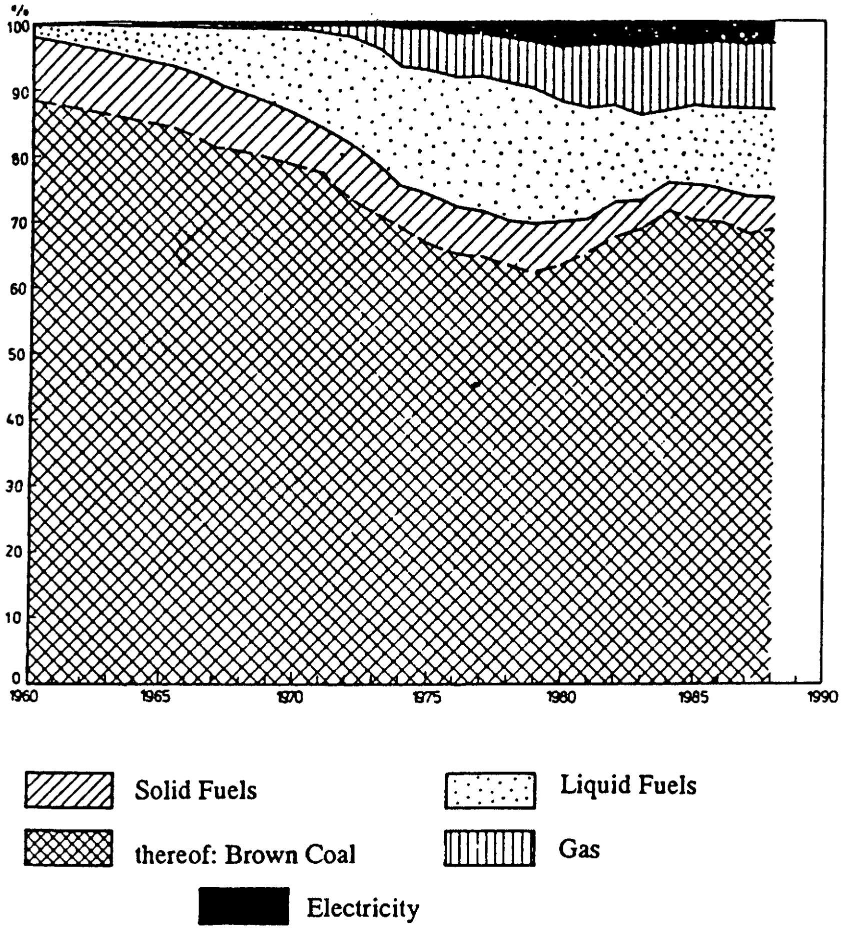
In 1988, primary energy consumption totalled 3751 PJ or 128 million tce, which was slightly less than in 1987 and 1986. The shares of the various energies were as follows[5]:

Energies		GDR
Brown Coal	Mtce	88.1
	PJ	2.582
	%	68.8
Hard Coal	Mtce	6.1
	PJ	179
	%	4.8
Mineral Oil	Mtce	17.0
	PJ	498
	%	13.3
Natural Gas	Mtce	12.4
	PJ	363
	%	9.7
Nuclear Energy	Mtce	3.9
	PJ	113
	%	3.0
Others	Mtce	0.5
	PJ	16
	%	0.4
Total	Mtce	128.0
	PJ	3.751
	%	100.0

As can be seen from the following graph, the share of solid fuels exhibits a downward trend, whereas the share of gas is increasing moderately, and liquid fuels as well as electricity have been kept at a more or less stable level.

5 cf. Energiestatistik der DDR, Leipzig 1989

Structure of Primary Energy Consumption



Source: IfE–Leipzig

2.5 Electricity Supply and Consumption

In the following, a time series on supply and consumption of electricity covering the period 1960 - 1988 is given.

	1960	1970	1980	1985	1986	1987	1988
GWh							
Supply							
Production	40,305	67,650	98,808	113,834	115,291	114,189	118,328
Imports	103	1,230	4,150	3,836	4,872	7,451	5,759
Total	40,408	68,880	102,958	117,670	120,163	121,631	124,087
Consumption							
Energy Sector	6,171	11,196	18,266	20,417	20,702	20,722	20,905
Chemical Industry	13,007	19,590	20,466	21,063	20,940	20,212	21,486
Metallurgy	2,684	4,071	6,118	6,681	6,919	6,985	6,952
Building & Construction	749	1,520	2,379	2,424	2,492	2,510	2,588
Water Supply		,577	1,086	1,265	1,345	1,363	1,399
Machinery & Vehicles	1,791	3,489	5,375	6,036	6,260	6,321	6,377
Electronics	457	1,093	1,676	2,099	2,173	2,228	2,301
Light Industries (without textile ind.)	1,490	2,435	3,944	4,383	4,483	4,524	4,612
Textile Industry	865	1,208	1,551	1,584	1,627	1,657	1,702
Food Industry	777	1,358	2,338	2,630	2,659	2,717	2,736
INDUSTRY IN TOTAL (incl. internal consumption of power stations)	27,991	46,597	63,199	68,582	69,600	69,239	71,059
Other Production Sectors	6,560	10,152	18,381	22,318	22,594	23,301	23,386
Households	2,823	7,118	12,039	15,323	16,165	17,532	17,405
Network Losses	2,553	4,183	6,654	7,773	7,931	7,895	8,149
Exports	481	830	2,685	3,674	3,873	3,664	4,088
Total	40,408	68,880	102,958	117,670	120,163	121,631	124,087

Source: Statistical Yearbook for the GDR, 1989

Since the mid-eighties, electricity production figures are in the narrow range of 114 to 118 TWh. Imports of electricity, however, have been fluctuating between 3.8 TWh and 7.5 TWh. The industry accounts for nearly 60 % of total electricity consumption, with the energy and chemical sector gaining the lion's share, followed by metallurgy and machinery and vehicles.

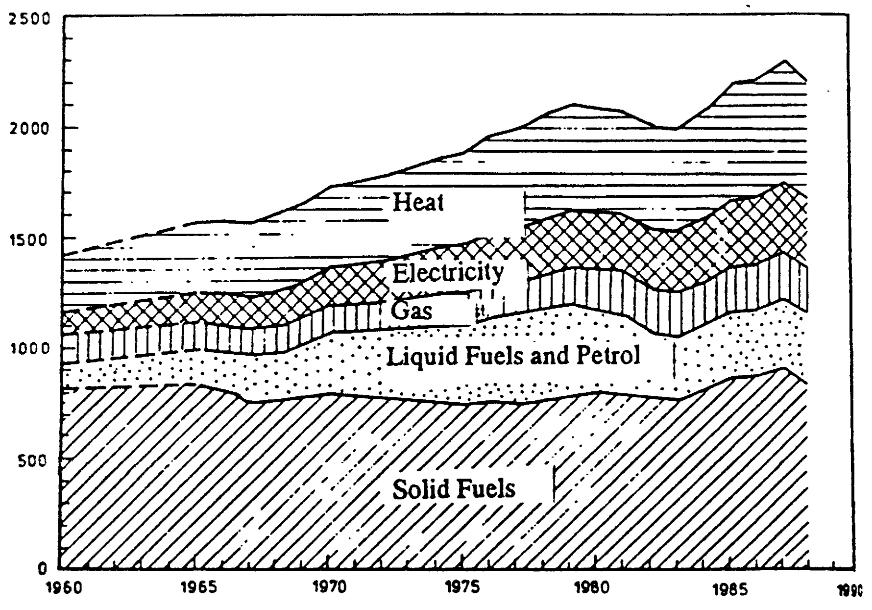
The production of electricity is focussed on lignite-based power stations, which held shares of 83 % in 1987, 85 % in 1988 and 82 % in 1989. Nuclear power stations accounted for 9.9 % in 1988 and 10.3 % in 1989.

2.6 Final Energy Consumption

Final energy consumption is in the magnitude of 2200 PJ per year. (1987: 2302.2 PJ; 1988: 2196.2 PJ). According to the types of energy, its breakdown looked as follows in 1988[6]:

Solid fuels: 835.3 PJ	(38 %)
Liquid fuels and petrol: 318.3 PJ	(14.5 %)
Gaseous fuels: 209.1 PJ	(9.5 %)
Electricity: 315.3 PJ	(14.4 %)
Heat: 518.5 PJ	(23.6 %)

Structure of Final Energy Consumption (by Types of Energy)



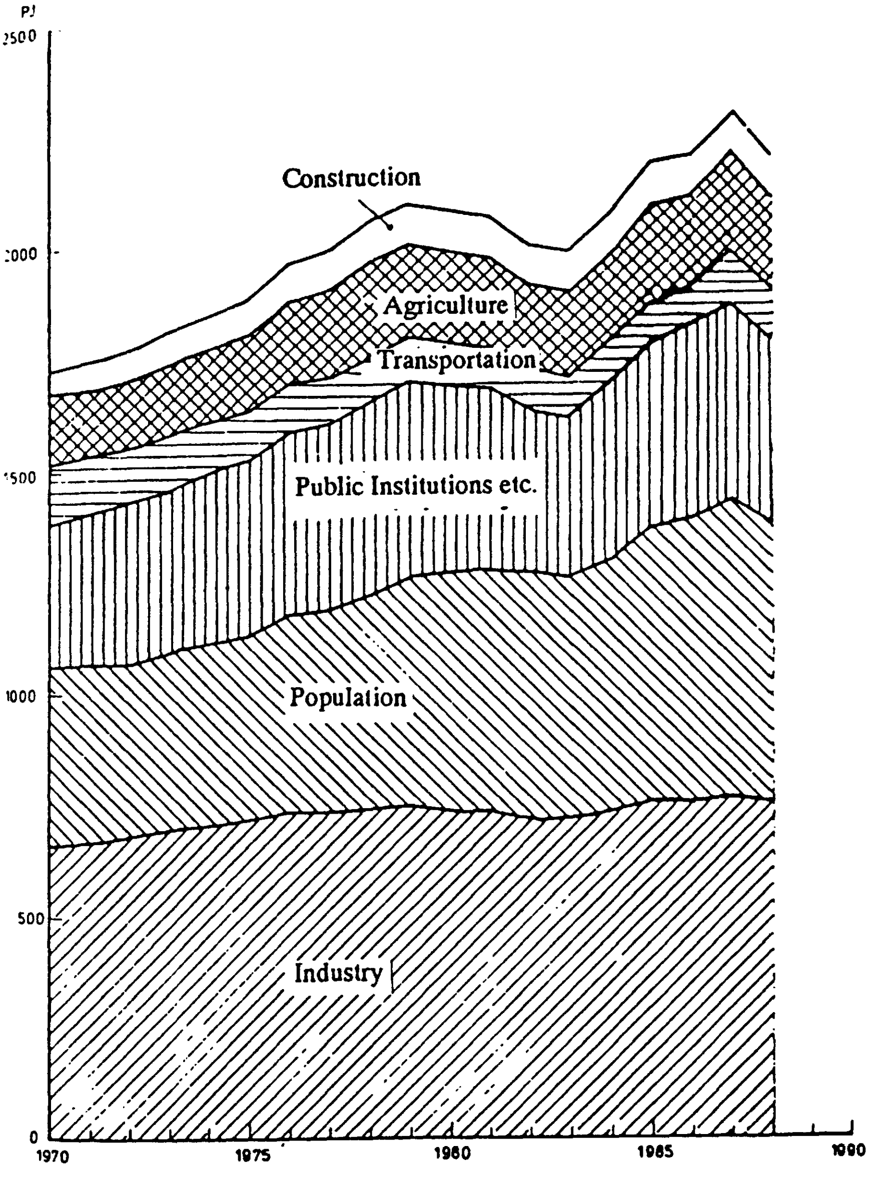
Source: IfE-Leipzig

The official classification scheme distinguishes between the following end-users of energy (in brackets their respective shares in 1988):

Industry	(34.3 %)
Construction	(4.3 %)
Agriculture	(9.2 %)
Transportation	(5.2 %)
Population	(28.3 %)
Public Institutions, Trade, Supply, Others	(18.7 %)

6 cf. Energiestatistik der DDR, Leipzig 1989

Consumption of Final Energy (by Types of End-Users)



Source: IfE-Leipzig

A review of the time series of sectoral consumption figures shows that for industry, construction and agriculture decreasing consumption shares are reported since the beginning of the 1980s, whereas for the population the picture exhibits a reverse trend towards increasing shares. In the transportation and tertiary sector no clear trend pattern can be identified.

An intrasectoral analysis reveals that the ranking of energies dominantly used in the different sectors is as follows:

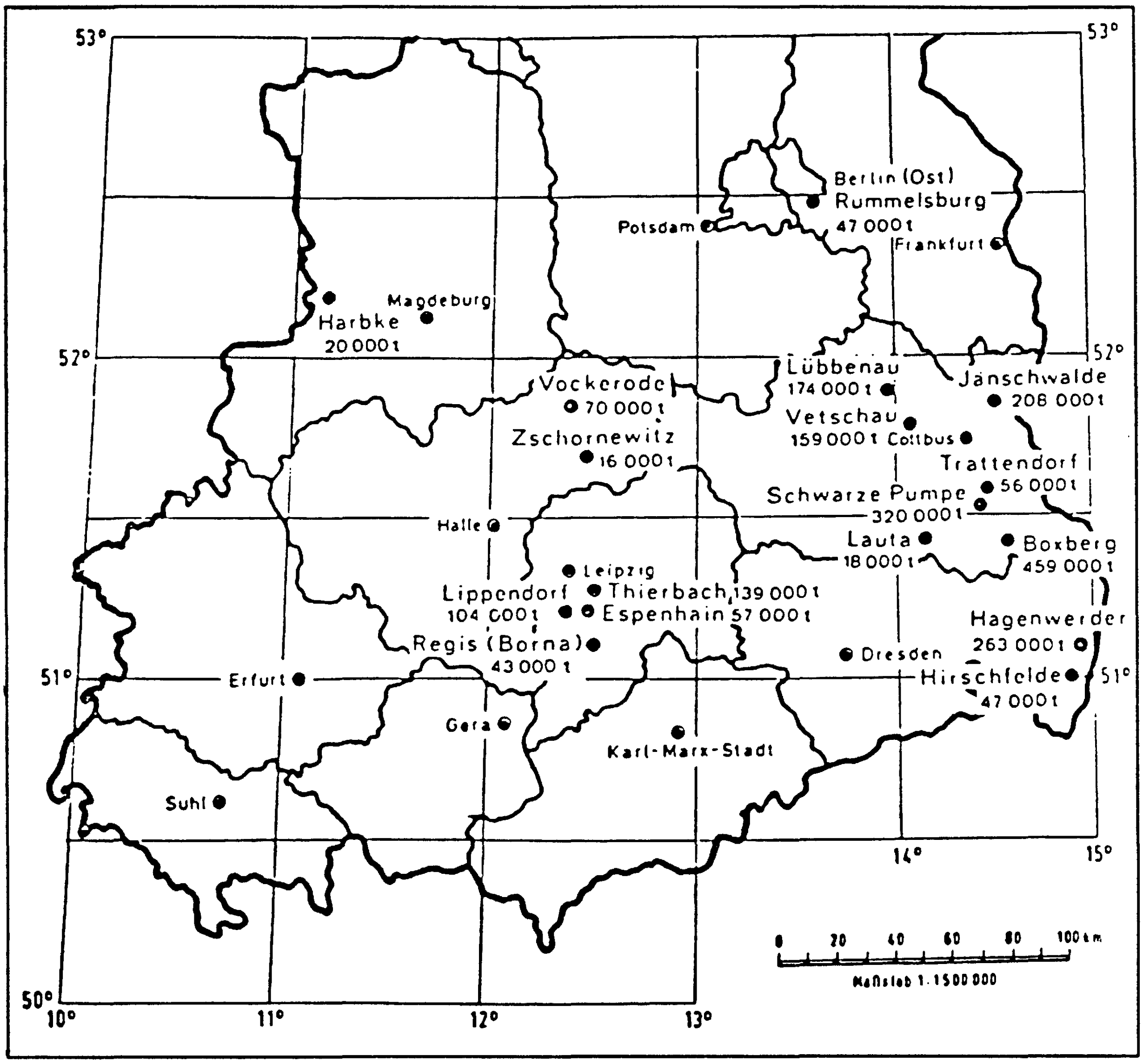
Industry:	**Heat and electricity**
Construction:	**Solid fuels and heat**
Agriculture:	**Solid fuels and heat**
Tansportation:	**Liquid fuels/petrol and electricity**
Population:	**Solid fuels and liquid fuels/petrol**
Tertiary sector:	**Solid fuels and electricity**

2.7 Energy-induced Environmental Pollution

Many environmental damages are caused by the energy sector: Destruction of the landscape, losses of cultivated areas, air pollution etc. With regard to SO_2 emissions, the GDR is ranked first in Europe; more than 5.2 million tons were emitted in 1988, which corresponds to 48 tons per km^2. Apart from the CSFR, where 24 tons per km^2 had to be borne, all other European countries produced less than 15 tons of SO_2 emissions per km^2. According to estimates put forward by the German Institute for Economic Research (DIW), alone the lignite-based power stations account for about 3 million tons of SO_2 emissions per year, thereof nearly 1.5 million tons in the Cottbus area (see map overleaf).

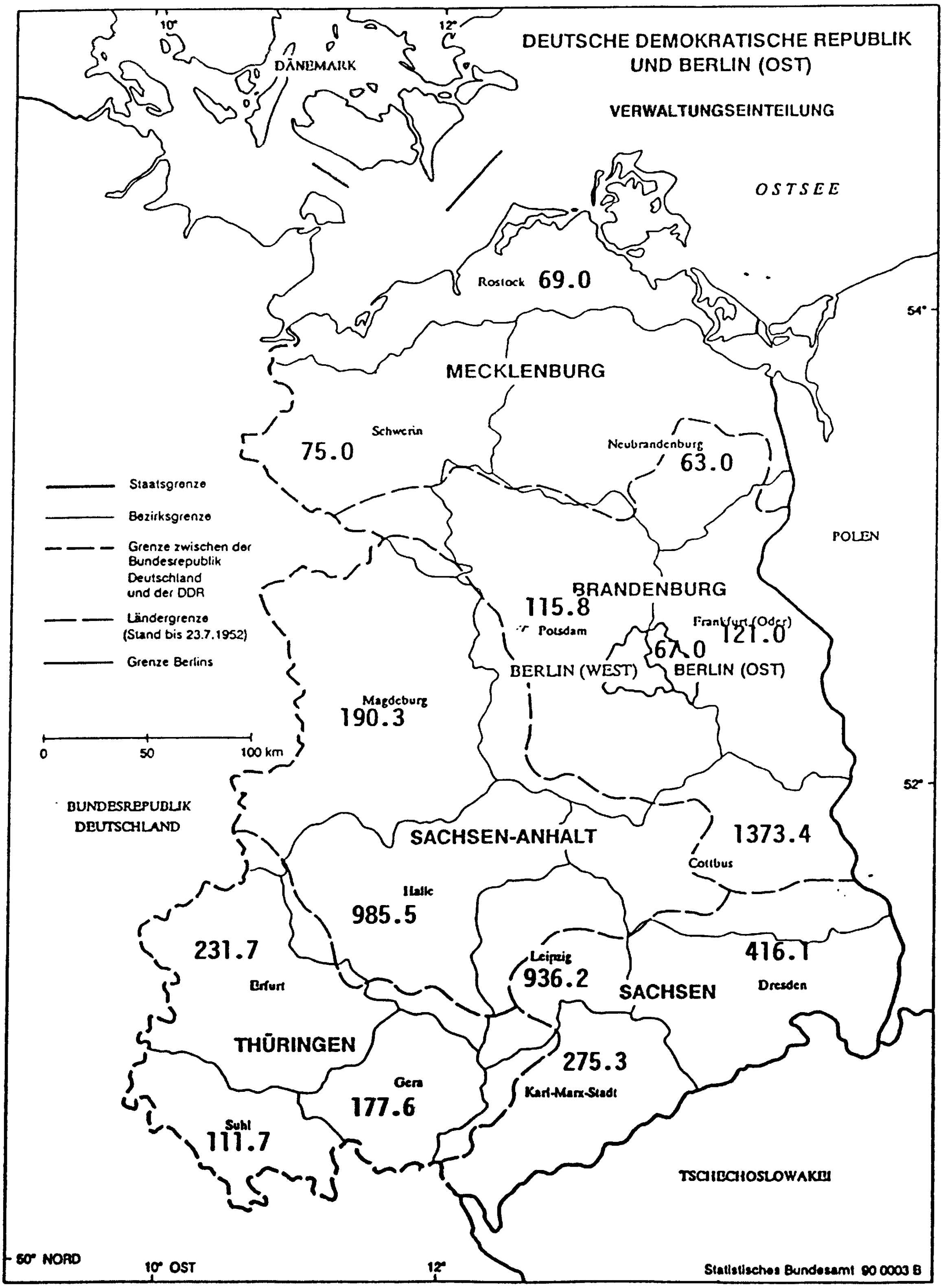
On a per capita basis, 320 kg of SO_2 are reported yearly, thus exceeding the West German emissions, for instance, by a factor of ten to eleven.

SO_2 Emissions from Lignite-based Power Stations in the GDR (1985) - Emissions in t SO_2 -

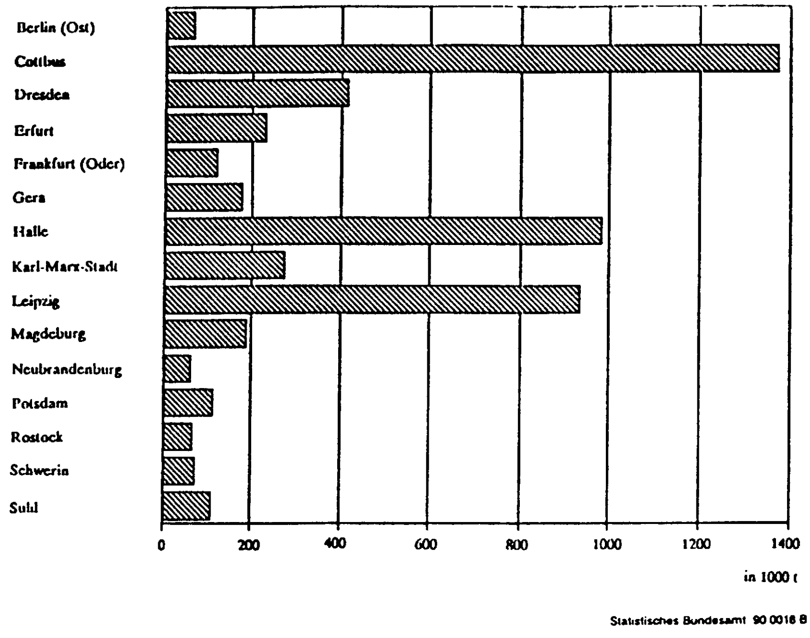


Source: DIW

SO2 Emissions in 1988
(in 1000 t)

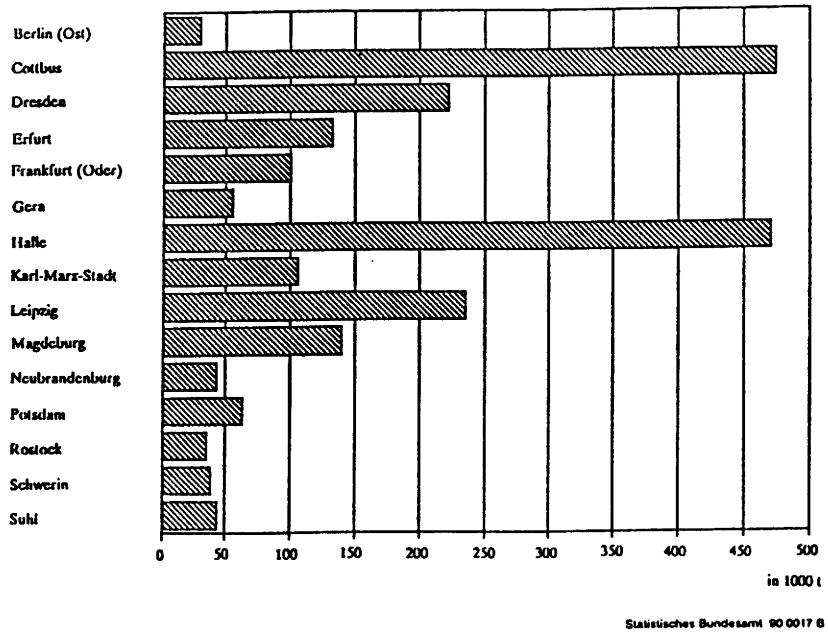


SO_2 Emissions in 1988
– Distribution by Districts –



Emissions of dust, which are reported to be in the magnitude of more than 2.2 million tons per year, are first of all caused by the energy sector (which is responsible for about 0.9 million tons p.a.). Especially the districts of Cottbus and Halle, Leipzig and Dresden have to suffer from dust.

Dust Emissions in 1988
– Distribution by Districts –



Concerning CO_2 emissions, which amounted to 23 tons per capita in 1988, the GDR is also the biggest air polluter in Europe.

Using the common emission factors, the following energy-specific CO_2 emission values can be calculated:

CO_2 Emissions 1988

Type of Energy	Energy Use PJ	%	CO_2 Emissions mill. t/a
Primary Energy, Solid Fuels	2760	76.8	320
thereof for Electricity Generation	(1100)		(130)
Final Energy			
Imported and domestically produced Natural Gas	304	8.5	15
Mineral Oil	486	13.5	40
Electricity from Nuclear Energy	42	1.2	0
	Total		**375**

Source: Energiewirtschaftliche Tagesfragen, Heft 1/2 1990

Of course, the dominant role of lignite in electricity generation and the low conversion efficiency of East German power stations are responsible for that poor result.

Nitrogen monoxide emissions, also being reduced since the early 1980s, still make up 0.7 million tons per year, i.e. 6.6 tons per km^2 or 43.5 kg per capita, respectively[7]. This rather moderate degree of pollution most certainly is a consequence of the comparatively low intensity of car traffic in the GDR. The same holds true for the air pollution caused by volatile hydrocarbons, the extent of which is estimated at 345,000 tons yearly (whereas in the FRG 2.45 million tons are generated).

In total, the environmental damages which occur in the GDR each year, and of which the energy sector obviously is responsible for the lion's share, are in the magnitude of 30 billion M according to a recently published DIW study.

7 **This is the officially published figure on NO_x emissions. Other figures, however, assume up to 59 kg per capita and year**

2.8 Renewable Energies

Realistically estimated, the share of the renewable energies in the primary energy base cannot significantly exceed the level of 1 % until the year 2000. This is mainly due to the limitations in the availability of these energy resources (especially with regard to hydropower and solar energy) in the country and the progressively augmenting investment costs. At some places, however, renewable energies may significantly contribute to energy supply. Geothermal energy, for instance, is of importance in the Northern parts of the territory, where it is occasionally used for district heating purposes. The company VEB Geothermie in Neubrandenburg is engaged in further developing this energy resource by conducting various studies on this subject. Wind energy and biomass/biogas also may have chances in the future. First wind energy cooperation schemes between Denmark and the GDR have already been taken into consideration. Yet, until now there are only very few studies and on-site experience at hand regarding the use of wind energy in the GDR. Besides this, more than 8000 cow-sheds and many rubbish dumps provide a certain basis for the use of biomass or the generation of biogas, respectively.

The practical experiences with renewables and the already existing initiatives for their further development can be summarized as follows:

- Set-up of a central heating plant based on geothermal energy in the city of Waren in 1984, which is supplying about 1000 dwellings, and another two plants in Prenzlau and Neubrandenburg in 1988

- Operation of six biogas plants in the agricultural sector, some of them dating back to the year 1982

- About 120 small hydropower stations are operating with an installed capacity of approximately 42 MW. (In the past, much more stations were in operation, but had to be closed due to old fashioned technology standards)

- Installation of a 200 kW wind turbine from Denmark in October 1989, generating about 570 MWh during 7000 hours of operation p.a.

- Use of heat pumping systems since 1984, for instance in Dresden (2.7 MW), Berlin (1.8 MW) and in Oranienburg

- Elaboration of a wind energy atlas for the regions of Mecklenburg and Pommern. (The work, which is based upon the methodology of the European Wind Atlas, is not yet finished)

- Scientific research on the basis of the CMEA agreement on "Development of New Methods for the Conversion of Solar-, Chemical-, Wind- and Geothermal Energy into Electrical, Thermal and Mechanical Energy"

- Research activities in a ministerial working group called "Use of Renewable Energies in the GDR", which has been set up in 1984.

The Institute of Energetics (IfE) in Leipzig has estimated the following potentials for renewable energies until the year 2000:

- Geothermal energy	250 MW
- Biogas	110 mill. m^3
- Small hydropower	100 MW
- Wind energy	30 MW
- Solar collector area	200 000 m^2
- Heat pumps	25 MW

Within the framework of the future energy policy all scientific and technical ideas to promote the use of renewable energies shall be supported, and international cooperation in this field shall be intensified. Incentive schemes (subsidies, preferential tariffs, special credit systems, tax deductions, etc.) will be implemented in order to stimulate private initiatives in favour of renewable energies.

3. *TRENDS AND ISSUES*

3.1 Energy Policy Objectives

3.1.1 Promotion of Energy Substitution

Given the above mentioned environmental crisis in the GDR, the country first needs some support to manage to replace the use of lignite. To arrive at significant positive ecological effects, annual lignite output should be decreased by 50 to 70 million tons. Energy supply bottle necks, which might be due to this decrease in coal production, could be overcome in the following ways:

- Construction of new power stations/cogeneration plants based on hard coal and oil
- Construction of modern nuclear power plants which are in line with the up–to–date safety standards
- Increase in imports of natural gas from currently 8 billion m^3 to 20 billion m^3, for instance through a link with the West European gas network.

Fuel oils, which for the time being practically are not used due to foreign currency problems, should enter the energy market. In the heat market, for instance, the use of light fuel oil instead of lignite would bring about a huge reduction of specific emissions of CO, NO_x and SO_2.

Of course, to achieve these levels means, in a first step, to adapt the existing central heating systems for solid fuels so that they can be operated with fuel oil as well, and in a second step, to set up new fuel oil based energy supply systems, be it for electricity generation, district heating or whatsoever5.

Looking back into the past, one can say that the tendency to reduce the consumption of oil should be reversed nowadays. During the period 1979 – 1985, i.e. after the second oil price shock, oil consumption dropped from 18 million tons to 10 million tons, mainly due to a reduction of fuel oil consumption from 6.6 million tons in 1981 to 1.8 million tons in 1985. The fuel oil share in the fuel consumption of the power stations thus was only 0.6 % in 1984, and 2.6 % in the heating stations and industrial boiler plants. In 1987, oil consumption was about 12 million tons only, despite the favourable oil price trends both in the world market and within CMEA.

To reduce CO_2 emissions, it would be a promising alternative to base electricity generation on nuclear power. In the extreme case of a complete substitution, CO_2 emissions could be diminished by some 120 million tons yearly. In this case, an installed capacity of 20,000 MW had to be replaced which means, under the assumption that the nuclear power plant investment is equal to 5000 DM/kW on the average, that total investment cost would be about 100 billion DM. Related to the emissions saved, costs would be equal to 833 DM/t CO_2. In addition to CO_2 effects, of course, SO_2– and NO_x emissions would substantially decrease as well.

If it were aimed at to replace lignite also in the non–electricity generation areas, for instance by natural gas, CO_2 emissions could be avoided to the extent of 115 million tons per annum.

3.1.2 Restructuring of the Power Stations

About 50 % of the East German power stations were set up before 1970 – some of them even date back to the decades before the second World War. From the technical point of view, these power stations are to be discarded. However, they are still in operation, with the consequence that

- internal consumption is about 75 % higher than in West German power stations, mainly due to the fact that the share of network losses in electricity production amounts to 6.5 %, whereas this figure is only 3.8 % in the FRG

- transportation and distribution losses are three times above the level of high technology plants

- conversion efficiency is very low; on the average only 24 % of the energy content of coal can be transformed into electricity, which is to be considered a poor performance given a percentage of 38 % in West German power stations, for instance

- specific fuel consumption to generate one kWh electricity is substantially higher than in the Federal Republic of Germany.

To renovate completely the East German coal-based power stations, which in total accounted for a capacity of 19,000 MW in 1988, would bring about investment costs totalling 60 billion DM, according to estimation made by the West German Association of Electricity Generating Plants (VDEW). Replacing only the older ones (those which are older than 20 years), would cause costs of about 30 billion DM. Rehabilitation measures, for instance the installation of dedusting and desulphurating facilities, which might be possible in some cases, will be very expensive: In Senftenberg, rehabilitation costs are estimated at 15 – 20 billion M, for the total sector about 100 billion M might be a realistic figure.

In the nuclear power sector, which currently holds a share of 10 % in electricity generation, technical problems leading to serious safety risks are well known. Especially in the nuclear power plant at Lubmin nearby Greifswald (which is the only plant besides another one being set up at Stendal and the old plant at Rheinsberg, which will be closed in 1992) the risks obviously can no longer be accepted, so that it has been strongly recommended by nuclear energy experts to close the existing plant at all and to add new reactor blocks. Safety increasing measures, if possible, would cost more than 5 billion DM for the plants at Lubmin and Stendal.

The official programme for the restructuring of the power stations is making only little progress in the GDR, although there are some exceptions to this rule, for instance with regard to the construction of a modern coal-based power station in Frankfurt/Oder, the cost of which will reach about 350 million M. Its completion is scheduled for 1996. Main constructor is the West German Babcock Company, Oberhausen.

In the following, an overview of electricity generation by types of power stations is given, which clearly shows the overwhelming role of lignite-based power stations in the GDR.

Electricity Generation by Types of Power Stations

	1970	1975	1980	1985	1986	1987	1988
			in bill. kWh				
Thermal Power Plants	65.9	80.5	85.3	99.3	102.6	101.2	104.9
thereof based on							
Lignite	57.5	70.8	77.8	94.2	96.5	94.8	89.2
Hydropower	1.3	1.3	1.7	1.8	1.8	1.7	1.7
Nuclear energy	0.5	2.7	11.9	12.7	10.9	11.2	11.7
Total	**67.7**	**84.5**	**98.8**	**113.8**	**115.3**	**114.2**	**118.3**
			Shares in %				
Thermal Power Plants	97.5	95.3	86.3	87.3	89.0	88.7	88.7
thereof based on							
Lignite	85.0	83.8	78.7	82.7	83.7	83.1	85.0
Hydropower	1.8	1.5	1.7	1.5	1.5	1.5	1.4
Nuclear energy	0.7	3.2	12.0	11.2	9.5	9.8	9.9
Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**

Source: DIW 1989 and IfE 1989

Given an expected electricity consumption growth rate of 2.5 % p.a. up to the year 2000, the installed capacity of the power stations has to be increased by 10,000 MW during the next ten years, if energy supply shortages should be avoided. The respective investment costs in this case would amount to 30 billion DM approximately.

3.1.3 Enforcement of Energy Conservation and Rational Use of Energy

The energy economy of the GDR is working at a low level of efficiency: Per capita consumption of primary energy is equal to almost 8 tce (compared to 5.6 tce in the FRG or 3.7 tce in France, for instance), electricity consumption per capita amounts to 5700 kWh which is nearly as much as in West-Germany (6200 kWh) and significantly more than in the Soviet Union or in the CSFR (4750 kWh), in the industrial sector as well as in the residential sector specific energy consumption figures of products and consumer goods are well above the international standards in some cases[8], as can be seen from the following tables, and energy consumption for heating and hot water is up to five times higher in East German dwellings compared to West German energy consumption levels.

8 Although the specific energy consumption in the East German industry could be reduced by 14 % during the period 1980 - 1988, its value of 0.414 tce per 1000 M of output still is very high

Development of Specific Energy Consumption Figures of Selected Products

Product	Unit	1985	1989	International Standard 1989
Carbide	GJ/t	31.60	31.78	27.8
Container Glass	GJ/t	10.10	9.12	6.0
White Sugar	GJ/t	10.80	10.25	6.70
Total Traction	GJ/Mio Bt km	245.30	196.60	148.30
Ammonium	GJ/t NH3	38.43	39.17	38.43
Alum Earth	GJ/t	23.14	24.13	14.00
Sheet Glass	GJ/10^3m^2 ED	89.47	78.63	68.96
Woodpulp	GJ/t atro	13.62	13.66	13.10
Cement Clinker	GJ/t	4.58	4.49	3.10
Bricks and Clinker	GJ/10^3St NF	8.75	8.12	4.00

Source: ZRE–Leipzig

Specific Energy Consumption Figures of Selected Consumer Goods

Consumer Good	GDR Figures 1988	International Standard 1987
Washing Machine		
- VA 861 E	0.50 kWh/kg	0.50 kWh/kg
- V 8000	0.48 kWh/kg	0.50 kWh/kg
Deep Freezing Cupboard		
- GS 70	0.82 kWh/d	0.80 kWh/d
- GS 150	1.10 kWh/d	0.90 kWh/d
Refrigerator		
- H 172	0.99 kWh/d	0.82 kWh/d
- KSI 1500	0.62 kWh/d	0.62 kWh/d
Electric Kitchener		
- EHA 720	11.70 W/l	11.50 W/l
Boiler		
80 l	1.52 kWh/d	1.44 kWh/d
Na–Steam Lamp	85.00 Lm/W	85.00 Lm/W
Fluorescent Lamp	80.00 Lm/W	85.00 Lm/W
Compact Fluorescent Lamp	40.00 LM/W	43.00 Lm/W

Source: ZRE–Leipzig

Besides the specific energy consumption of industrial processes and energy equipment, the main parameters of the degree of efficiency in the energy sector are the

- energy input in the energy production process
- conversion efficiency in the transformation sector
- effectiveness in energy transportation
- vintage of the capital stock.

To save energy and to use it in the most efficient way means to

- reduce the direct energy inputs necessary for the provision of goods and services and the use of durables

- economize on the use of energy-intensive raw materials and intermediate products for the production of final products

- make use of recycling techniques with regard to secondary raw materials and, first of all, secondary energy.

The importance of energy conservation and rational use of energy is underlined by the fact that each kWh saved will avoid the output of 1.25 kg lignite and, consequently, all the disadvantages which usually are inherent to the use of lignite.

In the past, more or less only administrative measures were taken to reduce energy consumption. In 1979, a "Central Energy Commission associated with the Council of Ministers" was founded which has been responsible for the elaboration of energy saving proposals, the implementation of which is to be supervised by the "Energy Inspection Agency" in Leipzig. In this way, the following regulations have been introduced: Speed limits, maximum temperatures in private houses and offices, limits to energy consumption per product covering 192 production lines, etc. However, economic incentives to save energy have hardly been offered until now. On the contrary, one can say that disincentives have been established by granting generous subsidies to the private energy consumer and by a central energy allocation system in the industrial sector.

The "Central Agency for Rational Use of Energy (ZRE)" in Leipzig, therefore, has set up an Energy Conservation Programme putting emphasis upon

- elaboration of reliable energy statistics and analyses

- development of economic viable and ecologically acceptable energy supply concepts for different regions, consumers and energy resources

- promotion of the commercialization of energy saving products, machinery and technology

- carrying out process oriented analyses (e.g. use of secondary energies, etc.)

- preparation of expertises concerning energy conservation in the building sector

- development of software to improve energy flows in enterprises

- publication of brochures dealing with efficient use of energy.

3.2 Forecasts/Projections

3.2.1 Forecasts for the Solid Fuels Market

In May 1990, the companies BKK Senftenberg, BKK Bitterfeld, GK Schwarze Pumpe, the Governmental Coal Supply Company, the Coal Export–Import Agency and the West German company Rheinbraun have prepared a study on the sales prospects and the future demand in the East German solid fuels market up to the year 2000. In this study, the main overall energy–related and socioeconomic trends have been specified as follows:

- Oil and gas will be used on an increased scale, but infrastructural and logistical preconditions will have to be established beforehand, which will take about 5 years
- Economic growth rates will be in the range of 5–10 % p.a.
- Size of population will stagnate at a level of 16 million inhabitants
- Energy prices will increase substantially
- Technical progress will be considerable
- District heating systems will be further expanded
- Construction figures in the residential sector will amount to 120 000 units per year
- Around 100 000 units will be modernized in the residential sector per year

Based on these assumptions, different scenarios have been set up for the residential, industrial and electricity generating sector.

For the residential sector, the following scenarios have been specified:

1) Market penetration of oil and gas from 1992/93 onwards, enforced extension of the district heating systems, reduction of subsidies and increase in energy prices

2) As 1), but oil will enter the market in 1991 and gas in 1993

3) As 2), but strong price competition between coal, oil and gas and imposition of many environmental protection measures

In this way, the study ends up with the following forecasts on output of briquettes:

1) 6.5 million tons
2) 5.0 million tons
3) 3.0 million tons

The scenarios for the industrial sector look as follows:

1) Briquettes will replace pit coal and sifted coal, oil and gas will gain market shares from 1992/93 onwards, restructuring measures in the plants will be hindered by financial bottle necks, fluidized coal will be used increasingly

2) As 1), but restructuring measures can be achieved in the short run, use of fluidized coal experiences only moderate growth rates

3) All lignite-based products will have a downward trend

In these cases, the respective briquettes output figures would be:

1) 13.0 million tons
2) 11.0 million tons
3) 7.5 million tons

In the electricity generating sector, the variants analyzed are:

1) Modernization of power plants until 1995, increase in electricity imports, operation of some new power stations after 1995, link with the West European electricity network

2) As 1), but more new power stations until the year 2000

3) As 2), but imposition of strong environmental protection measures

With regard to the demand for lignite this means:

1) 128.0 million tons
2) 111.0 million tons
3) 94.0 million tons

Taking into account the demand due to exportation and gasification, which is estimated at 10–13 million tons yearly, the following forecasts on raw lignite output will result from the scenarios:

1) 200 million tons
2) 170 million tons
3) 130 million tons

For the output of briquettes, the forecasts indicate a range of 14.0 to 26.5 million tons (including exportation).

3.2.2 Projections of the New Energy Concept

The Institute of Energetics (IfE) in Leipzig is elaborating the fundamentals of a New Energy Concept for the GDR. In the following, the major propositions of this concept are summarized.

The basic targets to be achieved until the year 2000 comprise:

a) Zero growth rate of primary energy requirements or even a decrease in absolute terms

b) Marginal growth rate of final energy consumption (about 0.2 – 0.3 % p.a.)

c) Decrease in energy consumption in industry, construction, transportation and agriculture (here referred to as economic sectors)

In detail, the demand analyses are based upon the following assumptions:

1) Economic sectors

   Due to factors which will reduce energy consumption, such as changes in the production structure, reduction of energy-intensive production lines, rationalization measures, investment into production plants, energy demand will decrease in the economic sectors, although some reverse trends will also occur, for instance because of substitution of human labour by modern machinery (thus increasing electricity consumption)

2) Population

   In total, energy consumption might increase at a rate of 1.0 % per year, mainly caused by construction of 150 000 dwellings until 2000, modernization of heating systems, penetration of electricity consuming equipment in the households, and increasing demand for mineral oil products. Consumption of electricity is expected to grow at a rate of 2.0 % p.a., although energy conservation will be brought about by technical improvements of electrical appliances and increasing energy prices. This is mainly due to an expansion of the service sector and the infrastructural systems, which the population will strongly draw upon.

Supply of primary energy has been projected as follows:

- Lignite: 200 million tons p.a. for the big power stations (105 mill. t), the combined heating and power stations (35 mill. t), and the briquetting plants (60 mill. t)

- Natural gas: 18 billion m^3 p.a., with imports from the Soviet Union, Northern Africa and West Europe

- Crude oil: 22 million tons p.a.

- Hard coal/coke: Annual growth of 3–4 million tons due to the construction of hard coal based power stations

- Nuclear energy: Installation of 7000 MW during the period 1990–2000 in order to secure electricity supply

- Renewables: Share in primary energy supply of about 1–2 % (especially geothermal energy and biogas)

If the above mentioned projections concerning energy demand and supply became true, the following environmental impacts would result (2000 compared to 1990):

- SO_2 minus 30 %
- NO_x minus 15 %
- Dust minus 35 %
- CO_2 minus 23 %

Besides this, the extent of devastation caused by mining operations, which currently is at a level of 3000 ha p.a., could be reduced by 30 %.

4. PROPOSALS FOR COOPERATION

4.1 Areas of Cooperation

4.1.1 Support to Secure Energy Supply

Between the GDR and the FRG, the following forms of cooperation to secure GDR's energy supply basis have been discussed during the last months:

- Transfer of the surplus of electricity generation, which would be available if West German power stations were run at their full capacity level, to the East German network. In this case, nearly all the amount of electricity generated in lignite based power stations could be substituted. However, due to technical problems related to significant frequence fluctuations in the GDR network, a high voltage interconnection would be necessary requiring investment costs of about 250 million DM. Thus, technical and financial assistance is urgently needed in this field. By end of June, West German companies Bayernwerk, Preussen Elektra and RWE even started negotiating a contract with East German Government to take over majority ownership of GDR's electricity generation and distribution companies.

- Exports of natural gas from West to East Germany up to several billion cubic meters. Such plans, which could be implemented at the latest from 1992/93 onwards, have been put forward by Ruhrgas AG, Essen, and Contigas, Munich, on the one hand and energy combinates on the other hand (VEB Gaskombinat Schwarze Pumpe at Spremberg/Cottbus, VEB Energiekombinate Erfurt, Gera and Suhl).

- Construction of new power stations or, if possible, rehabilitation of existing ones. At Lübeck and Rostock, for instance, hard coal based thermal power stations will be jointly set up by the West German Companies Bayernwerk AG, Munich, and Preussenelektra, Hanover, together with the GDR combinates Kernkraftwerke (Nuclear power plants), Braunkohle-Kraftwerke (Lignite-based power stations), Verbundnetze Energie (Interconnected energy network), Kraftwerksanlagenbau (Power plant engineering) and the trading company Intrac. In total, the estimated investment costs amount to 2.5 billion DM, which will have to be financed in equal shares in the framework of a newly built joint company.

With regard to modernization measures, GDR industries sometimes lack the specific know-how or they have insufficient capacities. To come to grips with such problems, direct contracting of experts or licensing agreements should be taken into consideration.

At the community level, the approaches towards the European Electricity Network[9] and the European Gas Network, as described in the CEC's Guidelines on Electricity Transit from May 1990 and the proposal for Guidelines on Gas Transit which was issued in July 1989, also provide a good basis for making GDR's energy supply system more compatible with economic, technological and environmental needs. As a secondary effect, the objective of setting up a competitive energy market in the GDR would be supported in this way as well. Of course, important economic, financial and legal questions will arise in this context, which have to be answered properly in the spirit of the forthcoming common European house, of which the GDR is considered to be a sovereign member. For the CEC this means to offer the full range of financial and technical assistance that is usually granted to EC member countries which suffer from structural deficiencies and bottle necks, be it in the energy sector or in other sectors.

