COMMISSION OF THE EUROPEAN COMMUNITIES

SECOND REPORT ON THE COMMUNITY PROGRAMME FOR THE RATIONAL USE OF ENERGY

DIRECTIVE PROPOSAL AND RECOMMENDATIONS OF THE COUNCIL

In its resolution of 17 December 1974 on the Community action programme on the rational use of energy, the Council of Ministers adopted the objective of reducing the growth rate in energy consumption throughout the Community, so as to achieve a 15 % lower level of consumption in 1985 than was estimated for that date in the original projections of 1973.

The Council also took note of the procedure proposed by the Commission for implementing the Community action programme on the subject. It asked the Commission to make regular reports on the situation in the Member States and on the achievement of the Community objective and to send it suitable proposals.

This document contains the second of these reports on the rational use of energy for 1976 and the recommendations adopted by the Council.

COMMISSION OF THE EUROPEAN COMMUNITIES

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DIRECTIVE PROPOSAL AND RECOMMENDATIONS OF THE COUNCIL

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This publication contains the periodical reports of the expert groups set up by the Commission under the Community's action programme for the rational use of energy - COM(74)1950. The contents of these reports do not necessarily represent the views of the Commission.

AN INTENSIFICATION OF THE COMMUNITY'S PROGRAMME FOR ENERGY SAVING

(Communication by the Commission to the Council)

I. PROGRESS SO FAR

1. The Commission believes that the size of the shortfall now foreseen for the production of energy from indigenous sources, and the difficulties which stand in the way of any new acceleration, especially in nuclear energy, justify a major effort to step up the Community's energy-saving programme. Failure to reduce the Community's requirement of imported energy, coupled with growing requirements elsewhere in the industrialized and in the developing world, will very probably result in price increases which will force energy saving both by conservation and by reduced economic growth. By taking more vigorous action now, the Community, together with the rest of the industrialized world, can hope to increase the margin for economic growth consistent with orderly developments in world energy markets.

2. During the past two years, the Commission's departments and groups of experts nominated by the Member States have together examined the twenty-two action areas in the programme for the rational utilization of energy, adopted by the Council of Ministers in its Resolution of 17 December 1974.

3. The Council of Ministers has already adopted eight recommendations. A series of technical reports has also been produced by the expert groups and the Commission intends a wide distribution for them after suitable editing. Some, but not all, of these expert groups will need to continue their work, to obtain the full benefit from what has been already achieved.

4. The Community's programme draws heavily, of course, on the experience of Member States. That experience is by no means uniform, but in general it can be said that most Member States

(1) OJ No L 140, 28.5.1976.

have relied mainly on the price mechanism, backed up by suitable publicity and information campaigns. Specific measures have also been adopted, especially for new construction in the domestic, and, to a lesser extent, in the tertiary sector. Some Member States have extended their action to a programme of incentives and standards in the industrial sector. However, action in other sectors which should contribute an important part of the total savings needed has developed more slowly - for example in the transport and energy industry sectors (1).

5. It is difficult to estimate what energy savings have already been obtained, because recent developments in energy consumption have been strongly influenced by cyclical variations in economic activity and in the climate. Most estimates agree that, for the Community as a whole, the reduction obtained in energy consumption through decisions originating within the Member States themselves is small: probably no more than half the total reduction of some 7% in energy requirements per unit of GNP, observed between 1973 and 1976.

6. In fact, energy saving has yet to make much of an impact on those whose decisions shape the future course of demand, but whose principal motivations lie elsewhere. The problem has been clearly put by governments to householders and to private enterprise. It has been less clearly posed within government administrations, and energy-saving considerations have so far played little part in the formation of general economic policy, fiscal, industrial, transport and environment policy, and policies for urban development and renewal.

7. A large part of the explanation is that, while a much better understanding now exists of practical ways to save energy, the big questions are still unanswered :

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(1) It is worth remembering here, by way of illustration, the estimates given by the Commission in 1974 for the savings to be made by each sector through the twenty-two courses of action of the Rational Use of Energy programme, up to 1985:

- domestic and tertiary:	18%	- transport:	16%
- industry:	15%	- energy industry:	6%
- overall saving on inland consumption:	15%		

(i) in what areas will efforts to conserve energy give the best returns in practice ?

(ii) is it enough to rely mainly on the price mechanism backed up by suitable publicity and information campaigns ?

8. The answers to these questions will emerge more clearly when we are able to see what the different balances of energy supply and demand in the future will entail for the Community; for that we need a broader statistical and experimental basis for cost/benefit analyses, to judge how much energy can be saved, and at what cost, through each of the actions under consideration.

9. The results of the energy R&D programme for energy conservation adopted by the Council on the 22nd August 1975 will also begin to have a useful impact during the next few years.

II. THE NEXT STEPS IN THE COMMUNITY'S PROGRAMME

10. One of the first tasks of the Member States and the Commission must be to generate and maintain more active public discussion of possible scenarios for energy supply and demand, and thus to set the European and worldwide context in which particular proposals will be discussed. The present economic crisis is much discussed, but the coming energy problems are worth at least as much attention.

11. We should also reinforce the statistical and experimental basis for judging how much energy can be saved, and at what cost. Developing reliable and representative data based on experience in Member States is a medium-term exercise, slow to give results, but essential if a major investment effort is to be mounted to conserve energy. With such data one could set guidelines for the reduction of energy consumption in terms of the total balance of benefits and costs to society as a whole. This would be an extension of existing practices, such as the setting of the medium-term "15%" target for reducing energy requirements by 1985, adopted by the Council of Ministers in 1974.

12. The sectoral guidelines should take into account the degree of waste at existing levels of economic activity and the existing standards of comfort and convenience, but also the need to provide for continued economic growth and some rises in standards of comfort and convenience, particularly at the lower end of the social scale.

13. Areas where rapid conclusions should now be sought are :

(i) the energy requirements for residential, industrial and commercial space heating, the implications for thermal insulation and for the associated materials and construction industries;

(ii) the motor vehicle industry : in particular measures to standardize the measurement of fuel consumption, to achieve lower fuel consumption and longer vehicle life;

(iii) the electrical appliance industry, in particular the domestic appliance industry, to standardize the measurement of energy consumption, to reduce energy consumption and to increase the durability of appliances;

(iv) energy transformation, particularly reduction of losses during electricity production, and the production of combined heat and power;

(v) the possibility of further savings in certain energy-intensive industries.

To be sufficiently grounded in reality this work should be undertaken in very close contact with the industries and professional associations concerned. Conflicts may arise between other policy considerations (e.g. environmental or social) and energy saving, and here a balanced solution must be found.

14. The Commission also proposes that the Community should assist in the financing of selected demonstration projects, the results of which would be made available to all Member States without discrimination. Without waiting for further research and development, demonstration projects could be proposed for the following :

(i) heat pumps,

(ii) heat recovery,

(iii) the combined production of heat and power,

(iv) energy storage,

(v) selected projects for reducing waste in industry,

(vi) low-energy houses.

The programme will need to be coordinated with national and Community R&D programmes. The Commission will shortly submit detailed proposals for Community demonstration programmes of this kind. Overlaps between the energy conservation R&D programme and the demonstration programme should be avoided.

III. DRAWING ON THE EXPERIENCE OF MEMBER STATES

15. The scale of the task ahead and the limited resources available make it imperative to pool the experience of individual Member States at Community level. The experience to be shared is as much political as technical. An Energy Saving Policy Committee should therefore be set up at the highest official level, within the framework of the Energy Committee. It should consist of national government officials directly responsible for implementing an energy conservation programme. The Committee could expect to meet, say, twice a year.

16. The functions of the Energy Saving Policy Committee would be :

(i) to pool the experience of individual Member States at the Community level, by examining, in particular, how governments have mobilised the political, organisational and technical support necessary for energy-saving programmes;

(ii) to assist the Commission in the selection of the best methods of saving energy and to give policy impact to them;

(iii) to ensure coordinated application of national efforts and to advise the Commission on the contribution the Community can make towards promoting national efforts.