4.1.2 Assistance in Implementing Local and Regional Energy Supply Concepts

Given the disadvantages of the centrally planned energy supply system, decentralization and implementation of energy concepts at the regional and local level is looked for at present. This also includes the increasing use of renewable energies, such as geothermal, wind and solar energy, and biogas. In doing so, the following work sequence and methodology has to be applied:

- *Preparatory Analysis*: Before the actual preparations for the LRES[10] can begin, preparatory talks and debates aimed at consensus have to be held with the responsible local and regional representatives. In these meetings general and geographically specific outline data, preconditions, targets and the contents of the planned projects will be discussed. An attempt is to be made in this way to reach a consensus on matters under dispute so that the projects planned can then be carried through without risk or impediment and local and regional interests can be taken into account in the best possible way. Indeed, the success of projects could not be guaranteed without their close involvement in the solution of any energy supply problems arising.

- *Survey of the Energy Market*: This step aims at plotting both the energy demand and supply structure of the area under consideration and their examination in accordance with certain criteria (e.g. energy conservation). An analysis of this type forms the basis for estimating possible future development of the local or regional energy system and, in addition, provides hints on the need for implementing a LRES.

- *Preparation of an Overall Inventory*: The preparation of a strategic overall inventory for a LRES, confined to specific problem areas, will be based upon the local/regional energy market survey. In principle the inventories drawn up can be broken down into inventories for cities, urban districts and urban and rural regions. Special significance has to be attached to the search for suitable planning alternatives when inventories are drawn up.

- *Analysis and Evaluation of Effects*: The energy-related, economic and ecological effects of the planning options developed as part of the overall inventory for the area under study should be determined by means of theoretical effect analyses and assessed on the basis of technical and economic criteria such as utilization factors, impacts on jobs etc.

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9 Currently, about 4 % of electricity consumption within the EC countries are delivered across the frontiers by other member states
10 Local/Regional Energy System

- ***Recommendations and Implementation***: The recommendations concerning the implementation of LRESs which, for example, relate to technical, organizational or strategic matters, should be integrated into the local or regional overall preliminary plans before practical use is made of them.

In each of the above mentioned areas, the Commission can provide valuable assistance by transferring its experience and know-how gained in this field of activity during the eighties.

4.1.3 Adaptation of Energy and Environmental Policy Framework to Western Principles and Standards

Energy price changes and the introduction of new legal regulations covering energy and environmental issues will be at the forefront of the reform activities in the energy sector.

Current electricity tariffs lead to prices of 8 Pf/KWh in the residential sector and 16–20 Pf/KWh in the industrial sector, whereas generation costs amount to at least 25 Pf/KWh. With regard to gas, the same situation is given: Private consumers pay 16 Pf/m^3 town gas although production costs are equal to 48 Pf/m^3, and the natural gas price in the industry stays at 56 Pf/m^3 only, but should be increased to about 80 Pf/m^3. Thus, substantial price increases are necessary so that an end can be put to the gigantic waste of energy on all consumer levels. New energy prices will be part of the implementation of comprehensive incentive schemes allowing for energy conservation and the protection of the environment. However, an energy price reform will not take place before the end of 1990 according to a governmental decision.

The price reforms will have to be accompanied by the introduction of new environment-related laws, thus redefining the legal framework for the actors in the energy sector towards efficient use of energy and compatibility with environmental objectives.

The Minister responsible for Environment, Energy and Reactor Safety, Prof. Dr. K.-H. Steinberg, for instance, is asking for a programme of action aiming at the adoption of West German standards in the East German energy sector and in the chemical sector until 1996. This would mean to adopt, in a first step, the laws on imissions, waste disposal, use of nuclear energy and radiological safety.

The role of the Commission in this context could be seen in such a way as to mitigate the economic frictions which may come up from the envisaged reform measures and to act as a catalyst for the harmonization of the energy and environmental laws. A first step in this direction has already been made with the set-up of a long-term trade and cooperation agreement which foresees, for instance, the promotion of joint ventures or the exchange of licences, among others, in the energy and environmental sector.

4.1.4 Development of Financial Systems and Markets

The financial needs of the GDR for the rehabilitation and the modernization of its energy sector (including investment into environmental protection) are enormous: Estimates range between 130 and 250 billion DM, the majority of which could be financed by the private sector if the general economic framework will be set on the basis of a market economy. The Government, which presently spends only 0.4 % of the national income for environment protection measures but has promised to raise this share up to 1.5 % (which is about 2 billion DM[11]) and the international donor community will have to finance the remaining amount. Examples of international cooperation in this field do already exist, for instance the Austrian East West Fund which has made available nearly 1 billion DM for the promotion of industrial enterprises in East Europe, or the ERP credit lines offered by the German Kreditanstalt für Wiederaufbau (KfW) and the German Ausgleichsbank to found new companies, to modernize existing enterprises and to finance investment into environmental protection, for which 6 billion DM have been budgeted in 1990, or the CEC-managed assistance programme of 24 industrialized countries, into which the GDR will be included in July 1990. In addition, the Bank for Reconstruction and Development in East Europe will help the GDR to finance its necessary investments through providing grants and mobilizing national capital, besides cofinancing of multilateral assistance projects.

With regard to the allocation of resources, the stimulation of savings and investment the financial markets in the GDR have to be liberalized and put under the rules of competitiveness in order to be able to function adequately. This also means to open these markets for modern financing techniques, such as the introduction of so-called venture capital funds which enlarge the equity basis temporarily, thus providing funds for investment decisions which otherwise probably would not be taken due to undeterminable returns on investment in the short run (e.g. investment into new production processes).

4.1.5 Set-up of Formal Information Exchange Channels and Institutions

Lack of adequate information generally is an obstacle to any efforts to get rid of existing problems. Concerning the situation in the energy sector of the German Democratic Republic, a lot of information is lacking, especially with regard to environmental impacts of the energy system. What is urgently needed is a set of consistent and reliable data banks covering, for instance

- Environmental media (air, water, soil)
- Types of emission (gases, dust, waste water etc.)
- Pollutant substances (SO_2, NO_x, CO, etc.)
- Intensity of pollution
- Technical data related to pollution

which will allow to arrive at comparable analyses of the energy-environment relationship and to design efficient policies for the energy sector. To make best use of the international know-how available in the field, the idea to found a European Environment Agency and to implement a European plan for the protection and rehabilitation of the environment is greatly appreciated.

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5 4 billion Mark, respectively

On a lower level, many other ways how to institutionalize the exchange of information would be possible as well, for instance

- Organization of seminars together with local cooperation partners (e.g. ministries, universities, energy institutes)
- Promotion of sector-specific information exchange and cooperation offices
- Distribution of engineering periodicals
- Set-up of programmes to exchange experts temporarily, e.g. between technical universities, research institutes or administrative units

4.2 Cooperation Schemes of High Priority

On the basis of the results of the problem analysis concerning the situation in the East German energy sector, and in accordance with the statements given by energy experts during the mission, the following ranking of proposals for an energy cooperation programme EEC-GDR can be established:

- ***First Priority Proposals***
  * Assistance in setting up an energy masterplan which should put emphasis upon
    . design of the future energy policy (macroeconomic framework, decentralized structure, policy instruments etc.)
    . elaboration of strategies for the modernization of the power stations (rehabilitation/reconstruction)
    . impacts generated by a reduction of lignite production (especially economic and socioeconomic impacts, such as unemployment)
    . means to exhaust the energy conservation potential (macroeconomic and microeconomic means)
    . implementation of environmentally acceptable energy technologies
  * Support to develop ecological sanitation concepts for areas suffering from long-lasting mining burdens
- ***Second Priority Proposals***
  * Organizational studies for public utilities to be founded (covering functional set-up, management system, staffing, planning and steering mechanisms, etc.)
  * Implementation of vocational training programmes for employees who will get unemployed due to the structural shifting within the energy sector

With regard to the already existing EEC cooperation programmes, the GDR organizations have been primarily interested to participate in the following programmes:

VALOREN	Use of Endogenous Energy Potential
SPRINT	Innovation and Technology Transfer
STEP/EPOCH	Environmental Protection, Climatology and Natural Hazards
Technical Research on Coal	
JOULE	Unconventional or Long-term Energy Supply
THERMIE	Promotion of Energy Technologies

4.3 Short-term, Medium-term and Long-term Measures

The following measures have been classified as suitable for cooperation in the short, medium and long run:

- Short-term measures
  . Development of a concept for the shutdown or the rehabilitation of old plants in the chemical and energy sector
  . Promotion of an enforced integration of the East German energy sector into the West German or European energy system, e.g. by means of additional electricity transfer to the GDR

- Medium-term measures
  . Improvement and modernization of those parts of the machinery and equipment which still can be used for some years, for instance through desulphurating, removing of nitrogen, installing of dust boxes etc.
  . Carrying out an energy price reform so that prices really reflect social costs and can be used as powerful instruments by economic and energy policy makers. Especially, a more rational use of energy in the residential sector should be achieved in this way
  . Improvement of the network, e.g. gas pipelines

- Long-term measures
  . Development of a comprehensive concept for long-term energy supply (among others, reduction of brown coal output and, consequently, use of other energies such as hard coal, gas, oil and nuclear energy)
  . Complete link with the West European energy network

4.4 Profiles of Possible Cooperation Partners

Up to now, the most important enterprises in the East German energy sector have been

- VE BKK Bitterfeld
- VE BKK Senftenberg
- VEB KAB Berlin

In the following, some strategic data on these enterprises are given.

a) VE BKK Bitterfeld

* Foundation in 1980
* 49 800 employees in 6 plants, thereof 11.3 % scientific collaborators
* Operation of 19 open-pit mining plants and 24 briquetting plants
* Research and development capacity of 950 staff members
* Value of industrial production: about 4 billion M p.a.
* Main products: Brown coal, briquettes and fuel dust
* Existing cooperation programmes with CMEA countries in the fields of soil mechanics, geophysics, mining water supply systems and mining engineering. National cooperation partner is the Mining Academy at Freiberg

b) VE BKK Senftenberg

* Foundation in 1980
* 52 000 employees
* 17 open-pit mining plants and 12 briquetting plants
* Research and development capacity of 1600 staff members
* Annual turnover: 6.5 billion M
* Main products: Brown coal, briquettes and fuel dust
* Existing cooperation programme with CMEA countries in the field of computer-aided planning methods. Mining Academy at Freiberg is among the national cooperation partners

c) VEB KAB Berlin

* 42 000 employees
* Significant know-how in engineering disciplines
* Main services: Construction, rehabilitation and modernization as well as maintenance of all power stations and combined heating and power stations in the GDR; planning, fabrication and installation of equipment for energy generation and heat supply for industrial plants in the GDR and abroad
* Cooperation mainly with enterprises and institutes in the USSR and, on the national level, with technical universities

However, these three enterprises are in the process of being restructured and reorganized, so that at present only little can be said about their future set-up and role in the economy.

Well-known institutions in the fields of energy technology and energy economics are the Central Agency for Rational Use of Energy (ZRE) and the Institute of Energetics (IfE), both situated in Leipzig. Their main characteristics are as follows:

d) ZRE

* Number of staff members: about 150, many of those are scientists
* 2 departments for planning and energy balances/energy conservation
* Cooperation with the Technical University of Chemnitz
* Engineering consulting activities are aimed at, but probably administrative works on behalf of the Ministry of Energy will be dominating

e) IfE

* Founded in 1953
* Number of collaborators: 700, thereof 500 scientists
* 2 departments, namely a scientific–technical research center with 200 scientists working in the following areas
  . Macroeconomic energy planning
  . Electro–technics (High–voltage)
  . Power station chemistry
  . Environment and energy
  . Siting issues

  and a center for computation and microelectronics with 300 scientific collaborators working in the fields of
  . Information science, and
  . Automatisation
* Existing cooperation programmes with energy institutes in CSFR (Vupek–Institute), Bulgaria and Soviet Union (Siberian Institute of Energetics of the Academy of Sciences at Irkutsk, and Research Institute of Fuels at the State Planning Commission in Moscow) as well as cooperation agreements with national institutes (for instance, Technical University of Zittau). In the past, cooperation with Polish and Hungarian institutes had been established, too
* Main fields of activity in the future will be energy statistics and analysis of energy demand according to energy sources and economic sectors
* IfE is becoming a commercially oriented independent institute

Some information on the Ministry of Energy is given in paragraph 2.1 of this report.

4.4 Hungary

Hungary

A Survey of Energy Issues
and a Proposal for Cooperation with the
Commission of the European
Communities

CONTENTS

1. GENERAL ECONOMIC SITUATION

In 1988, Hungary's economy showed signs of stagflation. Gross domestic product grew by 0.5 % instead of the planned 1 – 1.5 %, industrial production remained at the previous year's level and gross agricultural production grew by 4.5 % only, meaning that production was below the 1986 level. The stagnation of overall production was accompanied by continuously accelerating inflation. The growth rate of the cost of living reached a post-war record of almost 16 %, according to official statistics.

Domestic private consumption fell by 4 – 5.5 % and taking the considerable amount of private imports into account by 2 %, in spite of nominal increases in income of 7 – 8 %. Investments in expansion and modernization also declined by 7.7 % in real terms. Altogether, the share of investment in domestic expenditure increased.

In spite of the decrease in domestic expenditure, to which the government budget contributed, gross debts in convertible currencies continued to grow in 1988. An increase in revenue and an accompanying decrease in subsidies led to relief of pressure on government finances. The impetus of the debt increase slackened off, however, in comparison with previous years. The new foreign currency deficit was greater than the US$ 500 million planned, but it remained lower than the previous year's level, which was above all a result of a trade surplus in convertible currencies on a level which had not been expected.

In 1989 this trend continued with a decrease of GDP of 1.8 %. Industrial production decreased by 3 % according to the Hungarian National Bank (NZZ, 31/3/1990). The balance of payments also deteriorated. The deficit in the balance of payments (in convertible currencies) rose to 1.4 billion US$ (1988: 592 million US$), which is attributed to private expenditures of Hungarians abroad. In trade in convertible currencies, Hungary attained a surplus of 540 million US$.

According to western banking experts the main problems of the Hungarian industry are:

- restructuring of exports
- shortage of liquidity.

The Soviet Union is the main trade partner in rouble-accounting trade making up approximately 60 % of both imports and exports (see Table 1). The main western trade partner is the Federal Republic of Germany (27.2 % of convertible currency imports) followed by Austria (20.2 % of imports in convertible currency trade).

Table 1: Country Pattern of Rouble-Accounting Imports and Exports

	Import Percent of Total	**Export**
Soviet Union	57.3	59.8
GDR	15.4	13.5
Czechoslovakia	12.0	12.6
Poland	7.3	6.6
Bulgaria	2.1	1.5
Other	5.9	6.0

The total values (1989) in both rouble accounting and convertible currency trade were as given in Table 2. Rouble-accounting trade was roughly 3 times the convertible currency trade.

Table 2: Values of Hungarian Imports and Exports

	Imports in million US $	**Exports**
Convertible currency	5435.5	5975.2
rouble-accounting (2.8 US$/Rb)	19760	21286

The inflation rate is expected to reach 22 - 27 % in 1990. Hungarian National Bank has created a shortage of money in order to combat inflation.

Interest rates are 32-34 % for industrial customers, for some old customers (large government owned companies) less. The commercial banking system is newly created and there are some adjustment problems. The high interest rate can be considered a major issue slowing down modernization and energy conservation investment, in any case.

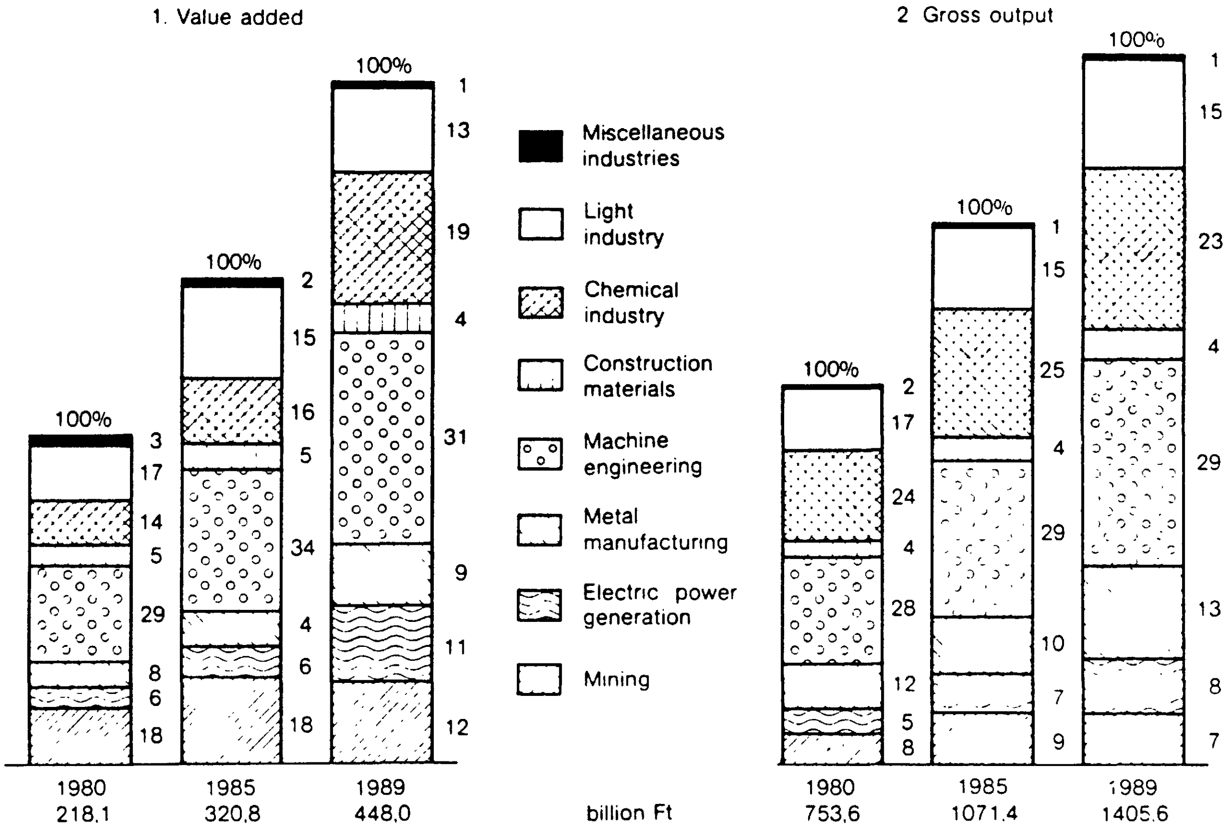
Further important factors are:

- population is becoming more and more aware of environmental problems
- energy prices are rising
- the competitiveness of the economy must be improved.

The energy sector is central to the development process of the Hungarian economy. At the same time a number of economic measures to restructure the economy address the energy sector, i. e. important price adjustments, re-allocation of investment funds and cancelation of subsidies.

As can be seen from the following figure, electric power generation and mining alone make up 23 % of industrial value added and 15 % of gross output (Figure 1).

Figure 1: Key Indicators of Industry



Source: Ministry of Industry. Hungarian Industry 1980 – 1989, April 1990

The Hungarian Oil and Gas Trust, OKGT, is the largest company in Hungary with 200 billion Ft. sales revenues. The second largest company is the Hungarian Electricity Board (MVMT) with 140 billion Ft. sales. Both companies deliver 80 billion Ft. to the Budget through special energy taxes. These taxes were mainly impressed on the import of energy from the Soviet Union.

The industrial sector is by far the largest consumer of energy which means that the development of industry is very dependent upon the availability and price of energy. Shares of sectors of total energy consumption are given in Table 3 in %.

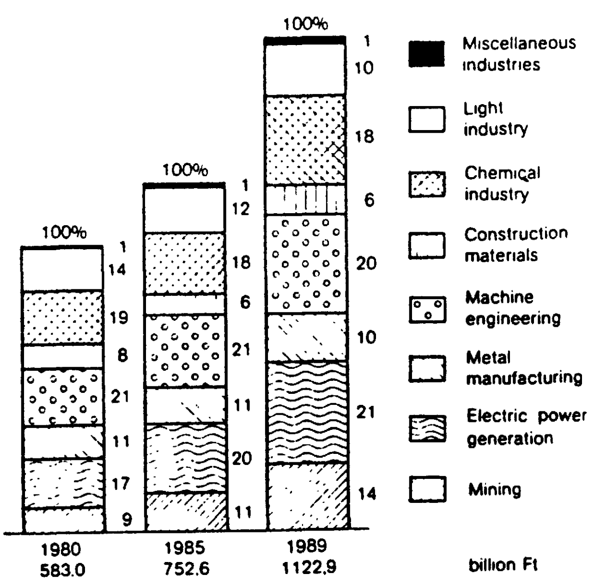
Table 3: Shares of Total Energy Consumption

	1985	1986	1987	1988
Industry	46.8	46.6	45.0	43.5
Construction	1.3	1.9	1.1	1.0
Agriculture etc.	8.0	7.6	7.6	7.8
Transport and Telecom	6.0	5.9	5.9	5.7
Households	29.3	28.3	31.1	32.3
Other	8.6	9.7	9.3	9.7

Source: Bfai: Ungarn Energiewirtschaft 1988/89

The energy sector has received a large share of total investment (around 15 %) during the last 15 years. This amounts to 50 % of investment in industrial plant and equipment and two-thirds of government funded investment. Electric power generation and mining made up for 35 % of gross value of fixed assets in 1989 as shown in figure. This investment share is not going to be able to be kept up in the coming years. Investment must be restructured to directly productive activities.

Figure 2: Gross Value of Fixed Assets



Source: Ministry of Industry. Hungarian Industry 1980–1989, April 1990

Economic and political trends

Hungary is in the process of transition to a market oriented economic structure. Democracy is also making headway but the standard of living is sinking so that presently large parts of the population are at or below the poverty level. Unemployment will reach more than 5 % soon and may even reach 10 %. Foreign debt is the highest per capita of the central and east European countries (20 billion US $).

As an example of the pace of liberalization, in 1989, 40 % of foreign trade had been liberalized. Private trading companies have been registered next to the traditional government trading companies. Still the large majority of production units are state owned and the new policies will require transformation and spreading of capital to the private sector. It is estimated that about 200 state owned production units are running with deficits. About 50 of these are to be closed.

Figure 3: Pattern of Ownership Forms in Industry

Source: Ministry of Industry, Hungarian Industry 1980 – 1989, April 1990

The efforts to reform the trade structures will be met with difficulties due to the traditional linkages and due to the need to deliver higher quality of goods to western markets. There are still extensive contracts with planned economies, which have led to problems with deliveries and balance of payments in the past. The conversion of transfer rouble trade to convertible currency has been agreed with the Soviet Union and will begin on January 1, 1991. The exact implications of this change are not forseeable at the moment.

Presently, industry has a "wait and see" attitude. Managers are being very careful in all matters as they are not sure of the conditions which will prevail (new government policies). The newly established agency to watch over the use of national wealth has made managers even more careful. Many came to their positions as a result of political contacts and are just trying to survive by not doing anything (wrong).

On the other hand, there is a positive trend in foreign trade and the overall attitude is optimistic.

At the same time the political system is changing from a one–party system to a pluralistic system. Elections were held in April and the new government has been in office only a number of weeks (at the time of writing). Important steps have been taken to restructure the economy, but much work is still to be done. The government is concerned with managing the transition without creating unacceptable social hardships and social upheavals. This means that the transition period will be longer but hopefully smoother.

In general, it is expected that this period of uncertainty will last perhaps six months and that once the government has made important first steps, the overall positive aspects will prevail.

Hungary

Selected Economic Indicators (1988)

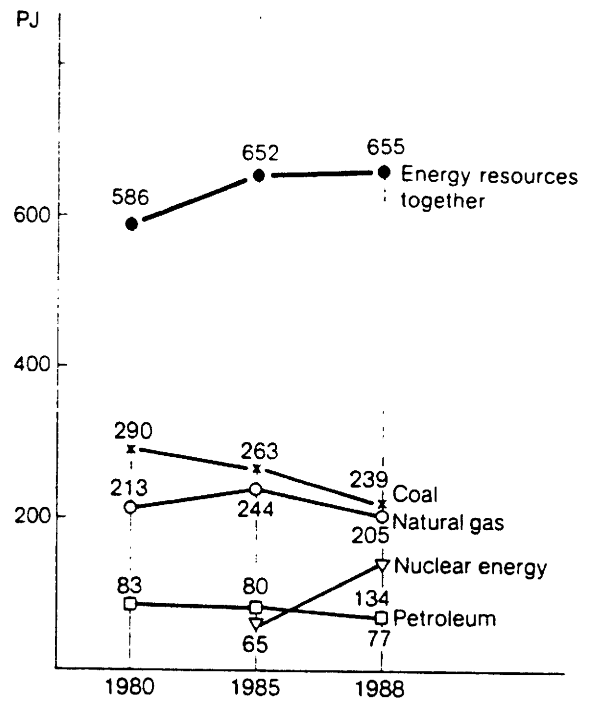
– GNP per capita (PPP–concept, 1980 prices) (EEC range: 4810 to 12040 US$) 4610 US$	
– Population and Employment	
. Resident Population (1989)	10.59 mill.
thereof children	20.8 %
thereof earning a livelihood (men 15–59 years, women 15–54 years)	57.3 %
thereof pensioners	21.9 %
. Active Employees	45.5 %
. Inactive Employees	24.2 %
. Share of Women in Active Employment Force	46.0 %
. Population Density (Persons per km²)	113.8
. Sectoral Employment Shares	
Industry	30.9 %
Building	7.1 %
Agriculture, Forestry and Water Supply	20.4 %
Transportation and Communication	8.3 %
Trade	10.7 %
Other Sectors	22.6 %
– Sectoral Output Shares (1987)	
. Agriculture	22.8 %
. Industry	33.0 %
. Produictive Services	24.8 %
. Non–productive Services	19.4 %
– Selected National Resources and Raw Materials Production	
. Bauxite	2.59 mill. t
. Aluminium	74.7 thousand t
. Alumina	873 thousand t
. Raw Steel	3.58 mill. t

2. *ENERGY SYSTEM*

2.1 Major Issues at a Glance

Hungary is able to cover about half of its energy consumption from domestic supply sources. Hungary has substantial coal resources but the quality is poor and the costs for recovery are increasing. Hungary is also a mature oil and gas producing country but the resource is dwindling and efforts must be made to sustain production at the current level. The overall domestic production of energy is decreasing with the exception of nuclear energy (see Figure 4):

Figure 4: Production of Specific Energy Resources



Source: Ministry of Industry: Hungarian Industry 1980–1989, April 1990

Table 4 shows the industrial energy consumption of the most important branches of industry. Socialist sector contains the largest majority of the firms by output and employment. Metal manufacturing and chemical industries are by far the largest consumers of energy with about 28 % each. Food processing accounts for about 9 % of total industrial energy consumption.

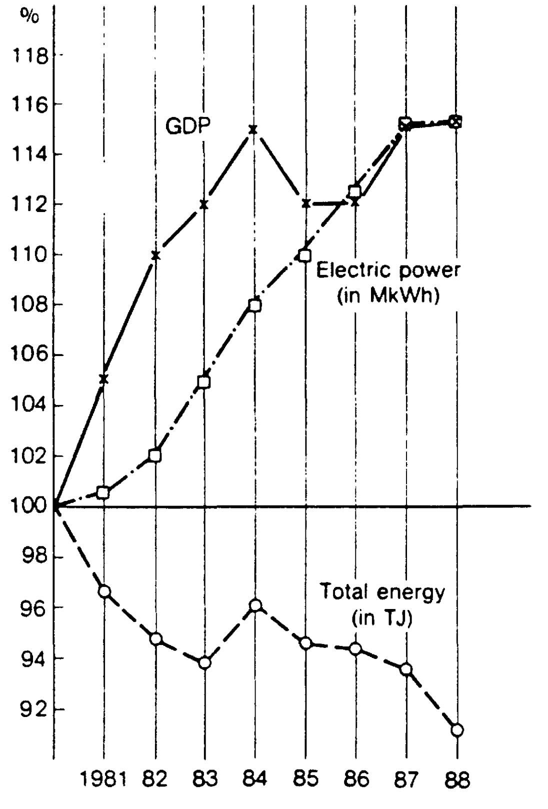
Table 4: Industrial Energy Consumption of the Most Important Energy Carriers (Socialist sector, in billion kJ)

	Total Consumption	Coal/ Briquettes	Coke	Petrol	Diesel	Light Heating Oil	Natural Gas
1970	338929	29387	50690	6468	12962	14846	69446
1975	401725	23458	52377	23201	16710	21930	86341
1980	463564	16667	52942	39299	18001	20754	113747
1985	436963	13009	47835	36817	13303	9335	116869
1986	436969	11856	46829	36350	12713	8045	121100
1987	433525	11342	42625	35369	13450	9502	117234
Mining	25383	1135	6	505	2645	174	9473
Electric Power	18312	8	15	309	313	3	13
Metal Manufacturing	122567	2486	40506	130	1046	4045	28567
Machine Engineering	33237	186	935	770	2556	211	6452
Construction Materials	48537	6984	598	185	1060	4578	27114
Chemical Industry	119656	11	6	32318	765	62	41512
Light Industry	26584	172	58	370	803	70	1125
Other	1326	32	5	69	96	-	147
Food Processing	37918	328	496	713	4166	359	2831

Source: Hungary, Statistical Yearbook 1988

Hungary's industry is energy intensive (using 43.5 % of total energy) as a result of the industrial development strategy of the past, the price structure and the technological standard of production facilities. However, there has been a trend to reduced energy intensity in the past years (Figure 5).

Figure 5: Trend of GDP and Energy Consumption in Industry (Index of changes 1980 = 100 %)



Source: Ministry of Industry. Hungarian Industry 1980–1989, April 1990

Total energy consumption was covered to the following percentages by individual energy sources (Table 5). Oil and natural gas make up over 50 % of PEC; Coal covers 23 %.

Table 5: Share of Energy Sources on Total Primary Energy Consumption

in %	1985	1986	1987	1988
Coal	26.7	25.5	23.7	23.2
Oil and Products	32.8	33.0	32.3	31.6
Nat. Gas	27.9	27.8	27.6	26.8
Nuclear and other	13.4	13.7	16.4	18.4
Import share	50.1	51.3	49.1	50.8

Source: Bfai: Ungarn Energiewirtschaft 1988/89

Table 6: Hungarian Energy Imports (1988)

	Quantity t	Value (1,000 Ft)
Hard Coal and Anthracite		
Total:	2,076,309	3,559,827
thereof from:		
FRG	11,139	66,649
Soviet Union	1,157,983	1,427,926
CSFR	160,036	263,298
Crude Oil		
Total	7,261,969	26,770,691
thereof from:		
Soviet Union	7,000,000	25,148,300
Iran	261,969	1,622,391
Natural Gas (in Mill. m3)		
Total	5,371,229	13,590,865
thereof:		
Soviet Union	5,371,229	13,590,865
Coal Briquettes		
Total	917,931	1,649,857
thereof:		
GDR	917,931	1,649,857
Propane-, Butane Gas		
Total	22,434	113,216
thereof:		
Austria	2,665	19,575
Soviet Union	19,769	93,641
Petrol		
Total	21,064	170,115
thereof:		
Soviet Union	20,983	167,052
Austria	82	3,063
Petrol for Chemical Industry		
Total	19,785	158,903
thereof:		
Albania	9,828	46,352
Yugoslavia	9,957	112,551
Light Heating Oil		
Total	221,264	662,826
thereof:		
Great Britain	19,914	89,529
Soviet Union	201,350	573,297

to be continued

Continued

	Quantity t	Value 1,000 Ft)
Diesel		
Total	759,419	3,049,677
thereof:		
Great Britain	11,541	92,800
Soviet Union	747,878	2,956,877
Hungarian Exports (1988)		
Natural Gas (Mill. m^3)		
Soviet Union	22,890	59,012
Propane–, Butane Gas		
Total	84,228	498,651
thereof:		
FRG	2,216	18,653
Yugoslavia	1,023	6,979
Austria	13,968	80,385
Crude Oil and Products		
(quantities are not given)		
Total (in Forint)		10,919,132
thereof:		
GDR		36,843
FRG		1,704,316
European harbours		1,472,425
France		6,331
Great Britain		13,032
Italy		42,127
Yugoslavia		331,381
Netherlands		6,362
Austria		5,158,226
Poland		161,117
Romania		35,358
Switzerland/Liechenstein		1,432,312
Sweden		8,153
Soviet Union		415,061
Syria		11,247
USA		20,287

Source: Statistisches Jahrbuch für Außenhandel 1988

Although Hungary is a net importer of oil, about 1.5 mill. tons to 2.5 mill. tons of annual imports of about 10 million tons are re–exported. A share of 0.5 to 1.0 mill. tons is directly re–exported crude oil, the other share consists of mineral oil products.

In 1989 about 30 % of domestic electricity consumption was imported from the USSR. If one adds the indirect electricity imports in form of nuclear fuel, the dependency on imported electricity amounts to 60 %.

2.2 Energy Resources

Coal is Hungary's most important domestic resource. Coal resources are estimated at 7.4 billion tons: 56 % lignite, 25 % brown coal and 19 % hard coal. About 4.4 billions are economically exploitable.

The largest deposits of lignite are located in the Northeast of Hungary, in the vicinity of the Matra and Bükk mountains. Extraction is by open-pit mining. The calorific value is very low (between 7.0 and 8.0 MJ/kg) and, therefore, the lignite is mainly fired in power plants located directly at the mines.

Brown coal deposits in the West (Transdanubia) and in the North are qualitatively better than the lignite resources and have a heating value of 20 MJ/kg. The most important deposits are located in the fields of Tatabanya, west of Budapest. The thickness of the seams lies between 4 and 30 m. Northeast of these fields, the Doroger rim at the border to Czechoslovakia exhibits further high-grade brown coal deposits. With thicknesses up to 15 meters the seams are extracted in underground and deep opencast mines.

The only known deposit of hard coal is located in Southern Hungary in the Meczek Mountains. It consists of Lias coal with a calorific value of 20 MJ/kg. To some extent the hard coal can be coked. Total resources are estimated to be 800 mill. tons, of which 435 mill. tons are exploitable. At present production rates the extraction could continue for 150 years.

Hungary is a mature oil and gas producing country. Oil and natural gas are located in Southwestern Transdanubia and in the Eastern parts of the Hungarian basin; in this region around 90 % of new deposits were explored recently. The statistical lifetime is indicated with 12 years for oil reserves and with 17 years for gas reserves, equal to absolute amounts of 24 mill. tons of oil or, respectively 120 billion m^3 gas. Currently, the exploration of new oil and gas deposits is going on, partly financed with IBRD loans. Hungary's producing areas have been well explored. It is not expected that major new fields will be found (WB,89) although better methods should improve the discovery rate. All efforts are concentrating on slowing the declining trend of oil and gas production.

Finally, Hungary possesses uranium deposits in the Western part of the Meczek Mountains, but the amount of resources is not published.

2.3 Primary Energy Production

2.3.1 Coal

With the Five–Year–Plan 1976 to 1980 four new hard coal mines were established with a planned production of 8 mill. tons. But expectations of increased coal production were not met. In 1985, production of 24 mill. tons coal fell below the level of 1980 (25.7 mill. tons). Due to this experience targets for the last Five–Year–Plan were adapted: Until 1990 production should be stabilized at a level of 24 mill. tons. With the new system of energy prices, production plans were revised in 1986. Extraction of expensive coal from deep mines is to be substituted by a production increase of opencast–minede coal. 14 out of 36 mines should be closed. In spite of considerable investments, hard coal production was decreasing in the second half of the eighties (to 20.8 mill. tons in 1988).

The development of coal produciton and import is shown in Table 7.

Table 7: Production and Import of Coal

	Average Heat Value		Production				Coal Import
					thereof		
Year	PJ	kJ/kg	1,000 t	Hard Coal	Brown Coal	Lignite	1,000 t
1975	304543	12242	24887	3030	14963	6904	1438
1976	301581	11941	25257	2934	14779	7544	1297
1977	296528	11648	25454	2925	14433	8096	1524
1978	295164	11498	25670	2954	14303	8414	1420
1979	292088	11383	25659	3002	14182	8475	1515
1980	288992	11245	25701	3065	14157	8479	1623
1981	290441	11196	25942	3066	14463	8413	1678
1982	291368	11173	26079	3039	14754	8268	1997
1983	277701	11014	25213	2827	14406	7980	1756
1984	275472	10998	25047	2573	14448	8026	1610
1985	262616	10923	24042	2639	14016	7387	2518
1986	252508	10918	23128	2324	13821	6983	2317
1987	253186	11083	22844	2360	13261	7223	1955
1988	236786	11343	20875	2255	12986	5634	2076

Source: Bfai: Ungarn Energiewirtschaft 1988–89

The production of lignite was planned to reach 14 mill. tons in the opencast mines of Brukkabrang in the mid eighties. But this target was not achieved. Total lignite production was only 7.2 mill. tons in 1987 and 5.6 mill. tons in 1988. At the beginning of the nineties production is to start in the Visontra fields and is planned to increase to 8 mill. tons in 2000.

2.3.2 Oil and Gas

For 20 years the production of oil has remained constant at around 2 mill. tons p.a. To maintain this production level, increasing application of secondary and tertiary extraction methods is required. Presently, about 40 % of the oil is already extracted with these methods.

The production of natural gas was slightly increased in the eighties to 7.1 billion m^3 in 1986. Future demand can only be met by additional imports. To achieve higher flexibility present storage capacity of about 1 billion m^3 is to be enlarged.

Some figures reflecting the activities of the Hungarian Oil and Gas Trust (OKGT), which is responsible of all activities in this area, are shown in Table 8.

Table 8: Some Typical Data about OKGT from 1984 to 1989

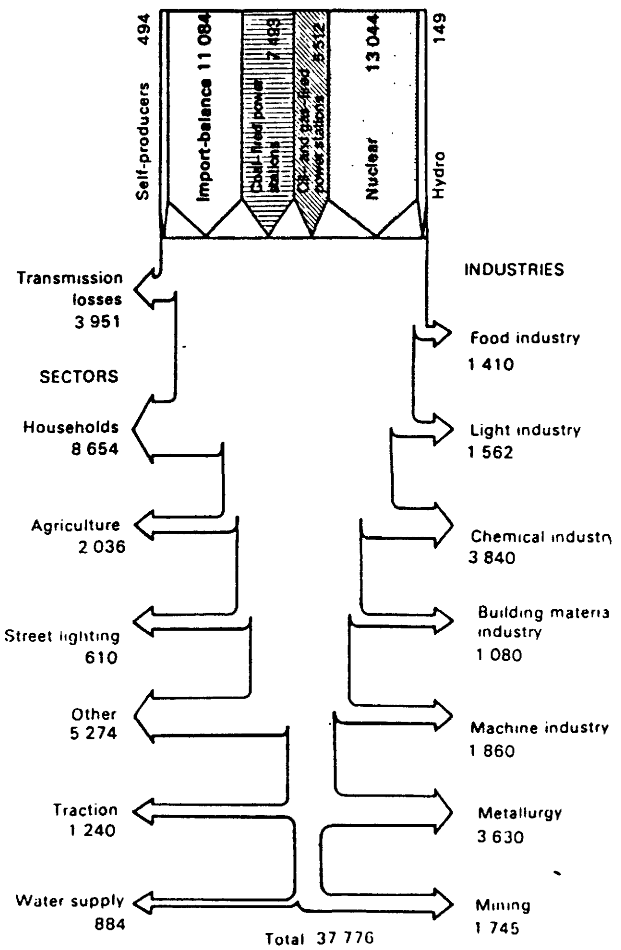
	Unit	1984	1985	1986	1987	1988	1989
Drilling	thousand m	386.4	388.5	382.7	383.0	333.7	284.9
Oil produced	million t	2.0	2.0	2.0	1.9	1.9	2.0
Oil imported	million t	6.6	6.4	6.8	6.5	6.9	6.3
Natural gas produced (net, dry)	billion m^3	6.9	7.5	7.1	7.0	6.3	6.1
Natural gas imported (at 15°C)	billion m^3	3.7	3.9	4.7	4.8	5.3	5.9
Oil refined	million t	8.7	8.4	8.7	8.3	8.7	8.3
Oil products imported	million t	1.4	2.0	1.6	1.3	1.3	1.4
Fixed assets	billion Ft	90.3	95.6	101.7	110.2	163.2	175.5
Gross income	billion Ft	337.6	356.0	309.9	301.7	334.0	362.3
Profit	billion Ft	9.4	12.3	7.2	10.3	9.3	27.0
Exports	million US$	352.2	403.3	286.7	327.3	352.9	400.4
	million Rbl	54.0	52.1	42.3	44.8	38.7	32.6

Source: OKGT

2.3.3 Electricity Generation

In 1989, 26982 GWh of electric power were produced in Hungarian power plants. 11084 GWh was the import/export balance (29.1 % of domestic consumption). Consumption of electric energy by customers was 33 942 GWh. The overall picture is given in Figure 6.

Figure 6: Net Generation and Consumption in the Power System (GWh)



Total generation capacity of Hungarian power plants is 7168 MW (1989). The capacity of the power plants of the MVMT was 6956 MW. The MVMT capacity is put together as follows (Table 9).

Table 9: Main Power Stations

		Units				In the year of 1989	
Power Stations	Fuel	Number	Capacities of each of them MW	Total electrical capacity MW	Nominal heat capacity MW	Electricity generation GWh	Heat supply PJ
Ajka	Coal	5	3x30+12+10	112	332	616	4797
Borsod	Coal	9	4x30+4+5+10+12+21	172	532	870	4609
Budapest	Oil and Gas	16	1,3-19	131	2315	646	17727
Dunamenti	Oil and Gas	13	6x215+3x150+50+40+2x20	1870	514	3245	8044
Gagarin	Lignite	5	3x200+2x100	800	47	2769	241
November 7	Coal	5	5x20	100	138	237	784
November 7 gt.	Gas	2	2x85	170	-	9	-
Oroszlany	Coal	4	1x55+2x60+3x60	235	42	1195	385
Paks	Nuclear	8	8x220	1760	135	13891	621
Pécs	Coal	6	2x60+3x30+19	229	537	992	3753
Bánhida	Coal	1	100	100	16	492	97
Tiszapalkonya	Coal	7	1x50+13+15+7+3x55	255	278	1283	2623
Tisza II	Oil and Gas	4	4x215	860	-	1975	-

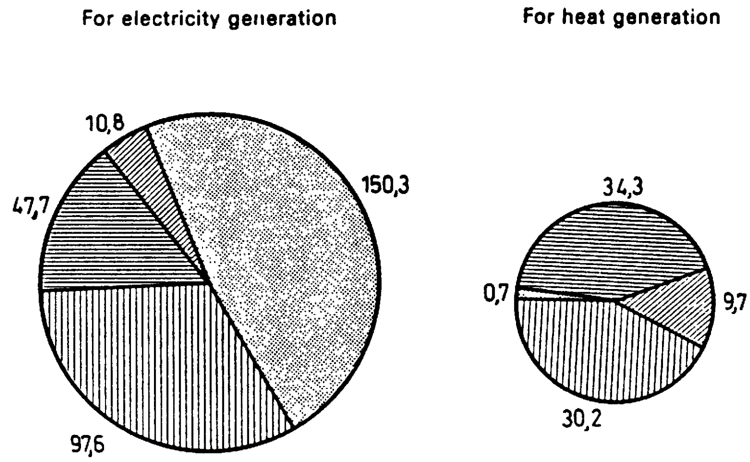
Source: MVMT. Statistical Data Featuring the Power Industry 1989 Summary

MW_{el}	Type
4800	Steam
1760	nuclear
200	combustion turbine
140	hydropower
6900	TOTAL

Source: Discussions with MVMT (figures are rounded) on 12.6.1990

Primary energy consumption of MVMT's power and heat production totalled 381.3 PJ in 1989 (see Figure 7).

Figure 7: Primary Energy Consumption of MVMT (PJ)



For electricity and heat generation

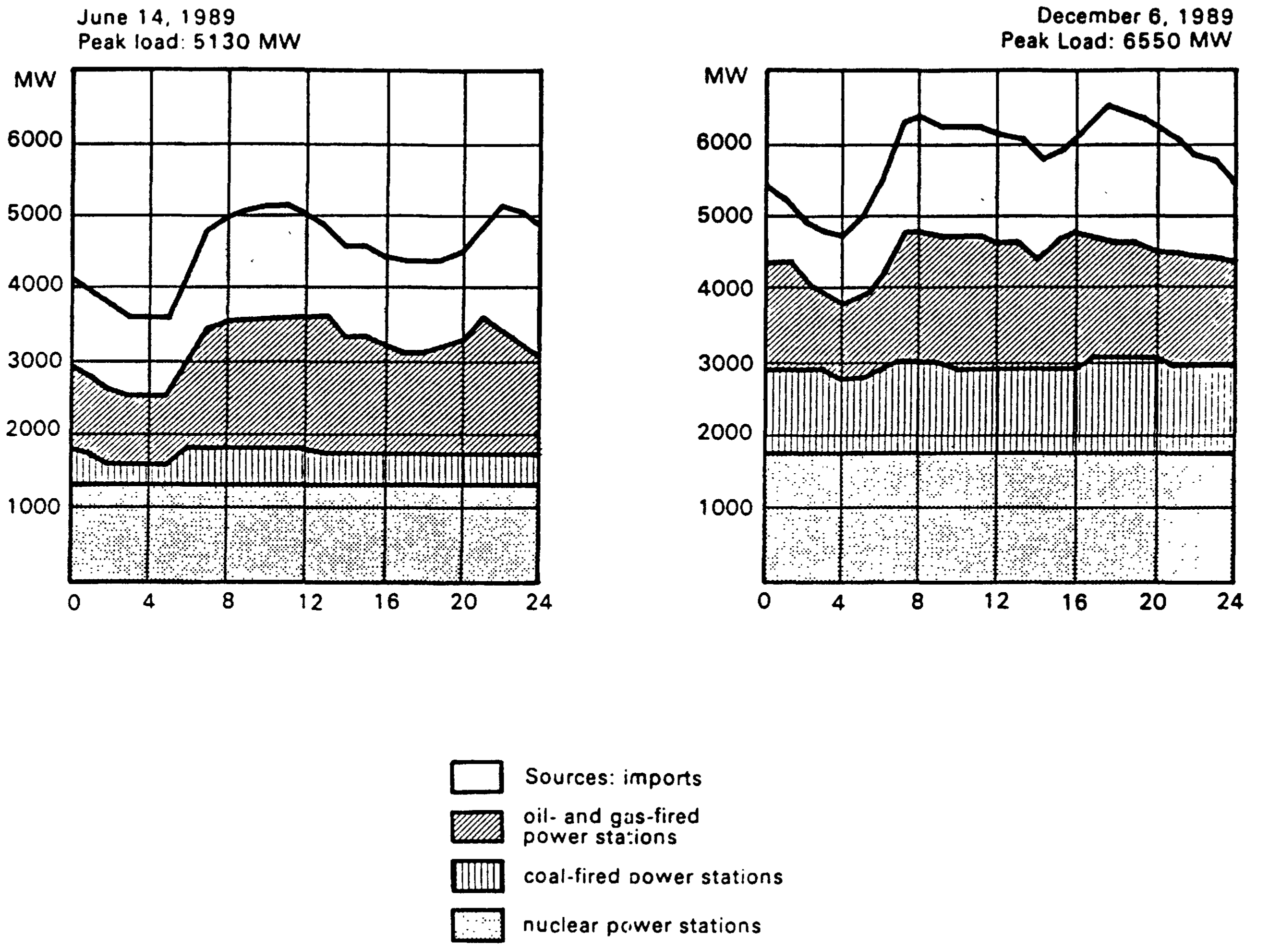
	PJ	%
coal	127.8	33.5
oil	20.5	5.4
gas	82.0	21.5
nuclear	151.0	39.6

Source: MVMT. Statistical Data Featuring the Power Industry 1989

Electricity demand was still strongly influenced by household electricity demand. As shown in Figure 8, the peak load of the utility was in the evening.

Lighting efficiency is another area of interest for energy saving. Peaking capacity needs for lighting amounts to more than 1000 MW. This could be reduced significantly by introducing more efficient lighting through incentives to customers

Figure 8: Breakdown of the Daily Loads



Source: MVMT. Statistical Data Featuring the Power Industry 1989

The development of household energy consumption from 1940 to 1989 is shown in Table 10. Household consumed 2006 kWh/Household in 1989. 4,314,000 households were served in 1989.

Table 10: Consumption of Households

	1940	1951	1970	1980	1989
Gross consumption per capita, kWh/inhabitant	143	342	1597	2748	3602
Number of household consumers (thousands)	771	1167	2846	3675	4314
Household consumption per capita, kWh/inhabitant	11	17	175	469	819
Average household consumption, kWh/household	134	139	638	1366	2006

Source: Statistical Data Featuring the Power Industry 1989

The share of nuclear energy grew from 24 % in 1985 to 36.9 % in 1987, corresponding to a production of 11 billion kWh. The nuclear plants of Paks are located 100 km south of Budapest. For 1994 and 1996 two additional plants with 1000 MW each were planned to go on stream. With these additions, the share of nuclear energy in electricity generation would rise to 50 %. The two nuclear power plants of Soviet origin have been canceled, however. Presently there are discussions of the following projects to substitute for these:

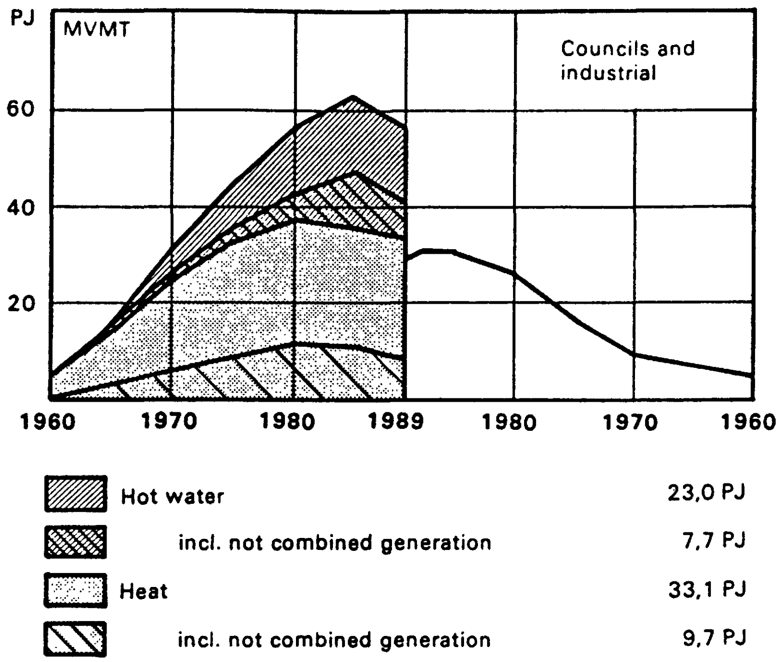
- EdF nuclear
- Candu
- Steag, VEW coal fired

The reserve margin of domestic peak demand is presently about 40 % (6550–1800= 4750 domestic required peak capacity). Capacity is not urgently needed at present. Combined cycle has been looked at (option for 1000 MW has been discussed) mainly because of the short lead times and low investment cost. However, costs appear not to be so low and the dependency on Soviet oil increases. Also fuel prices are uncertain. Price uncertainties will prevail even after conversion to convertible currency trade with the Soviet Union due to barter trade which will continue (busses for oil).

A ripple control system is to be financed by the EIB.

District heating is also an important service of the Hungarian Electricity Board and a number of municipal authorities. The large majority of power stations do give up some heat load for district heating on process heat (see Table 8). Figure 9 shows the development of heat supply over the years from 1960 to 1989.

Figure 9: District Heating



The main risk element for the future electricity long-range planning is the import dependency on the Soviet Union.

peak demand (1989)	6550 MW
total capacity	7200 MW
Soviet import	1800 MW

The indefinite availability of Soviet supply is in question. The Soviets deliver gas, oil and electricity. The Hungarians authorities know that the Soviet electricity supply is in poor shape. There is the possibility of a combination of shut-offs for all three at the same time (political reasons?). Soviet supply is based on:

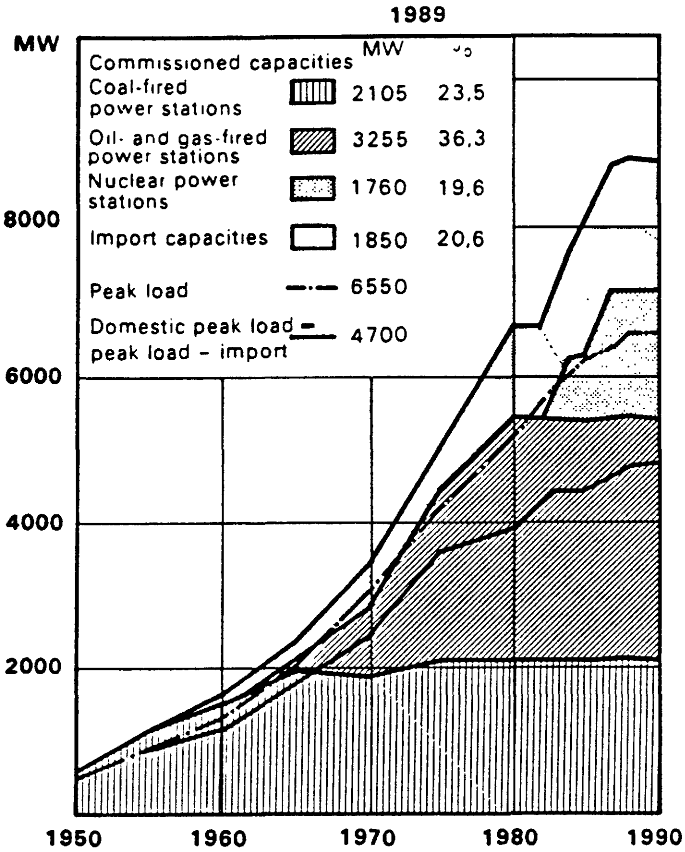
- 1100 MW joint investment in Soviet Union
- 750 MW short-term 5-year agreement up for renewal this year.

The interconnection with the UCPTE is not sufficient. There must be an AC/DC coupling built. Hungarians are sure that GDR will connect and expect Czechs to connect also. The Electricity authorities of 4 countries (GDR, Poland, Czechoslovakia, Hungary) are cooperating to decide on the form of connection to the UCPTE system.

The second risk factor for planning is the growth rate of electricity demand. Electricity demand decreased 1989 and is expected to do so this year also. The political moves of the government are uncertain and the economy is down.

Figure 10 shows the trends of capacity, generation and consumption of Hungarian electricity up to 1989. Future projections foresee an increase in electricity use of 1.5 – 2.0 % per year.

Figure 10: Capacities, Generation and Consumption in the Power System



2.3.4 Renewable Energy

Renewable sources of energy are not expected to play a decisive role in Hungary's energy supply in the coming years. The hydropower potential of the Danube in Hungary is limited. The most prominent project in this area is the Gabcikovo–Nagymoros project.

After political discussions and petitions the Hungarian Government decided to stop all construction work at the hydropower plant of Nagymaros on the Danube. The project would have contributed to about 5 % of the electricity production. Other hydropower plants in Hungary are of minor importance. Only 42 MW of an estimated potential of 1000 MW are exploited.

The Nagymoros hydropower project was canceled for environmental reasons. Gabcikovo in CSFR will be finished although this part threatens the largest environmental damage. As a result of the pull–out, Hungary must pay Austria in the form of electricity export without the output of the plant.

One other hydro power project is being proposed by Yugoslavia on the river Drava. This will probably be opposed by the Ministry of Environment.

Although Hungary is very rich in geothermal energy, the possibilities for utilization are limited. Within the PHARE programme a survey of the geothermal potential is to be carried out.

The thermal waters of Hungary constitute some of the most valuable resources of the country. The thermal water is exploited for both heating and medical purposes. At present about 500,000 m^3/day of thermal water is used from the natural springs as well as the about 1100 drilled wells. Extraction of water has resulted in substantial loss of pressure and volume in many cases and there is the fear that the tapped resources are over–exploited. Despite the long tradition in Hungary of making use of these resources, relatively little is known about their characteristics.

The objective of the study is to undertake an assessment of the thermal water potential of the country to gain a better understanding of the characteristics of this resource. It serves the general objective of defining the necessary policies and methods for making sustained and environmentally sound use of the country's thermal water.

The study constitutes the first phase of a longer term programme and comprises

1. A basic survey of all wells and springs
2. Procurement of equipment for the instrumental survey of wells and springs
3. A detailed survey of the 200 most important wells and springs
4. Establishment of a theoretical model for assessing thermal water resources, and
5. Study tours.

Execution of the study would be the responsibility of the Research Centre for Water Resources Development (VITUKI), with Mr. B. Ferenc being the study coordinator. VITUKI would also involve those organizations in the study that are presently utilizing thermal waters or are undertaking research and development work. The study will be supervised by the Department of Water Management of the Ministry for Environment and Water Management (KVW).

The procurement of the required equipment will be completed by 30 September 1990.

The survey will last from September 1990 to December 1991 and the water modelling work will be completed by the end of 1991.

The capital costs and financing plan of the project is as follows:

Capital costs (ECU million)

Item	Foreign	Local	Total
Basic survey of wells and springs	–	0.05	0.05
Equipment	0.13	0.02	0.15
Survey of 200 wells	–	0.28	0.28
Water modelling	–	0.02	0.02
Study tours etc.	0.03	0.01	0.04
Base costs (as of January 1990)	0.16	0.38	0.54
Physical and price contingencies	0.02	0.04	0.06
Total costs	**0.18**	**0.42**	**0.60**

Of the total estimated cost of the study of ECU 0.6 million, ECU 0.2 million will be financed by local sources and ECU 0.4 million are included in the PHARE programme on a grant basis.

Undertaking the study will provide the basis for better decision making with respect to the most appropriate use of the country's thermal water resources. The benefits of the study thus will be the avoidance of misinvestments and environmental damage that could result from the continuation of the present practices.

The use of solar energy is still in an experimental phase. Hungary has been a member of the international solar energy Society since 1983. Some work has been done in the area of solar thermal energy (Hungarian Electro–technical Institute, Tiszafödvar Cooperative, University of Debrecen).

A biogas plant was installed in Szembathely, a community in western Hungary, in 1982 for the first time. In 1983 a biogas plant was installed at a poultry farm in Szecseny. Further experience with biogas production and utilization was gained by the University of Keszethely in western Hungary. In order to push the use of biogas technology a bio–invest company was founded.

Wind energy has been experimentally used for water pumping.

2.4 Institutional Structure

There are now 13 ministries in the new government

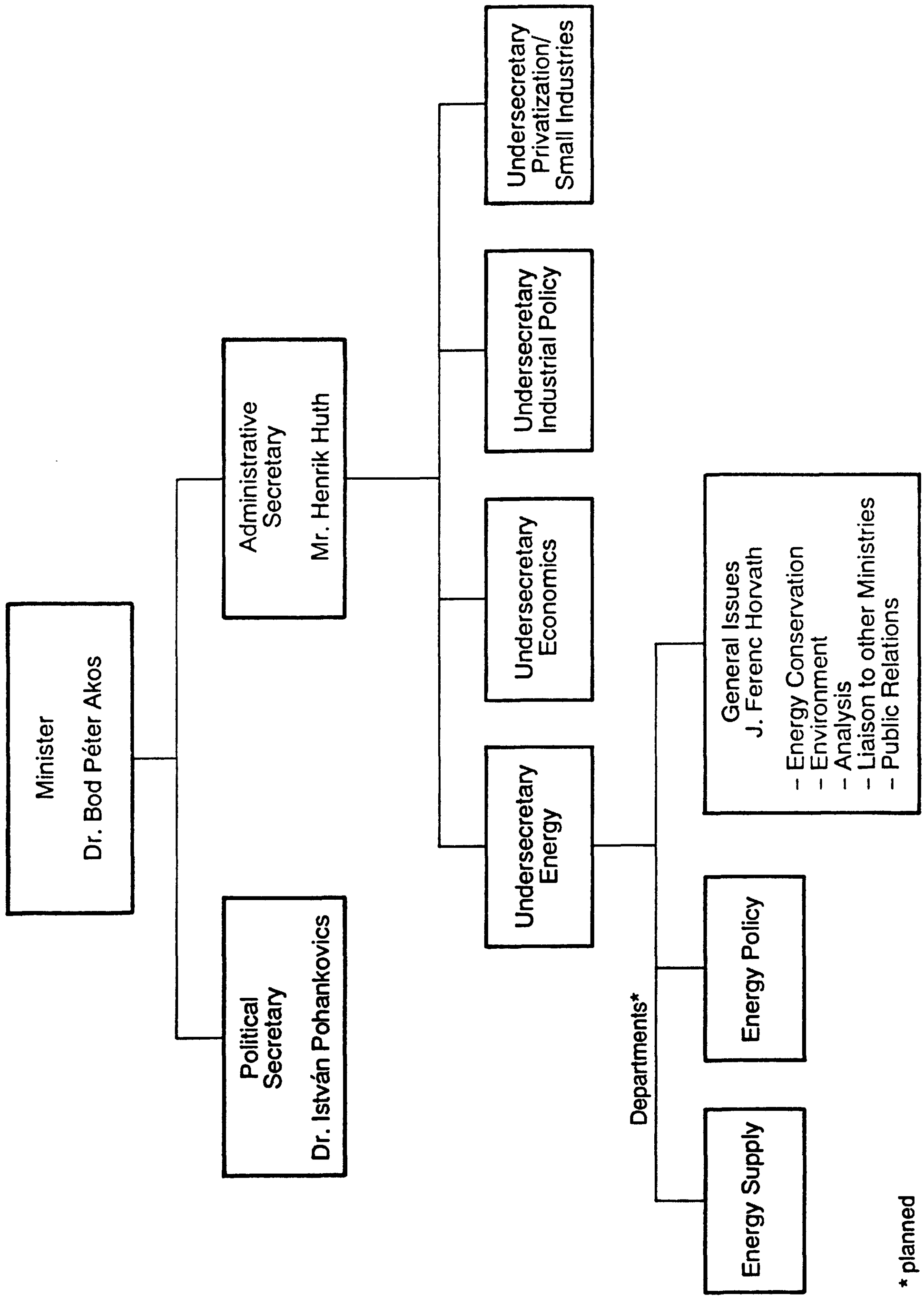
1 International Economic Contacts (foreign trade)
2 Transport, Telecommunications and Housing
3 Finance
4 Environment
5 Justice
6 Internal Affairs
7 Social Policies and Health
8 Foreign Affairs
9 Defense
10 Agriculture
11 Labour Issues

12 Public Education
13 Industry and (domestic) Trade

2.4.1 Ministry of Industry and Trade

Ministry of Industry and Trade has the overall responsibility for the energy sector. At the moment, there are reorganization plans in the ministry, but the following organization chart covers the newest developments regarding the energy sections.

Figure 11: Organization Chart of the Ministry of Industry and Trade



Under the Ministy of Industry and Trade, there are a number of institutions with responsibilities in the energy sector. The most prominent are the State Authority for Energy Management and Energy Safety and the major supply organiozations:

- OKGT
- MVMT

as well as the Mining Associations. In addition, the municipalities are partly responsible for the district heating systems throughout the country.

Two major national institutions which have a strong influence on the energy sector are the National Planning Office and the National Office for Materials and Prices (NOMP). However, the NOMP is being replaced by a cartell office.

2.4.1.1 National Authority of Energy (OEGH)

The National Authority for Energy Economy (OEGH) is part of the Ministry of Industry and Trade and has the direct responsiblity for policies and supervision of the various energy sector companies. In which section of the future ministry structure this unit will be integrated is as yet unknown.

2.4.1.2 State Authority for Energy Management and Energy Safety

State Authority for Energy Management and Energy Safety (AEEF) is a "background institute" of the OEGH, that is, it is an independent agency supervised by the OEGH. Responsibilities are for energy management and energy safety, e.g. pressure vessels etc. (something like the West German TÜV). AEEF has three sections:

- energy safety
- energy management
- financial and administration.

2.4.1.3 Energy Efficiency Office

The EEO is a subsection of the AEEF under the energy management section. EEO was founded in 1984 as a result of the stipulation in the first WB loan contract (1983) that there be established "a national energy conservation office". EEO is responsible for:

- demonstration projects
- identification of constraints to energy saving
- publicity campaigns (i.e. awards to journalists for the best energy conservation story, publications on energy saving in small businesses). The Office has its own press manager to assure that energy saving is covered in the media
- seminars
- training
- R&D (i.e. natural gas vehicle project now underway)

The Energy Efficiency Office presently has a staff of 6 engineers and economists. In addition there is an energy audit group of 9 engineers which is resumably part of the AEEF. The EEO can drawn upon the resources of the AEEF. The AEEF has 6 regional offices which can also be used by the EEO.

The first World Bank loan to the Hungarian energy sector (2317–HU) had a supplementary letter about the agreement of IBRD and the Government of Hungary on establishing an Energy Efficiency Office.

Foreign consultants were involved in the organization of EEO, determining its scope of activity and training its staff. During its first three years of operation the Office maintained good reputation amont the energy managers of the country.

The main activity of the Energy Efficiency Office is to motivate energy users in more effective use of energy. In order to meet this requirement is organizes training courses on energy auditing, waste energy recovery, and energy management in different industrial sectors.

It conducts energy audit demonstrations, implementation programmes, study tours for processing and manufacturing industries, public institutions and for the commercial sector.

EEO is responsible for the publicity campaigns on energy saving. TV commercials, children drawing competitions, tram–, filling station posters, calendars etc. support those campaigns on energy saving.

Under the sponsorship of EEO research and engineering groups prepare feasibility studies on application of new energy conservation techniques.

The Energy Efficiency Office offers its services

- in advising how to reduce specific energy consumption in different industries
- in reduction of energy losses and utilization of waste energy
- in supporting the implementation of new techniques which are energy conservative and productive.

The EEO has an adequate office infrastructure for its assignments with a telex and access to a Telefax at AEEF. Also copying facilities are available.

The EEO is trying to encourage the establishment of energy service companies which will also engage in third–party–financing.

According to the plans, the EEO is to be partly funded by the clients of the Offices services. Mr. Biro (Manager of EEO) has sent out questionnaires to selected firms asking if they would subscribe to membership in the EEO. Some positive responses have been received so that the EEO can count on at least 10 million Ft of a total of estimated 40 million Ft/year budget (according to original TOR).

2.4.1.4 Hungarian Electricity Board (MVMT)

The Hungarian Electicity Board (MVMT) is one of the largest companies in Hungary employing more than 43000 persons in 1989. MVMT sold 33 942 GWh to electricity customers in 1989 and provided 265000 customers with district heating amounting to 56 087 TJ in the same year. More details on the MVMT were provided in section 2.3.3.

There is some discussion of a reorganization of the electricity supply, which would lead to creation of more regional utilities and a desintegration of the MVMT.

The tariff structure of MVMT has been studied and discussed with the World Bank on many occasions.

A Household tariff study is being prepared for WB by end 1990. Main dificiency noted by WB is the regional differentiation, which will be eliminated. Problems regarding introduction of new HH tariff systems are:

- metering (new meters might be necessary)
- social aspects.

In the productive sector time-of-day rates are used for some metered customers but the differences between peak price and off-peak is too little to induce shifts of load or energy conservation. The total peak demand of large customers (greater than 1 MW) is about 2500 MW. A reduction of about 300 MW at peak times could be easily attained according to MVMT.

Bechtel was commissioned by MVMT to prepare a demand management study, which was finished January 1990, but came to very unsatisfactory results. Apparently, top management is not interested in energy conservation incentives.

2.4.1.5 Institute for Energy Economics (EGI)

The Institute for Energy Economics (EGI) is an institution directly responsible to the Ministry of Industry and Trade. EGI is an engineering establishment with now about 600 employees after having to release 200 because of the economic situation. It has international contacts and contracts in eastern European countries and abroad. It is also under the direct authority of the Ministry of Industry and Trade.

EGI is also one of two manufacturers of refrigeration equipment in Hungary.

EGI has been carrying out energy audits for years. Persons spoken to believe that the hungarian engineers can do this task even better than foreign firms. They are familiar with the institutional setting and the environment in which the firms must operate. They have had to function in an environment which was not functioning well. They have had greater hardships to overcome: lack of materials, delays, poor quality deliveries etc. They have been learning to be more ingenious.

2.4.2 Ministry of Environment

Originally there were two organizations: National Authority for Environmental Protection, National Authority for Water Management. These were joined to the present Ministry three years ago. Now they will be divided again. Water management will probably be taken out of the Ministry and given to the Ministry of Public Works (Transport, Telecommunication, Housing). The dividing line is not completely clear: water quality will remain, water management (resource) will move.

Regional development will be included in the agenda of the Ministry of Environment. The minister is an expert in this area.

In the future, local government will have more say about issues concerning local population. The public is very aware of environmental problems.

2.4.3 Donor Activities

A number of western agencies are active in Hungary. The most notable in the energy sector is the World Bank which has already granted the fourth loan in the energy area.

2.4.3.1 World Bank

The WB has given 4 energy sector loans to the Hungarian Government since 1983. Two loans provided funds for energy conservation measures which were administered by the Hungarian National Bank. Also pricing studies are being carried out in connection with the WB projects.

The lion's share of the World Bank support has gone to oil and gas production and exploration, but energy conservation has also been an element of the World Bank programme. Pricing issues have also played a major role so that the Hungarians are well aware of the adjustment necessary and the principles involved.

2.4.3.2 UNDP

A programme was carried out together with the world bank which apparently consisted mainly of studies of different aspects of the energy situation and some energy conservation studies.

2.4.3.3 Commission of the European Communities

DG XVII

The following actions have been agreed between Ministry of Industry and Trade and CEC, DG XVII:

- set up an Information and Dissemination Centre to improve knowledge of energy conservation in Hungary.
- perform energy audits in the food processing sector (tendering in already in progress)
- information exchange, study of Third–Party–Financing.

PHARE Programme

Mr. Diosy, Ministry of Environment, is responsible for the management of the PHARE programme. The Ministry was surprised to learn that the PHARE–programme funding is coming only from the CEC, not from the CEC/OECD as originally planned. Some bilateral projects are also included involving U.S. and Canada. 100 million ECU is available for Hungary, thereof 25 million ECU for environment. 22 projects have been accepted.

Energy and Environment projects (4) were decided on by MoI and passed on for administration to Ministry of Environment. The four projects are:

1. SO_2 reduction at 3 power plants
2. Conversion of existing power plants to fluidized bed combustion
3. Geothermal energy utilization in Szeged with re–injection
4. Computerized Energy Management system at rubber manufacturing plant.

In addition to these energy projects, there are several projects in other areas that have an energy or energy/environment component (see Table 11).

Operation PHARE has developed programmes for:

- Environmental protection
- The Regional Environmental Centre in Budapest
- The financial system
- The cooperation in the field of economics
- Technical assistance for the implementation of TEMPUS.

The energy sector is already present in programmes that have entered the implementation phase, and it is pretty obvious that it will be present in the ones that will be formulated in the near future. It is also obvious that the energy sector has ample opportunities to participate in a number of programmes having a more general character, e.g. in training or technical assistance.

Table 11: List of Environmental Projects of PHARE Programme for Hungary

General	**Million ECU**
Estalishment of a Regional Integrating Monitoring (RIM) System	0.11
Protection of Caves and Springs of Budapest	1.00
Establishment of Ferto Lake National Park	1.40
Wetlands and Grasslands Protection Study	0.15
Environmental Education and Training Study	0.25
Environmental Education and Training Exchange Programme	0.25
Sub-total	**3.16**
AIR	
Modernization of the Emission Monitoring Network	1.90
Modernization of the Air Quality Monitoring Network	1.90
Modernization of the Network Registering Background Air Pollution	0.50
Catalyzer Programme	0.50
Sub-total	**4.80**
WATER	
Koros Oxbow Rehabilitation	0.82
Silt Dredging and Reed Harvesting at Lake Batalon and Lake Valence	0.82
Identification and Measurements of Micropollutants	0.82
Modernization of the Hydrological Monitoring System	0.50
Groundwater Pollution Study	0.50
Thermal Water Resources Study	0.40
Sub-total	**3.86**
WASTE	
Val-Vertesacsa Industrial Waste Disposal Project	2.00
Inventory of Groundwater Pollution Sources	1.30
Sub-total	3.30
Energy	
Study for SO_2 Emission Reduction at three Power Stations	0.20
Fluidized Bed Installations at Ajka and Dorog Power Stations	1.35
Gethermal Pilot Project	3.20
Taurus Rubber Energy Savings Project	1.13
Sub-total	**5.88**
Total	**21.00**

Exchange rates used: ECU 1 = HUF 75.5; US$ 1 = HUF 62; ECU 1 = US$ 1.22

The Environmental Protection Programmes

Environmental protection programmes have been approved for Hungary.

The Environmental protection programme for Hungary is composed of 22 projects for actions (Table 1) with a total budget of 21.0 MECU and duration until the end of 1991. Out of these 22 projects four refer to the sector of energy with a total budget of 5.88 MECU, while the project for the Thermal Water Resources Study (cf. section 2.3.4), with a budget of 0.4 MECU, is also of extreme interest to the energy sector.

The specifics of the energy related projects are presented in the following paragraphs.

Study for SO_2 Emission Reduction at three Power Stations

The Hungarian Electricity Board (MVMT) committed itself to the national environmental programme by, inter alia, pledging to reduce SO_2 emissions from its thermal power generation stations. For this purpose, the three plants of Pecs, Oroszlany and Gagarin have been selected as they have high SO_2 emissions.

For the plant at Pecs, a preliminary assessment of the most suitable technology for reducing SO_2 emissions has been conducted.

The objective of the study is to determine the most appropriate technical and economic manner in which the SO_2 emissions at these three plants can be effectively reduced and how this equipment is best internationally tendered for.

The study will investigate the specific technical problems and characteristics of each one of the three plants, especially with respect to the type of coal fired. Based on this and an assessment of the internationally existing technologies available for SO_2 reduction, the study will determine the most appropriate technology in terms of effectiveness and costs. For the plant at Pecs, technical assistance will be provided to MVMT to prepare tender documents, for tendering and bid evaluation.

The three plants are subsidiaries of MVMT. From the government's side, the study would be monitored by the Ministry of Industry on behalf of the Project Management Unit (PMU) at the Ministry for Environment and Water Management.

The terms of reference of the study will be prepared by the end of June 1990, and the study will be completed by the end of March 1991.

The total cost of the study is estimated at 0.2 Mecu, all of which is included in the PHARE programme for financing on a grant basis.

Without undertaking the study, there is a danger of less than optimal decisions being made concerning the most appropriate technology and equipment. The benefits of the study lie in the reduction of such less than optimal decisions and their associated high costs.

The study is justified on the grounds that its cost is very small in relation to the investment requirements for reducing SO_2 emissions at the three plants, while the potential benefit of achieving considerable cost savings is substantial.

Fluidized Bed Installations at Ajka and Dorog Power Stations

The Hungarian Electricity Board (MVMT) has been analyzing possible technical solutions for the cost–effective reduction of its coal fired power plants. For this purpose it developed its own technology of combining fluidized bed firing with the conventional process of pulverized coal burning. A pilot project has been operating for three years with excellent results. MVMT therefore now plans to apply the technology to the boilers of the two power plants at Ajka and Dorog.

The objective of the project is to reduce SO_2 and, to a more limited extend, also NO_X emissions at the power plants of Ajka and Dorog, without reducing their steam generating capacity.

The project comprises the conversion of two boilers of 100 t/h of steam generating capacity at Ajka and one boiler of 50 t/h capacity at Dorog. Since the coal at Dorog has a low calcium content and thus a limited capacity to bind the sulphur in the ash, additives have to be added to the coal and for this an appropriate system is included in the project.

For the Ajka power plant installation, the Research Institute for the Electric Power Industry (VEIKI), which developed the fluidized bed technology, has assumed the role of the main contractor. For the conversion of the boiler at Dorog, the Institute for Energy Economics (EGI) will assume this role, as the capacity of VEIKI is limited to undertaking the work at Ajka. Monitoring of the project will be done by the Ministry of Industry on behalf of the Project Management Unit (PMU) at the Ministry for Environment and Water Management (KVM).

The first boiler at Ajka will be completed by August 1990 and the installations are expected to be completed by August 1991.

The capital cost and the financing plan of the project (in MECU) is as follows:

Item	**Foreign**	**Local**	**Total**
First boiler Ajka	0.42	0.80	1.22
Second boiler Ajka	0.42	0.80	1.22
First boiler Dorog	0.40	0.51	0.91
Base costs (as of January 1990)	1.24	2.11	3.35
Physical and price contingencies	0.11	0.24	0.35
Total costs	1.35	2.35	3.70

Financing of the foreign exchange requirements amounting to 1.35 Mecu is included in the PHARE programme. The possibility for providing the financing partly as a grant is being considered. The local costs will be covered by the government.

The operation of the converted boilers will result in a reduction of SO_2 emissions totalling 4,900 t/year and of NOx of 310 t/year. In relative terms, the SO_2 and NOx emissions will be reduced by about 50 and 35 % respectively.

The project is justified on the grounds that the Hungarian technology is, for the relative reduction of emissions to a level of 70 %, the lowest cost technology available and thus highly cost-effective.

Geothermal Pilot Project

Hungary is one of the richest countries in Europe regarding geothermal energy. However, as the thermal waters are highly saline and contaminated by hydrocarbons, their discharge into surface waters after utilizing their energy, as practiced now, causes considerable damage to the Environment. Another constraint stems from the fact that replenishment in many of the thermal water sources is very slow so that production pressure and yields decrease with increasing extraction.

The only technical solution to these problems is the reinjection of the used water into the ground. Limited experience is available for this technology in Hungary as well as in other countries.

The objective of the pilot project is to demonstrate the technical feasibility as well as the financial and economic viability of making environmentally sound use of the geothermal water potential of Hungary.

The pilot project comprises:

a. drilling and commissioning two thermal water reinjection wells at the Felso Varos housing estate (of 12,000 inhabitants) in the town of Szeged, where thermal waters are now utilized for heating purposes and discharged into surface waters;

b. drilling and commissioning of two thermal water production and reinjection wells for providing another housing estate in Szeged with heating water, replacing a gas fired boiler system; and

c. a long-term monitoring and evaluation programme, ensuring that the results of the pilot project are properly analyzed and used for the further exploitation of the geothermal water potential.

The firm Geo-Thermal Cooperative of Budapest, specializing in this field, has prepared the project and would be responsible for its implementation and long-term monitoring. All construction work will be tendered on a turn-key basis. Operation of the wells and heat exchange system will be the responsibility of the city council of Szeged. The project would be supervised by the Ministry of Industry on behalf of the PHARE Project Management Unit of the Ministry for Environment and Water Management.

The project has already started. The contracts are expected to be awarded by the end of next October, and the project to be completed by the end of 1991.

The capital costs and the financial plan of the project, in Mecu, are as follows:

Item	Foreign	Local	Total
Reinjection wells at Felso Varos	0.18	0.90	1.08
Production and reinjection wells at	0.26	1.46	1.72
Eszak Base costs (as of January 1990)	0.44	2.36	2.80
Physical and price contingencies	0.07	0.33	0.40
Total costs	0.51	2.69	3.20

The cost of the long-term monitoring and evaluation programme is not included in the capital costs, as these activities will only be carried out after 1991. As no local funds are available for this pilot project, the total amount of 3.2 Mecu is included in the PHARE programme for financing. Considering the pilot character of this otherwise revenue earning project, part of the financing is foreseen on a grant basis.

The project will demonstrate the feasibility of utilizing thermal waters in an environmentally sound manner. In addition, the pilot project will save 5.3 million m3 of natural gas per year and stop the pollution now caused by the discharge of the used thermal waters.

According to calculations made by Geo-Thermal, the investment will be recovered within six years and is therefore already justified on economic grounds alone.

Taurus Rubber Energy Savings Project

Know-how and technological development for saving energy in industrial processes through modern computer based energy management systems are not well developed in Hungary. The Taurus Hungarian Rubber Works is one of the industrial enterprises in the country with high energy throughput. For two of their factories, the one in Szeged processing rubber for industrial use and the other in Budapest producing tyres Taurus, the potential for energy savings through improved energy management has been analyzed in detail before the corresponding project was prepared.

The objective of the project is to reduce the specific energy consumption at Taurus' Szeged and Budapest plants. This serves the overall objectives of decreasing air pollution reducing unit costs and thus increasing the competitiveness for the company's products, improving the energy balance of the country and demonstrating that improved energy management applying up-to-date technology is a feasible and economic undertaking.

The project comprises the procurement, development, installation and commissioning of computer based energy management systems for the plants at Szeged and Budapest, including the associated hardware and software, data collection systems, actuators, interfaces to other computer equipment, etc.

The project has been prepared and will be implemented by Taurus, with Mrs K. Bekes, chief of the company's energy department, assuming project management responsibility. The project will be monitored by the Ministry of Industry on behalf of the Project Management Unit (PMU) of the Ministry for Environment and Water Management (KVM).

The technical specifications have already been completed, and the systems are expected to be operational by the end of August 1991.

The capital cost and financing plan of the project, in Mecu, is as follows:

Item	**Foreign**	**Local**	**Total**
Szeged system	0.20	0.12	0.32
Budapest	0.78	0.57	1.35
Base costs (as of January 1990)	0.98	0.69	1.67
Physical and price contingencies	0.15	0.11	0.40
Total costs	1.13	0.80	1.93

The foreign exchange cost of the project amounting to 1.13 Mecu is included in the PHARE programme on a loan basis with terms and conditions to be determined. The local costs will be financed by Taurus.

The projected energy savings are estimated at 210 TJ/year, valued at HUF 48.3 million (0.64 Mecu).

The project is justified on the basis of financial and economic internal rates of return of 30 and 38 % respectively.

2.4.3.4 The Regional Environment Centre for Central and East Europe in Budapest

In July 1989, as a follow-up to the initiative to help Central and East Europe overcome their environmental problems, the President of the USA proposed the establishment of a Regional Environmental Centre located in Budapest, as a potential major contribution to the improvement of the environmental situation in the region linked with the ongoing process of economic reforms. From the start, the Centre has been presented as a possible multinational venture.

The interest G-24 could have in the establishment relates not only to the support it could provide to improving environmental action in the region, but also because of the close relatiohsip and interaction existing between environmental issues over Europe. In this respect a close relationship with the proposed future Community environmental agency is of interest.

According to the draft charter established in January 1990 by the US and Hungarian authorities, the Centre is to be an independent, non-advocacy, non-profit making organization. Recognizing that local and regional actions are essential to resolving global environment problems, and responding to growing private and public concern for the environment in the region, the Centre is established to address environmental challenges generally common to Central and East Europe. The Centre will be a source of information and assistance for citizens of the region regarding critical or persistent local, national and regional problems. These purposes are served best by the active participation of non-governmental organizations (NGOS – business and non-profit organisations) from Hungary, the United States and elsewhere in the organization and operation of the Centre.

The Centre will act as a catalyst for the support of individuals and organization that advocate or implement solutions to the environmental problems in this region. It will promote interaction and cooperation among diverse interests. The Centre may engage in, support and encourage activities in the following areas:

- Data collection and dissemination
- Development of institutional capacity
- Education
- Clearing house: for matching resources from a variety of sources.

The Centre will sponsor and support seminars, workshops, exhibitions, training courses, exchanges, fellowships, studies, professionals, maintains and publicize a collection of environmental information.

The Centre may develop formal or informal ties to other organizations with related interests. Participation by government agencies and non-governmental groups, international organizations, citizen's groups, scientific community and industry is encouraged.

The Centre is to be governed by a Board of Trustees (10 to 15 members). Membership should be broadly representative. The Chairman shall be elected for a term of 3 years. The Board shall appoint an Executive Director to manage the day-to-day affairs of the Centre. According to the charter drafted by the US and Hungarian authorities, the first Executive Director shall be a Hungarian citizen supported by a Programme Manager who is a US-citizen.

It is expected that this proposed structure will be subject to modification after discussion with other potential prticipants. The Commission intends, within this context, to obtain a significant role for the European Community and its Member States in the Centre's structures, corresponding to theif financial and substantive commitment to its aims.

The following timetable has been set by the US and Hungarian parties:

March – April:	Develop and refine the programme description, financial plan etc.
April – May:	Form the Board of Trustees and select the Executive Director and Programme Manager
May – June:	Finish the charter and set priorities for the initial activities of the Centre – Formulate and publish the programme announcement
July:	Start operation.

The timetable could be influenced by negotiation with other possible participation. The Centre will be a permanent organization.

According to the draft charter, the Centre is initially established with funds provided by the Government of the United States, the Government of the Republic of Hungary and by other sources. The hypothesis under which the US and Hungarian authorities appear to have discussed is a tripartite financing: 1/3 US, 1/3 Hungary, 1/3 others for a total estimated cost of 12 MECU (15 million US$) over 3 years (1990 – 1992).

Accordingly, the original purpose of the US was to devote 5 million dollars for 3 years to cover 1/3 of the Center's expenditure, assuming that one year's expenditure would reach 5 million dollars, part of which going to the endowment fund.

The Commission's view is that financing should be spilt in four equal parts: Hungary, USA, European Community and other potential participants.

It was, therefore, proposed that the Commission's participation from the 1990 budget will be a significant contribution for the years 1990 and 1991, i.e. 2 MECU (= 1/4 of the total cost), the US would contribute 2 MECU, the Hungarian authorities 2 MECU or equivalent and from other sources a contribution of 2 MECU was also expected.

The Centre is to be served by two types of financial arrangements.

The first is an operating account, from which disbursements are made to support projects and activities authorized by the Board of Trustees. The second account is the endowment fund from which withdrawals are made by Board resolution. An international accounting firm with offices in Budapest shall be retained to audit.

Whether or in which proportion the EC contribution would be allocated to the operating account or the endowment fund is to be decided, considering the total financing available from the different participants and its modalities.

Possible later contributions and their modalities will have to be considered in the light of the achievements of the Centre, its future programmes, and its financial situation.

2.4.3.5 IEA

Energy Policy Workshop

An IEA workshop was held in Budapest between 25 and 29 June. Organizer at IEA is Mr. Vlaanderen, Non–member Country Section.

It was a limited participation high–level workshop with 6 experts from IEA and about 20 from Hungary (round table discussion).

Topics:

1. Systems of organization of the energy sector in market economies
2. Special Issues of Energy Markets
3. Prices of Energy Carriers
4. Financial Policies to support energy conservation
5. The role of the government in regulating the energy sector
6. The areas of Government Intervention
7. Questions regarding connection to the west European energy networks for gas/electricity/oil
8. The role and importance of privatization in the energy sector
9. The critical issues regarding Hungary's adjustment to a common European energy market (roughly translated form Hungarian to German to English).

The emphasis was on gaining experience from western Europe and the western world for Hungary

Following the workshop there will be a series of lectures.
Study on Energy and Environmental Issues

Coal Research Institute of London is performing a study on energy and environmental issues in central and eastern Europe for the IEA. Emphasis is apparently on Coal.

2.5 Prices

At present there is a dual price system in Hungary which treats the productive and the consumptive sectors differently. Over a three year transition period prices are to be increased to reach the "world-market-price level". At present the prices in the productive sector are about 15 % under World Market level. In the consumptive sector there is a difference of about 50 %. Social hardships caused by these measures in the consumptive (household) sector will be smoothed over social welfare measures not through the price.

For electricity there is still some question regarding the optimal price level due to the lack of a comparable world market price. Also, other than the intention to raise the prices to WM level, there has been little consideration of a price differentiation to attain an optimal allocation of energy and other factors in the productive sector.

At the same time the prices are being changed, there is a reorganization going on in the energy sector. The electricity sector is to be broken down into distribution, generation and transport companies (similar to the British Energy Act demonopolization). Also there is an idea to create Energy Service Companies which are to be involved in project evaluation, planning and financing (third-party-financing)

Beginning 1991 there will be a new energy price policy

1) for oil and gas and products, the price will be world market price plus transport etc. This will mean a price increase of about 50 %.

2) other energy carriers above all electricity and district heating: long-term marginal costs (World Bank method). For electricity there will be larger price differences depending on voltage levels. For Household (low voltage) customers the costs are presently about 3.5 Ft/kWh with the present tariff being about 2 Ft/kWh. This will mean a large jump in price for the smaller cutomers. For large industrial customers connected to high voltage, there will be benefits for load shape.

The following table summarizes the planned prices and their relation to economic prices

Table 12: Selected Energy Prices (in Ft. per Gigajoule)

	1980	1983	1985	1986	1988
Consumers					
Coal	26.8	30.6	43.1	43.1	47.2
Briquettes	37.7	44.6	54.7	54.7	57.0
Coke	57.0	73.9	100.0	100.0	100.7
Fuelwood	51.7	67.9	82.2	82.2	89.0
LPG summer	79.7	87.6	95.6	95.0	111.5
LPG winter	70.7	87.6	131.5	131.5	153.5
Natural gas	59.6	87.6	76.0	76.0	86.6
Heating Oil	70.8	113.6	176.1	176.1	227.3
Electricity – Budapest	287.0	270.9	317.8	337.1	348.0
Producers					
Hard Coal	n.a.	72.4	80.3	86.5	96.5
Brown Coal	57.7	70.2	86.1	101.0	111.5
Lignite	n.a.	50.9	65.7	70.7	75.3
Crude Oil	143.7	200.5	200.5	162.8	126.9
Naptha	183.3	244.9	244.0	151.1	163.1
Gas (large)	74.9	121.5	125.5	135.8	143.6
Gas (int.)	n.a.	94.9	99.0	105.4	112.7
Gas (fert.)	n.a.	114.6	84.0	97.4	94.3
Diesel Oil	197.5	257.7	257.7	257.7	295.0
Heating Oil	92.6	160.9	160.9	138.1	113.2
Resid. Fuel Oil	79.7	147.6	147.0	134.7	107.7
Steam Heat	95.0	191.9	161.1	175.0	189.1
Electricity (Large users)	347.1	448.5	514.8	570.3	634.0

Source: WB and National Planning Office

Table 13: Planned Consumer Price Increases

	Estimated Economic Cost as of 01/01/89 (a)	Average Price as of 01/01/89	Average Price in % of Economic Price (02/89)	Expected Levels of Average Prices in % of May 30 1990	1991	1992	1993
	(Forint/gigajoule)		%	%			
Coal	160	47	30	50	67	84	100
Gasoline (ft/liter)	10	24	230	At or above 100			
Heating Oil	129	278	180	At or above 100			
Natural Gas	132	100	72	90	100	100	100
Electricity (Day)							
Budapest	958	347	36	57	71	85	100
Other Large Cities	958	472	49	62	75	87	100
Other Urban Areas	958	569	59	80	100	100	100
Rural Areas	958	681	71	85	100	100	100
Electricity (Night)	362	250	69	85	100	100	100
District Heating ($Ft/dm^2/y$)	106	34	32	52	68	84	100

Source: WB – Energy Development and Conservation Project

(a) Economic prices estimated as follows:

Coal: Production cost for high quality consumer coal. The economic price of coal will be reviewed under the forthcoming coal study to be commissioned by the Government

Heating Oil: International Rotterdam fob prices

Natural Gas: Based on cif Algerian LNG '(to France) of Ft '3,315 per MCM plus '40 % distribution cost

Electricity (day): Industrial low voltage tariffs

Electricity (night): Industrial night tariff average. (The regional and day/night tariffs for consumers are subject to further study)

District Heat: Price required to cover full costs

n.a.: Not applicable since prices are already above economic costs

3. *TRENDS AND ISSUES*

3.1 Forecasts/Scenarios

In the report to the parliament by the Minister of Industry presented on 17 November 1989, the basic scenarios for the development of the energy sector are described. The main issues of future disposition are the coal mines and the structure of the power generation capacity. Although the government has changed, it is assumed that the analysis underlying the Minister's presentation is still valid and the situation the same. The World Bank has made projections of the future oil and gas production indicating basically that the production of oil and gas will decline without increased efforts in the area of prospecting and enhanced recovery of the resources. In both of these points the World Bank is advising the OKGT and projects are underway.

3.2 Policy

Up through the 1970s, government policy, including low energy prices, encouraged energy intensive industrial investment and thus high energy demand growth. The resulting demand was met through expanded energy imports from the Soviet Union coupled with large investments for increasing the electricity generation capacity and domestic production of primary fuels.

Since the second oil price shock, Hungarian energy policy has aimed at reducing the dependency on energy imports. The main objectives were the enlargement of coal production and the stabilization of oil and gas extraction. Considerable funds were invested to meet these targets

Government policies to encourage energy saving were formulated in 1980 and are still effective today. Special tax treatment for investment in energy saving equipment was terminated in 1988. Up to the beginning of 1989 there were tax incentives and low interest loan for energy saving measures. These were canceled because now all investments should have equal priority only depending on the profitability.

The government's present economic program (taken over from the previous government as mentioned above) for the next decade aims at an imcome elesticity of demand for energy far lower than it has been in the past, in order to keep investments within the macro-economic investment capabilities of the country. At the present time there are several critical issues for the energy sector:

- how to contain the growth of energy demand (especially for electricity) to a level that can be met with the limited investment resources available to the sector
- how to price energy carriers (especially oil and coal) among alternative users and provide for appropriate levels of interfuel substitution in each energy using sector
- how to determine and adjust the least cost investment program in the power sector to meet the expected growth in electricity demand
- how to strengthen the institutions that produce energy, so that they can improve their ability to plan and implement economic least cost investment programs (World Bank,Hungary; Energy Development and Conservation Project)

3.3 Problems

The main problems and challenges of the Hungarian energy sector can be summerized as:

- Need to restructure the sector according to the new economic priorities and to provide incentive structures of economic operation of the sector
- Need to adjust prices to promote efficiency
- Need to reduce the import dependency especially the one-sided dependency on Soviet supplies
- Need to stabilize domestic energy production at an economic level sustainable for the future
- Need to connect to west European energy systems and to move into the mainstream of western technology Know-how
- Need to improve management of the energy sector institutions.

Regarding restructuring of the energy sector as part of the economic reforms, several points can be made.