17. Under the general direction of the Energy Saving Policy Committee, the present Steering and Co-ordinating Group of national experts on the rational use of energy should continue to advise the Commission on detailed proposals and to guide the work of groups of experts in specific sectors.

This should be done in close association with the Advisory Committee for Management of the energy conservation R&D programme.

IV. IMMEDIATE ACTION

18. The Council of Ministers is asked to note with approval the programme of work described above and the intention to set up an Energy Saving Policy Committee, as described in § 15 and 16 above, likewise the priorities identified in § 13.

19. On the basis of the work already done by the groups of experts, the Commission intends to submit a series of proposals for specific action in time for adoption before the summer recess. They will cover:

(i) the improvement of thermal insulation and the efficiency of heating installations in existing buildings. The programme should provide a significant number of jobs over the next ten years and make a major contribution to the achievement of the Community's objectives for energy conservation. The programme would be based essentially on national efforts, with a general supporting role for the Community;

(ii) standards of installation and maintenance for newly installed heating systems;

(iii) the setting up of one or more national advisory bodies for energy saving, with specific responsibilities, and the appointment of an energy manager in industrial and commercial enterprises where the scale of energy use justifies it.

COMMUNITY ACTION PROGRAMME FOR THE RATIONAL USE OF ENERGY (RUE) - 2ND SERIES OF LEGISLATIVE PROPOSALS

(Communication from the Commission to the Council)

EXPLANATORY MEMORANDUM

In its resolution of 17 December 1974 on the rational use of energy, the Council noted the Community action programme in that field, noted that the Commission will submit appropriate proposals (1), and invited the Commission to report periodically on the situation in the Member States.

On a proposal by the Commission, the Council adopted on 4 May 1976 five recommendations on the rational use of energy (2), covering the thermal insulation of buildings, the heating systems of existing buildings, better driving habits, urban passenger transport and electrical household appliances.

The document in annex 1 contains the following new series of proposals :

1) Proposal for a Council Directive on the performance, maintenance and regulation of heat generators and the insulation of the heat distribution system in new buildings;

2) Council Recommendation on the regulating of space heating, the production of domestic hot water and the metering of heat in new buildings; (3)

3) Council Recommendation on the rational utilization of energy in industrial undertakings; (3)

4) Council Recommendation on the creation of national advisory bodies to promote combined heat and power production in the industrial sector and for district heating. (3)

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(1) OJ No C 153, 9.7.1975.
(2) OJ No L 140, 28.5.1976.
(3) OJ No L 295, 18.11.1977.

To allow the Council to have a clearer view of the context in which these proposals are made, the Commission attaches as annex 2 a series of tables listing the actions and individual measures adopted or proposed by the Member States. These tables were drawn up in October 1976.

During the second half of the year 1977, the Commission is planning to submit to the Council a new series of proposals based on work now in progress. These proposals will especially cover :

- a standard label and standardized methods of measuring consumption of various electric household appliances;
- approximation of the laws of the Member States on energy consumption for the heating of buildings, and
- removal of legal or administrative barriers to the development of combined heat and power production.

Finally, still in the field of energy-saving, it is to be noted that a measure concerning a standard test of fuel consumption by motor vehicles is now being discussed at Council level in the context of approximation of the laws of the Member States.

Note 2

COMMISSION

Proposal for a Council Directive on the performance, maintenance and regulation of heat generators and the insulation of the distribution system in new buildings.

(Submitted by the Commission to the Council on 27 May 1977)

THE COUNCIL OF THE EUROPEAN COMMUNITIES

Having regard to the Treaty establishing the European Economic Community, and in particularly Article 103 thereof,

Having regard to the proposal from the Commission,

Having regard to the opinion of the European Parliament,

Whereas it is of importance to adopt at Community level measures in the field of rational use and savings of energy, in order to reduce present and future difficulties in the supply of hydrocarbons;

Whereas, in its resolution of 17 September 1974 concerning a new energy policy strategy for the Community (1), the Council accepted as an objective 'the reduction of the rate of growth of internal consumption by measures for using energy rationally and economically without jeopardizing social and economic growth objectives';

Whereas all improvements in the rational use of energy are also beneficial for the environment;

Whereas, in its resolution of 17 December 1974 on a Community action programme on the rational utilization of energy (2), the Council noted that, in its communication to the Council entitled 'Rational utilization of energy', the Commission had drawn up a Community action programme in this field;

Whereas the sector of heating systems in new buildings lends itself to such measures;

Whereas the Council recommendation of 4 May 1976 (3) related to the heating systems of existing buildings;

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(1) OJ No C 153, 9.7.1975, p. 1.
(2) OJ No C 153, 9.7.1975, p. 5.
(3) OJ No L 140, 28.5.1976, p. 12.

Whereas it is necessary to obtain as soon as possible energy savings from the heating systems in new buildings which will have an influence on total energy consumption as new buildings are constructed;

Whereas to this end the heat generators for space heating and the production of domestic hot water must be of a type approved and maintained periodically;

Whereas the burners of these heat generators must be fitted with controls for their regulation;

Whereas the thermal insulation of the distribution system must be economically determined and properly monitored and whereas the following measures are likely to produce sufficiently large savings in energy to make the required investment economically worthwhile, while favouring the functioning of the common market,

HAS ADOPTED THIS DIRECTIVE :

Article 1

The Member States shall take all necessary measures so that each heat generator used in a new building for space heating and/or for the centralized production of domestic hot water to be of a type within the framework set out in Article 2, approved by authorized bodies.

The term 'heat generator' used in this Directive covers hot-water boilers, steam boilers and air heaters, including the associated firing equipment appropriate to the type of fossil fuel being used, and excepting electric heat generators.

Article 2

1. The approval foreseen in Article 1 shall not be given unless the heat generator achieves minimum performance characteristics defined by the Member States and eventually harmonized by means of a Council Directive adopted under Article 100 of the Treaty.

2. Each multi-fuel heat generator must have the burners appropriate to each type of fossil fuel approved.

3. Heat generators cannot be approved unless fitted with a data plate showing at least the following data:

   - the maker's name,
   - the type of heat generator and its year of manufacture,
   - the heat rating in kW,
   - the type and characteristics of fuel or fuels,
   - the maximum flow temperature,
   - the design pressure,
   - an identification of organization giving the approval.

   The data plate fitted to the appliances within the meaning of Article 1, and using gaseous fuels, must in addition carry the data foreseen in the proposal for a Council Directive on the approximation of the laws of the Member States relating to appliances using gaseous fuels, to safety and control devices for these appliances and to methods for inspecting these appliances (1)

4. The term 'heat rating' used in this text refers to the highest output that can be continuously supplied by the heat generator in a state of inertia as defined by Standard No TC 116/SC 2 of the International Standards Organization.

Article 3

The Member States shall take all necessary measures so that burners for heat generators within the meaning of Article 1 with heat ratings above 300 kW are fitted with high/low/off or fully modulating controls with a turndown to at least the range of 60 to 100 % of full load, burners arranged for on/off control being only installed for heat ratings of 300 kW or less, and that detailed written instructions on operation and maintenance, to obtain maximum efficiency, are given to the client. The instructions must be simultaneously approved with the generator and shall include the essential points of the certificate of approval.

Article 4

The Member States shall take all necessary measures so that heat generators are maintained and regulated in accordance with a programme planned by the national authorities.

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(1) OJ No C 134, 16.6.1975, p. 27.

Article 5

The Member States shall take all necessary measures so that an economical degree of insulation for the distribution systems and for the storage of the fluid heated above the ambiant temperature is made compulsory. To this end they will establish model calculations so that changes in the costs of insulation or energy can easily be taken into account.

Article 6

Member States shall require the insulation, foreseen in Article 5, to be approved and maintained in accordance with a programme planned by the national authorities.