Beginning 1 January 1991, trade with the Soviet Union and other Eastern European countries will be in convertible currency. At this time there will be no more government revenue from special taxes in the energy sector. At the same time the investment funds reallocated to the energy sector will also be reduced. In other words the entire process of funding the government budget and the energy sector will be changed in a short time.

The question of the final structure of the electric power sector is not yet answered. The Ministry of Industry and TRade is looking at several models of electric utility organization and regulation including several examples from EC countries (e.g. British Energy Act). There will apparently be several regional utilities in the future. Whether or not the generation, transmission and distribution will be separated is not decided.

The fate of the coal mines is closely connected to the supply of the power stations. Mining is in deficit and power plants are making profits, so that it is being discussed whether the two could be brought together to form viable units.It is quite clear that there will be a number of mines closed. It is being discussed on what basis the prices in this sector are to be made. British Mining Consulting is preparing an expertise on the competitiveness of the mines. Right now, the government is considering a solution in the direction of the british system (without support from the government as in Germany).

Some of the main Problems in the electricity sector (MVMT) were discussed briefly during the mission. A more detailed analysis of the sector is necessary.

Planning capabilities (and management systems) are missing. Planning tools are available, for example WASP, but there is no integrated planning process. Different aspects of the planning process are treated independently.

One reason for this is the fiscal system which eliminated the incentives for proper planning through the imposition of special taxes and the fiscally determined upper limits to profits for the MVMT. Changes in the system are pending, but the outcome of the changes are not known. Managment of MVMT is trying to keep their chairs.

Economic knowledge is missing. The enterprise will have to adjust to the new economic conditions. For this, they will have to base decisions on market–economic considerations. They are not prepared for this. Training and guidebooks are necessary to convey knowledge in the area of project assessment, planning, etc. Organizational consulting would also be important once the transitional period is over in order to integrate the planning process and decision making. The period of complete uncertainty is expected to last at least 6 months.

Energy Conservation is an important option to reduce the need for new capacity. In general, the problem with energy saving investments at the consumer is that the interest rate is very high (about 35%). The inflation rate is expected to be above 20% this year.

The World Bank loans administered by the Hungarian National Bank have met the problem that 19 firms with accepted investment projects have declined to go ahead with the investment because of the uncertainty of the future economic development.

3.4 Environment

The main environmenal problems caused by the energy sector are the air pollution from power plants and transport and environmental damage caused by the oil and gas industry. Some aspects of the environmental problems are covered by the PHARE grogramme

- Coal quality (SO_2, NO_x and Fly Ash). is major problem. Energy conservation could aleviate the environmental problems.

The PHARE programme includes rehabilitation of two power plants resulting in lower air pollution and using Hungarian technology.

- Air quality in the urban areas due to vehicles (transport energy) is another problem.

A catalyzer programme is part of PHARE. It covers research of the best catalyzer types for vehicles including 2–stroke motors, which are common and also policy issues. Project was suggested by Ministry of Transport, Telecommunication and Housing. At the Commission, Mr. Naqvi and Mr. Broekhuisen are responsible.

Regarding major energy related environmental problems at the consumer side the Ministry of Environment mentions the cement factories having serious SO_2, NO_x and sometimes dust problems. In addition, air pollution of chemical plants is a problem and there are apparently serious problems at the refineries according to the OKGT.

Environmental Problems in Refinery Area

Danubian Oil Refinery was built about 30 years ago in a time when environmental considerations were not discussed. Pollution of the soil was the main environmental damage as a result. In the meantime a system for waste water collection and treatment has been built but the system is not up to capacity presently.

The three main environmental problems at the refinery are:

- prevention of soil pollution
- protection of ground water
- waste water treatment

furthermore,

- the application of toxic materials in products, for example tube oil (phenols, cyanide pollution) are problems for later treatment
- air pollution.

For each of these topics the refinery has elaborated a proposal which was presented to the EIB on 22.2.1990. The most difficult and serious problem is the ground water pollution.

4. PROPOSALS FOR COOPERATION

4.1 Counterpart Evaluation and General Recommendations

Hungary has a well educated work force and capable engineers and technicians. In industry government policy has prescribed a certain level of energy awareness and in large firms there are energy managers. The Energy Efficiency Office is adequately staffed and the AEEF has a team of energy auditors. The Hungarian engineers, for example at EGI, hve a certain amount of foreign experience and Hungarian machine engineering industry has had some success in exporting its products. All in all the technical basis for cooperation is very good.

The main deficit of hungarian engineering is that the access to information about the newest technology is difficult. Getting information is time-consuming and arduous. For example, the western professional journals are available in Hungary, but due to the language barrier more time-consuming to digest. Presently there is a trend to cut these types of costs due to foreign currency problems. Western suppliers often do not answer to requests for information about products or equipment because they do not believe that there is a serious interest. It is difficult to get quotations from western companies.

For these reasons it is encouraged:

- using Hungarian engineers (for example, for energy audits)
- working together with Hungarian engineers and firms
- getting rid of the information deficit
- give the Hungarians information about the experiences made in the Western European countries
- information (for example, in seminars) should be to specific problem areas or specific technology topics (state of the art of ...)
- help Hungary to decide on advantageous Technology Transfer. For example, Hungary must improve electric motors or they will fall out of the market for many machines. How can Hungary get this technology?

Recommendations

Next to the results of the analysis of the energy situation in Hungary, there are three important considerations influencing the recommendations for cooperation with Hungary in the energy area.

High qualification of Hungarian experts
Institutional uncertainties
Activities of other donors

These considerations result in the requirement to select very carefully the scope and depth of any cooperation scheme to meet the specific needs of the Hungarian energy sector.

The deficits to be noted in Hungary are:

- knowledge of the experience made in the EC in energy economic issues
- knowledge of the state-of-the-art of energy technology available in the EC
- management skills and methods
- ways and means of evaluating and financing projects.

Regarding the fields of activities for cooperation with Hungary, three can be named:

- energy conservation and management
- energy planning and pricing (selected issues only)
- gas interconnection with western Europe (only in connection with the other central and east European countries).

4.2 Energy Efficiency Improvements

Energy efficiency improvements are a problem. There need to be some supporting measures (next to the price adjustments).

Ministry of Industry and Trade would be interested in experience form western Europe regarding such supporting measures (policy level). The trend is towards equal treatment of all sectors, e.g. no special government actions (low-interest rates for energy conservation etc.) for energy. The situation is similar to the one of western Europe after the two oil price crisis: rapid increase of energy prices and necessity of industry to adjust.

In this area the ministry would be interested in seminars and studies reflecting the western European adjustment and government policies to cope with the energy crisis. Specifically, there is interest in Consultations regarding legal and administrative measures taken: for example, minimum insulation levels for homes, district heating programmmes.

The cooperation with the Energy Efficiency Office seems to be a good focal point for this type of support. The EEO is adequately staffed and well established, being founded in 1984. It has the necessary institutional support and infrastructure. It is recommended, however, that the level and type of expert services and projects (like seminars) be very critically watched by the Commission and that other institutions be involved or allowed to participate (for example, EGI). In this way a better spread of Know-How can be achieved.

4.3 Pricing

Ministry of Industry and Trade is interested in knowing some details of the tariff process, for example:

- What cost elements are in the prices in Western Europe
  - environmental protection
  - compensation for unplanned outages.

- Pricing of Electricity and the Aluminium Industry. Relationship between electricity rates and profitability of the alu-industry in EC countries. Experience of pricing electricity for the Alu-industry in EC-countries.

- Basic pricing principles for energy intensive industries. Optimal pricing systems for gas and electricity, Customer specific price differentiation. Sonderverträge. This is an overall problems encompassing the questions regarding the aluminium industry.

4.4 Gas Supply and Interconnection

Integration or optimization of the international long-range gas pipeline network, mainline west or the trunk line to Italy is an area of cooperation in which the CEC could provide high level experts. However, it should be noted that the World Bank is very active in the oil and gas area and that any cooperation in this area should be carefully coordinated with other donors. Also the middle and east European countries are themselves coordinating the efforts in this direction. There is a good possibility to coordinate these activities and to provide assistance to several of the countries at the same time.

The goal of possible interconnection schemes is the diversification of supply (not primarily pricing or cost issues or currency needs). There are two possible approaches:

- gas from the Mediterranean Region (Algeria)
  pipeline through Italy
  LNG
- North Sea gas

Algerian gas

Preliminary feasibility studies are being prepared with World Bank cooperation. Different versions have mainly different time-horizons. The Italian pipeline is being expanded and will be operable in 1994. LNG needs 6-7 years from time of decision. The disadvantage of the Algerian gas option is the uncertainty of the price.

North Sea gas

Connection to the western European gas network will take about 1 to 1.5 years to implement. The price for North Sea gas is well defined. However, questions such as details of the spot purchases from western Europe and other question about contracting for supplies etc. could be supported by high-level experts (same or similar issues as CSFR). These issues have been discussed with EID.

This policy of diversification of gas supply will have priority in the future. These projects will presumably be supported by the World Bank. For short-term solutions, such as a 100 km section of pipeline (costs: 100 million US$) to improve the connection to the main pipeline, CEC support would be welcome (feasibility studies).

4.5 Energy and Environment

Environmental Projects have been defined in the PHARE programme. A possibility for further involvement is in the area of environmental aspects of oil refineries. Information and experience regarding environmental protection measures, investments required, Cost-Benefit-Analysis have been mentioned by Ministry of Industry as possible areas of interest for EC cooperation. 4 proposals have already been drawn up and presented to the Group of 24.

4.5 Poland

Poland

A Survey of Energy Issues
and a Proposal for Cooperation with the
Commission of the European
Communities

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Poland

I. THE GENERAL ECONOMIC SITUATION

I.1. INFLATION AND ECONOMIC STAGNATION IN THE EIGHTIES

A. The polish economic crisis of the last ten years has been characterized by sustained inflationary pressures, cumulatively rising external indebtedness and stagnant economic output.

While in the 1970s open inflation was low and shortages intermittent and partial, the 1980s brought about persistent generalized shortages and/or much faster open inflation.

The rate of inflation was 7 to 8% in 1988. In 1989, it accelerated, resulting in an annual rate of 740% for 1989.

B. Real output over the last 10 years has stagnated : after the drastic fall of 1980-82, the levels formely achieved were recovered fairly rapidly. Consumption per head over the last ten years has fallen by about 10%, due to the population growth and the slower growth of distributed relative to produced income, being partially offset by the reduction of the investment over the period. By mid-1989, there was a deterioration of economic trends : in September 1989 with respect to September 1988, industrial output was dow 6%, food processing down 17%, grain procurement down 28%, meat procurement down 34%.

C. In the last five years, the hard currency trade surplus have been insufficient to service a net debt in convertible currencies standing at 39.2 billion US$ at the end of 1988, with most interest being unpaid and capitalized through rescheduling agreements or de facto. At the end of 1989, the total debt exceeded 40 billion US$.

D. An important structural feature of the Polish economy is the large size of hard currency holdings in the hands of the population, about 5 billion US$ in deposits with State banks and an estimate 4 to 8 billion US$ in bank notes.

E. Until the end of 1989, the free market exchange rate was a multiple of the official rate. On January 1st 1990, the official rate of exchange of hard currencies was raised to the free rate lev

I.2. THE ECONOMIC REFORMS

A. Since 1981, the Polish economy has introduced various measures of economic reforms - a process which, after the initial reverseal, continued even under martial law. Among achievements of the previous government, one can list : the dismantling of central planning procedures, the abolition of branch ministries now merged into a single Ministry of Industry (responsible for energy), the substantial retention of foreign currency earnings by exporters to finance imports or for free sale, resale, etc.

B. Against the catastrophic economic background of year 1989, the new Solidarity-led government coalition (M. Mazowieski as Prime Minister) which took power in mid-September 1989 adopted a drastic stabilization programme backed by an IMF standby agreement and other sources of international finances.

C. This stabilization programme or "Balcerowicz Plan" after the name of the Minister of Finances, was adopted at the end of December 1989, with effect from January 1, 1990.

The main measures of this plan are the following :
a) Budgetary cuts : abolition of subsidies and reduction of budget deficit.
b) Almost complete price liberalization, except for a very small number of goods (including energy).
c) Extremely mild wage indexation (30% of inflation in January to February 1990 ; 20% in March and April ; 60% from May to December).
d) Exchange rate unification (1 US $ = 9500 zlotys) and zloty convertibility for current transactions.
e) Opening of discussions for privatization.

As a result, inflation took place in January at the monthly rate of 75% but then decelerated and fell to single digit rates in March and April. The new nominal exchange rate is being maintained. Real wages have been falling in January by the full amount expected for the whole of 1990. One can say that the fight against inflation has succeded until now.

I.3. A GREAT DEAL LIES AHEAD

The Polish government, under the pressure of the IMF, has put the end of inflation as their primary and only concern of economic policy for the first part of 1990, assuming that the population will accept the related sacrifices. At this stage, the government reform is of monetary inspiration. The main economic reform remains to be done by restructuring the industry and giving an impulse to new activities.

In the industrial sector, the coal industry and the "heavy" industry (steel) play an important role, in particular in the coal mining regions (Silesia). The stabilization programme will lead to economic improvement only if this restructuration succeeds, which means a fast decrease in these industries, and in particular in coal mining. This will lead in turn to mass unemployment if careful workers conversion measures (long and difficult) are not taken. Unemployment will be regionally and sectorally concentrated and therefore politically dangerous.

Such trends obviously strengthen the case for external aid,in order to ease the hardship of transition to a new political and economic system.

II. THE ENERGY SYSTEM

The Polish energy system is dominated by the production and use of hard coal and, in a lesser degree, lignite, not only at the primary energy level but also in the final consumption. The structure of the Polish energy system reflects the structure of proven energy resources, apart from geothermy which is abundant and not yet utilized.

The coal-oriented structure of primary energy was formed in Poland many years ago when coal was rather easily accessible in continuously increasing volumes of production, which was forced in turn by the development of energy intensive industrial production (steel industry). Due to increasingly difficult mining conditions, the high quality coal is rapidly becoming a high-cost coal. The future of the coal industry is one of the major problems faced by the Polish economic and energetic policies.

II.1. PRIMARY ENERGY : RESOURCES, PRODUCTION, CONSUMPTION

A The Energy Resources

The most recent data delivered by the Ministry of Industry*, responsible for energy, are given in Table II.1.

Table II.1. The Energy Reserves (1988)

Energy Sources	Physical Units	Proven		Probable
		Total	Recoverable	
Hard coal	1 million ton	63 800	28 700	100 500
Lignite	" "	13 000	11 700	10 000
Crude oil	" "	3,8	2,0	-
Natural gas	1 billion m3	163	130	655

Hydropower :
. Economically and technically recoverable potential : 12 000 GWh
. Share of this potential harnessed by 1988 : 13%

Source : Ministry of Industry (ECE information sheet)

Note : The geothermal potential of Poland is high and rather completely known. The reserve of exploitable geothermal water represents an amount of heat equivalent to 7.8 x 10 9 tons of coal (Source : Prof. Sokolowski). There is however no development at present but the interest in geothermal energy is emerging.

B. The Primary Energy Production

Poland is the fourth largest hard coal producer in the world, ranking after China, the United States and USSR.

The oil production is negligible ; that of natural gas and hydroelectricity very low.

* means that the attached organization or person has been personally met by the author of this report.

Table II.2. Primary Energy Production in 1988

Hard coal	193 Mt
Lignite	73 Mt
Crude oil	0.1 Mt
Natural Gas	4.7 billion m 3
Hydroelectricity	4 TWh

While hard coal production has stabilized since 1980, the lignite production has doubled. The hard coal production comes almost exclusively from Upper Silesia. 28% of current hard coal production is coking coal. A third of the lignite production comes from the opencast mine of Belchatow (130 km south of Warsaw, open in 1975) ; 90% of its output is burnt in a 4 300 MW power plant next to the mine (the biggest coal-fired plant in Europe). Polish hard coal is of rather good quality. However it is difficult to mine. Average deposit depth is 600 m and increases by 8 to 10 m per year.

Investment in Polish coal supply industry grows due to many factors : building a new mine is extremely capital intensive ; shift to poorer resources brings to the multiplication of material and labour expenses (more energy and material intensive techniques are employed to go deeper with the excavation of coal). The productivity of underground mining in terms of tons per manshift has decreased by 25% from 1978 to 1988 (A. Spilewicz), in spite of good performance in the largest mines. Polish coal mining absorbs a growing share of the national steel production (7% in 1978, 19% in 1985). A number of mines (15 to 30 Mt) will have to be closed in the next ten years for global productivity reasons.

Table II.3. Steel Deliveries in percent of Total Steel Output (A. Spilewicz)

	1978	1985
Fuel mining	7.3	19.4
Electricity & water supply	1.4	3.2
Autoconsumption of steel mills	12.3	22.5
Others	79.0	54.9

Nuclear Energy :

Construction of the first nuclear plant was started in 1981 at Zarnowiec, near Gdansk. It consists in two Soviet design VVER (PWR) reactors of 440 MWe each. At the end of 1989, the project was said to be 40% complete.

The Polish Council of Ministers ordered at the end of December 1989 a year-long halt of the construction. The main reasons for this decision are the lack of capital (and the need to direct the few new investments to more productive activities), the lack of safety of the Soviet technology, the public and scientific criticisms due to nuclear industry risks and hazards.

C. The Primary Energy Consumption

The primary energy consumption reflects the national energy resources : in 1988, coal and lignite represented respectively 68% and 11% of the total. The shares of oil and natural gas remain very low (14% and 7% in 1988). The coal oriented structure of primary energy consumption has many disadvantages such as high-capital and energy-consuming for the production itself and high energy-consuming for transportation.

Table II.4. Primary Energy Consumption

	1978			1988		
P Energy Sources	Phys.units	PJ*	%	Phys.units	PJ*	%
Hard coal million ton	153	3336	70	160	3520	68
Lignite million ton	41	324	7	73	577	11
Oil and derivates million ton	19.8	812	17	17.4	713	14
Natural gas billion cubic meter	9.4	314	6	11.7	391	7
TOTAL	PJ 4816 Mtoe 116.6				5201 125.9	100

Source : A. Spilewicz (1989)

Energy Conversion Factors (1988)

Hard coal : 22.0 GJ/t
Lignite : 7.9 GJ/t
Coke : 26.4 GJ/t
Oil : 41 GJ/t
Nat. Gas : 33.4 GJ/1000 m3
Oven gas : 16.7 GJ/1000 m3
Electricity : 3.6 GJ/GWh

1 GJ = 1 gigajoule = 10 9 joule
* 1 PJ = 1 petajoule = 10 15 joule

1 tce (ton of coal equivalent) = 29.3 GJ
1 toe (ton of oil equivalent) = 1.41 tce

II.2. THE ENERGY TRADE

A. Top priority was given to hard coal output to meet internal demand and to acquire hard currency. About 30 million tons of the best quality coal is directed for sale to the convertible currency zone.

Table II.5. Polish Hard Coal Exports (Mt)

	Total	Eastern Europe	Others (OECD)
1980	31	11	20 - (19)
1984	43	18	25 - (23)
1985	36	15	21 - (19)
1986	35	17	18 - (15)
1987	31	14	17
1988	32	14	18
1989	28	14	14

The coal export decreased regularly after the record year 1984. This decrease is due to the increase in domestic demand in parallel with the stabilization of production. These exports represented 25% of the currencies gained in 1975, 20% in 1985 and only 12% in 1987.

B. Crude oil (14 million tons in 1988) and natural gas (7 billion m3 in 1988) are imported from the Soviet Union. The main pipeline for gas imports runs 26O km from Bielorussia to Warsaw.

C. The electricity trade is almost in equilibrium, with roughly 2 TWh of net imports.

Table II.6. Electricity Trade (TWh - 1987)

Total Imports	10.4
from USSR	3.8
other Eastern Europe	0.9
on a swap basis	5.7
Total Exports	8
to USSR	0.5
other Eastern Europe	0.9
other Europe	1.6
on a swap basis	5.7

D. Poland is now becoming a net importer of energy. In 1988, imports totalled 25 Mtoe of crude oil, oil products and natural gas, while exports reached 20 Mtoe of coal and coke. Until now, Poland is still a net exporter in direction of OECD countries (hard currency area).

II.3. THE TRANSFORMATION SECTOR

A. Hard coal accounts for 64% of total electricity generation and the remainder is about entirely from lignite (3% from hydro).

Table II.7. Electricity Production and Transport

	1980	1988
Total Gross Capacity (GW)	25.3	32.1
. public power stations	22.3	28.9
. self-producers	3.0	3.2
Net Electricity Production (TWh)	121.9	144.3
. public power stations	111.5	135.9
- thermal	97%	97%
- hydro (+pumping)	3%	3%
. self-producers	10.4	8.4
Number of Power Plants		
- thermal	58	54
-hydro	117	119
Fuel consumed by Public Power Plants		
Hard coal (10 6t)	59.0	58.0
Lignite (10 6t)	33.7	70.5
Liquid Fuel (10 6t)	1.0	0.5
Gas (10 6 Nm3)	0.03	0.02
High Voltage Network (10 3 km)		
750 kV		0.1
400 kV		3.8
220 kV		8.2
110 kV		29.6

N.B. The distribution losses are estimated at 11% of net production.

B. Table II.8. Heat Production by Power Plants

	1980	1988
Total Production of Heat (PJ)	217	248
. in combined production	125	152
. in separate production	92	96

C. The refinery capacity is about 17 Mt per year, mostly concentrated in the refineries of Plock (13.5 Mt) and Gdansk (3 Mt).

D. Secondary gas in the form of coke oven and blast furnace gas plays an important part in the Polish energy system.

II.4. THE FINAL ENERGY CONSUMPTION

A. Table II.9. Final Energy Consumption by Energy Product

	1978			1988			
	Phys unit	PJ	share %	Phys unit	PJ	share %	ratio 88/78 %
Hard coal (10 6t)	84.0	1848	50.3	75.0	1650	46.1	89.3
Coke (10 6t)	18.4	486	13.2	14.5	383	10.2	78.8
Coke ov. gas (10 9m3)	4.9	82	2.2	3.4	57	1.6	69.5
Natural Gas (10 9 m3)	8.4	281	7.7	10.6	354	9.9	126
Liquid fuels (10 6t)	11.7	490	13.3	12.0	503	14.1	103
Electricity (TWh)	84.2	303	8.3	107.0	385	10.8	127
District heat (TWh)	50.3	181	4.9	69.0	248	6.9	137
Total		3671 Mtoe 88.8	100		3580 Mtoe 86.7	100	97.5

The total final energy consumption has slightly decreased from 1978 to 1988. This phenomenon has been more acute in 1988-89 due to economic depression.

Hard coal represents 50% of the final consumption, while the shares of liquid fuels (oil products) and gas remain low (natural gas consumption increased by 26%).

The electricity and heat consumption have increased by respectively 27% and 37% over the last ten years.

B. Table II.10. Final Energy Consumption by Sector and Product (PJ)

	1978	1988	share in 1988
1. Mining	124	138	3.8%
of which hard coal	88	88	
liquid fuels	8.5	13	
electricity	27	38	
2. Industry	1602	1452	40.6%
of which hard coal	703	637	
coke	316	266	
coke oven gas	65	26	
natural gas	224	244	
liquid fuels	122	84	
electricity	144	157	
district heat	28	38	
3. Public Transport	222	149	4.2%
of which hard coal	86	42	
coke	5	5	
liquid fuels	117	84	
electricity	14	18	
4. Domestic and Tertiary	1723	1841	51.4%
of which hard coal	969	881	
coke	164	111	
coke oven gas	17	17	
natural gas	57	110	
electricity	120	173	
district heat	152	226	
Total PJ	3671	3580	
Mtoe	88.8	86.7	100%

The importance of the industrial sector is expected for. The decline of energy consumption in this sector is mainly due to economic recession but it will be confirmed certainly during the next decade by the structural shift from energy intensive industries to light industries with higher added value.

The following table shows the share of each industrial branch in the total energy consumption of the sector.

Table II.11. Energy Consumption in Industry (1988 - %)

Iron and steel	31.1
Non ferrous metals	3.8
Engineering	8.8
Minerals	12.5
Chemicals	26.6
Paper, pulp, wood	5.6
Textiles, etc.	4.5
Food processing	7.1

II.5. GLOBAL ENERGY CONSUMPTION INDICATORS

Two global energy consumption indicators are relevant to characterize the energy consumption of a country, its evolution with time, and to compare it with that of other countries : the energy consumption per capita (primary and final) and the energy intensity, ratio of the energy consumption (primary or final) to the gross domestic product (GDP).

Table II. 12. Energy Consumption per Capita and Energy Intensity

	1978	1988
Population (million)	35.0	37.8
Primary energy consumption (Mtoe)	116.6	125.9
Pr. En. Cons. per capita (toe)	3.33	3.33
Final En. Consumption (Mtoe)	88.8	86.7
Final En. Cons. per capita (toe)	2.54	2.29
GDP per capita (1986 US$) (1)	2285	2070
Primary en. intensity (3)	1.46	1.61
Final en. intensity (3)	1.11	1.11
GDP per capita (1980 US$) (2)	4684	4258 (5)
Primary en. intensity (4)	0.71	0.78
Final en. intensity (4)	0.54	0.54

(1) World Development Report, World Bank
(2) GDP calculated with purchase power parities, PPP (CEPII)
(3) toe/1 000 US$ of 1986
(4) toe/1 000 US$ of 1980 (PPP)
(5) 1987 value.

A. The energy consumption per capita of Poland is of the order of magnitude of that of the Western European countries (primary energy consumption per capita is 3.2 toe for France and 2.4 for Italy).

B. Even taking into consideration the effect of more drastic climatic conditions, the energy intensity (primary or final) is much higher in Poland (as in other Eastern European countries) than in Western European countries. If we use the energy intensities calculated with the purchase power parities equivalence (PPP, coefficients taken from the French Institute CEPII), the Western European primary energy intensities are of the order of 0.4 compared to approximately 0.8 for Poland.

High energy intensity is associated with the structure of the industrial activities, the primary energy input, the low efficiency of the production and transformation sector (energy consuming coal mining and transportation, rather low efficiency of power plants, heavy losses and energy consumption in the transportation and distribution system).

But the main factor of the high energy intensity is the inefficiency of energy use :
. loss of heat in the district heating network
. badly insulated buildings
. low efficiency residential furnaces (about 30 Mt of coal burnt in residentail furnaces is utilized at an efficiency of about 20% or less)
. low efficiency cars, trucks, buses
. old factories, with obsolete processes and high heat losses
The potential for energy efficiency improvement is enormous.

II. 6. THE ORGANIZATION OF THE ENERGY SECTOR

The Parliament elected in June 1989 and the present government are undertaking political, economic and social reforms. Among them is the entire reorganization of the energy sector : work is underway in various commissions and the new organisation will emerge in September 1990 after approval by the Parliament. The present trend of thought of the Commissions is to decentralize the energy system and to privatize some of its components. The implementation of these reforms is hampered by the inertia of the old system and the lack of knowledge which managers and engineers have to acquire under the new system.

At present, the energy sector is under the responsibility of the Minister of Industry (M. Syryjczyk), Energy and Fuel Department (director : Dr. Kazimierz Adamczyk*), also in charge of energy conservation (M. Zawadzki*).

The electric power industry has five regional production and distribution enterprises. They all belong to a national dispatching network with its center in Warsaw (director : M. Krystof Lipko*).

The coal sector is organized in five "multi-establishment coal mining enterprises" and three specialized coal agencies "Polmag Emag" for mining mechanization, "Kopex" for overseas mine construction and "Weglokoks" for coal marketing on the national and international market.

Various Institutes of the University and the Academy of Sciences are very active on energy planning and forecasting methods. Among the prominent scientists in this field are Prof. A Spilewicz* (Academy of Sciences, member of the economic council of the government), Prof. Bojarski* (Academy of Sciences, head of the Department of Energy Problems), Prof. Ney (head of the Institute for Energy Research Methods), Prof. Michna.

All nuclear issues are under the responsibility of the "National Atomic Energy Agency", the recently appointed President is Dr. Roman Zelazny*.

It is of the greatest importance to follow the reorganization of the energy sector and to know the structures (and the people) which will emerge after the September 1990 reform.

III. TRENDS AND ISSUES

III. 1. ENERGY ECONOMICS

A. Investments

Given the importance of domestic and exported energy, investment in the energy sector takes an important part of total investment in the national economy. This share has remained unchanged at 11% between 1980 and 1987. When related to industial investment (including energy), it decreased from 36% to 34% over the same period (still a very high proportion).

The share of the electricity sector in total energy investment is continuously increasing. This not only reflects the growing share of electricity in total energy consumption but also the growing capital intensity of modern power stations (in particular if nuclear was to be continued). In 1980, Poland spent 41% of all energy investment on electricity. In 1987, this was already up to 52%.

B. Subsidies

Subsidies to entreprises for consumer goods and services were, in the years 1983-89, very large, equal to about 10% of GDP or about 20% of the government's total expenditures ; as such, they equalled the combined expenditure on health services and education (S. Gomulka). These and other officially reported subsidies accounted for about one third of total government expenditure. This an extremely high ratio by international standards due to administered prices at the consumer level.

Following A. Spilewicz*, subsidy rates for 1987 addressed to the main energy products amount to : coal 49%, gas 83%, elecricity 27% of their prices.

In the 1990 budget, there is a substantial reduction of subsidies (compared to the last 1989 budget) from 14.2 to 6.2% of the GDP, due in part to large rises in the consumer prices of energy products in January 1990 (coal prices by 400% to industrial users and 600% to households and electricity prices by 300%). We shall see below that the improvement in the government budget as a result of these changes is largely illusory.

C. Prices

Even before the inflation which started in 1988, the domestic prices of all important fuels were much lower than their comparable border prices at any plausible exchange rate. In addition, the ratios of border to domestic prices differ greatly between fuels.

In 1987, the ratios of border to domestic prices for industrial purchasers are estimated (G. Hughes) to have been approximately 3 for coal and electricity, 2 for gas and 1.5 for petroleum products when calculated using a conservative estimate of the shadow exchange rate for the period. For commercial and residential users, the equivalent ratios of border to domestic prices were 4.2 for coal, 13.3 for electricity, 8.7 for gas, 1.3 for heating oil and 9.6 for district heating. These figures reveal massive distortions in the relative prices of different fuels accross the different categories of users.

During the second half of 1989, rises in energy prices lagged behing the general level of inflation, so that one can estimate that the large increases which were implemented at the beginning of 1990 simply represented a return to the pattern of domestic energy prices relative to border prices that had prevailed before the inflation period.

Petroleum products, notably gasoline and diesel fuel are an exception to this pattern in the fact that the gap between domestic and border prices has now been eliminated and the government has removed all control from their prices.

However, the main concern focusses on coal, electricity and district heat prices, which are still estimated to be set at about one-third of the comparable border prices (or long-run marginal cost in the case of electricity and district heat).

The pricing of gas also presents difficulties for the future because of the move towards hard currency pricing of gas imports from the Soviet Union in 1991.

The fact that the price increase is mostly compensating the 1989 inflation shows that the improvement in the government budget as a result of these price changes is largely illusory except to the extent that households find themselves paying higher prices for coal, electricity and district heat. The rest of the burden of the price changes has the effect of reducing the surpluses of the enterprises or increasing their deficits and those of local authorities and other public bodies. Since the government is the residual claimant/payer for those surpluses and deficits, the price change simply redistributes parts of the overall coal sector deficit, i.e. the difference between the prices paid by purchasers and the cost of producing coal - from one branch of the public sector to other branches.

The elimination of the price distortions of energy products at consumer level must be one of the main objectives of the general pricing policy of the government in order to provide a more appropriate balance between different fuels and facilitate the implementation of an energy conservation policy. But the magnitude of the distortions and the perceived impact of enrgy price increases on the general price level means that the political costs of rapid adjustment are high. Furthermore, the implementation of a cost-based price policy by the government is not sufficient : fundamental changes are required in the structure and operation of the coal mining industry.

III.2. THE ENVIRONMENTAL PROBLEM

The current environmental stresses due to the Polish energy system and the growing awareness of environmental issues at all levels (government, parliament, scientists, public at large) of the Polish society are certainly, with the economic situation, the major driving force for a new energy policy.

A.SO2 Emissions

Poland is amongst the largest SO2 polluters in Europe. Its high coal consumption in outdated coal-burning equipment and its lack of desulphurization equipment have produced a high level of SO2 pollution.

Table III.1. Energy Consumption and SO2 Emission (1985)

	Energy Cons. (Mtoe)	Coal Cons. (Mtoe)	SO 2 Emis. (Mt)	SO 2 per toe of en. cons.	NOx (Mt)
Poland	127	102	3.2	0.025	1.3
W. Germany	269	81	2.6	0.01	

B. Coal Mining and Environment

Coal production constraints are both physical and environmental. One major fact is the depth of coal deposits in Upper Silesia (98% of output). Average depth is now about 600 meters and increasing by 8-10 meters per year which could rise considerably the costs of future workings with over 40°C rock temperature which require cooling and reduction in working time. Over half of mines have serious rock-burst conditions and are very gassy (degassing rates up to 120 cu.m/t) with associated decrease in productivity and increase in explosion hazards. Some mines have problems with gas and rock outbursts and water interruptions.

Upper Silesia is a densely populated and industrialized area. About 30% of coal production comes from safety pillars under industrial and communal installations. It necessitates expensive measures like hydraulic or pneumatic back-filling and coordinated advance of longwall faces among neighbouring mines. Another environmental constraint to new mine production is the high salinity of mine water and its disposal into rivers. There is a severe shortage of land available for new infrastructure and equally serious for waste disposal. Because of lack of space, some mines are transporting waste rock and washeries refuse for distance up to 80 km for disposal. There is no doubt that all these constraints could become still more severe in the future assuming that the present coal output be supported.

C. CO2 Emissions and the Greenhouse Effect

Among major greenhouse gases, CO 2 has a predominant position in the Polish emission structure. The scale and structure of CO 2 emission is presented in the following table (A. Spilewicz, 1989).

Table III.2. Global CO2 Emissions from Fossil Fuels

	1978	1988
1. Total emission of CO2 (Mt)*	114.5	119.8
from hard coal	86.1	86.2
lignite	7.8	13.8
oil products	16.3	14.4
natural gas	4.3	5.4
2. Percentage of emission due		
to energy transformation	37.8	46.2
energy utilization	62.2	53.8

* carbon content

Remark :
It is remarkable to see that the best quality energy consumption forecast studies have been undertaken as "Scenarios for Energy and Environment Future for Poland", addressing the SO2, NOX and CO2 issues (see chapter III).

III. 3. ENERGY CONSUMPTION FORECASTS

A. The Polish Energy Future

With changes in the political situation, Polish economy is undertaking a deep transformation. Main current objectives of the Polish economic policy are directed towards abatement of high inflationary rates (the "Balcerowicz policy", named after the Minister of Finances), adjustement of prices, restructuration of industry towards less-intensive industries and more value-added ones, improvement of the efficiency of the economic activities... All that should improve both economic results and the environment.

But the energy constraint is so strong for the economic and environmental situation of Poland that a sustainable development - both economically and environmentally - is only possible in Poland if the energy policy is rapidly and vigourously reoriented following two major objectives :

a) Reduction of the energy consumption burden on the national economy by a strong energy conservation policy aiming at increasing the energy efficiency in all social and economic activities.

b) Restructuring energy consumption by interfuel subsitution, in particular an increasing use of natural gas.

Various energy future scenarios have been developed in Poland. The two most interesting ones were presented by Prof. Spilewicz* (energetician from the Academy of Sciences, member of the Council of advisers to the government for economic affairs) and J. Cofala* et al. (M. Cofala is working in the Department of Energy problems, Institute of Fundamental Technology Research, of the Academy of Sciences).

It is worth underlining the fact that these two studies were undertaken as "Scenarios of Energy and Environment Future for Poland" aiming at reducing the SO_2, NO_x and CO_2 emissions in the future.

B. The Spilewicz Scenario

a) The scenario outline

Limited investment outlays does not allow to expand both energy supply and modern processing technology on a scale that ensures efficient performances. There is no doubt that moving forward with growing investments in coal mining and energy generation without noticeable reduction in energy intensity brings no real GDP rise. The energy supply scenario which is envisaged projects therefore no growth in fuel consumption in global terms, but interfuel substitution following a shift towards less material intensive sectors and a contribution of every efficient improvements. Country's economy is viewed to be able to hold its present per capita demand for final energy while maintaining annual growth rate of 2 to 3 per cent in real GDP per capita.

Table III.3. Population and GDP Prospect

	1988	2000	2010
Population (million)	38.0	40.0	41.6
GDP (billion US $)	78.6	105.8	149.2
GDP per capita (US $)	2070	2647	3585

The future energy scenario, according to Prof. A. Spilewicz, must be based on :

- Decline in coal production : it is a precondition for reaching an adjustment between cost and price ; consequence of good quality deposits exhaustion ; an environmental necessity.

- Consistent energy conservation policy in all transformation and consumption sectors ;

_ Increase in natural gas consumption and, at a lesser degree, oil products.

Remark : The nuclear component is excluded in this scenario due to "soaring of construction costs, long lead time, sophisticated operation and maintenance, external debt burden, safety issues and public opposition".

b) Energy Consumption and Supply

Table III.4. Primary Energy Consumption

	Unit	1988	2000	2010
1. Energy Production				
coal	1 million t	193	140	80
lignite	1 million t	73	73	73
crude oil	1 million t	0.1	0.1	0.1
nat. gas	1 billion m3	4.3	5	5
2. Imports				
coking coal	1 million t	1	1	1
oil and derivates	1 million t	18	25	35
nat. gas	1 billion m3	7.5	18	40
3. Exports				
coal	1 million t	32	-	-
coke	1 million t	2	2	-
4. Gross energy consumption (Mtoe)		126	136	132
5. Likely CO_2 emission (carbon content)	1 million t	117	122	109

Table III.5. Final Energy Consumption

		1988	2000	2010
1. By products	Total (Mtoe)	86.7	93.6	86.3
coal	1 million t	75	60	15
coke	1 " "	14.5	10.0	8.0
coke oven gas	1 billion m3	3.4	2.0	1.0
liquid fuels	1 million t	12.0	18.0	24.0
natural gas	1 billion m3	10.8	20.0	33.0
district heat	TWh	69.0	73.0	76.0
electricity	TWh	107	123	175
2. By sectors (Mtoe)				
industry & mining (Mtoe)		39	38	37
public transport (1) (Mtoe)		3.6	4.2	4.9
domestic and tertiary (1) (Mtoe)		44	48	44.5

(1) keeping the same definitions as now.

Gas will complement coal for electricity generation : combined cycle, small scale cogeneration...

C. The Cofala Scenario

This scenario was studied by using the environmental version of the energy model SPSEK-E up to the year 2010. This computer set deals with the evolution of the structure of the economy (model STRUK), the analysis and forecast of the final energy demand including pollutant emissions (model PROSK-E) and the optimization of the energy supply system (DORSEK-E).

a) The scenario outline

Several economic scenarios have been studied. We shall concentrate on the "rationalization" scenario which assumes slow growth rates at the beginning of the period (2.2% per annum) and a faster rate (3%/a) after the year 1995 with simultaneous radical change in production structure : successful pricing and tax reforms, phasing out of outdated energy intensive industries.

b) The final energy demand

The final energy demand resulting from this study is presented in table III.6.

Table III.6. Final Energy Demand until 2010

		1985*	1990	2000	2010
Total	PJ	3396	3589	3853	4433
	Mtoe	82.2	86.9	92.3	107.3
By sectors	%	100	100	100	100
industry		41.4	39.1	34.6	32.9
construction		2.0	1.9	2.4	3.1
agriculture		3.1	2.7	3.1	3.4
transport		6.6	5.9	5.9	6.1
domestic and tertiary		47.0	50.5	53.9	54.4
By energy products	%				
solid fuels		35.8	34.0	25.5	19.9
liquid fuels		13.7	14.4	16.6	18.2
gazeous fuels		11.3	11.5	12.5	13.0
electricity		10.2	11.1	13.1	14.3
heat (district & local)		25.8	25.6	29.3	32.1
others		3.2	3.4	3.0	2.5

* 1985 : base year.

The most important shift in sectorial composition of final energy demand is the increasing share of Domestic and Tertiary sector by simultaneous decrease of the share of industry. There are also substantial changes in the structure of energy carriers used. The share of solid fuels decreases, whereas the shares of other energy products increase (liquid fuels, electricity, heat).

The total final energy demand increases by approximately 30% up to year 2010, compared to the increase in the national income by 90%. The energy intensity of the Polish economy will decrease as a result of closing down obsolete plants, lower growth rates for energy intensive industries. It is also assumed that unit energy consumption in households sector will decrease due to sucessful pricing reform, promotion of fuel-switching as well as enhanced energy conservation also in this sector.

D. Conclusion

The Cofala scenario is more conservative than the Spilewicz scenario. Nevertheless, both of them emphasize the need for restructuring industry, adjusting the prices, accelarating fuel substitution (faster in Spilewicz, with an emphasis on natural gas) and promoting a vigorous energy conservation policy.

Both scenarios aim at driving the Polish energy system nearer to its Western European counterparts.

The main problem remains the speed at which these modifications will occur, which depend upon the avaibility ofcapital for investments in the modernization of the economy.

III.4. ENERGY CONSERVATION

Energy conservation is widely recognized in Poland as the best method to escape the ever increasing burden of energy supply and consumption on the economy and the environment.

The examination of energy conservation in Poland has been conducted in the middle of the 80's. Various energy conservation programmes have been set up at government level, in particular in 1985-86 for the industrial sector, with poor results due to inadequate pricing, lack of incentives, lack of institutional and organisational efforts.

A. The Energy Conservation Potential

The energy conservation potential of the Polish economy has been studied in great detail (particularly by Prof. Michna).

In order to get the evaluation of total potential, separate objectives deduced from about 3 500 measures were collected into groups representing the main industrial branches or activities, both by assessing savings due to reduction of energy consumed and costs of their implementation.

Table III.7. gives the result of this survey as established by Prof. Michna. The energy saving potential is given in Mtoe per year in year 2005, in comparison with the present trend in energy intensity of the various activities.

Table III.7. Energy Conservation Potentials

Option	Mtoe/year up to 2005
1. New industrial technology	2.4
2. More efficient industrial equipment	6.6
3. Measurement and automation	3.4
4. Reduction of losses in energy network	3.6
5. Cogeneration of electricity and heat	1.8
6. Coal quality improvement	3.6
7. Changes in industry structure	4.8
8. Buildings insulation	5.3
9. Heating efficiency improvements	1.4
10. Railway electrification	1.5
Total	34.3 Mtoe

Compared to what has been achieved in most of the OECD countries, these figures seem very conservative but the conditions under which these plans must be undertaken are very different. Nevertheless, they make a good starting point for further calculations, in particular for the industrial sector.

B. The Obstacles to Energy Conservation

The obstacles to energy conservation in the current situation of Poland are well presented by Prof. W. Bojarksi, head of the Department of Energy Problems of the Polish Academy of Sciences, and Senator.

He sees several barriers to the implementation of an efficient energy conservation policy :
a) structure of costs and prices
b) lack of information (examples, equipment, etc.)
c) lack of efficient equipement and appliances, even for energy consumption measurements and regulations
d) lack of competent engineering companies to implement energy conservation programmes
e) lack of capital for energy saving investments.

C. The Needs for Implementing an Energy Conservation Policy

The technical answers do exist, at least on the international market, for efficient equipment but many savings can be made by low-cost and local means, to achieve a large potential of energy conservation.

The main question remains the amount of human and financial resources which will be allocated to energy conservation and the political will to implement energy conservation policies through institutional, legislative and economic reforms. To describe an optimal sharing of the various responsibilities, one can summarize them in the following way :

a) The State is responsible for the price policy and for setting up a legislative framework in order to encourage energy conservation (regulations, incentives).

b) It is necessary to create an "Agency for Energy Conservation" in charge of programming, coordinating and organizing the implementation of a national programme for energy conservation.

c) It is necessary to promote enterprises for the engineering of energy conservation action : energy audits in the various consumption sectors, technical and economic evaluation of projects, implementation of actual operations, etc.

The first and urgent step, in parallel with the economic reform, is the setting up of the "Agency for Energy Conservation", which among other responsabilities will act as the indispensable focal point of the international cooperation in this field. Regional Agencies should also be created, working in a "network" system with the national Agency.

IV. PROPOSALS FOR COOPERATION

The general analysis of the Polish energy system and its place in the economy presented in the preceeding chapters leads to several guidelines for the cooperation which can be envisaged by the Commission of the European Communities.

A. The Polish economy is rapidly changing. One of the main reforms deals with **the adjustment of prices with the actual cost of production.** This is particularly true for energy products which are at present largely subsidized, even after the sharp increase of the beginning of year 1990. In general, the managerial education to deal with a market economy is lacking among most enterprises staff.

A step of valuable cooperation would be to help the Polish authorities in training for the management of energy companies and to evaluate the pricing policies, as a component of a global energy planning activity.

B. In the same trend of reforms, the energy sector is under strong reorganization. **Decentralization of the energy administration** is part of the general management reforms aiming at more responsibility and independent decision-making at the plant level. New accounting schemes are elaborated to allow the local managers to retain a larger share of their profits for the implementation of their own investment decisions. The energy sector will be decentralized, in particular the electricity sector.

It will be of great interest for CEC to follow these reforms and their implementation and to propose to the Polish government the help of some expertise in the organization of the energy system.

C. One of the most striking evidence which follows the survey of Poland's energy situation is that **it is impossible to separate the energy problem from the environmental issues.** The environmental stresses due to the energy activities (mainly coal mining and coal utilization) are so great in Poland that any energy policy decision must take into high consideration the improvement of the environment.

The environmental constraint emphasizes the importance of a vigorous energy conservation policy, which is strongly supported by the Ministry of Environment and the various ecology movements (in which the scientists are deeply involved).

As a consequence, the CEC cooperation must take as a whole the economic and environmental aspects of modernizing the energy system : the desulphurization of coal-fired power plants for example, has to be a strong component of CEC cooperation in the field of energy.

D. We have seen that **the two main directions of the Polish energy policy,** due to economic and environmental constraints, must be in the future :

a) a vigorous energy conservation policy
b) a more balanced energy supply with a higher share for natural gas and, in a lesser degree for some experts, oil products. This means a decrease of the importance of the coal production and utilization.

These objectives open field to active cooperation.

E. On the supply side, the technological transfer is of utmost importance : there is a need for introducing in the Polish economy clean and efficient technologies.

. power and heating plants with fluidized bed boilers
. steam-gas combined cycle power palnts
. production of synthesis gas based on hard coal gasification
. etc.

One first step of CEC cooperation in this field would be to organize the best **information on the various techniques, their performances and their costs.** A second step could be to set up **demonstration operations** for clean and efficient equipment.

One of the main challenges on the supply side is the increase of the share of natural gas in the Polish energy system. The EEC could propose to the Polish authorities **a joint study** on this problem to exmine the various options for gas import (including LNG from Algeria) and for gas utilization, in particular for the production of electricity.

Concerning renewable energies, there is a considerable field for cooperation in the development of the **geothermal resources.**

F. In the short term, **the main effort of cooperation must be devoted to the implementation of a vigorous energy conservation policy.** The various steps of cooperation would be the following :

a) Help the Polish government to set up an "Agency for Energy Conservation". Dealing with all sectors of the economic and social activities, this Agency should not be restricted institutionally to the energy and industrial sector, but situated at interministerial level or better, at Prime Minister level. Regional Agencies should also be created in the main regions, autonomous from the national Agency and under the responsibility of the Regional authorities.

During their discussions with the Polish authorities, CEC representatives should underline **the necessity of the national Agency as a focal point of international cooperation in energy conservation.**

b) Provide expertise to the Agency for Energy Conservation in the various fields of its activities :
. information
. training, in management and implementation of energy conservation programmes
. programming and evaluation of energy conservation programmes
. organization of energy audits in all consumption sectors
. organization of demonstration operation programmes
. etc.

c) Provide expertise and information service on all high efficiency (and low pollution) equipment

d) Provide expertise, information and financial support to set up the best financial mechanisms - including foreing aid and loans - as incentives for energy conservation instruments ;

e) Provide expertise, information and financial support to help the modernization of the public transport system in urban areas (which is a great advantage in most Eastern Europe cities, compared to the "car societies" of the West).

G. There is a temptation in the Polish energy sector, strongly supported by Western companies promoting their own equipment, to achieve large investments in modern technology. While this target is understandable for the medium and long term, it seems preferable on the short term to invest much smaller ammounts on improving the efficiency and the environmental quality of the existing energy system.

H. Last but not least, there exists in Poland a high quality manpower, as well at scientific as at engineering level, capable of handling economic calculations, energy planning, energy efficiency improvement programmes (for instance energy audits). The best cooperation probably lies with the transfer of methods and know-how, and the building of appropriate institutional structures well established in the Polish decision-making system.

4.6 Romania

Romania

A Survey of Energy Issues
and a Proposal for Cooperation with the
Commission of the European Communities

CONTENTS

1. SOCIOECONOMIC PROFILE

1.1 General Background

Romania is located at the upper middle East Balkans with a total country area of 237.533 km^2. Neighbouring countries are: north – USSR, south – Bulgaria, west – Yugoslavia and Hungary, east – USSR where the southeast part is open to the Black Sea.

Based on the 1988 census the population of Romania totalled at 23.11 mill. The average annual population growth rate for the 1980's was situated in the order of 0.56 %. The employment ratio was 47.9 % where the vast majority of the work force was occupied in the industrial and the agricultural sectors as presented in Table 1.1.

1.2 Overall Economic Profile

The permanent economic crisis in Romania, which affects not only private consumption but also the producing sector, shows up again now in the official statistics for the economy, after high rates of growth for the economy were reported for the years 1984–86. National income, for which the plan had foreseen a growth rate of 9 – 10 %, rose in 1988 by only 3.2 % compared to 1987 in real terms; nominally it even rose by only 2.9 % to 822.3 % billion lei. The overall price level thus fell slightly in 1988 due to strict price controls and the legally stipulated socalled upper limits to profitability.

As a result of Ceausescu's continued economic policy directed towards the repayment of debts a surplus in the balance of trade was achieved in 1988, which amounted to 63.3 billion lei. National income, with a nominal growth of only 0.6 %, remained virtually at the previous year's level.

Investment activity fell clearly behind the plan, with a real drop of 1.3 % instead of a growth of 3 – 3.5 % compared to 1987. Altogether, 243.4 billion lei were invested, mainly in mining and the fuel and electricity sectors, in industrial and agricultural production, in transport and in building.

Trends in industry were not in line with the plan. The industrial production of goods (including semi–finished goods) increased by only 3.6 % instead of 7 – 8 %, In spite of considerable increases in the production of energy, industry suffered from a scarcity of electricity. In particular the frequency of outages in the electricity network, the incorrect operation of plant and machinery and the use of of inferior coal led to power stations producing only 45 – 50 % of their installed capacity in 1988.

Agricultural production rose in 1988 by 2.9 %. Cereals showed a new record of 32.6 million tons. The production of field vegetables was 10.05 million tons and of fruit and grapes 5.125 million tons. In order to further increase agricultural production, the cultivated area had to be extended in 1989. The measures announced for this purpose – the planned levelling of 7,000 villages and the conversion of rural areas into around 550 new so–called agro–industrial districts – brought Ceausescu and Romania into the headlines of the Western press in the early summer of 1988.

According to the plan fulfilment report Romanian foreign trade grew in 1988 by 6 % (at current prices to 329.5 billion lei). Imports stagnated at 133 billion lei while exports alone increased by 10.5 to 196.4 billion lei. Converted at the annual average exchange rate for 1988 (14.28 lei/dollar), the surplus was US$ 4.43 billion, of which about US$ 4 billion are said to have been achieved in the balance of trade in convertible currencies. According to official statements, the convertible surplus was thus US$ 1.2 billion higher than in the year before.

Whereas almost all other CMEA-countries recently expanded their foreign debts, Romania used the high surpluses in its trade balance with Western countries, as in previous years, to reduce its debts drastically. Romania's total long-term debt, which at the end of 1987 stood at US$ 5,425 million (according to the World Bank's World Dept Tables) - of which US$ 2,039 million were with the World Bank and US$ 500 million with the IMF - was completely repaid by the end of March, 1989.

1.3 Current Economic Situation

Official sources claim that industrial output grew by "more than 6 %" in the first six months of 1989. This probably grossly overstates actual economic growth, however, which is likely to have been closer to 1 % last year. "Significant" growth rates were also claimed, inter alia, for goods that figure prominently among Romanian exports to the West. We know, however, that such exports (most notably of agricultural goods) were made possible by repressed consumption at home. The collapse of the former regime has revealed that economic growth claims were exaggerated.

The new government has announced significant measures, such as the freeing of employment by foreign and mixed firms, the liberalisation of nontrade foreign transactions, higher output of electricity and therefore higher levels of heating, larger petrol rations, the end of food exports (which supplied one quarter of Soviet food imports), the distribution of 6000 square meters of land to each member of agricultural cooperatives plus the possibility of leasing a further 5000 square meters, and the sale of land to city dwellers who want to return to the land. These measures are designed more to alleviate the hardships imposed by the old regime than to stabilise the economy. The reduction of the working week, together with higher consumption, lower prices, and export cuts, are bound to create immediate domestic and external imbalances.

Romania sharply devalued its currency, unifying its former two-tier system into a single rate of 21 lei to the dollar (from 8.74 for the non-commercial rate and 14.23 for commercial transactions, compared to a black market rate of 60-90 lei per dollar; the rouble rate has not been fixed). This followed a visit by an IMF and World Bank team, and was said to have been done in anticipation of a revival of Romania's links with both institutions. The rate will float weekly following fluctuations in the dollar value with respect to other currencies.

A new degree coming into force on 7 March 19900 authorises small private enterprises and allows for direct foreign investment in them. A new National Committee for Small Enterprises, in association with the Ministries of Economy and Finance and the National Bank, is to define tax and credit treatment as areas of operation. Four categories are envisaged: small enterprises employing up to 20 people, profit-making local association of up to 10 people, family businesses and self-employment. Foreign involvement is subject to authorization by the National Bank. Enterprises, subject to an authorization to be granted within 30 days, would be free to set prices and trade internationally directly or through state intermediaries; 50 per cent of export earnings would be surrendered at the official rate, the rest could be retained to finance imports. Enterprises could associate, forming larger holdings. However the supply of raw materials and energy would still be controlled centrally through the new committee.

An economic program for the restructuring of the economy is expected after the elections (due to be held on 20 May 1990), specifying also possible areas in which Western aid could be directed.

In the medium term, the revival of peasant farming should improve food supply, but Romania will need massive resources for industrial modernisation. During ten years no Western machinery was imported and a deliberate policy was followed of holding down services and high technology in favour of heavy industry and manual labour. This was alleged to maintain the class basis of the old regime.

Table 1.1: Sectoral Employment Shares

Sector	Share (%)
Industry	37.3
Agriculture and Forestry	28.7
Building	7.4
Telecommunication	0.8
Trade and Transport	11.9
Community Affairs	4.2
Education, Culture and Arts	3.8
Science and Research	1.3
Health and Social Affairs	2.7
Administration	0.5
Other Sectors	1.4
	100.0

2. *THE ENERGY SYSTEM*

The evolution of the Romanian energy system has been concentrating on oil and gas exploration and indigenous coal utilization in power plants. Due to the policy of the Ceausescu government to repay foreign currency debts prematurely through sales of primary indigenous energy sources, energy shortages were experienced in all economic sectors. Recent government reforms after the 1989 revolution aim to alter this situation, but it does not seem likely that results will appear in the near future.

2.1 Institutional Structure of the Energy Sector

The institutional structure of the Romanian energy sector is organized and managed through different ministries responsible for the exploitation the transformation and the trade of specific energy forms and fuels. The general planning gidelines are set by the Central Planning Agency. The most important ministries dealing with major branches of the energy sector are:

- Ministry of Chemicals and Petrochemicals
- Ministry of Electric Power

The Ministry of Chemicals and petrochemicals is responsible for the management, the development and the exploitation of the oil and gas branches. All foreign trade of oil and gas is the responsibility of the Foreign Trade Ministry. Finally, the Ministry of Electric Power is responsible for the management, development and exploitation of the indigenous coal mines as well as the electrical power stations. It should be mentioned that this energy transformation branch bears the major deficiencies of the Romanian energy sector.

2.2 Primary Energy Profile

In the early 1970's the Romanian energy system was characterized by its exporting capabilities, but since then has become increasingly dependent on primary fuel imports. In specific, in 1970 the primary energy import share was 8.7% of the total primary needs whereas in 1987 this figure rose to 25.7 %. The present energy imports are hard coal, coke, oil, gas and electricity.

2.2.1 National Energy Resources

The national primary energy resources of Romania are hard coal, lignite, oil and gas. The current reserves of these fuels are as follows:

Fuel Type	Reserves (1988)
Crude oil	122 Mton
Natural gas	235 Gm^3
Hard coal	1 Gtons
Lignite and Brown Coal	3 Gtons

Oil reserves have diminished drastically since 1980 from 190 Mton to 122 Mton, where with the current rate of utilization the reserves correspond to a 12 year coverage, if no new oil field are found and exploited. Most of the reserves are located north of Bucharest and nearby the city Bacau which is situated in the Eastern parts of the Carpathians.

The 1988 natural gas reserves were at a level of 235 Gm^3 of what they were in 1985 impling that new gas field have been explored during the last years. The primary natural gas reserves are located in the area of Transylvania at Tirgu Mures.

The coal resource reserves are in the order of 4 Gtons, out of which only 1 Gton is proven and recoverable and the other 3 Gtons are of future potential. Most of the mines (over 50 %) are of the opencast type. Brown coal and lignite mining, which constitutes the majority of the mines, have unfavourable mining overall characteristics. In specific, the seam thickness is in the order of 2 to 8 m with an overburden to coal ratio of 7:1 with a future expected value of 14:1 and an associated heating value of 6.6 to 8.0 MJ/kg. These coal properties have created numerous problems to the energy transformation system. Mining fields are located at the Resita district south of Tirgu-Jiu and Chimpulung.

2.2.2 Primary Energy Supply

The energy sector of Romania depends mostly on its indigenous primary energy production and on fossil fuel imports. The main primary energy sources utilized are:

- Coal
- Oil
- Gas
- Electricity (hydro)

Ceausescu's government halted all foreign investment loans except those associated with the first nuclear power plant. A result of this policy was the stagnation of the energy investments, especially the ones in the energy transformation sector. Thus, intensification of oil, gas and indigenous coal utilization were the main energy supply means for that period, as it is shown in table 2.1. At the same period, imports increased substantially, in specific crude oil for the refineries which was in turn exported to earn hard currency to repay the foreign loans as shown in tables 2.2 and 2.3.

Coal Sector

Domestic coal production has increased at an average rate of 10 to 14 % during the last years constituting 21.4 % of the 1987 primary energy production and 15.2 % of overall energy needs. Most of the production increases are attributed to open cast lignite mining the majority of which is produced at Rovinari (west of Bucharest). This additional coal production has a relatively low heating value, in most cases less than 8MJ/kg. These coals are mainly used for electricity and heat generation. Coal imports have been exclusively hard and coking coals, for primary use in the steel industry.

Oil Sector

The Romanian oil industry is one of the oldest in Europe with a relatively high technological capability for the investigation and the exploitation of oil field as well as a substantial oil refining capacity. Most of the oil reserves are located in the north and west part of Bucharest. The domestic crude oil production rate has been declining steadily from a peak of 0.3 mbd in 1976 to 0.2 mbd in 1988. Due to this reduction in domestic oil supply efforts were undertaken for the intensification of off-shore oil exploitation at East Swan field 70km from Constanza. According to recent reports, only one sector with six rigs was put in operation by the beginning of 1989.

Since domestic oil production declined, Romania became a net crude oil importer. Thus, in 1987 the sector imported 14.0 Mton of crude while the domestic production was at a lower level of 9.5 Mton. Romania has a more diversified crude suppliers list than other CMEA countries. For example, in 1987 only 25 % of the oil imports came from the USSR and the rest was supplied by Iran, Iraq and others. The step up of oil imports was also due to increases in production of oil refined products for Romania's export market. It should be noted that the refining industry was designed as a key exporter with an annual refining capacity (1986) of 3 Mton. The technology used is traditional, based on fractionation techniques rather than more modern methods. Most of the refined products are exported to OECD countries for hard currency earnings.

The domestic oil consumption has been drasticly cut, by a factor of 25 % of what it was in 1977, where substantial domestic oil production decline was also experienced. Also, delays in the first nuclear power plant as well as the low hydrology situation in recent years has stepped up the oil imports.

Gas Sector

Natural gas is ranked first in the national primary energy statistics. It is exploited both as methane gas and as petroleum gas. Domestic natural gas production has been stagnating since 1977. At current production rates of 38 Gm^3 per year it is estimated that the reserves (235 Gm^3) will last up to the end of the century.

Imports from the USSR have increased from 1.6 Gm^3 in 1980 to 3.3 Gm^3 in 1987. The natural gas volume is supplied through three pipelines entering the country at Ismail and continuing to Bulgaria, Turkey and Greece.

Natural gas is mainly consumed in the domestic sector for heating and cooking. Before the 1989 revolution the consumption was held very low by forced and stringent rationing of only a few days per week and for a few hours. It appears that the increased supplies from USSR are used in power generation to overcome the deficiencies of the energy transformation sector.

Primary Electricity Sector

Primary electricity is supplied mainly by hydroelectric power plants and by imports. Delays of the five 700 MW nuclear unit at Cernavoda have stagnated the primary electricity supply. The only energy plans which have been met are concentrated in the hydroelectric production. The total hydro system capacity in 1987 was 5.1 GW with an annual production level of 11.2 TWh with an associated utilization factor of 2200 hours.

Romanian electricity imports for 1987 were in the order of 3 TWh, mainly from the USSR. There were no electricity exports due to the severe deficiencies and shortages which summed up to about 6.5 TWh, 9 % of the total generation for 1986.

Prior to the 1989 revolution, electricity consumption was regulated by monthly quotas in all economic sectors. Electricity shortages were particularly painful during the winter months mostly in the domestic sector where each household was allowed to use 35 KWh of electricity on monthly base. Also, public lighting of streets and buildings was cut to bare minimum.

Renewable Energy Sources

According to a number of reports, renewable energy sources could contribute significantly to the Romanian energy balance system. The sources considered are:

- Biogas
- Biomass
- Solar energy
- Wind
- Small hydro

The above reports contradict each other stating a renewable energy source potential of annual production between 0.5 to 3.0 Mtoe excluding the hydro share. At present, the renewable energy contribution is in the order of 0.15 Mtoe per year excluding hydro. The largest share is due to the contribution of solar collectors for hot water supply to households and hotels on the Black Sea. It is estimated that 80000 m2 of solar collector areas have been installed. Potential estimates for each particular source contribution are not available at this time.

2.3 Energy Transformation

The main energy transformation systems of the Romanian energy economy are the following:

- Electrical power system

- Refineries

The energy transformation sector is characterized by major deficiencies, obsolete technological status and bad management practices. Also due to the Ceausescu foreign debt policy, hard currency investments were halted imposing great burden on the existing energy transformation system.

2.3.1 Electricity Sector

Electricity in Romania is mainly generated by fossil fired power plants. The power system is constituted by coal, oil and natural gas fired power stations as presented in the table below. The total installed capacity for 1987 was 19830 MW including the hydro stations. It should be noted that the electrical power generation system has suffered severe reliability problems mainly due to:

- Organizational and managerial problems

- Uneffective and lengthy maintenance programs

- Solid fuel supply with heating values up to 20 % below the minimum required levels.

As a result, the available reliable capacity was and is in the order of 50 % of the installed designed capacity. It is important to note that coal and lignite fired power plants experience extremely high forced outage rates forcing the utility to limit the production level to absolute minimum.

Capacity Mix (1987)		**(MWe)**	**Type (%)**
Coal Fired:	Turceni	2640	
	Rovinari	1720	
	Isalnita	1035	
	Mintia	1260	
	Doicesti	520	
	Paroseni	300	
	Others	95	
Total Coal		7570	38.2
Oil and Gas Fired		7760	39.1
Hydro		4500	22.7
Total		19830	100.0

One of the major drawbacks of the Romanian electrical power generation system is the constant construction delays and design modifications of the Cernavoda nuclear power plant. Current plans for this station call for five 700 MW Canadian design units and two 1000 MW Soviet design ones. The 1989 official schedule called for the first of the five units to go into operation by 1990. Apparently this goal has not been achieved. It should be noted that public opposition along with international concern over the station will arise mainly due to the fact that the nuclear site is located within an earthquake zone.

2.3.2 Oil Refining Sector

The Romanian oil refining capacity has been increased within the last 20 years from an annual 16 Mton in 1970 to an estimated 31 Mton in 1986. The refining industry is using traditional fractionation methods at 13 plant locations in the country. These refineries are: Bacan, Borzesti, Brazil, Brazov, Cimpina, Darmenesti, G. Georghi Dij, Novodari, Onesti, Pitesti, Ploesti, Salpacu and Telaejen.

2.4 End Use Consumption

The end-use of energy of the main sectors of Romania's national economy has remained relatively constant. Especially within the last years, mainly due to primary energy production and supply stagnation. The total consumption for 1986 was in the order of 54 Mtoe. The particular energy demand share characteristics for the major economic sectors for 1986 are the following:

End-Use Energy Consumption (1987)

Sector	(Mtoe)	(%)
Industry	41.2	76.3
Transport	1.6	3.0
Other	11.2	20.7
Total	54.0	100.0

The most energy intensive sector is industry which is also characterized by its high specific energy consumption. At present, according to a Romanian scientific journal, the industry is using 20 % to 50 % more electricity than other western countries to manufacture standard products. The other sectors include the domestic, tertiary and the agricultural sector. It can clearly be seen that the consumption share of these sectors is relatively low due to energy rationing imposed upon them. This situation is anticipated to change through the recent socioeconomic reforms.

The relative final energy consumption by fuel type along with the system losses for the specific sectors has the characteristics presented in the table below which is representative for the year 1986.

Energy Consumption (1986)

Fuel Type	**(Ktoe)**	**(%)**
Coal	9383	17.4
Oil	10769	19.9
Gas	28287	52.4
Electricity	5571	10.3
Total	54010	100.0
Losses		
Transmission	143	3.8
Refinery	2318	61.3
Other	1321	34.9
Total	3782	100.0
Total Consumption	**57792**	

2.5 Energy Balance System

Romania's energy system is called upon to satisfy the energy needs of the economic sectors presented in section 2.4. The primary fuels and energy sources supplied to satisfy these energy needs are coal, oil, gas and electricity.

The energy balance of the electrical system is presented in the table below.

Electricity–Energy Balance Transformation and Supply 1986

Generation Type	**(ktoe)**	**(%)**
Primary System Input		
Coal	9269	41.1
. Oil	4000	17.7
. Gas	6571	29.2
. Hydro	2698	12.0
Total	**22538**	**100.0**
Net Supply	**(TWh)**	**(%)**
. Thermal	64.7	82.4
. Hydro	10.8	13.8
. Imports	3.0	3.8
Total	**78.5**	**100.0**

The final energy balance for the year 1986 is presented in the table below. The energy balance is supplied by 83 % of domestic production and 17 % of net imports. It should be noted that the losses presented in the table represent only the transformation losses and not those associated with the particular processes.

Energy Balance of Romania's Demand/Supply System for 1986

	Supply (ktoe)
Domestic output	60784
Imports	22293
Total resources	83077
Exports	9824
Transformation losses	20163
Final End Use available	53090

Table 2.1: Primary Energy Production

Year	Browncoal (Mton)	Hardcoal (Mton)	Oil (Mton)	Gas (Gm^3)	Hydro (TWh)	Total (PJ)
1970	14.1	6.4	13.4	25.3	2.8	1700
1975	19.8	7.3	14.6	33.3	8.7	2151
1980	27.1	8.1	11.5	35.2	12.6	2193
1981	28.6	8.3	11.6	37.0	12.7	2282
1982	30.7	7.2	11.7	37.4	11.9	2291
1983	36.7	7.8	11.6	38.1	10.0	2359
1984	35.8	8.5	11.5	39.1	11.3	2412
1985	37.9	8.7	10.7	38.9	11.9	2411
1986	38.8	8.7	10.1	39.4	10.8	2405
1987	42.4	9.1	9.5	7.4	11.2	2351
			(in PJ)			
1970	114	134	554	864	33	1700
1975	160	154	604	1130	103	2151
1980	200	169	477	1197	150	2193
1981	211	174	482	1264	151	2282
1982	266	151	486	1287	140	2291
1983	271	164	480	1325	119	2359
1984	264	178	474	1362	134	2412
1985	279	182	444	1364	141	2411
1986	286	183	419	1389	128	2405
1987	313	191	394	1321	133	2351

Table 2.2: Primary Fuel Imports

Year	Hardcoal (Mton)	Coke (Mton)	Oil (Mton)	Gas (Gm^3)	Electricity (TWh)	Total (PJ)
1970	0.7	2.6	2.3	0.0	0.0	187
1975	2.4	2.5	5.1	0.0	0.5	350
1980	3.9	2.8	16.0	1.6	0.5	909
1981	4.9	3.4	12.9	1.5	0.6	819
1982	4.2	2.7	10.9	1.5	0.6	695
1983	5.3	1.7	12.4	1.7	2.1	784
1984	7.0	1.8	13.5	1.8	3.1	888
1985	6.0	1.9	14.6	1.8	3.3	916
1986	7.0	1.8	13.5	2.5	3.0	911
1987	7.0	1.8	14.0	3.3	3.0	959
			(in PJ)			
1970	17	72	98	0	0	187
1975	57	72	215	0	6	350
1980	93	79	675	56	6	909
1981	116	97	546	53	7	819
1982	99	75	461	53	6	695
1983	126	48	524	60	25	784
1984	167	50	571	63	36	888
1985	143	53	618	63	39	916
1986	166	51	571	88	36	911
1987	166	51	592	115	36	959

Table 2.3: Primary Fuel Exports

Year	Oil (Mton)	Gas (Gm^3)	Electricity (TWh)	Total (PJ)
1970	5.4	0.2	2.4	264
1975	6.2	0.2	3.0	305
1980	8.8	0.2	0.0	379
1981	8.1	0.2	0.7	360
1982	6.4	0.2	0.9	289
1983	9.1	0.0	0.0	394
1984	10.4	0.0	0.0	442
1985	9.7	0.0	0.0	410
1986	10.0	0.0	0.0	423
1987	10.0	0.0	0.0	423
		(in PJ)		
1970	227	8	29	264
1975	261	8	36	305
1980	370	8	1	379
1981	344	8	8	360
1982	270	8	11	289
1983	386	8	0	394
1984	441	1	0	442
1985	410	0	0	410
1986	423	0	0	423
1987	423	0	0	423

3. TRENDS AND ISSUES

The modernization and expansion needs of the Romanian energy system, which werehalted by the Ceausescu regime, have condemned the present energy sector to almost a permanent energy crisis. Particularly, the electrical power system can not supply the required electricity needs in all economic sectors, especially in the domestic sector. In specific, the 1989 increase of electricity generation was in the order of 0.5 % from the previous year, value far less than that demanded by the national economic needs. During the same period (1989) the share of the domestic consumption was and probably still is in the order of 5 – 6 % of the total consumption, which does not reflect by any means the real demand needs of the Romanian population.

The major issues which arise from the existing situation of the Romanian energy system could be characterized into two basic categories as follows:

- Organizational issues
- Technological issues.

The restructuring of the energy sector is underway. Since the 1989 revolution and the reforms passed by, the present government should rationalize the operations, the management and the future development of the sector. Also, modern technological techniques, and new equipment for the power industry are needed such that the energy supply situation may be improved.

3.1 Energy Policy Issues

At this point in time, after the national elections, the Romanian energy economy is under reform. These energy policy issues have not yet been finalized; most of the information available is open to speculation and criticism. Nevertheless generic energy policy issues at this time are obvious and may be summarized as follows:

- Rehabilitation of the existing energy transformation system with emphasis on electric power generation.
- Increase the extraction of indigenous coals to maximum possible levels.
- Improve the energy supply situation to all economic sectors, especially the domestic one.
- Energy conversation and rationalization for all end uses.
- Environmental protection.
- Review of the existing nuclear power expansion plan.
- Review of the situation of the oil and gas sectors taking into account the ongoing socioeconomic reforms.

It should be noted that the above energy policy issues are based on professional engineering judgment arising from the characteristics of the Romanian energy system and not on official statement. Also, at this time, it is of great risk to even make an attempt to forecast the future energy needs because they are very closely linked with the socioeconomic reforms and the improvement of the existing supply / demand balance.

3.2 Energy and Environmental Issues

The main environmental issues associated with Romania's energy sector are mainly concentrated in the energy transformation branch. In specific, pollution emissions from fossil fuel fired power plants and possible hazards and safety issues associated with the future operation of the nuclear power plants at the Cernovoda site.

Fossil Fired Power Plants

As it has already been mentioned in section 2.3, a large percentage of the electricity energy needs is generated by fossil fired thermal power plants utilizing indigenous low quality lignite and brown coal and imported coal. These coals are characterized by their high ash and sulfur contents imposing a great burden on the country's air quality.

Also, in case intensive lignite exploitation is implemented, groundwater supply deterioration problems will have to be dealt with in several areas. It should be emphasized at this point that the environmental problem in Romania has not been publicly addressed. Also, as in the case of other areas, public information is withheld. It is estimated that during the ongoing democratic process environmental issues will have to be openly addressed and dealt with.

Nuclear Power Plants

Major safety issues have arisen associated with the ongoing construction of the first nuclear power plant at the Cernodova site. Several design features of the original plans have been revised, mainly due to cost reduction and time delay reasons. Thus, the overall project is under great uncertainty and it is open to speculation. Also, since in the past all of the information was not available to the public, it is anticipated that the continuation of this project will have to overcome strong opposition. The general issues which have to be addressed could be the following:

- Resolve possible seismic problems that have not seriously been addressed at the Cernovoda site which is considered to be on an active earthquake area.

- Determine the safety level and features implemented in comparison to the original ones set up by the Canadian designers.

- Review the nuclear expansion program as far as the feasibility and the necessity associated with the 1000 MW USSR units are concerned while this issue will have to be addressed from the environmental point of view.

3.3 Energy System Development Problems

The development problems faced within the Romanian energy sector are of broad and diverse nature. Due to the socioeconomic reforms and changes underway, previous practices within the energy sector may not continue in the future. Modifications of the existing energy supply systems, as well as the end use practices, are necessarily taking into consideration modern technologies in the field of energy efficiency, safety, environmental control and system protection. Current major problems associated with the operation and the expansion of the Romanian energy sector may be summarized as follows:

- Rehabilitation, and in several cases repowering of the existing lignite and brown coal fired power plants in order to improve their reliability level and the firm capacity which can be generated by them.

- Examine the possibility of expanding the power system with natural gas fired combined cycle power plants.
- Utilization of the indigenous low grade coal stocks at future plants in an efficient and environmental friendly approach.
- Environmental protection considerations associated with all fossil fired power plants.
- Revision of the existing nuclear safety systems with regard to modern technology and practises.
- Energy efficiency improvements aiming towards major decreases in energy intensity, especially in the industrial sector.
- Rationalization of end use of energy in the domestic and the tertiary sectors.

The above technological issues should be analyzed in greater detail as soon as information becomes available from official government sources.

4. *PROPOSALS FOR COOPERATION*

The Romanian energy system deficiencies are mainly concentrated within the energy transformation sector. Delays in the construction and commission of the Cernavoda nuclear power plant have imposed electricity shortages and reliability problems to the electricity supply requirements. Also, as described in section 3.0 the efficiency of energy utilization in the industrial sector is relatively low. At present, primary energy import needs are higher than what have been in the past, mainly due to delays in the expansion of the oil and gas sectors. Thus, it is clear that overall energy system efficiency improvements are due in time, especially if one considers the anticipated industrial demand growth. According to intelligents reports, present socioeconomic reforms shift in direction towards an overall national rationalization of productivity and energy efficiency improvements while environmental issues and criteria should be incorporated in the decision process. Increases in the domestic and the commercial sector's energy demand and supply are also anticipated at the same time.

Implementation of the above general goals and needs require expertise and a technological know-how not included within the existing country energy system capabilities. Thus, cooperation between EEC and the Romanian energy industry could contribute towards the materialization of the above aim. The forms and the areas of cooperation in this field are specified and presented within this section. The specific proposals arise from the generic analysis of the national energy supply/demand system presented in section 2, and on the technological issues discussed in section 3.

It is unfortunate that a field trip to Romania was not possible due to the ongoing social and political instabilities started after the June elections. Thus, the proposals presented herein have not been discussed with Romanian officials but are rather based on rational professional engineering judgment arising from the available energy intelligents reports gathered by the CMSU project team.

4.1 Needs for Cooperation

The basic needs for cooperation between the EEC and Romania's energy sector arise from the analysis presented in sections 2.0 and 3.0. The main subject areas of cooperation which are given top priority and are considered herein include the following:

a. Existing fossil power plant modernization feasibility studies

b. Information network exchange

c. Energy planning

d. Energy conservation and renewable energy sources assessment studies

e. New thermal power plant feasibility studies

f. Environmental control technology know-how transfer

The proposed cooperation needs presented herein do not reflect only current and immediate prospects but rather keep in mind the evolution and the long term rationalization of the overall energy system for a medium and a long therm planning horizon.

a. Existing Fossil Power Plant Modernization Feasibility Studies

Long time maintenance delays and low heating quality of solid fuels (below plant specifications) have stagnated electricity production to almost 50 % of the designed capability levels. Modernization of the fossil power plants is needed such that to increase productivity levels in order to overcome the present electricity shortages. As a first step towards this goal, a detail investigation of the existing system is necessary through technoeconomic feasibility studies on the following:

- Specification of intensive and effective maintenance procedures along with reorganization programmes of the operations and management practices of the fossil power plants. Emphasis should be given on the lignite and brown coal fired power plants.

- Investigation for the adaptation of solid fuel quality control techniques developed within EEC in lignite and brown coal power plants.

- Investigation of the possible prospects for the repowering and the upgrading of the existing fossil power plants

- Reliability improvement studies for the thermal power plants especially those with high forced outage rates

The above should be of top priority in an integrated cooperation programme between the EEC and Romanian power industry. Specific organizational and implementation aspects must be specified within the framework of the feasibility studies.

b. Information Network Exchange

Adaptation of modern energy technologies to the Romanian energy system requires the support and promotion of professional knowledge and experiences which may be transferred through an extensive information exchange network. The main areas of interest are:

- Energy sector structure and management

- Experience in financing energy projects and budget control

- Organization and management of energy related engineering and consulting activities

- Scientific and production practices of the energy sector

- Oil and gas technology status at the primary level

- Training seminars on specific energy fields (oil refinery, power industry, energy conservation, renewable energy systems etc.).

c. Energy Planning

Present energy planning efforts aim towards a higher overall efficiency and an increase in the energy transformation system's build up capability. Evolution of the Romanian energy sector should also take into account the prospects and the conditions of the international energy market and economy. In order to proper plan the country's demand and supply needs while satisfying the above goals, cooperation is needed for expertise and technical assistance on the following subjects:

- Methodologies and computer model transfer for national energy demand forecast and energy supply system selection

- National energy planning supply/demand studies

- Regional energy assessment studies

- Energy conservation planning and implementation methods

- Renewable energy technology planning and implementation methods

- Feasibility studies on new energy technologies utilizing indigenous and imported fuels

- Energy pricing policies impact analysis.

d. Energy Conservation and Renewable Energy Sources Assessment Studies

Energy conservation measures and sound implementation projects should be given top priority within an integrated EEC/Romanian collaboration programme for the energy sector. Assessment studies should concentrate on the most energy intensive industries. Work efforts in this field should concentrate on the following:

- Energy conservation methodologies

- Energy audits

- Energy management techniques

- Rational end use of electricity

- Energy equipment retrofits

- Conservation equipment additions such as heat recovery systems etc.

Energy end use system rationalization could also be achieved through the utilization of renewable energy resources. Technoeconomic assessment studies are needed to determine the viability and the issues associated with the following renewable energy systems:

- Biogas

- Biomass

- Solar
- Wind
- Small hydro

e. New Thermal Power Plant Feasibilities Studies

Due to delays in the construction of the Cernavodo nuclear power plant mainly due to financial problems and environmental issues the Romanian power system expansion has been stagnated at extremely low levels. Given this present situation it seems that the nuclear option should be revised and other short and medium term power options should be considered as follows:

- Natural gas fired combined cycle power plants
- Coal fired fluedized bed boiler power plants

Technoeconomic feasibilities studies should examine the above power options in conjunction with the overall power demand/supply characteristics.

f. Environmental Control Technology Know-How Transfer

Technology know-how is needed in almost every energy sector for both the supply and the end use consumption side. Current goals and plans for modernization of Romania's energy system may be implemented through modern technology know-how transfer of crucial energy equipment and systems. Technology know-how of environmental control equipment could be transferred to the country's manufacturing facilities. The transfer could take place through licences, documentation, etc. Know-how is needed for the following energy technologies for environmental control:

- Fossil fired thermal power plants:
  . flue gas SO_2 and fly ash clean up equipment
  . environmental monitoring and control equipment
  . power plant control equipment and automatic generation control equipment

The above options and needs for cooperation should be reexamined in a later stage when the social and political situation in Romania will stabilize such that these scenarios may be discussed with energy officials. At this point in time useful contact points and names with the energy institution in Romania are the following:

1. Prof. Vladimir Constantinescu, Director of Plan Dezvoltate or Mr Manolescu tel. 595927 telex 11279 72301 Bucarest, Romania

2. Mr Adrian Georgescu (Minister) Ministry of Electric Energy 72301 Bucarest, Romania

4.7 USSR

USSR

A Survey of Energy Issues
and a Proposal for Cooperation with the
Commission of the European
Communities

TABLE OF CONTENTS

I. THE GENERAL ECONOMIC SITUATION

I.1 The Decline in the Soviet Union's Economic Performance since 1985

According to various indicators, the Soviet economy has shown a marked decline since 1985, even though the rate of growth in 1988 was given as 4.4% – a figure which is contested even by Soviet economists. Imbalances have also increased.

The Soviet Union has to increasingly face up to "apparent" inflation. According to M. Lavigne, "In 1988, the chairman of the Soviet Union's Gosplan admitted that inflation in retail prices was running at between 1 and 1.5% per annum; estimates by Soviet economists vary between 5 and 8%"1. Shortages have indeed become widespread, increasing the gap between supply and demand at a time when incomes have also increased. The consumer goods sector grew by only 5.9% in 1989, largely below the 12% incomes growth rate.2 Under such conditions, unmet demand will be of the order of 70 billion roubles as opposed to 28–30 billion at the beginning of the eighties3.

The appearance of a major budget deficit only serves to reinforce the impression of crisis. It was only in 1988 that the Soviet authorities admitted the existence of a budget deficit for the first time. Initially evaluated at 35 billion roubles, some Soviet economists now consider it to be nearer to 100 or even 120 billion roubles, or between 11% and 14% of Soviet GDP4.

In addition, the Soviet Union's financial situation has considerably deteriorated. In 1989, it showed a trade deficit for the first time in fourteen years. Its foreign debt in terms of convertible currencies increased by more than 15% over a single year from 40.8 billion dollars in 1988 to 48 billion dollars in 1989 .

1. LAVIGNE, M. "Les difficultés de l'économie soviétique et l'état d'avancement des réformes", Problèmes économiques, 12th July 1989, n°2133.
2. "La situation économique soviétique est catastrophique", Le Monde, 27th January 1990.
3. BEAUCOURT, Ch. "La Perestroïka embourbée. L'économie soviétique en 1988", Le Courrier des pays de l'Est, April 1989, n°399.
4. LAVIGNE, M. Op. cit., p.6.
5. "La situation financière de l'URSS se détériore", Le Monde, 14th March 1990.

The impression given by the Soviet Union after 3 years of Perestroïka is one of internal and external imbalances. It has to be said however, as Ch. Beaucourt pointed out in 1989, that the worsening of the situation comes not from the economic reforms but rather from the lack of reforms.

1.2 Gorbatchev's Perestroïka

Any attempt to evaluate the economic reforms (restructuring) which have resulted from three years of Perestroïka in the Soviet Union would appear to be not only virtually impossible, but possibly even a complete illusion. It is far from finished and new measures are constantly being introduced the most recent being still under discussion by the Supreme Soviet. In addition, given the state of confusion, it turns out to be extremely difficult to know which measures have actually been applied, where and how. To take only the energy field, the autonomy of enterprises is illusory rather than real, as are foreign trade reform.

Mr Gorbatchev's economic reforms are based on several main lines of action.

They are above all aimed at enterprises. The current laws governing State enterprises, which came into effect in 1988 but which only came to cover all enterprises in January 1989, is aimed at increasing their autonomy and is based on four principles:

- the principle of independence which provides entreprises with the possibility of freely choosing their customers and its suppliers. It can also be applied to orders from the State. The enterprise thus produces for the State which in return provides the necessary supplies to maintain production.

- the principle of auto-financing, i.e. the use of the enterprise's net income to finance investments.

- the principle of self-management, i.e. the election of the entreprise's managers.

- the writing-off of investments by the enterprise itself.

These changes at an enterprise level are complemented by the May 1988 law governing cooperatiuves which makes it possible to set up cooperatives in agriculture, industry (in particular within State enterprises), transport, commerce and services.

The various laws covering foreign trade have been aimed at reorganising the Soviet Union's economic relations abroad. The general aim of the reforms is to give greater freedom to foreign trade. The right to trade abroad, which was accorded to 68 enterprises and 21 administrations in 1986, was extended to all enterprises in April 1989 on condition that they produce goods and services which are competitive on foreign markets.

Finally, we should mention the restructuring of the banking system. The Soviet state bank, the Gosbank, has had its commercial functions transferred to specialized banks which cover the main sectors of the economy. In addition to this state banking sector, there are now over 150 independent financial organisations spread over the country.

It should however be noted that in the absence of any price reform, or the creation of a capital goods market, the economic autonomy of enterprises remains illusory rather than real, though Mr Gorbatchevs's main economic advisers wish to go further in this direction. For the moment the main decision to be announced has been the acceleration of reforms allowing retail price increases, although this remains far removed from a true price reform. At an enterprise level, all that is envisaged is the development of enterprise leasing (similar to that which has been adopted in the agricultural sector), joint stock companies and cooperatives.

II. THE ENERGY SYSTEM

II.1. ABUNDANCE OF RESOURCES AND SUPPLY

The first striking characteristic of the energy situation of U.S.S.R. is the abundance and diversity of resources and the high level of energy production.

The firm belief in "unlimited resources" (this expression is still used by the State Planning Committee, GOSPLAN) added to the economic strategy for development based on continuous growth of means of production and heavy industries led to an enormous effort in financial and human resources to develop an energy system drastically supply oriented, dominated by the aim of maximising production and exports.

This model of development reached its limits in the early 80's:

- The "extensive" development based on massive investment in the energy sector became less and less tenable due to the needs and objectives of modernization of the economy.

- The stresses on environment linked to the energy supply system (pollution, accidents) reached unbearable levels and led to strong and active opposal to the energy supply policy.

A - <u>The abundance of energy resources</u>

- Coal proven recoverable reserves:

  . 241 billion tons (estimate: end 1987),
  . about 24% of world proven reserves.

- Natural Gas proven reserves:

  . 41 trillion m^3 (estimate: end 1987),
  . about 38% of world proven reserves.

- Oil proven reserves:

  . U.S.S.R. does not publish its official figures. Estimates vary from 60 to 75 billion barrel (about 8.6 to 10.7 billion toe),

  . about 7% of world proven reserves.

The resources of renewable energy sources (hydro, biomass, solar, wind, geothermy) are enormous. Only hydro has been harnessed on a large scale.

Table II.1. - Shares in total primary energy production

(1987 - %)

OIL	MAT. GAS	COAL	NUCLEAR	HYDRO	OTHERS
37.2	35.7	19.7	2.6	3.1	1.6

C - Energy exports vital for the economy

U.S.S.R. is a large energy exporter, mainly of oil and natural gas.

In 1988, U.S.S.R. exported 203 Mtoe of crude oil and oil products, of which about 77 Mtoe to CAEM countries and about 97 Mtoe to OECD countries.

The natural gas exports amounted to 84 billion m^3 in 1987, of which 44 to CAEM countries and 40 to Western Europe (FRG, France, Italy, Austria).

D - The transformation sector

a/ The total capacity of the refining is about 613 Mt/year. The refining system consists of about forty large "complex", 80% of which are located in the Caucasian and Ural-Volga regions.

Most of the technologies are not sophisticated with a small share of cracking installations. Hence, the "heavy" prodùcts represent 70% of the output of the refining system.

b/ The total capacity of electricity production was 332000 MWe in 1987, of which 34500 MWe nuclear and 62700 MWe hydro.

In 1987, the total electricity production was 1665 TWh of which 218 TWh from hydro, 191 TWh from nuclear and 1256 TWh from fossil fuels (32% solid fuels, 22% oil, 46% natural gas).

In the seventies, the policy was to substitute oil by coal for the electricity production; in the eighties, natural gas is increasing its share. The objective of increasing the nuclear capacity to 150000 MWe in year 2000 was drastically revised after the Cernobyl accident.

II.2. A HIGH LEVEL CONSUMPTION WITH POOR EFFICIENCY

A - Primary Energy Consumption and Energy Intensity

In 1988, the total commercial primary energy consumption of U.S.S.R. was about 1400 MToe, ranking second among all countries of the world, after the U.S.A. (about 1950 Mtoe in 1988).

This consumption is shared 25% by coal, 37% by natural gas, 31% by oil, 4% by hydro and 3% by nuclear.

With a population of 285 million in 1988, the average annual consumption per capita amounts to 4.9 toe.

This consumption is lower than the US's (about 8 toe) but slightly higher than the FRG's (4.5 toe).

The primary energy intensity -ratio of the primary energy consumption to the GDP (calculated with purchase power parities)- is about 0.9 in 1988, to be compared to 0.6 for U.S.A., 0.4 for Western Europ and 0.3 for Japan.

These rough figures show a low efficiency in energy transformation and utilization. This first judgement has to be corrected partly if one realize that U.S.S.R. is a "continent" with enormous distances and drastic climatic conditions.

Nevertheless, the level of technological advancement in energy utilization fell in U.S.S.R. well behind the western industrialized countries level.

Furthermore, without having at our disposal detailed data to support it, there is a large discrepancy in energy use between the various republics of U.S.S.R.

B - The Final Energy Consumption

a/ The final energy consumption of U.S.S.R. is badly known, due to the lack of published reliable statistics. In particular, it is very difficult to get a clear picture of the consumption for each energy use.

The shift of the total final energy consumption by energy product is the following (1986):

- Coal	:	16.5%
- Oil products	:	28.9%
- Gas	:	17.8%
- Electricity	:	11.0%
- Heat	:	25.8%

II.3. THE ORGANIZATION OF THE ENERGY SECTOR

The system of responsibilities and decision making in the energy sector is multiple and complex since U.S.S.R. is living a period of changes and new structures and initiatives are mixing with the old organization. We shall try to present the current situation as logically as possible: the reality is often less clear and difficult to appreciate.

A - The traditional soviet structure is still present, with some important modifications in the recent years. It consists of two main levels: the level of "State Committees" and the level of "Ministries".

a/ The "Ministries" are vertical structures, responsible for all activities linked to an energy source or related activities. They are the following:

- Geology.
- Coal Industry.
- Petroleum and Gas Industry (here gas is only associated gas; natural gas is in another structure).
- Construction of Petroleum and Gas Industry Enterprises.
- Chemical and Petroleum Refining.
- The Ministry of Gas Industry has been replaced by the "concern" GAZPROM* (an "autonomous" "state enterprise" directly under the responsibility of the government).
- Power and electrification.
- Power machine building.
- General machine building.
- Electrical equipment industry.
- Nuclear Power and Industry.

* The asterisk means that the attached organization or person has been personnaly met by the author of this report.

b/ The State Committees are in general covering a wider range of sectors and responsibilities than energy but include energy issues:

- State Committee for Science and Technology (GKMT*) is responsible for all R and D programmes.

- State Planning Committee (GOSPLAN*) is responsible for the general planning of the whole economy (coordination of the five year plans).

- State Committee for Environment Protection is a new structure (1989).

- State Committee for supplying of material and technical ressources (GOSNAB).

- State Committee to Supervise Work Safety in Industry and Nuclear Energetics (the State Committee for Utilization of Atomic Power was suppressed).

Each Committee is directly linked to several Institutes working for it. For instance, VNIIKTEP*, Research Institute on the Energy System and the Energy Problems, studies the global energy problems for the GOSPLAN.

B - Independant from the Ministries and the State Committee, directly linked with the government as well in the new configuration as in the old, stands the powerful "U.S.S.R. Academy of Sciences".

The Academicians are respected and important people in the Soviet system. Some of them are members of the Supreme Soviet (vice-president of the Academy VELIKHOV is active in all scientific, energetic and environment matters and is said to be "Gorbatchev's man").

In global energy problems, the "Institute for Research in Energetics"*, led by Academician Alexei A. MAKAROV, plays an important role on energy forecasts, general energy policy planning, energy conservation potential assessment, etc.

C - At government level (Prime Minister RYZHKOV) the impossibility was felt to deal directly with this array of separate State Committees and Ministries, added to some suspicion regarding the possibility and will for the old structures (Ministries and State Committees) to implement reforms that would diminish their power.

The government set up, among others, the "Bureau of the Council of Ministers for Fuel-Energy Complex" which is in charge of preparing the new energy policy and coordinate all energy activities (Valery VASSILIEV*is head of the Department of the Energy System (in charge of global problems) of this Bureau.