Article 7

The provisions foreseen by Articles 5 and 6 of this Directive apply equally to electric water heating systems.

Article 8

The Member States shall, not later than 1 January 1979, bring into force the laws, regulations or administrative provisions necessary to comply with the Directive. They shall immediately inform the Commission thereof.

Further they shall annually inform the Commission of their estimates of the energy savings, forecast or obtained by enforcing those provisions. These estimates are to be included in the periodical report of the Commission to the Council foreseen in its resolution of 17 December 1974 on a Community action programme for the rational utilization of energy.

Article 9

This Directive is addressed to the Member States.

COUNCIL RECOMMENDATION OF 25 OCTOBER 1977

on the regulating of space heating, the production of domestic hot water and the metering of heat in new buildings (77/712/EEC)

THE COUNCIL OF THE EUROPEAN COMMUNITIES

Having regard to the Treaty establishing the European Economic Community,

Having regard to the draft from the Commission,

Whereas, in its resolution of 17 September 1974 concerning a new energy-policy strategy for the Community (1), the Council approved the objective of reduction of the rate of growth of internal consumption by measures for using energy rationally and economically without jeopardizing social and economic growth objectives;

Whereas improvements in the rational use of energy are generally beneficial to the environment;

Whereas, in its resolution of 17 December 1974 on a Community action programme on the rational utilization of energy (2), the Council noted that, in its communication to the Council entitled 'Rational Utilization of Energy', the Commission had drawn up a Community action programme in this field;

Whereas the Council recommendation of 4 May 1976 (3) related to the heating systems of existing buildings; whereas it is advisable to obtain energy savings as soon as possible for the heating systems of new buildings;

Whereas this objective can be achieved in buildings with collective heating systems only if the occupants are able to regulate their own energy consumption;

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(1) OJ No C 153, 9.7.1975, p. 1.
(2) OJ No C 153, 9.7.1975, p. 5.
(3) OJ No L 140, 28.5.1976, p. 12.

Whereas collective systems for space heating and production of domestic hot water of new buildings with several occupants should be fitted with the means for apportioning the heating costs among the various occupants on the basis of the amount of heat supplied;

Whereas the measures recommended are such as to produce sufficiently large savings in energy while ensuring that the required investments are economically worthwhile,

HEREBY RECOMMENDS TO THE MEMBER STATES :

that they adopt any laws, regulations or administrative measures necessary to ensure that:

1. in new buildings used as offices, public buildings and buildings which are not occupied all the time

   1.1. all heating systems are fitted with an automatic programming and regulating device which will produce the desired temperature curve for the premises served;

   1.2. when heat generators are operating, the temperature during occupation of premises for which a given occupant is accountable does not exceed 20°C on average and does not exceed 22°C in any one room;

2. in new residential accomodation

   2.1. the individual heating system, whether centralized or independent, is controlled by one or more automatic devices which regulate the supply of heat to the dwellings according to the outside or inside temperature or both;

   2.2. the heat supply to collective heating systems is regulated according to the outside and inside temperatures;

   2.3. a device is fitted so that the heating level may be reduced during the night and when the buildings are empty;

3. for the production of domestic hot water in new buildings

   3.1. the temperature of hot water at the entry to the common circuit does not exceed 60°C and is capable of regulation

below this maximum. The flow rate in the common circuit is as low as possible but always permitting rapid and sufficient supply at the drawing points; that dead legs are as short as possible;

3.2. when the power required for the production of domestic hot water and heating for the premises is provided by a multiple generator system, the production of domestic hot water during non-heating periods shall be ensured by one or more generators whose load capacity shall not exceed the requirements of the domestic hot water supply;

4. for heat metering in new buildings

each dwelling heated by a collective installation is fitted from the outset with the means of metering and/or directly or indirectly attributing the amount of heat and/or hot water supplied by this collective heating system, to permit the fair apportionment of the corresponding charges among the occupants of the building;

5. for the information of the Community

the Member States regularly inform the Commission of the measures taken in the field covered by this recommendation and of the results obtained or anticipated from the measures.