D - An increasing role is played in all matters of the U.S.S.R. political and economical future by the Supreme Soviet (500 deputies). On energy matters, the sub-Committee of the Supreme Soviet on Energetics is active and proposes interesting initiatives. The president of this sub-Commission, Vitaly BUSHUEV*, is also vice-president of the "International Center for Energy Efficiency*" recently created by the Academy of Sciences and "sponsored" by the Supreme Soviet.

E - Each Republic of the U.S.S.R. has its own responsibility in the energy sector, mostly for the supply of all non-industrial activities (for instance ROSKOMMUNENERGO PRODUCTION* for the Republic of Russia, in Moskow).

III. TRENDS AND ISSUES

III.1 GROWING CONSTRAINTS ON THE SUPPLY SIDE

The U.S.S.R. energy production is facing increasing difficulties, due to a series of factors.

A - The high level of investment in the energy sector is no longer tenable: energy investments currently account for 40% of the total industrial investment.

B - Coal production is suffering from poor coal quality. It roughly stabilized since 1970 around 600 Mt and will probably decrease, at least in the short term.

C - Concerning oil, a small number of abundant new basins supported the rapid development of production in the 70's. The Tymen oil and gas province of Tymen, in Western Siberia, covered 90% of the growth in primary energy in the country for the past twenty years.

This intensive exploitation of large fuel basins with non efficient technology led to a rapid rate of exhaustion of highly effective resources.

It became necessary to compensate by exploiting poorer and far distant fields in much worse climatic conditions, in increasingly difficult technical and human working conditions.

As a result, the average capital outlay per unit of new productive capacity rose intensively in the past and will continue to rise in the future.

The oil production, which reached a peak in 1988, declined in 1988 and 1989: it will be very difficult to stabilize it.

D - Natural gas is the best hope of the energy future of U.S.S.R. Its production increased regularly and could still increase, but more slowly, due to growing capital and environmental constraints.

Some experts (see below) advocate a high increase of the production (possible regarding the resources) but even the producer concern GAZPROM advocates a stabilization or a slow increase in the short and medium term.

E - Following the Cernobyl accident, the nuclear programme is slowing down and its future is totally uncertain.

In 1987, the construction of 1900 MWe (net) was cancelled (the 2 RBMK reactors of Cernobyl 5 and 6).

In 1988, the construction of 10715 MWe (net) was cancelled (1 RBMK - 10 VVER).

In 1989, the construction of 7100 MWe (net) was cancelled (3 RBMK - 2 VVER - 1 fast breeker).

In 1987, 1988, 1989, no construction for new power reactors started and no orders or commitments for new reactors were issued.

Several reactors in activity were or are being shut down, in particular in regions with earthquake risk (Crimea, Azerbaïdjan, Georgia, Armenia).

III.2. ENORMOUS ENVIRONMENTAL STRESSES

"Rapid development of Soviet Union's energy complex brought about widespread contamination of the environment" (Academician A. MAKAROV).

A - Fossil Fuel emissions and water problems

Academician MAKAROV writes the following: "The combustion of organic fuels produces today about three fourths of all greenhouse emission and up to 80% of all harmful ejections into the atmosphere as a part of the anthropogenic activities on the territory of the U.S.S.R. In 88 cities with a total population of about 42 million people, maximum permissible concentrations of harmful substances in the atmosphere were exceeded by more than ten times. The water reservoirs at hydro-electric power stations capture more than 10% of the land.

That could go for urban developments, industrial plants and transportation facilities. Plants in the energy complex take 25% of the fresh water available and produce more than one third of all the sewage (see table below)...".

The impact of the Power Industry on the Environment (1988)

	COMBUSTION OF ORGANIC FUELS	ENERGY COMPLEX	TOTAL
Greenhouse gases* (million ton of carbon)	1250	610	1700
Toxic gases and ash (million ton)	50	28	64
Land capture (million hectare)	-	7.5	71
Fresh water intake (billion m^3)	-	83.4	327
Sewage production (million m^3)	-	59	164

* Estimates: $C0_2$, CH_4 and N_20 in terms of carbon or carbon equivalent.

Entire regions and natural sites (Aral Sea, Baïkal Lake) are reported to have reached almost irreversible polluted levels. Very high figures of deaths and diseases are reported.

B - <u>The Cernobyl catastrophe</u>

The Cernobyl accident of the 25th of April, 1986, has been until now the greatest accident in the world on a nuclear power plant.
The impact on the energy system of USSR, on its environmen, have been and still are of enormous magnitude, often minimized in the Western countries.

a) A number of nuclear power plants projects have been cancelled (see III.1.E) In the beginning of June, the government of the Republic of Ukrainia announced the decision to shut down the three reactors of the Cernobyl power plant still in operation.

b)The official number of evacuated persons from the Cernobyl area is, at this date, 135 000. The average irradiaton for this population is around 12 Rems per capita. More than 200 000 workers have participated to the post-accident interventions.
Three thousand km2 have been totally evacuated and recent information tells of several hundred thousand people to be evacuated in the future, sometimes from towns and villages very distant from the Cernobyl area.

c)About 20% of the territory of the Republic of Bielorussia (total area of about 300 000 km2) has been durably contaminated, leading to much severe stresses on the agricultural production.

C - <u>The importance of environmental issues in the new political life</u>

The importance of environmental issues in the new policy, led by President GORBATCHEV, is clearly indicated by:

a/ The creation of the State Committee for Environment Protection.

b/ The nomination of Academician VORONZOF as Minister of Environment in the RYZHKOV government (VORONZOF is the first minister of U.S.S.R. non member of the Communist Party).

c/ The impressive speach delivered by President GORBATCHEV at the Kremlin in January 1990 (the report's author was attending) which is reproduced in Appendix 1 of this country report.

The public and the scientific community appear to be very active on environment and many "green" associations play an increasing role in the regional and national political landscape.

III.3. ENERGY FORECASTS

Analyzing the current situation of the U.S.S.R.'s energy system, Academician A. MAKAROV, head of the Institute of energetics of the Academy of Sciences of U.S.S.R., estimates that the gap between U.S.S.R. and the western industrialized countries in the exploitation, transformation and utilization of energy resources resulted in extra primary consumption of more than 500 Mtoe year, which amounts to 36% of the total primary consumption of the country.

A - Forecast scenarios

The Institute for Energetics* has done a fair amount of work on forecasting and evaluation of the energy conservation potential.

A. MAKAROV presents two scenarios for economic development which he considers as "extreme".

In the first scenario, one assumes that the transformations of the current economic mechanism and of the structure of the economy will be carried out succesfully in the coming 4-5 years. Then the average annual growth rates of the GDP (found by using the method of the U.S.S.R. State Committee of Statistics), which dropped from 3.7% for 1981-1985 to 3.5% for 1986-90, will further drop to 3.0% for 1991-1995 and then will rise to 3.8% for 1996-2000 and remain stable at this level in the future.

The second scenario assumes that ten years are needed to transform the economy and that this transformation will be less successful. As a result, the average annual growth rates of the GDP will fall in 1991-1995 to 2.0-2.2%, then remain stable at this level during the period 1996-2000, and rise to 2.5-2.8% thereafter. A. MAKAROV presents this scenario as the lowest possible for which "destruction of society will still be averted".

In these scenarios, the fundamental social problems are solved as follows.

Food stuffs enough to meet the normal nutrition standards will be available in 1997 with the first scenario and in 2005 with the second.

Both scenarios assume that each family will have an apartment or a house by 2005 (20-21 m^2 per person); today's West European standard (30-32 m^2 per person) will be reached by 2005 in the first scenario and 2030 in the second.

The amount of durable goods will double by 2005 in scenario one and 2020 in scenario two (and will triple by 2010 and 2030 respectively).

The number of private cars per capita will triple by 2015 and 2030 in scenarios one and two and will jump six-fold by 2025 by scenario one, reaching today's West European level.

Restructuring of the economic system and the industrial production is required in both scenarios. This in itself will produce energy savings of 55 and 30 Mtoe by the year 2000 with scenarios one and two respectively.

Intensification of technological energy conservation will double in the first scenario and increase by a factor of 1.5 in the second leading to savings at 230 and 160 Mtoe respectively, in year 2000. Corresponding figures for year 2010 are 480 and 340 Mtoe.

By integrating the scenarios for economic development with these optimum values for energy conservation, one obtains in both scenarios an increase of the total primary energy consumption from about 1400 Mtoe in 1990 to about 1600-1650 Mtoe in 2000 and 1700-1800 Mtoe in 2010.

Since the population of U.S.S.R. is seen to grow from 285 million in 1988 to 309 million in 2000 and 324 million in 2020, the primary energy consumption per capita would slightly increase to 5-5.5 toe/year over the period.

B - An Increase of Energy Production ?

Keeping in view the export of oil and mostly natural gas to European and Far East countries (China, Korea and Japan), such an increase in domestic energy demand would lead to an increase in primary energy which A. MAKAROV envisages as follows:

- Growth in gas production from 680 Mtoe in 1990 to 830-870 Mtoe by the year 2000 and 920-950 Mtoe by 2010 with fundamental reconstruction of electric power and heat production.

- Maintaining as high a level as possible of oil and condensate production: 590-610 Mtoe in 2000 and 570-600 Mtoe in 2010.

- Moderate systematic growth of nuclear plant capacity (60-65 GWe by 2000 and 70-100 GWe by 2010) provided "extra - safe reactors having reasonable costs will be designed in the nearest future".

- Moderate growth of coal mining from 325 Mtoe in 1990 to 340-370 Mtoe in 2000 and 380-340 in 2010.

As already seen in chapter III.1, these goals of increasing production are a formidable challenge, economically and environmentally.

C - A realistic Energy Conservation Potential

The largest "energy resource" of U.S.S.R. for the short and medium term lies with the rational use of energy.

The most realistic value of the energy saving potential presented by various soviet experts is about 280 Mtoe saved in year 2000. At first view, this figure seems to be very high, but one can remember that, between 1974 and 1987, the amount of energy saved in France on the 1987 primary energy consumption is estimated to be about 40 Mtoe, over a total primary consumption of about 200 Mtoe. U.S.S.R. consuming now about 1400 Mtoe, we find the same factor 7 between energy saving potential (280 compared to 40) and the total consumption (1400 compared to 200).

The need for higher energy efficiency is certainly more stringent in U.S.S.R. today - it is a vital necessity - than it was in France (and Western Europe) in 1974 and the France's economy was, at this time, more "energy sober" than the U.S.S.R.'s economy is today.

The main problem is not the amount of the potential, which is enormous, than the ways and means of the implementation of a vigorous energy conservation policy, consistent with the improvement of the environmental situation.

III.4. ENERGY CONSERVATION

A - Obstacles

Energy conservation objectives are no new thing in U.S.S.R., since already in the various Plans of the seventies they were integrated into the energy policy.

The failure of the energy conservation policy have numerous and complex reasons. Some are found worldwide (the "market economy" does not solve everything), others are more specific to the Soviet System. These can be classified into three large categories.

a/ The centralized decision-making system:

The energy saving objective (mostly in industry) were/are decided by the GOSPLAN: for instance 100 Mtep in 1995. Then, they are "distributed" by the same GOSPLAN between the various Ministries and enterprises which have "quotas" to achieve.

In parallel, the GOSPLAN gives to the GOSNAB instructions for the production of the necessary equipment to reach these objectives. A small amount of money is given for that to GOSNAB since the priority is given to energy supply.

As a result, the "complex" for mecanical industries cannot produce the required equipment. The Ministries and industries, not willing (and having no interest) to respect the objectives assigned, have an excellent reason (no equipment) for doing nothing...

b/ In spite of the high level of technological R & D, there is lack of equipment to improve the efficiency of the energy utilization in all sectors: insulation material, energy measuring or regulating devices, etc.

The first step of energy conservation, which is to know the energy consumption for each use is impossible at present.

c/ The consumer's price system: energy for the consumer (households, enterprises) is seen as a "basic need" and therefore its price is extremely low (like for instance the rent of an apartment). The consumer has absolutely no economic incantive to save energy.

The main difficulty is not the absolute price of energy at the consumer level but the fact that the prices of the energy products are very low relatively to the prices of energy saving material, equipment or appliances (for instance insulating material like fibre-glass).

To link those three obstacles, one can add that, even if there was an economic incentive (with higher prices), very often the consumer could not do anything (it is impossible to regulate the heat in the rooms - of an apartment or a hotel for instance - since there are no taps - ordinary - on the radiators), and will not find the necessary equipment.

B - Priority to organization

Many soviet experts (from GKNT, Academy of Sciences, Office for Energy of the Government) are convinced that the evolution towards a "market economy" with increasing prices of energy products, even if it succceeds will not be sufficient to give the necessary impulse to the energy conservation policy: it must goes deeper and faster.

They think that it is necessary to create an institution in charge of the implementation of this policy, independant of the Ministries and the energy producers, at the level of the Council of Ministers.

Until now, this proposal has not been accepted by the government, due to the opposal of the "vertical" Ministries.

This project is now in discussion in particular in GKNT, Academy of Sciences and the Office for Energy.

In parallel, the Academy of Sciences created in 1988 an "Agency for Innovation" (the president of which is M. IVANOV*) working in close collaboration with the Supreme Soviet. The president of the sub-Commission for Energy of the Supreme Soviet, M. BUSHUEV*, is also vice-president of the "International Centre for Energy Efficiency and Conservation"*, created in November 1989 by the Academy of Sciences as a department of the Agency for Innovation.

The International Centre, which has already the support of several foreign organizations (the US NRDC for instance), is acting as a network coordinator with various Institutes.

The International Centre is at the convergence of the most active institutions in the current situation (Academy of Sciences and Supreme Soviet). It wants to expand its programmes and responsibilities. It is open to international cooperation and willing to cooperate.

IV - PROPOSALS FOR COOPERATION

The analysis of the U.S.S.R.'s energy system and of its constraints presented in the preceeding chapters leads to guidelines for the cooperation which can be envisaged by the Commission of the European Communities.

U.S.S.R. having developed on a large scale the production, transformation and utilization of all energy sources, there is obviously opportunities of cooperation in all sectors.

Instead of establishing a list of all these possibilities, we shall try to focus on the subjects that we think are priorities or are in the interest of the European Community to be developed.

IV.1. RESEARCH AND DEVELOPMENT

It would be a misjudgement to consider U.S.S.R. only as a provider of energy sources (oil and natural gas) and a buyer of efficient equipment with an unlimited market that will open widely in the future to the Western firms.

If many difficulties arise at the manufacturing level, U.S.S.R. has a very high capability in Research and Development.

The reading of the "State scientific and technological programmes", established in 1989 and reproduced in Appendix 2, shows that many R & D programmes can be of interest for the European Community. In particular, in the field of energy (and environment):

- High-temperature conductivity.
- Technologies, machines and processes of the future.
- New materials.
- High speed ecologically clean transport.
- Ecologically clean power engineering.
- Resource-saving and ecologically clean metallurgic an chemical processes.

A deeper study of these programmes with the research Institutes involved would certainly lead to interesting cooperation between U.S.S.R. and European laboratoires, in the interest of both partners.

The Commission of the European Communities could play an important role to organize this cooperation, in particular in the field of environmentally benign and energy efficient technologies.

The best partner for this cooperation is GKNT.

IV.2. NATURAL GAS

Natural gas is the main energy resource of U.S.S.R.

It already ranks first in the total energy consumption with a 37% share. Natural gas exports from U.S.S.R. are very important for the Western European countries supply.

The concern GAZPROM knows difficulties to increase the amount of natural gas which seems necessary for domestic consumption and exports. It is willing to cooperate for improving the efficiency of the transportation system and the utilization of natural gas (including using LNG as fuel for vehicles).
On the supply side, cooperation in all the industries related to natural gas seems appropriate and at the mutual benefit of U.S.S.R. and the European Community.
We shall put Natural Gas as a priority in a future cooperation.
The best partner for this cooperation is the concern GAZPROM.

IV.3. ENERGY CONSERVATION

Regarding the economic and environmental constraints on the energy system, energy conservation and rational use of energy is certainly the main energy resource to be developed in U.S.S.R. for the near future and probably the twenty years to come.

We have seen that the main problems lie with organizational issues.

There is an urgent need to set up several institutions in charge of implementing energy conservation in all sectors of the economy, at national and regional level (regional meaning at the level of the various Republics of U.S.S.R. and in the various regions of the Republic of Russia).

The first cooperation in the field of energy to be proposed by the CEC to the Soviet government would be to help the creation and management of these institutions on the basis of the European experience.

The best partners for this cooperation are the Office for Energy of the Council of Ministers, on one side, and the International Centre for Energy Efficiency and Conservation (Academy of Sciences and Supreme Soviet), on the other side.

As a general recommandation and in view of the recent evolution of the political situation of U.S.S.R., it seems worthwile not to have only a global appraisal of the energy situation and problems of U.S.S.R. as a whole but to study the energy situation of the various Republics, in particular the European ones.

At least, in the field of energy conservation and probably also for the development of renewable energies, cooperation with Bielorussia for instance would be certainly of great interest.

APPENDIX 1

PRESIDENT GORBATCHEV's SPEECH ON ENVIRONMENT

(Moscow, January 19th, 1990)

MIKHAÏL GORBATCHEV

ALLOCUTION PRONONCÉE AU FORUM GLOBAL POUR LA PROTECTION DE L'ENVIRONNEMENT ET LE DÉVELOPPEMENT AU NOM DE LA SURVIE DE L'HUMANITÉ

Moscou, 19 janvier 1990

Editions de l'Agence de presse Novosti
Moscou—1990

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Chers invités,

Mesdames et messieurs,

Camarades,

Les cinq jours que vous avez passés ici, à Moscou, dans une atmosphère d'intenses contacts fructueux, vos discussions étoffées, les documents que vous avez adoptés permettent de dire: un pas important a été fait dans la formation de la conscience écologique de l'humanité. Or, c'est d'une extrême actualité.

La menace d'une catastrophe thermonucléaire militaire a déjà été comprise. Les savants ont fait, là aussi, un apport inappréciable. Les forces internationales à tous les niveaux: politiques, diplomatiques, sociales sont mobilisées contre cette menace. Et les premiers résultats sont là. Mais une seconde menace s'est précisée, jusque-là sous-estimée: la menace à la vie sur la Terre du fait de la dégradation de l'environnement.

Les grands esprits du passé avaient prévu les conséquences de la «domestication» de la nature par l'homme. Ils avertissaient: le genre humain peut s'exterminer lui-même en exterminant le

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monde végétal et animal, en empoisonnant la terre, l'eau, l'air. A la fin du XX^{e} siècle, nous sommes en présence d'une crise extrêmement grave dans les rapports entre l'homme, la société et la nature.

Reprenant les mots d'Emmanuel Kant, on peut affirmer: l'**impératif écologique** est entré catégoriquement dans la politique des Etats et dans la vie quotidienne des hommes. Il devient catégorique non seulement parce qu'un préjudice difficilement réparable a déjà été causé à la nature. La nouvelle révolution scientifique, technique, technologique dont nous ignorons encore toutes les conséquences, peut rendre ce préjudice irréversible. Contrairement à certains pessimistes excessifs, nous ne sommes pas fatalistes. Mais l'heure de la décision, l'heure du choix historique a sonné. Et il n'existe pas pour l'homme raisonnable d'alternative, étant donné qu'il n'est pas disposé au suicide. L'humanité est une partie de la biosphère, or la biosphère forme un tout.

Nous puisons les ressources pour la vie dans la production des biosphères d'autrefois. Et nous ne devons pas oublier que l'eau pure, l'oxygène dans l'atmosphère, le rendement des sols sont le résultat de l'interaction de centaines de milliers d'espèces de plantes, d'animaux et de micro-organismes, composantes des écosystèmes. La stabilité des systèmes écologiques et, par conséquent, la qualité du milieu dépend de la préservation et du maintien de la diversité biologique et de l'équilibre de la biosphère. Votre forum s'est prononcé sans équivoque: il faut changer fondamentalement quelque chose dans les facteurs du progrès ultérieur. Changer pour garantir le droit premier de l'homme, le droit à la vie. Nous sommes d'accord avec cette conclusion.

Je dois reconnaître que ce n'est que dernièrement qu'on a compris en Union Soviétique de la façon requise au niveau politique l'importance vitale du problème écologique. Le danger de guerre nous obnubilait. Il faut dire ce qui est. Mais ce n'est pas seulement de cela qu'il s'agit. Après la révolution, ayant déployé l'industrialisation du pays, nous n'étions pas enclins à nous «laisser détourner» par des questions qui nous semblaient alors secondaires et à plus forte raison à dépenser pour cela nos maigres ressources. Les dimensions du pays, ses richesses encourageaient cette insouciance écologique.

Même lorsque la pollution de l'environnement a commencé à prendre une allure dangereuse, dans plusieurs régions, cela n'a pas été tout de suite apprécié comme il aurait dû l'être. Ce sont nos savants, et il leur faut en rendre hommage, puis la population, qui ont sonné l'alarme écologique. La perestroïka, ayant modifié nos approches philosophiques mêmes des problèmes du développement de la société, a elle aussi modifié radicalement nos idées sur l'écologie. Un rapport circonstancié sur la situation écologique nationale, le premier dans l'histoire de l'Etat soviétique, a été dernièrement publié chez nous. Une analyse impartiale de nos malheurs et de nos périls est donnée dans ce «livre vert». La pollution de l'atmosphère de nombreuses grandes villes dépasse des taux prohibitifs. L'état des ressources d'eau menace de graves conséquences le monde végétal et animal. Le sol se dégrade, la santé des populations est atteinte, celle des générations futures menace de risque de l'être aussi.

Dans son arrêté «Les grandes options de la politique intérieure et extérieure de l'U.R.S.S.», le Premier Congrès des députés du peuple a appelé à un réexamen profond de notre développement, dont de notre attitude envers la nature, mis le cap sur l'écologisation de notre politique. Qu'entendons-nous par là?

C'est avant tout un changement radical du caractère des activités productives du point de vue de leurs conséquences écologiques. Nous devons prendre en considération la capacité écologique des régions en implantant des complexes économiques. Nous devons comparer les possibilités des systèmes écologiques des diverses régions à leurs plans économiques, en tenir compte dans la politique démographique, régionale et nationale. Il faut songer, bien entendu, à une mise en œuvre suivie et rigoureuse de mesures de protection de la nature, aux technologies mêmes employées dans l'industrie et dans l'agriculture, à l'économie de l'énergie et des ressources, à l'introduction de technologies et de productions sans déchets.

L'écologisation de la politique, c'est une nouvelle approche du problème de la consommation, de sa rationalisation. L'amélioration du niveau de vie ne doit pas se faire en épuisant la nature, elle doit s'accompagner de la préservation et du renouvellement des conditions d'existence du monde animal et végétal.

L'écologisation de la politique concerne également les approches de la solution de nombreux problèmes sociaux liés avant tout au préjudice causé à la santé des populations par la dégradation déjà effective de l'environnement.

L'écologisation de la politique, c'est le soutien maximum apporté aux recherches scientifiques, aux disciplines fondamentales s'occupant de la biosphère et de ses écosystèmes.

L'écologisation de la politique, c'est l'affirmation de la priorité des valeurs universelles, c'est l'enrichissement de l'instruction et de l'éducation, dès l'enfance, d'un contenu écologique. La formation d'une attitude nouvelle, moderne à l'égard de la nature. Et en même temps le retour à l'homme du sentiment qu'il est une partie de la nature. Sans cela, l'assainissement moral de la société est impensable.

Nous avons déjà engagé la restructuration radicale de l'ensemble du système de protection de la nature dans le pays. Des programmes finalisés par régions et entreprises sont approuvés ou en cours d'élaboration. Le Soviet suprême de l'U.R.S.S. a promulgué l'arrêté «Mesures urgentes à prendre pour l'assainissement écologique du pays». On met la dernière main au projet de programme d'Etat à long terme de protection de l'environnement et d'utilisation rationnelle des ressources naturelles. Il prévoit d'atteindre par étapes à l'horizon 2000 (2005 pour certains critères) la qualité exigée de l'environnement, de maintenir la diversité spécifique des ressources biologiques, les indices scientifiquement fondés d'utilisation des richesses naturelles. En d'autres termes, il s'agit d'accomplir un énorme travail d'harmonisation des rapports entre l'homme et la nature. Et il y a du travail pour chacun ici: aux organes législatifs et exécutifs, à la science et à l'instruction, aux organisations et mouvements sociaux, à l'initiative individuelle.

Les mouvements pour la protection de la nature ont pris une grande ampleur dans notre pays. Ils ont porté, il faut le dire, des coups vigoureux à l'incompréhension et à la résistance technocratiques dans ce domaine aussi. Parfois, il est vrai, de même que dans les autres pays, les actions de nos «verts» forcent la note. On ne doit pas, en défendant passionnément la nature, porter atteinte aux systèmes mêmes de survie de la population. Il n'est pas difficile, bien sûr, de fermer purement et simplement telles ou telles productions. Bien que l'on doive recourir à ces mesures aussi car le problème a été trop négligé. En principe, cette méthode radicale de protection de la nature ne donnera pas grand-chose, mais elle peut causer un énorme préjudice au développement des forces productives de la société et, par conséquent, aux possibilités de protéger la nature à un niveau moderne.

Quelle est la meilleure solution ici? La répartition raisonnable des forces productives, des entreprises productrices d'énergie et autres à vocation fédérale doit reposer aussi sur l'exigence obligatoire de la sécurité écologique en faisant appel à une expertise scientifique impartiale, et en cas de nécessité, internationale.

Je voudrais souligner l'importance croissante du contrôle de la réalisation de tous les programmes concernant la santé écologique de la société par le Soviet suprême de l'U.R.S.S., les Soviets des républiques et autres.

Encore une chose sur laquelle je souhaite attirer votre attention. Il existe encore dans notre immense pays des systèmes écologiques vierges. Nous accordons de ce point de vue une grande importance à la création de réserves et d'autres territoires sauvegardés. Vers l'an 2000, leur superficie doit tripler approximativement. Ce sont des laboratoires uniques de la nature situés depuis les îles de l'Arctique jusqu'au Caucase et à l'Asie Centrale. Ils peuvent servir d'étalons de la nature vierge et aussi d'objets de coopération écologique internationale.

Messieurs,

La situation écologique est différente dans chaque pays. Beaucoup ont une expérience intéressante de protection de la nature. Et nous estimons que toute expérience concluante mérite l'attention générale et une utilisation concrète. La crise écologique que nous traversons est une preuve convaincante, quoique tragique, de ce que le monde est interconnecté, interdépendant. Cela semble être aujourd'hui reconnu partout.

Mais il en découle une nécessité d'**une politique internationale dans la sphère de l'écologie aussi**. Ce n'est qu'en ayant une telle politique, ensemble, que nous pourrons éviter la tragédie. L'élaboration d'une telle politique pose évidemment des questions nouvelles et difficiles, touchant parfois à la souveraineté des Etats. Et pourtant, le problème peut être résolu. Mais aussi sur la base d'efforts collectifs et du consensus. Bien des choses intéressantes ont été dites à votre forum sur la façon dont pourrait se former une politique écologique mondiale. Et nous réfléchirons à tout ce qui a été dit, je peux vous en assurer. En principe, l'Union Soviétique est pour une préparation urgente, énergique d'un programme international pour sauver la biosphère et rétablir ses forces vitales. Voici nos principales idées à ce sujet.

Primo. L'Union Soviétique soutient résolument les plans de protection de la nature et les actions dans ce sens de l'Organisation des Nations Unies et de ses organes. Nous sommes pour que la Conférence sur l'environnement et le développement sous l'égide de l'O.N.U., prévue pour l'an 1992, au Brésil, ait lieu au niveau le plus élevé. Il serait sans doute bon qu'y soit posée la question de l'élaboration d'**un code international d'éthique écologique.** Obligatoire pour tous les Etats, il contiendrait des critères uniques d'attitude civilisée à l'égard de la nature. Une telle action symboliserait la volonté de la communauté mondiale, exprimée par ses plus hauts représentants, de construire la vie au XXIe siècle selon des lois nouvelles. La conférence de 1992 pourrait aussi adopter **un programme global d'actions** pour la protection de l'environnement et l'utilisation rationnelle des ressources naturelles. Il engloberait la protection du climat de la Terre, la protection de la flore et de la faune de la planète, le maintien de la diversité biologique sans laquelle il est impossible de sauvegarder les propriétés régulatrices de la biosphère et, par conséquent, la vie même sur la Terre.

Secundo. L'Union Soviétique estime indispensable de créer **un régime de protection des zones naturelles uniques**, ayant une importance planétaire, basé sur le droit international. Cela concerne en premier lieu l'Antarctique. L'épaisse couche de glace antarctique est un musée inestimable du passé de la Terre, de son histoire géologique et écologique. Il est significatif que l'Antarctique soit devenu la première zone non nucléaire au monde et le premier territoire de la planète entièrement ouvert aux recherches scientifiques internationales. On partage, en Union Soviétique, la préoccupation de beaucoup de savants et d'hommes publics au sujet de l'exploitation des ressources naturelles de l'Antarctique. Nos petits-enfants ne nous pardonneront pas si nous ne sauvegardons pas cet écosystème extraordinaire. L'U.R.S.S. est prête à participer à la préservation de la vie de l'Antarctique, réserve mondiale, notre laboratoire naturel commun.

Prenons le problème du Danube, de la mer Noire et de la Méditerranée. 75% des pollutions arrivent dans la mer Noire par le Danube. Au cours des dernières décennies, la couche supérieure de sulfure d'hydrogène y est montée de 200 m à 75 m de la surface. Encore un peu et, par le Bosphore, il gagnera la mer de Marmara, dans la mer Egée, puis la Méditerranée. Or, aux accords sur la mer Noire ne participent que la Bulgarie, la Roumanie, la Turquie et l'U.R.S.S. Pouvons-nous résoudre le problème de cette mer uniquement en épurant le Dniepr, le Dniestr, la mer d'Azov sans le Danube, sans les pays situés sur tout son cours? Est-il possible de résoudre les problèmes de la protection de la Méditerranée sans les pays de la mer Noire, sans l'U.R.S.S.? Il est temps que nous réfléchissions ensemble à cela.

Et un «héritage écologique», comme les forêts tropicales, les récifs coralliens, n'exige-t-il pas les soins de toute l'humanité? Ou tous ces phénomènes uniques de la nature comme le lac Baïkal?

Tertio. L'Union Soviétique estime qu'il est grand temps de créer un mécanisme international de **coopération technologique** pour la protection de la nature. La civilisation mondiale constitue un tout, ce qui implique l'unité d'action dans ce domaine aussi. Nous sommes pour l'élaboration d'un système d'échanges internationaux de technologies écologiquement propres qui garantisse efficacement l'accès à ces technologies de tous les pays, sans exception, dans le cadre du régime de la nation la plus favorisée. Nous sommes prêts à permettre l'inspection sur notre territoire pour dissiper tout soupçon que la technologie est utilisée à d'autres fins.

C'est pourquoi je partage la préoccupation qui a été exprimée ici, à savoir qu'il y ait eu peu de représentants du monde des affaires à cette rencontre de Moscou. Il faut pallier cette insuffisance aux prochaines rencontres. Et, j'espère que le docteur Hammer devienne le maillon de liaison entre l'actuelle rencontre et les futures. Quant à nous, nous lui souhaitons de longues années de vie.

Quarto. Le passage à de nouvelles formes de coopération, dignes du XXI^{e} siècle, inscrit à l'ordre du jour la nécessité d'avoir un **mécanisme de monitoring et de contrôle écologiques international.** Aujourd'hui, les mesures de confiance écologique peuvent s'appuyer sur des méthodes, des procédures et des appareils analogues à ceux qui sont utilisés dans le contrôle de la réduction des armements, y compris les inspections sur place. On pourrait commencer par la création de réserves nationales.

Quinto. Le droit à un environnement sain est un des droits de l'homme. **Le droit de l'individu et des associations de participer à l'élaboration de la politique écologique** doit être assuré aussi. L'Union Soviétique est d'accord avec cette conclusion de la conférence écologique de Sofia des Etats participant au processus paneuropéen. Cela implique une information écologique complète et sûre. Il faut instituer que chaque Etat présente régulièrement des comptes rendus sur son activité dans le domaine de la protection de la nature, sur les incidents écologiques survenus et évités.

Les pays membres des communautés européennes discutent activement à présent de l'organisation et des fonctions d'**une agence européenne pour l'environnement.** L'Union Soviétique soutient l'idée de créer une telle agence et est prête à participer dès le début à son travail. D'autres idées méritent aussi l'attention, par exemple, la proposition de l'Autriche de créer des détachements internationaux de protecteurs de la nature, de «casques verts de l'O.N.U.». Effectivement, il faudrait peut-être créer une sorte de «croix verte» internationale, qui aiderait les Etats en cas de catastrophes écologiques. La proposition de l'U.R.S.S. de créer auprès de l'O.N.U. un centre de secours écologique urgent va dans le même sens. Selon nous, la principale tâche du centre sera de former des groupes opérationnels internationaux d'experts se rendant sur les lieux de brusque dégradation de la situation écologique. Le Secrétaire général de l'O.N.U. recevra bientôt la liste des savants et spécialistes soviétiques que le gouvernement soviétique sera prêt à dépêcher à ses frais sur demande du centre.

Sexto, last but not least. L'Union Soviétique estime que le temps est venu où **l'activité militaire doit être réduite non seulement pour diminuer la menace de guerre, mais aussi par nécessité de préserver l'environnement.** Le plus juste et le plus décisif serait ici l'interdiction complète des essais nucléaires. Devant votre prestigieux forum international, je déclare à nouveau que l'Union Soviétique est prête, à tout moment, à cesser totalement et pour toujours les essais nucléaires si les Etats-Unis en font autant.

En liaison avec la convention sur l'interdiction et la destruction totale des armes chimiques qui, nous l'espérons, sera bientôt signée, la nécessité surgit de créer une technologie écologiquement sans danger pour mener cette tâche à bien. Une collaboration internationale en est encore nécessaire, car il s'agit de détruire des dizaines de milliers de tonnes de cette arme sinistre. Et en général, l'activité militaire sur terre, sur mer et dans les airs et même dans l'Espace doit tenir compte des conséquences écologiques. Nous avons l'intention, à ces fins, d'introduire des restrictions pour les vols de l'aviation militaire, les mouvements des troupes terrestres et des navires de guerre. Nous sommes prêts aussi à des accords internationaux à ce sujet.

Messieurs,

chers amis,

Bien souvent, des termes ont un sens à leur naissance et en acquièrent un nouveau avec le temps. C'est ce qui s'est produit avec le terme même «écologie», apparu au XIX^{e} siècle, comme concept exclusivement scientifique, a pris pour nous le sens de porteur de destin. C'est également ce qui s'est produit avec le terme «biosphère» apparu lui aussi au XIX^{e} siècle. Dans les œuvres du grand savant russe Vladimir Vernadski, ce mot a pris un sens nouveau. Il a créé la théorie de la biosphère et a posé le problème de la transformation de tout le milieu habité par l'humanité en sphère de domination de la raison.

Je veux vous dire en conclusion: tout ce qui s'est dit à ce forum, ses documents constituent un appel à assurer le triomphe de la triade, formant un tout, de la connaissance scientifique, de la raison humaine et de la morale universelle. La tâche est aussi grandiose que difficile. Je vous souhaite à tous, je nous souhaite un plein succès.

APPENDIX 2

STATE SCIENTIFIC AND TECHNOLOGICAL PROGRAMMES OF U.S.S.R.

(1989)

STATE

SCIENTIFIC AND TECHNOLOGICAL

PROGRAMMES

MOSCOW 1989

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State Scientific and Technological Programme

HIGH-ENERGY PHYSICS

Goal	Basic trends
Acquisition of new knowledge on the structure of matter, research on the laws of microcosm	NEW-GENERATION ACCELERATORS Design and development of a proton accelerator-accumulator complex of 3000 GeV, an accelerator complex with colliding linear electron-positron beams of 1000x1000 GeV and a complex of high-current proton accelerators
	STRUCTURE OF ELEMENTARY PARTICLES AND PROPERTIES OF BASIC INTERACTIONS Research on weak and strong interactions on ejected (hadron, gamma, electron, hyperon) and colliding (proton-proton, electron-positron, electron-proton) beams; research on rare processes and strong long-range interactions using accelerators with energies of 600 MeV (pions) and 30 GeV (kaons)

Goal	Basic trends
	LARGE-SCALE DETECTORS Research on flux of particles and on the mechanisms of energy emission by the Sun and stars using large-scale ground, underground, underwater and underice detectors

EXPLANATORY NOTE

to the "High-Energy Physics" Programme

High-energy physics is one of the most important trends of the present-day natural science that shapes the main concepts of the surrounding world, structure of matter, structure and interactions of elementary particles, origins and the structure of the Universe. The foregoing experience shows that research on the structure of matter has resulted in the development of methods for the practical application of nuclear power and the attendant changes in the life of society.

The main research tool in the high-energy physics is represented by charged-particle accelerators procuding powerful beams of protons, electrons, neutrinos and other particles which help, like x-rays, examine the substance to distances by scores of thousands times smaller than the size of an atomic nucleus. The higher the energy, the deeper the levels of the structure of matter that come under the scrutiny.

The state scientific and technological programme "High-Energy Physics" is aimed at the development and construction of powerful accelerators and nuclear installations, that are unique in complexity, for the purposes of basic and applied research. The experiments in the range of 6000 GeV envisaged within the framework of the programme may result in the discovery of new fundamental laws and interactions, including links of strong, weak and electromagnetic interactions that are considerably more powerful than those nuclear, and in a discovery of basically new phenomena and sources of energy, the existence of which is predicted by the current theory of elementary particles.

A broad range of enterprises and scientific establishments is involved in the design and development of accelerator technologies and their main components, magnetic systems in particular, including superconductor, large-scale superhigh-vacuum systems (up to 10^{-11} mm Hg); powerful cryogenic plants, microcryogenic equipment; radiation-resistant, electrical engineering, and vacuum materials and devices; remote-control robotics and new-generation picosecond electronics and VLSI chips. The participation of such establishments in solving of problems that are at the limit, and, occasionally, beyond the technological possibilities of today will have a stimulating impact on the whole sectors of the national economy and on scientific and technological progress of the country in general.

Tentative results on the development of bismuth and thalium ceramics and ceramics without copper or rare-earth elements and the envisaged basic and applied research provide a sound base for a fast progress in industrial applications of high-temperature superconductivity.

The State Scientific and Technological Programme

MARS

Goals	Basic trends
Global study of the Mars surface and atmosphere; building of theoretical models of the formation and evolution of Mars and other planets of the Solar system; preparation for a manned flight to Mars; extensive introduction of the programme's spin-offs in science, technology and the national economy	MARS MODEL Development of a detailed engineering model of the planet based on the study of its surface, ground, atmosphere and gravitational field by new-generation unmanned space vehicles PREPARATION OF MANNED FLIGHT Investigation of engineering feasibility of a manned flight to Mars; solving of relevant biomedical problems; organization of international cooperation and launching of the effort on design of hardware for a manned flight THE SOLAR SYSTEM Investigation of the origin and evolution of the Solar system through basic Mars-related research

EXPLANATORY NOTE

to the "Mars" Programme

Mars - related research will make a significant contribution to the understanding of the fundamental laws of the Solar system origin and evolution. Along with Venus, this planet has a great likeness to the Earth. There are grounds to believe that in the past Mars had a much warmer climate and denser atmosphere, favourable for the emergence of life. It is assumed that the simplest forms of life may exist in certain regions of the planet even now.

The history of climate and geology of Mars and the question of water on this planet, a search for extraterrestial forms of life, investigation of the planetary magnetic field and its changes constitute a complex of basic problems of the highest scientific priority. A manned flight with landing on Mars may be viewed as the final stage of this work. The general scientific and technological potential of the USSR, the US and other developed countries prompts feasibility of such expedition by the years 2015-2017. A manned flight to Mars through the effort of many states would have a great scientific importance coupled with a vast political effect.

In order to ensure the attainment of the final goal, a successful manned flight to Mars, it is necessary to implement a large-scale preparatory research programme using automated space vehicles to develop a detailed engineering model of Mars, determine the expedition's profile and solve a host of scientific, engineering and organisational problems. These include investigations of the Mars surface, its ground and atmosphere, compilation of detailed digital relief maps, building of the gravitational field model and selection of landing sites using unmanned space probes. This stage is to culminate in the creation of a maximally detailed engineering model of Mars. At the same time it is necessary to determine the ways of solving the biomedical problems of the flight and problems of radiation safety of the crew. To this end, it is necessary to continue flights of manned orbital stations, satellites of the "Prognoz" type and other special space vehicles.

Considering that the experimental data on various characteristics of the planet Mars and its satellites acquired even at an early stage will be of great scientific value it will be expedient to exchange the available data on Mars, e.g. data available in the US on giant planets and their satellites. Such an exchange will certainly promote gualitatively new research on the general properties of the Solar system and its origin and evolution. Solving of this fundamental problem will be of tremendous importance comparable with solving of the problem of the structure of matter and properties of the Universe.

Research on other problems relating to a manned flight to Mars will involve production of unique materials and substances for electronics, optics, medicine and pharmacology under the conditions of microgravitation.

The State Scientific and Technological Programme
HUMAN GENOME

Goal	Basic trends
Complete decoding of the molecular structure of the human genome and creation of new methods for diagnosing, prevention and treatment of various human diseases	MAPPING OF CHROMOSOMES AND SEQUENCING OF THEIR DEOXYRIBONUCLEIC ACIDS (DNA) Development of genetic and physical maps of human chromosomes and establishment of the primary sequence of nucleotides in their DNA STRUCTURAL AND FUNCTIONAL ANALYSIS OF GENOME Identification of functionally important parts of the genome and various genes including the use of DNA probes; establishment of the molecular mechanisms of realization of information encoded in the genome

EXPLANATORY NOTE

to the "Human genome" Programme

The establishment of the structural-functional organisation of the human genome is one of the priority tasks of the world science. In scope and significance it is on a par with the development of information and computer technology, utilization of nuclear power and conquering of the outer space.

The preceding stages of the evolution of molecular biology and molecular genetics were, essentially, the starting base for the implementation of this research, basic to humanity.

Tangibility of establishing the complete structure of the human genome has come to be perceived in the past two or three years in connection with the development of the theory and methodology in the molecular biology research fronts such as gene cloning, establishing of the genic structure, separation of chromosomes and large DNA fragments and creation of automatic sequencers for the determination of nucleotide sequences.

The complete decoding of the molecular structure of the human genome will give insights into the functioning and development of the human organism, the nature of ageing, hereditary defects and genetic predisposition to various diseases, their diagnosing and treatment. These studies will contribute to many parts of biology and will promote the development of new research fronts in medicine and biotechnology.

Large-scale application of the DNA sequencing technology is important in terms of monitoring of mutations in the human genome and in other living organisms, caused by the impact of diverse environmental factors including radiation.

The State Scientific and Technological Programme

NEW INFORMATION TECHNOLOGIES

Goal	Basic trends
Research, design and development of super-high-capacity computer technology based on new architectures and physical principles with the speed of up to 1000 bn operations per second; development of data-banks and knowledge bases in all sectors of economy; development of AI systems, data transfer and processing using high-speed communications lines with the carrying capacity of up to 600 m bit per second; building of systems models	HIGH-CAPACITY COMPUTERS Development of computers and systems based on new architectures and new physical principles (molecular, neural-net, optical, superconductor electronics) with the speed of up to 1000 bn operations per second SUPERLARGE-CAPACITY EXTERNAL MEMORY Development of memories using new physical principles (optical, holographic, etc.) with the capacity of up to 10000 bn byte ARTIFICIAL INTELLIGENCE SYSTEMS Creation of professionally-oriented man-machine complexes of higher complexity with natural-language interfaces

The "System Models" trend envisages designing of algorithmic and programming tools for management of large-scale engineering, economic and social projects including implication forecasting.

The State Scientific and Technological Programme
TECHNOLOGIES, MACHINES AND PROCESSES
OF THE FUTURE

Goal	Basic trends
Design of basically new technologies, development and organisation of manufacturing of new-generation systems and complexes of machines with subsequent implementation of projects of integrated machine-building production ensuring a many-fold increase in labour productivity, high quality of products, resource and energy saving, ecological safety and a radical improvement in working conditions	TECHNOLOGIES OF THE FUTURE Development of basically new methods of moulding using high-density energies, superhigh pressures and rates, superplasticity and layer-by-layer synthesis Development of methods for production of surfaces with prescribed properties including implanting electrophysical, electrochemical, laser and film strengthening of products and use of damping structures NEW-GENERATION MACHINES Block-module equipment and machine systems using electromechanotronic units

Goal	Basic trends
	One-piece units and sets with a quaranteed service life Machine systems integrating technologies of different physical nature Intelligent (learning) robots with opto- and biosensory systems Test systems and machine tools of submicrometre precision COMPUTERIZED INTEGRATED PROCESSES Research and development of projects of the processes of the future basing on electronization, advanced resource-saving technologies and materials, a changeover from individual technologies to systems and complexes of new-generation machines and flexible computer-controlled processes in various sectors of the national economy using unified highly integrated electronic, microprocessor and laser systems of management, information, diagnostics and control

EXPLANATORY NOTE

to the "Technologies, Machines and Processes" Programme

The goal of the programme is to develop intelligent integrated production systems relying on electronics, application of resource-saving technologies and materials ensuring a changeover from individual kinds of technology to systems and complexes of new-generation machines and flexible computer=controlled processes in various sectors of the national economy using unified high-integration electronic, microprocessor and laser systems of management, information, diagnostics and control.

The programme envisages the creation of basically new resource- and energy-saving low-waste technologies and materials to implement continuous processes for moulding of parts from construction materials on metallic and non-metallic base, high-density energy processes and computer-controlled assembly.

The programme provides for the development and introduction of new-generation systems of automatic machine tools and industrial robots performing a large number of operations with high accuracy of positioning and built-in microprocessers and sensors, and of machine tool complexes and devices for automation and mechanization in cooperatives and in the social sphere.

It is envisaged to implement integrated CAD/CAM systems in mechanical engineering using distributed networks and PCs and create a direct desgner-industrial engineer-machine interface.

The programme's implementation will make possible a breakthrough in the development of automated plants of the future using advanced technologies, equipment and industrial structures. It will help raise productivity in mechanical engineering by 8-10 times, reduce hazardous discharge by 2-3 times, including the reduction of gasous and solid waste by over 1 m/t per year.

The State Scientific and Technological Programme

NEW MATERIALS

Goal	Basic trends
Development and production of new structural and functional materials for the national economy	METALLIC MATERIALS Low-activated, radiation-resistant at irradiation of up to $3x10^{22}$ neutrons per sq.cm, resistant to hydrogen corrosion and cold of up to $-253^{o}C$ steels and alloys, hydrogen-accumulating alloys, steels with superquilibrium nitrogen content; alloys with the amorphous and microcrystalline structure, superplastic, monocrystallic, ensuring a 2-3-fold improvement of properties; steels and alloys with "shape memory" and 3-5-fold enhancement of stability of properties in the extreme conditions: aluminium alloys with enhanced modulus of elasticity and decreased density;

Goal	Basic trends
	increase in strength and operating characteristics as compared to source polymers;
	special-purpose polymer materials (electroconductor, liquid-crystal, photohardening, water-soluble, gas-separating, magnetic, optically-transparent, biodegradable, ecologically clean, etc.) with properties exceeding those of the existing polymers by several times;
	advanced technologies and equipment for production of polymer materials
	GLASS MATERIALS
	Glass ceramics with high biocompatibility;
	glass fibers 3-4 times stronger than the existing ones
	ULTRAPURE SUBSTANCES AND MATERIALS
	Development of methods for production of substances and materials with the content of admixtures of 10^{-6}-10^{-8}% mass

EXPLANATORY NOTE

to the "New Materials" Programme

Currently used structural and functional materials have reached the limit of their possibilities in terms of properties. Low indices of such critical characteristics as radiation resistance, activation, resistance to cold and heat, high-temperature strength, optical properties regulation and bio-compatibility do not allow for the implementation of fundamental developments of new-generation technologies.