Done at Luxembourg, 25 October 1977.

For the Council
The President
W. CLAES

COUNCIL RECOMMENDATION OF 25 OCTOBER 1977

on the rational use of energy in industrial undertakings (77/713/EEC)

THE COUNCIL OF THE EUROPEAN COMMUNITIES,

Having regard to the Treaty establishing the European Economic Community,

Having regard to the draft from the Commission,

Whereas in its resolution of 17 September 1974 concerning a new energy-policy strategy for the Community (1) the Council approved the objective of reduction of the rate of growth of internal consumption by measures for using energy rationally and economically without jeopardizing social and economic growth objectives;

Whereas improvements in the rational use of energy are generally beneficial to the environment;

Whereas in its resolution of 17 December 1974 on a Community action programme on the rational utilization of energy (2) the Council noted that, in its communication to the Council entitled 'Rational Utilization of Energy', the Commission had drawn up a Community action programme in this field;

Whereas the industrial sector also lends itself to the more efficient utilization of energy, in keeping with its economic objectives; whereas this possibility varies according to the size, location, production processes and products of the undertaking;

Whereas it is desirable to inform, increase the awareness of and encourage undertakings, in accordance with Article 92 et seq. of the Treaty, in their efforts to save energy; whereas the initiatives already taken by some Member States to set up public or approved bodies charged with these tasks should be extended;

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(1) OJ No C 153, 9.7.1975, p. 1.
(2) OJ No C 153, 9.7.1975, p. 5.

Whereas in practice already adopted by some undertakings, in particular the large energy-intensive ones, of appointing an energy management officer, should be extended;

Whereas the bodies referred to above should monitor the progress achieved by the undertakings in realizing their energy-saving programmes;

Whereas since one of the most profitable exercises at Community level is the systematic and regular exchange of information on energy-saving processes between Community undertakings and in particular small- and medium-sized undertakings, professional organizations should collate information from energy management officers on experience gained and difficulties encountered in order to disseminate this information; whereas these same organizations should also periodically organize meetings or seminars to exchange details of their members' experiences,

HEREBY RECOMMENDS TO THE MEMBER STATES:

1. that they take the necessary measures to mount campaigns to provide information and increase awareness, and to encourage, in accordance with Article 92 et seq. of the Treaty, the achievement of energy savings; and, to this end, to set up, in so far as they do not already exist and along the lines of the initiatives already taken by some Member States, one or more public or approved bodies or departments with particular resposibility for these tasks;

2. that they invite sectoral and general professional organizations as well as technical and scientific associations and consultancy services to arrange periodically for meetings and seminars, to exchange details of experience at national level, and possibly at Community level, in order to ensure the widest and most rapid dissemination of information possible;

3. that they encourage industrial undertakings:

   - to set up an energy department within their organization, if they have not already done so, or call in an outside expert. The duties and tasks of such departments or persons could be along the line of those proposed as a guide in the Annex to this recommendation;

   - if they are required to prepare an annual report, to devote a chapter of it to their energy consumption, also including any energy-saving measures taken or planned and the results obtained;

4. that they collate, as efficiently as possible, all useful information concerning the results of the energy-saving measures taken by the industrial undertakings mentioned in 3;

5. that they inform the Commission regularly of the measures taken in the field covered by this recommendation and of the results obtained or anticipated from the measures.

Done at Luxembourg, 25 October 1977.

For the Council

The President

W. CLAES

Annex 1

SUGGESTED DUTIES AND TASKS OF THE ENERGY MANAGEMENT OFFICER IN INDUSTRIAL UNDERTAKINGS

1. In keeping with the economic objectives of their undertaking, the functions of the energy management departments or officers could be focused on the following tasks:

   (i) Within the undertaking

   deciding on the appropriate ways and means of carrying out the energy-saving programme which the undertaking has devised and in particular:

   - keeping a permanent check that the undertaking is not wasting energy,
   - suggesting ways in which industrial equipment and processes might be modified to bring about a more rational use of energy; in this respect any investment in new or additional equipment or processes should be the subject of energy appraisals as well as financial ones,
   - establishing channels of communication between the various sections or departments and with office staff and manual workers and making them aware of the aims of energy saving.