Classes of materials selected in the programme correspond to the world trends of scientific and technological progress whereas the threshold characteristics sought after represent a problem to be solved by the world science and technology.

The suggested projects on the development and introduction of the latest structural and functional materials with a unique array of properties are based on the discoveries of the domestic science and other scientific advances, and are aimed at the development of technology of the future.

Metallic Materials

- radiation-resistant and low-activated steels and alloys will ensure a 2-3-fold enhancement of reliability and safety of nuclear power engineering structures and complete protection of vehicle-borne space equipment from radiation;

- high-strength steels with the superequilibrium content of nitrogen, metals and alloys with the amorphous and micro-crystalline structures, steels and alloys with the "shape memory" with stable properties in the temperature range of -253°C to 500°C, alloys with a high damping ability, high-strength aluminium alloys of decreased density and enhanced modulus of elasticity help design space stations with long service life in the orbit (25 and over years), improve the operating characteristics of aircraft by 1.5-2 times and develop propulsive devices of new types;

- ultradispersion powders of metals and alloys for electrochemical current sources with the efficiency of over 90% and by 2-3 times improved weight, size and service life characteristics open up new ways towards the development of large effective and ecologically safe power plants for power supply of cities and regions;

- water-, corrosion- and cold-resistant steels and alloys as well as hydrogen accumulating alloys will help develop ecologically clean hydrogen-fuelled transport;

- general-purpose steels with enhanced strength will help reduce metal-intensity of structures, machines and equipment by 20-25%.

Ceramic Materials

- structural ceramics with prescribed physico-mechanical properties make it possible to develop a new generation of engines which save 25% of fuel and have the 20% higher efficiency with service life of up to 10000 hours for various means of transport;

- ceramics with damping structures and durability by an order of magnitude exceeding durability of the existing hard-alloy materials will be used for manufacturing of wear-resistant and cheap tools for working of materials;

- ceramic membranes will help perform separation processes in corrosive media and under high pressure and temperature.

Composite materials

- carbon-carbon, carbon-carbide-silicon, metal-carbon composites in combination with laminated metal composites reducing weight of structures by 15-20% provide for the production of reliable and cost-effective aerospace shuttle technology and hypersonic aircraft for civil aviation;

- composites with carbon fibers made of pitch provide for cost-effective production of parts and units for transport, agricultural and other machinery with by twice increased service life and 30-40% saving of fuel as compared to the existing machinery.

Polymer Materials

- structural polymers and their mixtures and alloys, synthesized using the new technology, with techno-economic indices improved by 20-30% will make it possible to design general-purpose structures, units and sets with operating characteristics improved by over 2 times;

- polymer conductors and magnetoactive materials used instead of alloys of silver, non-ferrous metals and electrical-sheet steels will help develop electric motors, generators and transformers with losses of energy decreased by 10 times and 5-fold lower metal-intensity of power engineering equipment;

- liquid-crystal polymers provide a possibility for the development of reliable optoelectronics, parts and units of aerospace technology operating in the extreme conditions;

- membranes for separation of gas mixtures - hydrogen, helium, hydrocarbons, oxygen, nitrogen, carbon oxides, etc. - with a high carrying capacity and selectivity up to

12 times exceeding the currently existing, make it possible to develop oil and gas refining equipment of a new generation for work in corrosive media.

Glass Materials

- biological glass ceramics make it possible to implant bone and dental prostheses possessing high biocompatibility;

- special glasses help develop fiber optoelectronics with performance characteristics improved by an order of magnitude.

Ultrapure Substances and Materials

- monocrystallic silicon, gallium arsenide, indium phosphide, volatile inorganic hydrides and other substances with the prescribed level of purity make it possible to begin the development of new-generation computer technology with memory capacity of 10 gigabit and speed of 10^{10} operations per second;

- superhigh silicon dioxide, metal chlorides and organometallic compounds will ensure the development of optical communications lines with the carrying capacity of over one gigabit per second and the distance between the relays of over 300 km;

- monocrystals of non-compensated germanium with the admixture content of 10^{-10} % mass help produce nuclear emission detectors with resolution by scores of times exceeding the existing ones.

The development of new structural and functional materials within the scope of the given programme is aimed at creation of technology of the future envisaged in other state programmes including the projects of the programmes "High-Energy Physics", "New Information Technologies", "Ecologically Clean Power Engineering", and "High-Speed Ecologically Clean Transport".

The development and commercial production of new structural materials will increase their share in the total volume of metallic and polymer structural materials used in production of new-generation technology by up to 20% by the year 2005.

The State Scientific and Technological Programme

ADVANCED BIOLOGICAL ENGINEERING METHODS

Goal	Basic trends
Use of advanced bio-engineering methods for accelerated development and effective utilization of bio-technologies in various industries, agriculture and health care	GENETIC AND CELLULAR ENGINEERING Development of recombination micro-organisms, cellular and tissue cultures -producers of physiologically active substances, drugs, chemicals and the original forms of transgenic plants and animals with economically useful properties
	BIOTECHNOLOGY Development of biotechnological methods for extraction and processing of mineral resources, extraction of metals from solutions and treatment of industrial wastewater for protection of the environment

Goal	Basic trends
	PROTEIN ENGINEERING Designing of peptides and proteins for their subsequent use as diagnostic and medicinal preparations
	EXTRACELLULAR PROTEIN SYNTHESIS Development of a cell-free biotechnology for producing genetic materials and substances of the protein nature realizing protective and regulatory functions in organisms of man and animals
	ENZYMOLOGICAL ENGINEERING Production of biocatalysts including immobilized biocatalysts for application in various industrial processes and in the agro-industrial complex

EXPLANATORY NOTE
to the "Advanced Biological Engineering Methods"
Programme

The programme envisages a further extension of research into the physico-chemical bases of life, development of new bioengineering methods and their introduction. Genetic engineering will be used to produce substances that implement the regulatory and protective functions in human and animal organisms such as insulin, interleukins, vaccines against hepatitis A and B, growth hormones, angiogenin, tumor necrosis factor, neuropeptides, etc. The development and application of recombination microorganisms, human, animal and plant cells and tissues in production of such substances will make it cheaper and faster, especially at cultivation of animal cells in serum-free media to enhance the yield and purity of the end product. This will promote the development of new methods for diagnosing, treatment and prevention of the most widespread diseases (neoplasms, viral and cardio-vascular diseases).

Recombination microorganisms will also be used to develop the technology of full extraction of some metals (copper, gold, cobalt, etc.) from ores and ore dumps and develop the continuous process to produce fodder protein from various kinds of renewable resources.

It is envisaged to use the methods of genetic and cellular engineering to create the original forms of transgenic high-yield crops resistant to various diseases caused by viruses, bacteria and fungi and to stress factors (drought, elevated and decreased temperatures, soil salinization, etc.) and of animals of high productivity and hereditary immunity to leukosis, brucellosis and other diseases.

Besides, transgenic plants and animals may be used as "live bioreactors" to produce some kinds of biologically active substances.

An effort will be launched to develop the theoretical bases of an original method for extracellular synthesis of protein for production of drugs enhancing the regulatory and immune properties of the organism and those to treat tumors, cardio-vascular and other diseases (interleukins, calcitonin, AHC-factor, etc.).

In enzymological engineering it is envisaged to study the mechanism of the enzymatic action and develop biocatalysts for new processes for production of large-tonnage chemicals, i.e. hydrogen, organic acids and alcohols, acrylamide, etc. with lower (by 2-3 times) specific energy expenditure decreased through regulated selectivity.

The State Scientific and Technological Programme
HIGH-SPEED ECOLOGICALLY CLEAN TRANSPORT

Goal	Basic trends
Development of basically new transportation technologies and means of ground transport of a high level of safety, comfort and ecological purity; development of the optimal structure of passanger traffic and freight haulage	RAILWAY "CENTRE-SOUTH" LINE Development of the system and the supporting equipment of transport by rail for carriage of passengers with the speed of up to 350 km/h
	MAGNETIC FLOATERS Development of a transport means and a road structure for urban, commuter and interuroan passanger services with the speed of 500 km/h
	ECOLOGICALLY CLEAN MOTOR VEHICLE Development of motor vehicles using advanced technical sclutions and new materials, and alternative kinds of fuel and energy

EXPLANATORY NOTE
to the "High-Speed Ecologically Clean Transport"
Programme

Assessment of techno-economic and operating parameters of a specialized high-speed railway passanger service Centre-South and selection of options for freight carriage by this railway are under way in the USSR.

Putting this railway in operation will create the conditions for the extension of the network of high-speed railways by linking the Centre-South and Moscow-Leningrad lines and constructing lines to connect different regions.

Magnetic floaters are a new kind of high-speed ecologically clean transport.

A possibility for creating such means of transport has appeared in recent years owing to new advances in electrical engineering and electronics and to the development of new materials. Intensive research on high-temperature super-conductivity may also yield good results in this direction.

The programme envisages the development of motor vehicles of future generations using new technical solutions such as "ceramic", "plastic", and steam-power engines, hybrid engines with regeneration of energy, engines working on hydrogen and other alternative kinds of energy, stepless electronically-controlled transmissions with a flywheel energy accumulator, use of optic-fiber and electronic systems of warning, multiplex wiring and control, high-strength materials, plastics, composites and ceramics as well as new technologies.

Besides, the implementation of the programme will help create new prototype systems embodying new ideas and adaptable to automatic transport systems of the future using new navigation principles of motor vehicle transport organisation and management.

Introduction of new generations of trucks, buses, cars and electric cars will qualitatively improve the fleet of motor vehicles for carrying passangers and freight, reduce the consumption of oil-based fuels by 1.4-2 times and save ferrous and non-ferrous metals in production and operation.

The State Scientific and Technological Programme
ECOLOGICALLY CLEAN POWER ENGINEERING

Goal	Basic trends
Design and development of new technologies for generation of electric and thermal power that ensure greater involvement of low-grade fuels and nuclear power into the energy balance, provide for saving and rational management of power resources and drastic mitigation of harmful impacts of energy sources on the environment	SAFE NUCLEAR POWER PLANT Development of a technology and equipment for new-generation nuclear power plants of enhanced safety ECOLOGICALLY CLEAN THERMAL POWER STATION Development of advanced technologies and equipment for thermal power stations on solid fuel (coal, shale) ensuring a drastic reduction of hazardous emissions, integrated utilization of mineral resources and waste NONTRADITIONAL POWER ENGINEERING Development of cost-effective reliable equipment for utilization of renewable energy resources (solar, geothermal, wind and biological); development of methods for utilization of low-potential energy resources FUELS OF THE FUTURE Development of advanced technologies and equipment for production of effective kinds of fuel by deep processing of coal and by gas refining

EXPLANATORY NOTE
to the "Ecologically Clean Power Engineering " Programme

In formulating the main trends of the programme the need for the accelerated development of nuclear power engineering and for the improvement of the energy and fuel balance of the country through broader utilization of coal and reduction of oil and gas consumption was taken into account.

The task is posed of reducing consumption of organic fuel by 280-310 m t. equivalent fuel by the year 2005 through utilization of nuclear power and by 35-40 m ton equivalent fuel through the use of nontraditional sources of energy and an increase in the share of coal consumption (mostly low-grade coal) in the total consumption of organic fuels by electric power plants from 32-34% to 50-55%.

Special emphasis is on construction of nuclear power plants with a radical improvement of the reactor design in terms of self-protection, broad use of failure control devices, protective and localizing systems ensuring a decrease in the probability of radioactive emissions presenting radiation hazard to 10^{-6}-10^{-7} events per year.

The implementation of the programme's oojectives will provide for

- progressive involvement of nuclear power in the sphere of electric and thermal power generation to replace organic fuel against the background of increased safety and effectiveness of nuclear power plants;
- extended use of solid fuel in electric power engineering with a drastic mitigation of a negative impact of power plants and coal enterprises on the environment;
- further involvement of qualitatively new energy agents represented by renewable and low-potential sources of energy in the national economy.

The State Scientific and Technological Programme

RESOURCE-SAVING AND ECOLOGICALLY CLEAN METALLURGICAL AND CHEMICAL PROCESSES

Goal	Basic trends
Development and introduction of new metallurgical and chemical processes ensuring lower resource intensity and manyfold reduction of industrial discharge into the environment; recovery of purity of atmospheric air and natural waters through application of advanced ecologically clean technologies	STEEL-ROLLED PRODUCTS Development of basically new processes using continuous metallurgical plants for production of metal products with high consumer properties at a decrease of energy consumption by 20-30% and reduction of harmful emissions by 2-3 times TURBULENCE REACTOR Development of new-generation technologies of superfast chemical processes in turbulent flows ensuring an increase in the reactor specific output by 2-3 orders of magnitude, a decrease in the consumption of raw materials and catalysts by 15-20% and reduction of the amount of non-utilizable waste CLEAN CELLULOSE PRODUCTION Development of ecologically safe process for cellulose production ensuring the 5-fold decrease of the wastewater amount and the 10-fold decrease of its toxicity as well as elimination of hazardous substances in gas emissions MEMBRANE PROCESSES Development of membrane processes for product concentration and wastewater treatment in low-tonnage chemical productions; development of new methods for intensification (up to 30%) of operation of water treatment facilities, manyfold reduction

To this end, it is envisaged to create basically new cooking, washing and sorting equipment, new types of membranes and membrane devices to separate gas and liquid mixtures, bleaching agents, catalysts, etc.

The programme's implementation will allow for involvement of low-grade wood in production, elimination of hazardous impacts of pulp-and-paper mills emissions on the atmosphere and drastic reduction of hazardous discharge into water bodies (the 10-fold decrease of input of organic compounds, reduction of the amount of organochloric compounds from 17 to 1.5 t per t of cellulose). This will conform to the requirements of future ecological safety standards for the content of pollutants in wastewater of pulp-and-paper mills.

The "Membrane Processes" developments will help renovate chemical processes to prevent their harmful impact on the environment and involve valuable chemical substances in production.

Application of membrane technologies will make it possible to recover in the wastewater treatment process paint-work materials, pigments, acids, oils and other products, recover up to 8-10 t of silver as well as nickel, chromium and other rare and non-ferrous metals from wastewater of electroplating productions. It is envisaged to completely eliminate input of mercury into the environment in production of caustic soda and chlorine and to enhance by 20-22% the effectiveness of biological water treatment systems.

Introduction of membrane technologies in combination with adsorption and absorption processes of wastewater purification and utilization of by-products will help adopt closed turnover water supply systems.

The State Scientific and Technological Programme

HIGH-EFFICIENCY FOOD PRODUCTION PROCESSES

Goal	Basic trends
Development and introduction of new ecologically clean, intensive and resource-saving technologies for production of agricultural and food products	SOIL FERTILITY Development of ecologically safe methods to increase soil fertility through soil biology research, remote diagnostics, use of nontraditional natural and polymer materials, effective fertilizers, combination of dry and irrigation methods of land improvement INTEGRATED PLANT PROTECTION Development of integrated systems of plant protection from pests, diseases and weeds using entomophages, pheromones, biopesticider and ecologically safe chemicals HIGH-PRODUCTIVITY PLANTS AND ANIMALS Development of new varieties and hybrids of agricultural plants and new breeds of animal combining high productivity and resistance to the extreme conditions basing on the original forms of transgenic plants and animals

Goal	Basic trends
	FOOD AND FODDER PROTEINS Development of methods and technologies for production of food and fodder proteins with wide utilization of nontraditional kinds of vegetative materials to obtain high-quality food products
	STORAGE OF AGRICULTURAL PRODUCE Development of biological and physico-chemical methods and equipment to reduce losses of agricultural produce in transportation and long-term storage
	COMPLEX-2000 Development of ecologically clean pilot complexes for production and processing of grain and products of animal husbandry using new intensive technologies and equipment
	SEA FARMING Development of technologies for growing of valuable sea fish species, invertebrates and algae and for integrated processing of sea farming materials to produce high-quality food products, biologically active substances and fodder products.

EXPLANATORY NOTE

to the "High-Efficiency FOOD PRODUCTION PROCESSES"

Programme

The programme is aimed at improvement in production and processing of agricultural produce and in the structure of food products consumption.

It is envisaged to develop and adopt nontraditional methods for determination of the mineral composition of soils using remote ground and aerospace methods and new kinds of equipment. A system for optimization of the use of mineral fertilizers and other chemicals, natural (zeolites, etc.) and man-made polymer adsorbents will be created in order to regulate the water regime of soils; methods and technologies for desalting reclamation of soils and for the combined use of dry and irrigation land improvement will be developed.

The task is posed of broad application in plant growing of such agents as

- nitrogen-fixing soil bacteria, which will help decrease consumption of costly nitrogen fertilizers;

- chlorine-free potassium fertilizers and advanced kinds of phosphate fertilizers (melted magnezium-calcium phosphates, calcium and ammonia polyphosphates with the regulated rate of dissolving in the soil, complex liquid fertilizers, ammophosphates from poor phosphate raw materials that do not contain active fluorine and harmful admixtures of heavy metals);

- new safe chemical and biological means of plant protection including the use of Arthropoda insects (entomophages), biologically active compounds, pheromones among them, new-generation biopesticides based on nitrobacteria strains, etc. , inhibiting growth of some pathogens and promoting the creation of a system of integrated plant protection from pests, diseases and weeds relative to the specific regional features and species composition of crops (grains, industrial crops, vegetables and fruits).

This will ensure a combination of high plant productivity with other economically valuable properties required for plant cultivation and processing in various natural-climatic zones of the country, enhance land productivity by 2-3 times with a significant decrease of specific resource consumption, and provide for production of healthy and ecologically clean products.

It is envisaged to create immune and highly productive varieties and hybrids of agricultural plants through extension and utilization of the gene pool of cultured and transgenic plants, gene banks encoding resistance to cold, nitrogen fixing, tolerance to various viruses, pathogens and other extreme factors.

New systems will be developed to sanitate plants and diagnose pathogens using cheap noninmmunological methods based on application of genetic engineering DNA probes. Nonpathogenic viruses will be used to develop methods of transferring new genes capable of imparting to plants valuable properties without changing the comprehensive characteristics of varieties and hybrids.

Objectives in animal husbandry will involve breeding of new groupings of agricultural animals with the increased productivity potential and fodder assimilation, stable heredity and immunity to leukosis, brucellosis, tuberculosis and other dangerous diseases, and development of new genetic - engineering vaccines and diagnostic agents. This will help enhance average productivity of livestock by 2-3 times and improve the quality of meat and dairy products.

In order to remove the existing shortage of food protein and produce new kinds of food products on its base it is envisaged to create biotechnological, extrusion, and other advanced methods of protein production, primarily from beans and oil-yielding cultures, biomass and other promising and widely cultivated plants.

It is envisaged to develop effective methods of long-term storage through the application of new biological means, ionizing irradiation, electric-pulse and other methods for inactivation of tissue cells and inhibition of pathogenic microflora. An economico-mathematical model of the potential storage life of agricultural produce based on the account of agronomical factors, after-harvest treatment and storage, all tied in together, will be developed.

To solve the problem of stable production of quality grains and livestock breeding products it is planned to create highly mechanized pilot agricultural complexes based on model farms in different regions of the country. The harvest per area unit is to increase by 2.5-2 times as matched against the existing level while labour productivity is to increase by 3-4 times.

Comprehensive mechanization and automation of keeping of animals, cultivation, harvesting and fodder cultures processing will reduce labour expensiture for fodder production by 3-4 times and for meat production by 2 times. Meat-and-dairy

EXPLANATORY NOTE

to the "Combating Widespread Diseases" Programme

The programme is aimed at the implementation of the tasks stated in the position paper "The Guidelines for health population protection and restructuring of the USSR health care system in the 12th Five-Year Plan period and for the period ending in the year 2000" and envisaging the decrease in mortality and invalidism by 20-25% and the 15-20% decrease in incidence of diseases, causing a temporary loss of the working ability, and an increase in longivity of the population.

The programme covers research on the most widespread or socially dangerous diseases such as atherosclerosis, cancer, flu, hepatitis, diabetes, alcoholism, narcomania and AIDS.

Introduction of the research results in the health care practice will make it possible to attain by the year 2005:

- elimination of atherosclerosis as the main non-infectious "epidemic" disease and an increase in longivity of the population, the male population above all, by 8-10 years on the average. Such results will be attained through the development of new drugs and other medical means of treating various forms of hypercholestorolemias and some organisational measures on the creation of specialized network of lipid departments in hospitals;

- the 20% decrease in mortality caused by oncological diseases as a result of elucidation of the molecular - genetic mechanism of transformation of a normal cell into a tumor cell and its ability to metastatic spreading;

- elimination of controlled viral infections, primarily in children, and reduction in the incidence of the most widespread viral diseases (flu, hepatitis) by 20-30% as a result of fundamental studies on the mechanism of viral virulence, viral ecology, and on the development of new drugs and vaccines against flu and hepatitis A and B;

- a considerable decrease in the incidence of alcoholism and somatic diseases caused by the toxic action of alcohol and drugs. New pathogenetic means and methods of treatment of alcoholism and drug addiction will help increase the effectiveness of treatment and rehabilitation in this group of patients;

- a decrease in the term of hospitalization and rehabilitation of patients suffering from diabetes by 3-5 times owing to the development of new reliable technical means such as artificial paucreas and new drugs. The results will be attained through the development and quantity production of high-quality insulin, means of individual glycemia control, pocket insulin-meters and implanted feedback insulin-meters;

- creation of a reliable system of prevention, diagnosing and treatment of AIDS which would prevent its spreading in the country.

The State Scientific and Technological Programme

CONSTRUCTION IN THE YEAR 2000

Goal	Basic trends
Construction of new-generation buildings and structures using	NEW MATERIALS AND TECHNOLOGIES Development of new materials with prescribed properties using effective

Goal	Basic trends
new materials and technologies to solve the housing problem and to reduce the investment cycle in industrial engineering, to increase labour productivity by 3 times, save metal by 30%, cement by 35% and fuel by 40%	binders and low-tempersture ceramics ensuring a decrease in power-intensity by 2 times, in weight of structures by 1.5 times, in cement consumption by 1.5 times; development of new-generation constructions using new materials with prescribed properties, development of the technology and organisation of highly automated production of such constructions
	NEW-GENERATION BUILDINGS Construction of buildings and structures from new-generation constructions ensuring cost-effectiveness, increased comfort and architectural distinctiveness of residential, cultural and industrial structures and providing for the 2-fold decrease in the investment cycle

EXPLANATORY NOTE

to the "Construction in the Year 2000" Programme

The programme envisages a radical modernization of construction using new binders.

Accordingly, new processes, products and constructions for new-generation buildings and structures are under development.

The novelty of effective binders called "low water - consumption binders" (LWCB) consists in the complete utilization of the binding properties of cement clinker (at present over 50% of cement in concrete remains unhydrated) and in the effect from the introduction of dry superplasticizers into the mixture. LWCB help save up to 50% of cement and at the same time improve its quality. Binders of 1000-1500 brand have been developed, which makes it possible to completely replace metal by concrete in some cases and to save concrete in most cases.

Adaptability of LWCB- based concrete mixtures along with application of cellular concretes and ceramics provides for the introduction of automated lines and whole automated plants for production of effective construction materials and products for construction of new-generation residential, public and industrial buildings with improved specific techno-economic indicators, enhanced comfortableness and architectural distinction owing to the use of advanced and, sometimes, entirely new spatio-planning solutions.

The programme is also aimed at the development of an advanced construction technology and erection of new-generation buildings and structures using the state-of-the art construction equipment and means of transportation.

For the attention of those who display interest:

Proposals and suggestions with regard to participation in the above-mentioned projects within the scope of the State Scientific and Technological Programmes should be addressed to:

USSR State Committee for Science and Technology

11 Gorky Street
103009, Moscow
USSR.

В печать 12.10.89 г. Заказ 260 Тираж 500 экз.

ВНТИЦентр

CHAPTER 5

Approach and Proposals for Cooperation

5. *THE APPROACH AND THE PROPOSALS FOR COOPERATION*

5.1 Introduction

The proposals for cooperation in the energy sector between the EEC and **each** of the Central and East European countries, as presented in the concluding sections of the country reports (Chapter 4), are based on the investigation of the energy situation and the needs of **each** of these countries.

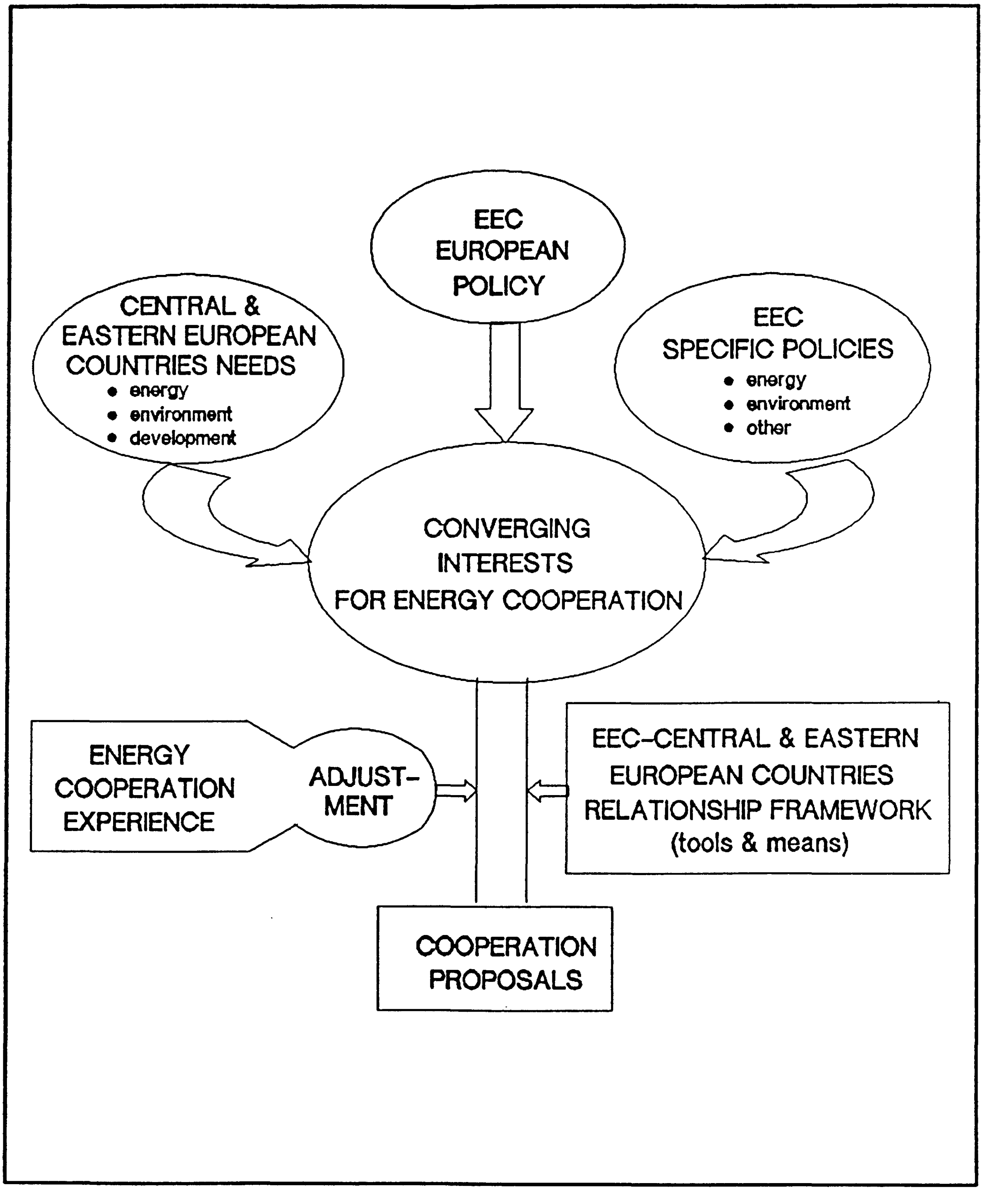
From an overview of these proposals it might be concluded that the problems and needs of the Central and East European countries can be classified in a number of categories, according to the general priority objectives and the means by which these objectives can be reached. It might also be concluded that the cooperation between the EEC and these countries will develop in a general political, social and economic environment, as defined by obvious the available opportunities and the existing limitations, that is or **seems to be** common for all countries.

These conclusions raise the expectations for the feasibility of formulating cooperation proposals for **all** the Central and East European countries in a more general way. What might be called a "structured approach". Such an approach is defined in this Chapter, and an effort is made to formulate the cooperation proposals according to it.

5.2 The Approach

The exercise of formulating proposals for the cooperation between the EEC and the Central and East European countries in any sector has to follow certain well defined steps, as indicated in Figure 1.

Figure 1: Formulating Cooperation Proposals



First the **converging interests** of the cooperation counterparts in the specific sector(s) should be defined. These interests should be based on:

a. the general policy of the EEC towards the specific countries with which cooperation is sought;

b. the specific policies of the EEC in the energy and related sectors, such as the Environment; and

c. the interests and needs of the counterpart countries especially in the energy and related sectors (such as the Environment), as well as their socioeconomic development problems and aspirations.

After the potential areas of converging interests are defined the existing and expected framework of relation between the EEC and the counterpart countries in the domain of politics, the economy, technology and science, as well as in culture, should be analysed in order to determine the most appropriate tools and means to be used for their cooperation.

Furthermore, the experiences in and the capacities for cooperation of the counterparts in the specific sectors should be analysed, evaluated and adjusted to the prevailing in each case conditions.

Input from the steps mentioned above will lead to *raw and unstructured* ideas concerning possible areas and forms of cooperation with each or all of the counterpart countries. Such material can be quickly formulated into **"proposals for immediate action"**. Most of these proposals will be in the form of country specific, yet "narrow", projects, aiming at specific priority objectives (Figure 2).

Experience, though, has proved that the efficiency of Community interventions increases dramatically if a **structured approach** is applied. Such an approach requires that a **Strategy** is adopted within which **Priority Objectives** are defined. Each priority objective is promoted by **Programmes and Subprogrammes**, which are implemented by appropriately designed **Projects and Activities** (Figure 3).

Figure 2: The "Immediate Action Approach", in Formulating Cooperation Proposals

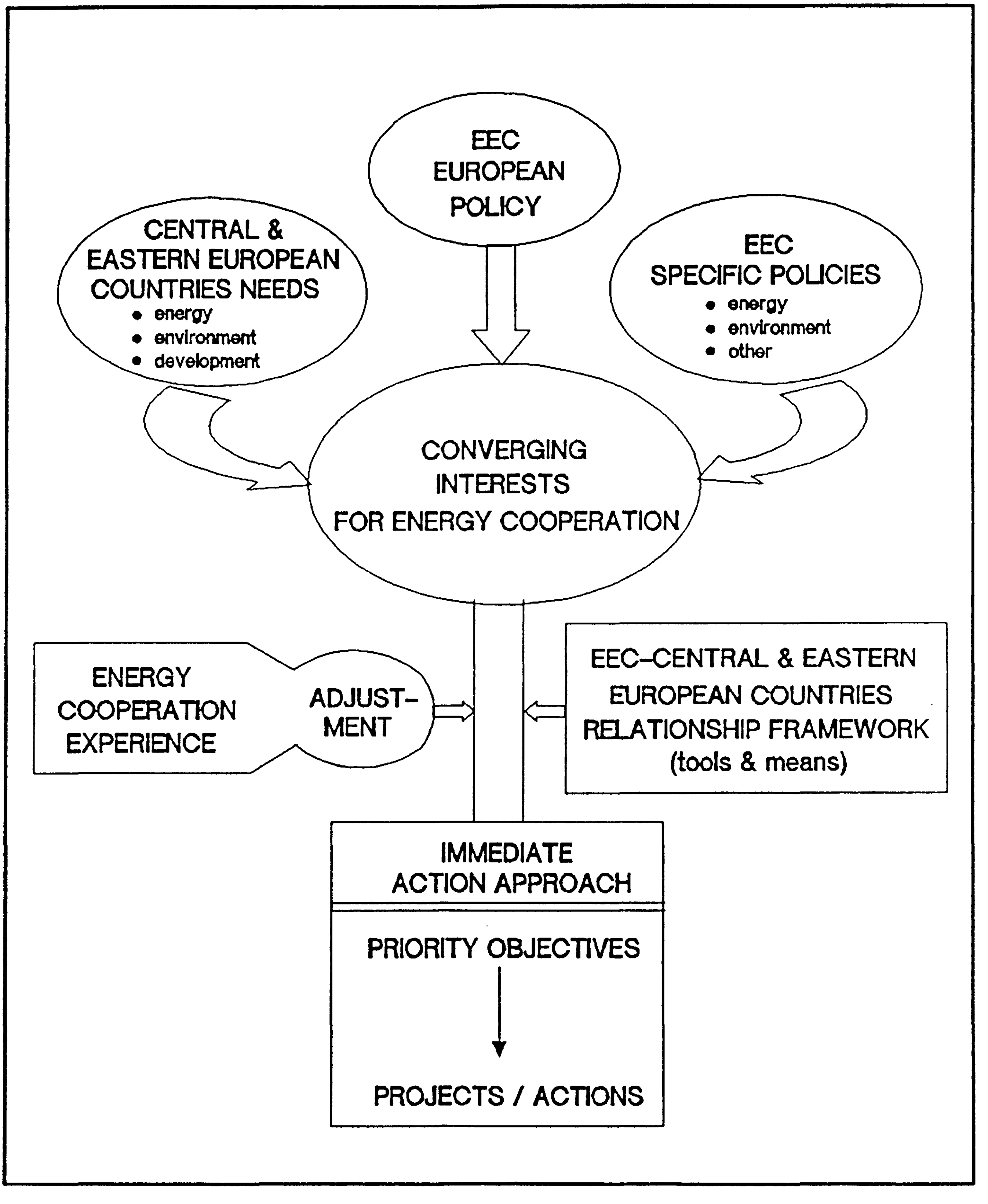
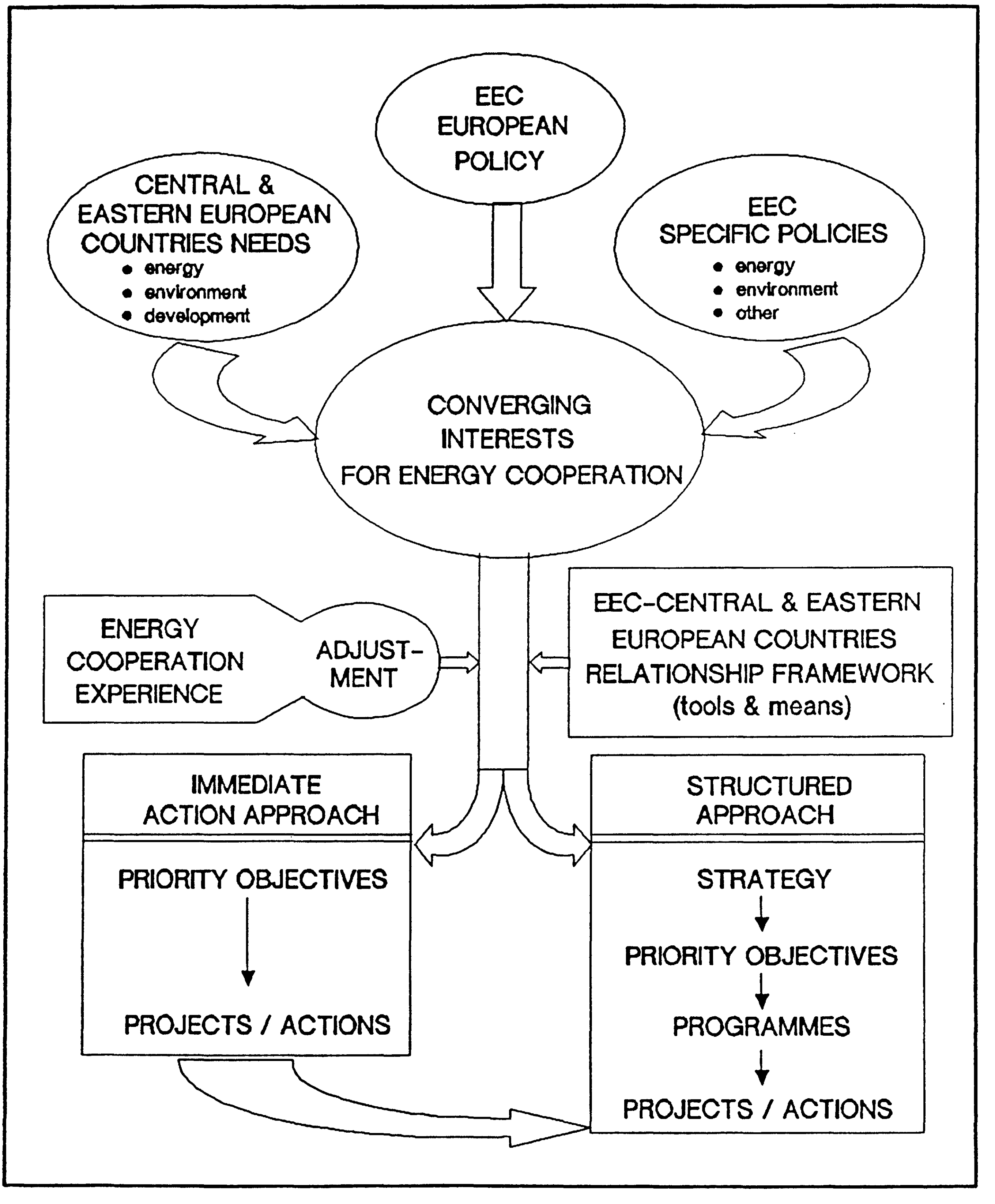


Figure 3: The "Structural Approach", in Formulating Cooperation Proposals



The possibilities to follow the structured approach depend on the experience accumulated over the years in the cooperation between the partners in the specific sector and on the stability of the political, social and economic environment into which the cooperation will develop.

These prerequisites do not exist at present. The experience of cooperation between the EEC and the Central and East European countries is quite small and mainly limited to conventional trade of energy products, while the political, social and economic environment in the counterpart countries is still quite unstable.

More specifically, the preceding analysis indicates that:

First, the problems and the needs of the Central and East European countries in the energy sector are quite different, even if the technical terms that describe them are the same. The economic, social and political situation in each of these countries and the way each has travelled along the road of reforms differ significantly from country to country. In some cases even the exact meaning of the term "reform" is different.

Second, the very fact that **all** the countries of Central and East Europe are in the flux of reforms makes meaningless every effort to define today the structure of a scheme of cooperation in a sector, like energy, which is characterized by the medium- to long-term impacts of its interventions. This is more so since, on the one hand, one of the major institutions that have to be reformed in these countries is their administration and its structure, while, on the other hand, the private sector is still at its "embryonic" stage.

Finally, the future of the Central and East European countries in quite different from case to casen - with the GDR, on the one end of the spectrum, becoming in less that six months part of the EEC, and Romania, on the other end, living through a period of almost complete institutional vacuum.

For these reasons, any effort to strictly follow the structured approach for the formulation of the proposals for the energy cooperation of the EEC with the Central and East European countries should be left for a later time. For the time being the proposals are formulated basically along the lines of the "immediate action" approach. Yet, the principles of *cohesion, synergies, supplementation* of actions etc.- which are the main characteristic of the structured approach, - although not fully employed, do remain as the basic underlying line of thought.

In this respect, and in an effort to **draw the first rough lines** of a probable future well structured programme for energy cooperation of the EEC with the Central and East European countries, the major priority fields of cooperation have been identified according to the country proposals, and the available means for promoting these priority objectives are recorded. For the latter, general principles referring to the selection of the most appropriate forms of these means are proposed, based on an evaluation of the current cooperation environment, as this is defined by the available opportunities and the existing limitations.

5.3 The Cooperation Environment: Opportunities and Limitations

The political, social and economic environmental in which the energy cooperations between the EEC and the Central and East European countries will develop is determined by the political pressures on and willingness of both sides, by the characteristics of the Central and East European Countries, especially those that describe their energy system, and the experience of both sides in energy cooperation.

At all three levels this environment offers significant opportunities; but it is also characterized by certain limitations, which have to be born in mind.

5.3.1 The Political and Economic Environment

Both sides are not only willing to enter into cooperation in the energy – among others – sector, but they are under significant political and economic pressure to do so.

5.3.1.1 The European Communities

The EC were not taken by complete surprise by the almost revolutionary developments in Central and East Europe of 1989. Yet, nobody could have predicted the speed and the extend of these developments. This puts now significant pressure on the Community and its Member States to more fast.

On purely **political grounds**, the developments in Central and East Europe bring to reality – if they do not surpass – the visions for one Europe – fully or partially united – from the Atlantic to the Urals. Thus, any delay towards this vision or omission, which would put it in jeopardy, is politically unacceptable.

The EEC, in this sense, does not only have to catch the opportunity to materialize its Great European concept. It also has the obligation to encourage the developments in Central and East Europe and to help the consolidation of the new regimes.

The pressure is much stronger on **economic grounds** in terms of the emerging new international order and the interrelationship between the effort of the EEC to create its own Internal Market and the opening of the overall European Market, as President Delors has pointed out addressing the European Parliament.

Finally, the developments in Central and East Europe affect the relations of both parties with the rest of the European countries. The new equilibrium that is being created in Europe now will not easily change later.

Specifically in the energy sector the opportunity offered to the EEC to reassess its energy policies is almost unique. Therefore, the closest possible cooperation with all the other European countries is required in order to deal with the energy problems on an all-European basis.

5.3.1.2 The Central and East European Countries

On the other hand, the Central and East European Countries have equally strong incentives to develop close cooperation in the energy sector with the EEC and equally strong disincentives not to do so.

Their energy sector - regardless of the availability of energy resources - is facing acute problems due to the development model they had adopted for almost half a century and their structural deficiencies at the economic and technological level.

Energy is one of the main resource of the producing Central and East European countries and a major problem for the rest of them. In both cases, though, their energy system creates a major bottleneck for their socioeconomic development. They are, therefore, in desperate need to improve the situation. A need that becomes more critical in the context of their effort to reform their economic and social system.

On **economic grounds**, unless the new regimes are able to produce observable results in their economy and more so to improve the consumer good domestic markets they are faced with severe dangers for setbacks. In order to achieve this they need to import foreign capital and technology. Their bad economic conditions, though, - and especially their high foreign debt - make it almost impossible for them to attract either of the two, unless they either move quickly into significant institutional changes - something not always politically feasible - or they develop the appropriate international cooperations. The latter does not, of coarse, eliminate the need for the former; it just gives them some time to shift the domestic balance of power towards the reformers' side and to better prepare the required institutional reforms. This fact transfers the pressure for cooperation onto **political grounds**.

5.3.2 The Characteristics of the Central and East European Countries

The framework and the forms of energy cooperation will be affected by the socioeconomic, the scientific and the technological characteristics of the Central and East European countries. Especially to the degree that such a cooperation takes, at least originally, the form of assistance. Three main characteristics of these countries differentiate the framework and the forms of cooperation, as compared to past experiences involving assistance.

5.3.2.1 The Level of Industrialization

Most of the Central and East European countries are industrialized; some of which with an old industrial tradition. Their energy problems are mainly related to the crisis of their industrial basis that needs modernization. In this sense they have more common characteristics with the EEC "regions in decline", rather than with the less developed regions; in Europe, or elsewhere.

Therefore, the cooperation in the energy sector almost directly implies cooperation in the industrial sector or the inter-relation of the two. The modernization of their industry is an almost absolute prerequisite for the solution of most of their energy problems.

5.3.2.2 Science and Technology

Most of the Central and East European countries are scientifically quite advanced, although they are lagging behind in most fields of technology. This means that the cooperation in these two spheres should develop at different levels. It should also aim at bridging this gap.

The levels of scientific and technological advancement in the countries of Central and East Europe sets at the same time the specifications of the level of the EEC representation in any cooperative effort and of the approach to be applied. It should be also realized that the western style interlinks between the academic institutions, on the one hand, and the sectoral technological, policy and government institutes, on the other, do not exist in most of these countries. The Academies of Sciences and the Universities are the "temples of science", while the technological problems are dealt with separately in State institutes responsible for specific sectors of economic activity.

5.3.2.3 The Human Factor

The long industrial tradition of the Central and East European countries has created an industrial society as well, although some of its characteristics have to be attributed to the specific economic model applied in these countries for the last half century.

On the basis of the industrial tradition, the workforce is quite well trained and disciplined. On the other hand, the state controls have "implanted" to the citizens a certain degree of "indifference" and inability to take initiatives or to assume responsibilities.

To the extend that this is so, any cooperation with the Central and East European countries will have a sound personnel basis at the medium level, while it might face certain difficulties at the top levels, and mainly in the administrative structure. Thus, intensive training for high level personnel is urgent and should take place in the very early phases of any cooperation, while the manpower needed for implementation phases can be easily produced locally by inhouse retraining.

5.3.3 The Value of Past Cooperation Experience

Both the EEC and the Central and East European countries have extensive experience in energy cooperation, as it has been presented in previous Chapter of this report. This experience has to be evaluated against the specific needs of any cooperation scheme before it adopted and applied.

5.3.3.1 The Main Experiences of the EEC

The European Communities have an extremely wide spectrum of experience in energy cooperation. The Commission:

a. has successfully coordinated the national energy policies of the Member States;

b. has run a variety of programmes, involving most forms of cooperation a variety of partners;

c. is involved in activities concerning all subsectors of energy, as well as cross-sectoral issues.

The experience of the Directorate General XVII as well as of the European energy scientific community cover almost all fields, means and forms of international cooperation. If the Community has a weak point, this lies with its ability to affect the behaviour and the practices of the private sector, as to converge more closely to the EEC energy priorities.

Thus, the EEC experience and expertise are more than adequate to offer the basis for its co-operation with the Central and East European countries in the energy sector. The only part of this experience that should not affect its cooperation efforts in Europe is the one related to activities in countries under development in the Third World.

5.3.3.2 The Main Experiences of the Central and East European Countries

The major cooperation experiences, with the exception of trade, of the Central and East European countries are either between themselves or with Third World countries. Their experience with other industrialized countries or in the framework of International Organizations is rather recent and limited.

The energy cooperation of the Central and East European countries while they were members of the CMEA has been characterized, to a significant degree, by the centralization, specialization and complementarity inherent in the centrally planned economies. A group of centrally planned nations could not apply any other model at the supranational level. These characteristics have marked the type of cooperation between them.

In most cases, due to specialization of the cooperating countries in specific fields (e.g. the USSR for nuclear or Bulgaria for thermal power stations) their cooperation was on the **"do it for me"**, rather than on a **"let's do it together"** basis. This is why transfer of technology processes have been shallow and, most of the time, restricted to operational matters of established facilities. Even the participation of the Central and East European countries in the construction of the large Soviet gas trunk pipelines was based on dividing the total length to "national shares" which were constructed by each participating country separately. Certain specific features of the project were the responsibility of countries specializing in these specific technologies; yet even these cases were on the basis of subcontracts, rather than on the basis of cooperation leading to technology and know-how transfer.

In the exercise of any EEC cooperation with the Central and East European Countries these practices should not prevail. The "do it for me" approach – and way of thinking – has to be replaced by the "let's do it together" approach, so that "I can do it myself later".

5.3.3.3 The Experience from the International Organizations

Some of the cooperation activities in the framework of the International Organizations in the energy sector – the ones that have led to success – have managed to put around the table countries of different levels of development, different cultural backgrounds, and with different needs and interests. In the framework of these activities the EEC and the Central and East European countries have already practiced cooperation with one another. These experiences will prove extremely valuable in defining the means and the forms of cooperation between the EEC and the Central and East European countries.

5.4 The Fields of Cooperation

One major conclusion from the preceding analysis of the energy trends and issues in the Central and East European countries as well as from the findings of the field and/or literature review of the energy situation in each of these countries is that the up to recently prevailing development model and the inadequacies of the policy making and planning system in energy have led to high energy intensities and extremely negative impacts on the environment. On the basis of this conclusion as well as on the basis of the analysis of the country cooperation proposals, identifying the areas of interest convergence between the EEC and the Central and East European countries, four major priority fields for cooperation in energy can be proposed. They are:

- policy and planning;
- energy related environmental problems;
- energy conservation; and
- the natural gas sector.

There are also three other fields in which possibilities for cooperation can be developed, as opportunities arise. These fields are:

- conventional energies
- nuclear power; and
- renewable sources

5.4.1 Cooperation in the Fields of Energy Policy and Planning

Energy policy making and planning in all the Central and East European countries has proved to be inadequate, under any type of socioeconomic system. Furthermore, and to the extend that it has been exercised in the recent past, there is a need for complete reassessment in order to be adapted to the market-oriented economy.

It is, therefore, necessary for the EEC to pursue the cooperation with these countries, with the objective to:

- support the reforms of the socioeconomic system by adapting the energy policies to the market-oriented economy;

- support the restructuring of the energy sector itself at both the mezzo- and the micro-economic levels;

- assist each of the Central and East European countries to develop a consistent national energy policy;

- promote an adequately supported dialogue between EEC and these countries aiming at accepting European energy objectives; and

- provide them with the appropriate techniques for policy implementation and planning.

The energy policy issues that can constitute grounds for cooperation, each time according to the specific needs of each specific country, include pricing, regional energy planning, institutional and organizational matters, modelling etc.

The main means for such a cooperation, as they will be defined in following paragraphs, are:

- information and data;
- training;
- modelling techniques;
- technical assistance; and
- administrative support.

5.4.2 Energy and the Environment

The development and energy model applied in the Central and East European countries in all - except the transportation - sectors have resulted to severe deterioration of both the physical and the cultural Environment. The energy related environmental problems created in these countries are already "exported" to their other European neighbours.

It is, therefore, in the interest of the EEC to develop close cooperation with all these countries with the objective to:

- reduce the already existing environmental energy induced problems, not limited to the ones referred to as "pollution", but including problems related to the landscape and the cultural heritage as well;

- adopt environmentally sensitive energy policy making and planning methods; and

- promote and provide environmentally acceptable technologies.

The main means for promoting the cooperation towards these objectives include:

- training;
- technology transfer;
- monitoring institutions, techniques, equipment and standards; and
- financing of investments and infrastructures.

5.4.3 Energy Conservation

The comparison of the energy intensity and the per capita energy consumption proves that in all Central and East European countries there is an enormous potential for energy conservation. The reduction of energy consumption through conservation should also reduce the energy induced environmental problems and improve the contribution of the energy sector in the economics of these countries. The EEC is also interested in the reduction of the share of the Central and East European countries in the world energy markets.

The scientific and administrative energy communities in these countries are not only aware of but they are also anxious to tackle the problem. The situation is therefore ripe for the EEC and the Central and East European countries to develop cooperation in energy conservation with the objective to:

- promote the efficient use of energy in all sectors, i.e. agricultural, industrial, tertiary and domestic;

- improve the energy security at a national and a regional (supranational) level;

- reduce the total energy costs of the Central and East European economies, both for production and for imports; and

- reduce the environmental impacts of energy production, transformation and consumption.

The main means for promoting cooperation in the field of energy conservation are proposed to be:

- information and data

- technical assistance, mainly on the institutional, organizational and management issues;

- industrial cooperation, part of which should be promoted through the private sector;

- training;

- monitoring, with emphasis to institution building, techniques, equipment and standards; and

- financing of investment and infrastructures.

5.4.4 The Natural Gas Sector

Natural gas is considered by most of the Central and East European countries to be the form of energy that will alleviate, if not solve, certain of their acute energy problems. This is, at least one, of the reasons that they have invested heavily in the construction of the Soviet pipeline system. Their recent international reorientation offers them wider alternatives in the gas sector and for exploring and developing them they need the cooperation of the EEC.

On the other side, the EEC has to reassess its policies in the gas sector on the basis of the new options of an all–European network, which can incorporate the European North–East and the Mediterranean regions leading to completely different – as compare to those before 1988 – seasonal balances.

It is, therefore, proposed that the EEC and the Central and East European countries develop their cooperation in the gas sector, having in the back of their mind the possibility of the extension of this cooperation to the countries of the Mediterranean basin, with the objective to:

- diversify their energy sources;
- substitute other sources for natural gas; and
- reduce environmental, energy induced, problems.

The basic means for promoting this cooperation are proposed to be:

- technical assistance, especially in planning, contracting, pricing, and substitution at end user;

- technology transfer; and

- financing of investment and infrastructure, mainly related to transportation and storage facilities, distribution networks and linking of national networks.

5.4.5 Other Fields

The fields of conventional energies, nuclear energy, and renewable energy resources are not of less significance compared to the four fields referred to previously. Nor the cooperation in these fields to less desired. Yet, the input received during the field-missions in the Central and East European countries indicates that practical extensive cooperation in these fields is either premature at this stage (as in the field of renewables), or related to major decisions that have to be taken before any specific cooperation can develop (as in the nuclear energy sector), or they offer day-by-day opportunities, most of which are in the domain and the competences of the private sector (as in the case of conventional energies, beyond the subjects included in the preceding paragraphs 5.2.1 to 5.2.4)

The Commission, therefore, should not exclude these fields from its plans for cooperation with the Central and East European countries. The fact that they do not offer opportunities for immediate action at this stage does not mean that such opportunities can not be developed nor that such cooperation will not become necessary in the framework of a more structured approach, when such an approach is ready to replace the immediate action approach employed at this stage.

5.4.5.1 Conventional Energies

Most of the cooperation in conventional energy sectors should be conducted through the private sector, given the appropriate incentives. The framework for such cooperation and the specific priorities will be developed by the Central and East European countries as soon as they are able to produce their new energy policies and to make enough progress in the socio-economic reforms required to attract foreign investments.

In this respect the role of the financial institutions, both the existing and the new (EBRD), should play the most decisive role. The point should be made that appropriate financing schemes (including global financing) as well as financial and technical support services should be come available to potential counterparts from both sides, wishing to cooperate.

The major objectives of the cooperation in the field of conventional energy sectors are to:

- increase the efficiency in production, transformation, distribution and consumption of energy; and
- reduce the capital intensity of the conventional energy sectors.

5.4.5.2 Nuclear Energy

The nuclear energy sector in the Central and East European countries has developed, exclusively for all practical purposes, under the Soviet influence. It is therefore carrying with it all the problems of Soviet nuclear technology intensified by the technological inadequacies of the specific country operating the respective plants in each case.

The cooperation between the EEC and each of these countries in the nuclear sector cannot be formulated unless decisions of higher priority, putting the nuclear sector in a coherent energy policy framework for each country, are reached.

In the meanwhile there is an urgent need to face the problems arising from the operation of the existing nuclear stations. It is therefore proposed that the EEC promotes the cooperation with the Central and East European countries in the nuclear sector with the objective to:

- reduce risks of existing nuclear plants; and
- reassess the need and the technological options of the nuclear sector on the basis of sound planning and policy considerations.

The basic means for promoting cooperation in this field are:

- technical assistance; and
- technology transfer.

5.4.5.3 Renewable Resources

The promotion of renewables is all Central and East European countries has been discussed with the appropriate experts and officials. It seems that, although they are aware of their national potential and the international, including EEC, progress and state of the art in this field, they place renewables at a second priority, due to the acuteness of the problems in the fields placed on first priority.

Still cooperation in this field should be sought with objectives to:

- explore and promote the use of renewables;
- reduce environmental cost associated with the exploitation of renewables, especially in geothermal and hydro;
- introduce clean energy technologies;
- reduce cost of energy and dependency on imports; and
- promote local socioeconomic development by exploiting local indigenous resources;

The cooperation in this field should and can capitalize on the considerable (positive and negative) experience accumulated in the Commission's services over the last years. It should be pointed out, though, that all efforts towards cooperating in this field should, from the very beginning, be incorporated into programmes, rather than take the form of independent individual actions or projects. This is basically due to the nature of this energy sector, which depends in most cases on many and small – rather than few and large – projects, while it interrelates with a large number of non–energy fields of economic activity.

The cooperation in the field of renewables can be promoted by all available means of cooperation, as they will be presented below, but emphasis should be given to:

- the financing through global schemes, obeying to appropriately formulated specifications; and
- the promotion of inter–regional cooperation, open to all regions of the EEC and the interested regions of the Central and East European countries.

5.5 The Means of Cooperation

Five main categories of means for the promotion of the cooperation between the European Communities and the Central and East European countries in the energy sector have been proposed in the previous paragraphs. They are:

- information and data;
- training;
- technical assistance;
- technology transfer; and
- financing.

Cooperation in the energy sector can also be promoted by or through:

- industrial cooperation;
- inter–regional cooperation;
- administrative support; and
- monitoring.

The specific content and form that these means will depend, of course, on the specific conditions that prevail in each instance. These conditions depend on the specific characteristics of the counterpart country and the capacity of the organization responsible for the management of the programme, as well as on the progress of the political, economic and institutional reforms in each specific country

Generally, though, each of proposed means should have a basic content and satisfy certain basic specifications, as it will be indicated in the following paragraphs.

5.5.1 Information and Data

The collection and management of information and data, usually in the framework of the appropriate institutional setting, is a basic means of international cooperation aiming at an intermediate objective to establish an Energy Information System (EIS).

The EISs ought to cover the needs of all cooperating partners and to be open to them for appropriate utilization. The Central and East European countries do need assistance both on the technical as well as on the administrative and the managerial level to create such systems at a national level, while at the same time they need to gain access to foreign information and data on energy issues.

The cooperation of the EEC with the Central and East European countries for the creation of such EISs should, more specifically, put its emphasis in supplying information on the demand side, which has been neglected up to now and in including a significant section on energy technologies. The problem of standardization should be one of the first to be settled in order to secure compatibility and consistency, drawing on the negative experience of existing western EISs.

The EISs can become a powerful means of cooperation for as long as they allow for the free access to all information and data available to all cooperating parties. Provisions, therefore, for the dissemination of information as well as for the acquisition of information, especially on technology, from EEC data banks will be necessary.

5.5.2 Training

Training can be a critical means for the promotion of all forms of cooperation, provided it is well planned and well integrated in the framework of a well structured programme.

Since training is the tool for developing the necessary human resources within a specific programme, an analysis of the target groups is a necessary prerequisite for the planning of such activities. Such an analysis should provide information on **who** are to be trained, what are their **existing capacities**, what should be the **content and the appropriate form** of the training operation, which is the **most appropriate institution** to carry out the programme, and what **external strengthening** does this institution need to carry out the task. If such analysis is not done the training operation will be either underdesigned or overdesigned, while it cannot be excluded that it might end up to miss its target altogether.

As a general rule, local institutions should be given the responsibility to carry out training operations, especially for the training of intermediate level personnel.

The existing programmes (such as those under the European Training Foundation, TEMPUS, the programme for the cooperation in economics etc.) should be integrated to satisfy the energy sector needs for training. This integration can be attempted in two directions:

a by including energy aspects and consideration in general training programmes, e.g. to the curriculae for economists, and

b by providing for curriculae, specializing on energy, e.g. curriculae for energy economists.

The optimum decentralization and regionalization of the training programmes should also be sought.
Finally, the cooperation in the energy sector should include training operations in the context of programmes for the restructuring of the energy sector or of other industrial sectors, relating to energy policies, which will displace manpower. Operations for the vocational reorientation of this manpower should form a part of the restructuring programmes in order to internalize part of the incurred social cost.

5.5.3 Technical Assistance

Cooperation through technical assistance can take the forms of consulting, advisory services, studies, assessments, etc. and can extend to technical, economic, financial, environmental and ecological, institutional, managerial and administrative issues

Technical assistance should be provided in the framework of all programmes. This is a basic prerequisite for the success of the programmes themselves. Furthermore, first, it usually increases the ratio of local-to-foreign capital costs of the projects, and, second, through technical assistance the benefits of each project are enhanced beyond the limits of the very specific technical results, as the component of self motivation of the recipients is increased.

Technical assistance should extend to all sectors of the economy, i.e. the public, the social and the private. It should be pointed out that at this phase of the history of the Central and East European countries the main emphasis should be given to the private sector activities and to the activities of the public and the social sectors that aim at reforming their operations towards the market-oriented economy.

Technical assistance should be provided mainly through the private sector of the participating in the cooperation scheme countries, under terms of reference, specifications and rules set by the Commission. Such an arrangement promotes the cooperation between the participating countries at a grass-roots level and opens up the way for further direct cooperation.

5.5.4 Technology Transfer

Technology can be transferred either directly – through specifically designed projects within integrated programmes – or though practically all other means of cooperation – i.e. EISs, training, technical assistance, and financing of investments. It is well known, though, that technology has to be adapted before being integrated into the local production system.

This means that any programme of technology transfer should include activities, such as technical assistance and training, aiming at adapting and integrating these technologies to the local production system.

It should also be born in mind that new technologies introduced in a given system might require or cause changes in other existing components of the system, as for example in the administrative or even in the institutional structure. It is for these reasons that programmes aiming at technology transfer should not limit the concerns to the technical and economic aspects of their main objectives.

5.5.5 Financing

There is a financing element in all cooperation programmes. The justification of the financial support offered by the Community, though, should not be based solely on the cost-benefit ratio of the specific programme or, even worse, of the specific project. The funds contributed by the EEC should, on the one hand, play a catalytic role for the attraction of other, mainly private, finances in the form of, mainly foreign to these countries, investments, and on the other, they should create strong multipliers.

Community financing should also reflect in a more and more clear way the EEC concerns for the Environment and energy efficiency and conservation. The inter-relationship between financing and these concerns should not be limited to the "yes-or-no" approach used by the Structural Funds on the basis of environmental impact studies. This approach can only deal with extreme situations and is contradicting to the principle "polluter pays", which aims at the internalization of the environmental costs, which is a continuous function.

It is, therefore, proposed that the financing of cooperation projects in energy is gradually connected to the objectives of environmental protection and energy conservation by a (continuous) function relating the level of EEC financing to the level of environmental impacts and energy intensity of the financed operation based on environmental and energy impact assessments and with reference to certain standards.

The EEC financing should also be related to the technological content of the investments included in each cooperation programme. This is more important in the case of the cooperation of the EEC with the Central and East European countries, which cannot buy – due to their extremely high international debt – the, badly needed for the modernization of their economies, technology and the can "import" it only through foreign investments.

Finally, financing of cooperation has to follow a well structured approach while its forms should be flexible enough as to allow for the most efficient and effective utilization of the available resources. This means that programme financing should be preferred over project financing. It also means that forms of global financing, under strict rules and procedures, should be used wherever appropriate in order to allow for the maximum adaptability of financing to the real need of the programmes as they develop in reality.

5.5.6 Other Means of Cooperation

Beyond the ones described in the previous paragraphs,

- industrial cooperation;
- inter-regional cooperation;
- administrative support; and
- monitoring

can prove extremely powerful means for promoting the cooperation of the EEC and the Central and East European countries in the energy sector.

These means, though, are not directly at the disposal of the Commission. The Commission can and should facilitate their utilization, where appropriate, by financing the expenses required for such activities.

5.6 Recommendations for Implementation

5.6.1 General Approach

5.6.1.1 Introduction

In the parts of chapter five of this study presented above the focus of the cooperation for the Central and East European countries has been synthesized regarding the contents as well as the forms and means.

There are, however, a number of further issues related to the implementation of the cooperation which are, to a very large extent, common to the Central and East European countries and which shall thus be developed in the first part of chapter 5.6. First some general strategical issues are commented in this chapter, followed by recommendations regarding the process of implementation. These recommendations developed are based on the findings of the missions to the Central and East European countries as well as on the experience of the cooperation with the developing countries.

The country-specific recommendations for the implementation of the cooperation programmes regarding all the aspects discussed so far are summarized in sections 5.6.2 to 5.6.8.

5.6.1.2 Strategies

Given the objective of fostering the change and promoting the economic and social development in the Central and East European countries and the huge size of the tasks related to these objectives, the Commission of the European Communities should concentrate on playing a **catalytic role** in this process. This catalytic role is also related to the principle of subsidiarity for the EC cooperation.

One of the areas to which this catalytic role has to apply is the investment into new technologies. The **transfer of western technologies** is related to investments - mainly in the modernization, rehabilitation or replacement of industrial equipment and processes as well as power plants as elaborated in the previous chapters.

These activities have not only to aim at technology transfer in an abstract way, but especially at joint ventures and other forms of cooperation, which link and transfer western capital to the technology. One of the strategies for the cooperation should therefore be to initiate and facilitate **industrial cooperation** between industries of the EC member states and industries from the Central and East European countries, as these countries are competing for western investments with established markets, i.e. in Asia and Latin America. The CEC could speed-up the process of technology transfer and industrial cooperation by intelligently using the means described in chapter 5.5 (e.g. information and financial guarantees).

The main aim of these activities would be to make available the full scale of European technology and investment potential by speeding up the process of industrial cooperation for small and medium-sized industries as well industries from the smaller member states.

This relates to a second area of recommendations regarding the implementation: the **regional approach.**

The industrial cooperation is an example where an **interregional approach** between the EC and the Central and East European Countries could prove useful. The increase of efficiency as well as the contribution to the economic integration are the main benefits of the regional features of cooperation.

A further field, where the possibilities of interregional cooperation should be studied, is training where regional training programmes should be designed as indicated above.

Intraregional cooperation is mainly considered beneficial regarding energy policy and planning where the differences in history and approach form a base for a fruitful exchange of experience. In the field of energy supply the decomposition of the Soviet dominated trade structures as well as new energy policies have completely changed the framework. The CEC could initiate the analysis of regional cooperation, e.g. in the field of **gas**.

Gas supply serves at the same time as an example for a regional **cooperation in the East–South–West** triangle. Given the responsibilities and commitments to both East and South, the EC should try to exploit synergies between the EC and the developing countries on one hand, and the EC and the Central and East European countries on the other hand. Whereas the geographical role of the EC is one logical reason to such an approach, the change in the East–South relations which is occurring as a function of the political developments in Central and East Europe requires the build–up of new cooperation structures. This applies to the trade between East and South as well as to other forms of cooperation which should be studies (see Section 5.5). The supply of gas from the Maghreb to the Central and East European countries could be studied especially regarding the benefits of economic cooperation as well as the seasonal demand. Industrial cooperation is a further field as east European exports of often subsidized products have to be replaced by the export/transfer of technology. An EC firm could, for example, operate with a firm from East Europe in a joint venture or as a subcontractor, in Asia or Africa.

The CEC should specifically promote all these forms of regional cooperation. This means that the individual actions ought to have a certain minimal size so as to justify the effort for coordination among numerous partners from the various countries.

The **coordination with and integration of other donors** for the cooperation activities is a matter of politics as well as of efficiency. Politically an important leverage can be achieved if all the different donors coordinate their policies of cooperation as well as their cooperation activities. From the experience of the cooperation with developing countries numerous examples are known where donors were pursuing policies which proved to be not only incompatible but conflicting. A further problem is presented by the fact that uncoordinated activities allow the receiving countries to play off one donor against another and thus achieve to get unsound projects funded.

Regarding the coordination with the Central and East European countries the PHARE programme is certainly a good stating point for coordination.

The coordination of policies and programmes should, however, concentrate on:

- coordination within the EC (integration of EC instruments):
  . PHARE and all other Directorate Generals of the Commission
  . other EC activities (e.g. EIB)
  . bilateral activities of EC member states (e.g. energy conservation agency in Poland)

- coordination with other bilateral donors (i.e. United States, Canada, Japan, for which the cofinancing of the regional environmental center in Budapest is a good example)

- coordination with multilateral donors (i.e. BRED, World Bank, UN Programmes).

More specifically DG XVII could, for example, initiate donor meetings on the cooperation in energy in East Europe or in specific countries.

The flexibility and speed in which DG XVII usually carries out its actions would lead to a coordinating role in which initial studies and project identifications could be financed by DG XVII whereas the total project would be financed by others (especially DG I), as it was successfully executed for Algeria. The design of integrated programmes which could prove to be very efficient could, for example be achieved in such a manner.

The general strategy towards implementation has to follow a twofold approach.

Whereas for political reasons some cooperation activities should be carried out immediately as **immediate actions**, the main cooperation effort should be based on a **structured approach** which results, for example, in programmes which incorporate a package of actions.

Regarding the priorities for the Commission (and the DG XVII) a conflict is felt to underlie the development of such a structured approach and the priorities related between the achievement of a political objective by executing a large number of actions and the impact and efficacy which those actions should have. The funding of a large number of activities will, of course, satisfy many wishes and often makes the EC cooperation highly visible (i.e. seminars).

On the other hand, there is a danger that a small action (one seminar only, a couple of audits, etc.) may not achieve the lasting impact and may not set free the momentum which is needed to trigger an inertia for a further development carried by the cooperation partners. The alternatives may in that case be to concentrate resources to design larger programmes (as for example the Asia training programme in energy management) or to concentrate on a catalytic function (e.g. to initiate further funding from other donors as mentioned above).

This concentration on programmes rather than projects also implies the change from an annual project oriented budget to multiannual frameworks as they are for example used successfully by the Commission for the cooperation with the Mediterranean countries.

It is interesting to note that the strategies laid out here are to a large extent congruent with the new "Guidelines for the cooperation with the developing countries of Latin-America and Asia" published in June 1990[1]).

5.6.1.3 Process of Implementation

The **planning of cooperation** can be differentiated into two phases. In a first phase the structured approach mentioned above has to be programmed and planned. In a second phase the specific cooperation activities or projects have to be planned.

The project planning has to be target oriented. To this end the problems and the programme environment have to be analyzed in detail. The hierarchy of objectives which shall be pursued has to be elaborated next. This serves as a base for the planning and structuring of the programme activities.

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1) see Commission publication from 90-176, June 11, 1990

An important feature of the planning of successful cooperation is the role of the counterpart organizations. On a first level the identification of counterpart institutions has to be an explicit part of the development of the **structured approach** to cooperation. On the project level the counterpart institutions have to be involved into the project planning. In this context the contribution of the counterpart organizations has to be defined in detail (see also Figure 1).

The planning of the cooperation activities has one of its main features in the choice of the means and instruments of cooperation in relation to the fields of cooperation chosen. In this area a large degree of flexibility is required. The flexible use and adaptation of cooperation instruments is less obvious than can be expected as everybody is limited by his experience and thus a firm believer in some cooperation instruments.

The border line between the planning and **preparation** is thin. The preparation of cooperation activities may concentrate on the next level of detail.

Regarding the preparation of the cooperation the Commission would probably be well advised to outcontract these activities as it has for example been done successfully for the training activities in China. This would leave more room to the planning and monitoring and evaluation.

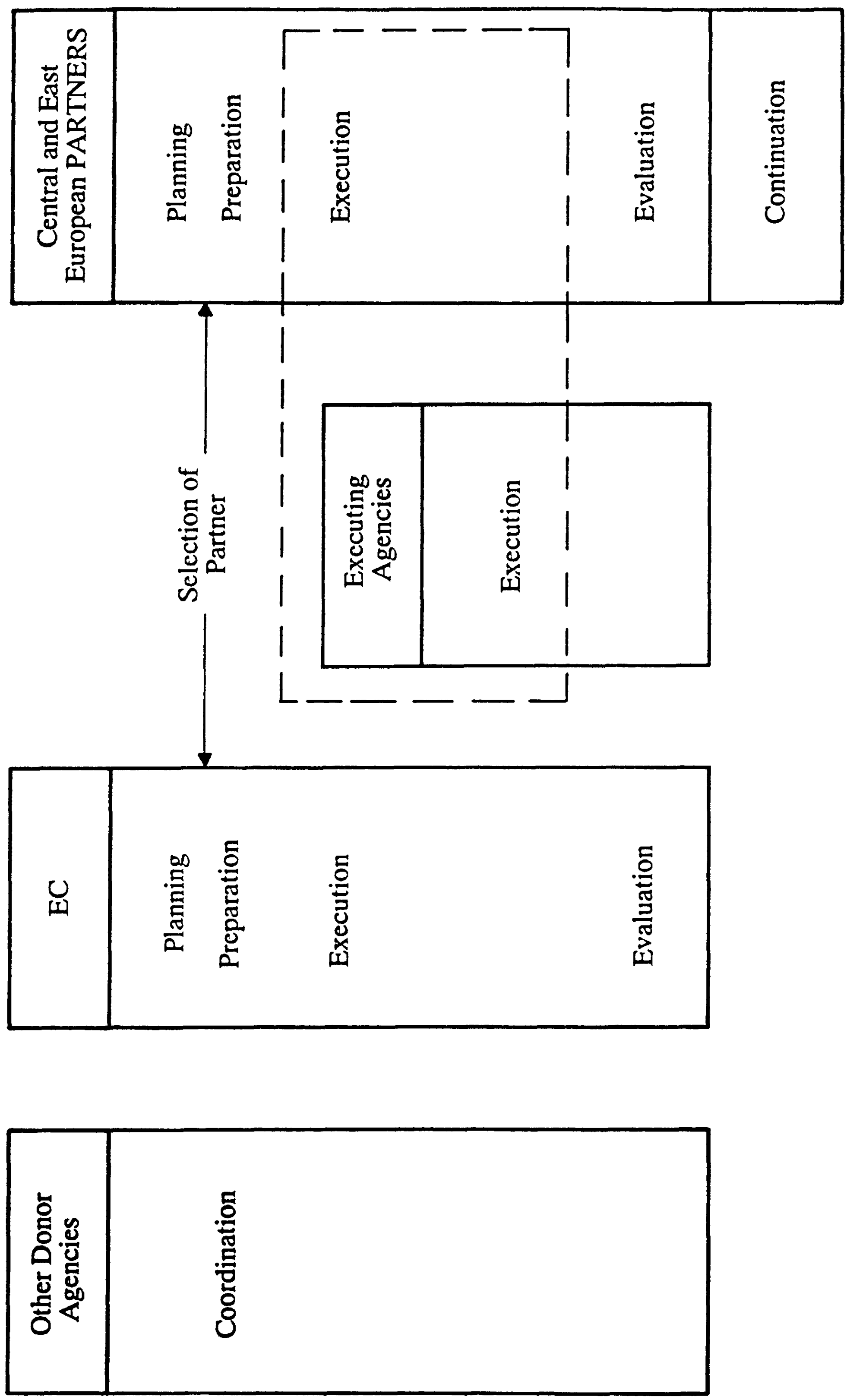
The project preparation should focus on the provision of the relevant background information, the detailed programme of work as a basis for the terms of reference as well as proper scheduling.

It may also be considered to include the counterpart organization in the evaluation in some cases. Even though this will obviously slow down the speed of implementation it may substantially increase the acceptance and support for sensible or difficult projects.

The **execution** of the cooperation should leave enough room for the executing parties to adapt the activity to the needs occurring. It is probably fair to say that the Commission has so far been getting substantial benefits from this policy.

On the other hand, such a loose guidance of the projects require some monitoring and evaluation as will be discussed below.

Process of Implementation



An important function in the process of execution lies in the support offered by the executing agent as regards the materialization of the contributions from the counterpart agencies. Even though this may not always be politically easy the efficiency and success of the cooperation requires that all partners contribute their part. Regarding the Central and East European countries this policy has to be established from the beginning so as to avoid that western cooperation is seen as a substitute for own effort.

Most of the cooperation activities will produce results which deserve to be disseminated, which also results from the catalytic function. Workshops on the results of a specific programme or project may be as adequate as the publication and distribution of suitable reports.

The introduction of a **monitoring and evaluation** of cooperation activities is one of the major recommendations for the implementation of the cooperation activities with the Central and East European countries for a number of reasons.

The main reason is that the cooperation with the Central and East European countries presents a new field of opportunities. Therefore the first experience has to be monitored and evaluated carefully to optimize the design of future activities. The need for monitoring arises also from the fact that activities and projects have to be adapted during the course of their execution. The monitoring of a project also lays ground for the decisions on the continuation of that activity in principle and allows the optimizing of the project.

A framework for the monitoring of typical cooperation activities has to be developed to this end as is elaborated in chapter 5.7.

Ex-post evaluation is an additional requirement but no substitute for the monitoring. This evaluation has to be carried out independently which means not only by the officials responsible for the execution. Enough resources have to be dedicated to the evaluation as the specific project related circumstances have to be taken into account. For technical assistance, for example, the output and results are often difficult to assess which leads to the a.m. large effort.

In general it becomes clear that much more effort should be dedicated to the planning and evaluation of the cooperation activities. In infrastructure and engineering projects planning costs are often between 5 to 10%. Cooperation activities in a new field certainly justify that the effort is at least as high or even higher.

5.6.2 Bulgaria

The basic needs, field and means of cooperation between the EEC and Bulgaria which should be given top priority and consideration are the following:

A. Energy Planning

Under the general issue of energy planning the following subjects need to be addressed:

- Analysis of the energy supply/demand situation.

- Price structure problems taking into account gradual adjustments of energy supply services reflecting actual market cost.

- Organizational and management structure of the energy sector.

The above work may be performed through collaboration with high level technical staff of the Bulgarian energy enterprises.

B. Conservation

Energy conservation measures and implementation should be given top priority. The cooperation should focus on the following subjects:

- Energy conservation methodologies and energy management techniques associated with assessment sectoral studies and project implementation

- Technology transfer of measuring and monitoring equipment used in detail energy audits.

- Technology transfer of energy conservation equipment and devices.

Energy conservation practices should be considered in close link with the environmental problems. It should be emphasized that the Bulgarian enterprise dealing with energy conservation is very well organized on both a central and a regional level.

C. Supply Side System

On the energy supply side, and in specific for the energy transformation system the following issues are proposed for cooperation

- Modernization of the fossil fired power plant giving emphasis on environmental monitoring and control systems.

- Modernization of the district heating system with monitoring and control equipment.

- Nuclear power plant environmental control and safety systems.

- Review the primary fuel supply options giving emphasis on gas imports from the USSR.

The cooperation should mostly take place through technology know how transfer to the Bulgarian energy enterprises.

5.6.3 CSFR

The energy situation in the CSFR is characterized by the importance of the coal (i.e. lignite) production. The decreasing quality of the lignite and the size of the environmental problems are one major problem of the energy sector in the CSFR. Furthermore, the issue of nuclear safety puts the policy of enhancing nuclear energy as a substitute for coal in jeopardy. This situation will lead to a complete reorientation of the energy policy in which energy conservation and gas become important options.

The cooperation with the CSFR should in the area of **energy planning and policy** focus as an immediate action on a policy dialogue. High level advisory services should be envisaged, as well. A structured approach should involve issues like data collection with emphasis on the energy demand as well as a more systematic effort in energy planning including a focus on institution building.

Within the reorientation of the energy policy **energy conservation** will play a major role – especially in the industrial sector. As immediate actions energy audits and especially a model factory as a demonstration project should be realized. To develop a more structured approach a sectorial study on energy conservation in industry should identify the industries to be treated with priority as well as the energy conservation programmes and measures to be developed by the CSFR including the proper institutional framework.

Energy conservation in the transport sector should also be included in the programming of the cooperation with the CSFR in order to avoid a too strong increase of the fuel consumption resulting from the one sided development of road transport (i.e. individual passenger transport).

Energy and environment are a further area for cooperation. Especially in the coal-fired power plants immediate action is required regarding desulphurisation and the reduction of NO_X emissions.

Natural gas represents the second clean technology for the CSFR. The issue of interfuel substitution in industry should therefore be studied as an area for immediate cooperation.

The implementation of the CSFR should take into account the high level of know-how and skills of the Czechoslovakian engineers.

AS the CSFR has been following to a large extent a classical socialist industrial policy the industry is mainly carried by heavy industry most of which is overaged. At the same time the CSFR did not allow most industries to use western technologies.

Technology transfer is therefore crucial to the modernization of the industrial and energy sector. The EEC should aim at playing a catalytic role especially in triggering the flow of capital necessary for the use of western technologies.

5.6.4 GDR

In the various fields of cooperation, the following recommendations for implementation can be given:

Energy Policy & Planning: Assist in setting up a market–oriented policy framework, especially with regard to economic incentives and new legal regulations aiming at rational use of energy and protection of the environment, and help to establish a consistent energy sector concept which takes account of intrasectoral and intersectoral interdependencies. Technical assistance measures (studies, institutional consultancy etc.) and provision of high–level training for energy experts will be at the forefront in these fields.

Energy & Environment: Provide assistance in the rehabilitation/reconstruction of the power stations through the transfer of environmentally acceptable energy technologies and grant financial and technical support to develop ecological sanitation concepts for areas suffering from longlasting mining burdens.

Energy Conservation: Help to exhaust the energy conservation potential by launching energy sector audits, providing information and training on how to save energy or to use it on a rational basis. To this end, one has to support the dissemination of energy saving equipment, the transfer of recycling techniques with regard to secondary raw materials and, first of all, secondary energy. Besides this, incentives to save energy have to be introduced. Thus, training, information and technical assistance are the most appropriate forms/means of cooperation in the field of energy conservation.

Utilization of Gas: Apply CEC's Proposal for Guidelines on Gas Transit to the energy sector of the GDR in order to make its energy supply system more compatible with economic, technological and environmental needs. In this context, financing should be provided first for the improvement/extension of the East German network of gas pipelines, and, secondly, the ways how to link the East German gas sector with the West European network have to be studied and proposals have to be elaborated (feasibility studies etc.)

Conventional Energies: Offer technical and financial assistance for solving problems regarding electricity transfer from the West to the East, and help to substitute lignite–based energy systems by those which are based upon oil, electricity or gas. Adequate means would be the spread of information on the advantages of the non–coal energies, actions towards diversification of the energy supply side (energy price policy, energy technology transfer etc.) and, perhaps, the implementation of demonstration projects.

Promotion of Renewables: Promote studies on the potential and the possible uses of geothermal energy, wind energy and biomass/biogas and set up demonstration projects.

Nuclear Energy: Assist in reassessing the role of nuclear energy in the future and in making existing plants more compatible with international safety standards by means of technical expertises and financial assistance.

The selection of appropriate **cooperation partners** will most probably be a difficult task for the CEC, because all possible cooperation partners are going to be reorganized and will experience fundamental changes in terms of legal setting, functions to be carried out etc. Nevertheless, the IfE–Institute (Institut für Energetik) in Leipzig might be a very professional potential partner in many of the above mentioned cooperation fields.

5.6.5 Hungary

Next to the results of the analysis of the energy situation in Hungary, there are three important considerations influencing the recommendations for cooperation with Hungary in the energy area. These are:

- high qualification of Hungarian experts
- institutional uncertainties
- activities of other donors.

These considerations result in the requirement to select very carefully the scope and depth of any cooperation scheme to meet the specific needs of the Hungarian energy sector.

Energy Policy and Planning: In the area of energy policy, the responsible ministry would be interested in seminars and studies reflecting the western European adjustment and government policies to cope with the energy crisis. Specifically, there is interest in Consultations regarding legal and administrative measures taken, for example, minimum insulation levels for homes, district heating programmes, etc.

Ministry of Industry and Trade is interested in advisory services regarding details of the tariff process, for example:

- What cost elements are in the prices in EC countries
  - costs of environmental protection
  - compensation to customers for unplanned outages.
- Basic pricing principles for energy intensive industries. Optimal pricing systems for gas and electricity, Customer specific price differentiation. Sonderverträge.

Energy Conservation: The cooperation with the Energy Efficiency Office seems to be a good focal point for this type of support. The EEO is adequately staffed and well established, being founded in 1984. It has the necessary institutional support and infrastructure. It is recommended, however, that the level and type of expert services and projects (like seminars) be very critically chosen by the Commission and that other institutions be involved or allowed to participate (for example, EGI). In this way a better spread of Know–How can be achieved.

Utilization of Gas: Integration or optimization of the international long–range gas pipeline network is an area of cooperation in which the CEC could provide high level experts. However, it should be noted that the World Bank is very active in the oil and gas area and that any cooperation in this area should be carefully coordinated with other donors. Also the middle and east European countries are themselves coordinating the efforts in this direction. There is a good possibility to coordinate these activities and to provide assistance to several of the countries at the same time.

Energy and Environment: Environmental Projects have been defined in the PHARE programme. A possibility for further involvement is in the area of environmental aspects of oil refineries. Information and experience regarding environmental protection measures, investments required, Cost–Benefit–Analysis have been mentioned by Ministry of Industry as possible areas of interest for EC cooperation.

5.6.6 Poland

The most appropriate fields and means of cooperation for Poland in the short and medium terms are the following:

A In the general field of ***energy planning:***

. The prices problems (gradual adjustment of energy products prices at consumer level to the actual cost of production)

. The organization, management and institutional aspects linked with the reorganization and decentralization of the energy system

. The analysis of energy demand by sectors and energy products and the establishment of energy consumption data base

Studies on these subjects should be immediately done, or reinforced, by high level technical assistance working in close relation with local experts and institutions on specific and well defined subjects.

B ***Energy Conservation*** is the first priority for the Polish energy and economic system. The cooperation must focus on

. Institutional building of national and regional "Agencies for energy conservation", well established in the decision making system

. Training on energy conservation methods with existing institutions (Universities, institutes)

. Support of energy audits and conservation programming by local experts (with a special attention for the transport system)

. Organization of the information on efficient end–use equipment

Energy conservation has to be dealt with in very close link with the environmental problems.

C. On the supply side, two major fields are proposed for cooperation, dealing with ***"traditional energies"***

. The first deals with the modernization of the existing energy system which is based mostly on solid fuels. Cooperation projects for the repowering of power plants, modernization of the distribution system and refurbishing of the district heating sector should be initiated

. The second deals with the increasing of the share of natural gas in the Polish energy system. In this field, the EEC should undertake a joint study to examine the various options for gas imports in the country, in relation with the needs of other countries of the region and examining the opportunity (politically important) of associating non–European nations (in particular the Mediterranean countries) in this development effort.

Concerning renewable energies, the effort of cooperation would consist on feasibility studies on geothermy.

5.6.7 Romania

The basic needs, fields and means of cooperation between the EEC and Romania which should be given top priority and consideration are the following:

A. Energy Planning

The restructure of Romania's energy sector and the rehabilitation of the existing energy transformation system as well as the future build up capability requires proper organization and planning techniques. The proposed fields of cooperation could be the following:

- National energy planning supply/demand studies with emphasis on the electrical power system.

- Organizational, management and institutional aspects associated with the decentralization of the energy sector.

- Energy price policy reforms taking into account the gradual evolution of prices towards actual market values.

B. Conservation

Conservation and rational use of energy should be of first priority for the Romanian energy economy sector. The cooperation should focus on the following:

- Institutional structure for energy conservation on national and regional level.

- Rational use of electricity in all economic sectors.

- Energy conservation methodologies (management, training, conservation programmes, conservation and environmental protection).

- Fossil fuel substitution with renewable energy sources (biomass, solar, wind, small hydro).

The cooperation should involve in all stages local experts and staff.

C. Energy Supply System

Most of the problems associated with the Romanian energy sector are those of the energy supply system at all levels. The following must be included in the cooperation.

- Reorganization of the energy transformation sector with emphasis on the electrical power system.

- Rehabilitation and repowering of power plants.

- Introduction of combined heat and power plants utilizing natural gas and new coal combustion technologies which could be considered friendly to the environment.

5.6.8 USSR

USSR is a "continent" with enormous resources and needs and advanced technology in various fields. Its political, economic and social situation is critical.

The case of cooperation with USSR must be treated specifically and with deep analysis of its implications before embarking on specific projects.

The most appropriate ways to initiate a cooperation on energy with the USSR are the following:

A To organize the follow-up of the evolution of the Soviet energy policy and the organization and problems of the energy system in the changing economic and political situation. In particular, increase the knowledge on the energy situation of the various republics, mostly the European ones, with which "bilateral" cooperation in the field of energy must be envisaged. This follow-up has to be done on a permanent basis by a group of experts, in dialogue with the Commission of the European Communities.

B A special study has to be done on the research and development activities and programmes in the USSR, in view of structuring the cooperation in this field for energy and environment matters.

In the short term, cooperation can be initiated on ***energy planning*** methods, including demand analysis and forecast and investment assessment (for instance, comparison of end-use efficiency programmes, cost and increasing marginal cost of the supply for different forms of energy).

C The economic and environmental constraints on the energy system are such in the USSR that ***energy conservation*** is the main "energy resource" to be developed in this country for the future.

The success of a vigorous energy conservation policy is vital for the USSR and very important for the EC for environmental and strategic reasons.

The first cooperation in this field to be proposed by the CEC to the Soviet government would be to help the creation and management of institutions in charge of planning and implementing energy conservation in all sectors of the economy, at national, republic and regional levels.

If financial aid to the USSR from the European Community is envisaged, energy efficiency investments must have high priority in the cooperation programmes.

D ***Natural Gas*** is the main energy resource of the USSR. It already ranks first in its energy consumption. Furthermore, the natural gas exports from the USSR are very important for the West European countries and for most of the other Central and East European countries.

Cooperation can be promoted on a wide range of technical matters with the Soviet gas industry.

5.7 Recommendations for Further Investigation

Whereas the analysis and recommendations in the previous sections of chapter five are related directly to the cooperation with the Central and East European countries in the following some ideas for actions are developed which should be pursued by DG XVII in any case independently of the progress and details of the cooperation with the individual countries.

These recommendations refer on one hand to further monitoring of the situation in the Central and East European countries. On the other hand, some areas and some countries require or deserve a more indepth analysis which was not possible within the scope of this study.

5.7.1 Monitoring of Future Developments

Energy policy developments need to be monitored as they are a function of the process of political and economic change which is far from being finished in most of the Central and East European countries.

The energy policies are undergoing a reassessment in most countries which is in general driven by

- the decomposition of the COMECON trade relations
- the environmental problems related to coal and nuclear power.

Furthermore, the policy related to gas may be another example which requires monitoring.

Regarding the **institutional developments** a monitoring is required as it is crucial for the success of any cooperation to rely on partners which are politically effective and technically strong. The institutional structure related to the energy sector is undergoing major changes which are mainly due to efforts in privatization and decentralization. At this stage EC delegations are not yet fully operational in most countries, so that the fast changes are not easy to assess for the Commission. The monitoring of the institutional change shall provide a clear picture to the persons responsible as well as to the role which each institution will take in the new economic structure.

The **cooperation** experience should also be monitored as mentioned above. In this context a general framework for the monitoring and evaluation of the cooperation programmes of the CEC should be developed. Such a framework would allow to transfer the experience from the cooperation with one country to a second country.

Such a monitoring framework could, for example, develop indicators for certain typical forms and means of cooperation like training courses, energy audits, technical assistance in energy planning, etc..

The change which **the energy situation** is undergoing will naturally not occur at the same speed as changes in the economic system but rather has to follow the change in the economic structure. As the official reporting system on energy data will, for example, need years to catch up with the western level a systematic monitoring is regarded worthwhile for the Commission. The approach used could follow the one used for the developing countries.

5.7.2 Indepth Analysis

The **energy situation** also requires further indepth analysis. The need for analysis and planning of the new structure of the energy system requires reliable data in the same way as does the improvement of the efficiency.

This refers especially to the data on the **end use of energy**. One main area for further analysis is the sectorial split of the use of the energies which has to be checked for inconsistencies (e.g. regarding the treatment of transport in the industrial sector). Furthermore the sectorial split has to be refined (i.e the break down of "other" in the household sector and the commercial sector).

A second area is the analysis of the end use efficiencies. The efficiencies of energy appliances have to be determined, and for the industrial sector specific energy consumptions and indicators have to be developed in order to assess the performance of the various industries in comparison with the state of the art of western processes. From these results priorities for energy conservation can be assessed.

The **conventional energy system** requires further in–depth analysis as it is the core of the energy system and will thus absorb a large share of the investments. There are a number of technological issues related to electricity generation which deserve further analysis in most of the Central and East European countries.

The efficient and environmentally sound use of coal is one of these issue. This refers to the use of advanced fluidized bed combustion techniques as well as to the gasification of coal.

A second area is the rehabilitation of power plants. The decision of rehabilitating or constructing power plants becomes especially important due to the high level of investment needed for the reinvestment and expansion of the electricity system. The CEC could play a catalytic role in this field by developing independent studies and assessments.

A further field for more indepth analysis is the reduction of transmission and distribution losses in the electricity system.

All of these studies are to be considered a first general assessment of the scope of the problem and thus at the same time represent a first market analysis for west European firms. As the problem in this respect is to a large extent similar in the Central and East European countries, a **regional study** could in a first phase disseminate the ideas and know–how in this area.

Renewable energies in the Central and East European countries also require a further analysis on a more indepth level.

In most of these countries renewable energies have in the past not been receiving the same amount of attention as in the west. The logic of pursuing the use of renewable energies is similar to the one applying to energy conservation especially regarding the positive effect on the environment.

Even though renewable energies will not solve the energy problems of the Central and East European countries, they should play their appropriate role in the future energy systems. To this end besides the potential of the various renewable energies the obstacles for their use have to be identified. Whereas solar and wind energy will play a role only in selected regions, the use of biomass (i.e. from agricultural residues) has to be examined indepth.

A systematic analysis of the perspectives of cooperation forms which would involve the **EC, Central and East European countries** as well as the **developing countries** should also be carried out. Besides identifying the interests and laying out the framework such an analysis projects for cooperation should be identified regarding all areas and all forms of cooperation including the scientific cooperation (e.g. association of research institutes from the Central and East European countries to the COPED network).

On one hand, the geographical proximity will favour the Mediterranean countries for cooperation with the Central and East European countries. On the other hand, the newly industrialized developing countries (like South Korea, Brazil, etc.) are in some areas very attractive partners for such a triangular cooperation.