   (ii) Outside the undertaking

   maintaining contact with other industrial sectors concerned so that their undertaking may draw on the experience gained elsewhere.

2. To enable it to discharge these duties effectively, the energy management department should be responsible directly to the decision-making bodies of its undertaking.

COUNCIL RECOMMENDATION OF 25 OCTOBER 1977

on the creation in the Member States of advisory bodies or committees to promote combined heat and power production and the exploitation of residual heat (77/714/EEC)

THE COUNCIL OF THE EUROPEAN COMMUNITIES,

Having regard to the Treaty establishing the European Economic Community,

Having regard to the draft from the Commission,

Whereas in its resolution of 17 September 1974 concerning a new energy-policy strategy for the Community (1) the Council approved the objective of reduction of the rate of growth of internal consumption by measures for using energy rationally and economically without jeopardizing social and economic growth objectives;

Whereas improvements in the rational use of energy are generally beneficial to the environment;

Whereas in its resolution of 17 December 1974 on a Community action programme on the rational utilization of energy (2) the Council noted that, in its communication to the Council entitled 'Rational Utilization of Energy', the Commission had drawn up a Community action programme in this field;

Whereas a more rational use of energy can be obtained by greater use of combined heat and power production and the exploitation of residual heat in industry, electricity generating and remote heat supply systems;

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(1) OJ No C 153, 9.7.1975, p. 1.
(2) OJ No C 153, 9.7.1975, p. 5.

Whereas implementation of this technique requires the solution of a number of complex problems of an economic, technical, administrative and legislative nature;

Whereas the solution of these problems depends to a large extent on local, regional and national factors;

Whereas the search for solutions at local and regional level is facilitated by an exchange of information and cooperation at national and Community level,

HEREBY RECOMMENDS TO THE MEMBER STATES:

1. that they create one or more advisory bodies or committees, in so far as these do not already exist, to be responsible for giving an opinion on all measures likely to lead to increased efficiency in the supply of heat for industry and to promote the use of remote heat supply systems, in particular by:

   - concentrating heat production and making greater use of combined heat and power production;
   - greater thermal efficiency of power stations by exploitation of their residual heat;
   - improved efficiency of heat conduits and associated distribution installations in industrial establishments and in district heating systems, while taking into account the service life of the conduits;

2. that to this end they invite the advisory bodies or Committees to consider the following measures:

   - broadening of cooperation between electrical utilities and heat-consuming industries;
   - identification and abolition of legal, administrative and price obstacles to the development of combined heat and power production to supply industry;
   - reservation of sites on which industrial complexes and combined heat and power stations can be built side by side;
   - encouragement, in accordance with Article 92 et seq. of the Treaty, of combined heat and power production and of the transport of heat;

- provision of better information to small- and medium-sized industrial undertakings;
- drawing up statements of heat requirements;

3. that they encourage the advisory bodies or Committees to have regular exchanges of experience and to cooperate at Community level through procedures organized by the Commission;

4. that they instigate and promote technical and economic studies with the aim of identifying new economically viable remote heat supplies and that they promote the development, where justifiable, of existing district heating and industrial heat supply systems;

5. that they inform the Commission regularly of the measures taken in the field covered by this recommendation and of the results obtained or anticipated from the measures.

Done at Luxembourg, 25 October 1977.

For the Council

The President

W. CLAES

Annex 1

COMPARATIVE TABLES OF SPECIFIC MEASURES ADOPTED BY MEMBER STATES AS PART OF A PROGRAMME FOR THE RATIONAL USE OF ENERGY SINCE OCTOBER 1973, OR PLANNED AND LIKELY TO BE ADOPTED IN THE NEAR FUTURE (COMPILED OCTOBER 1976)

Content

Measures more properly described as demand restraint are excluded (For definitions see 'A Community action programme for the rational use of energy: doc. COM (74) 1950 Final)

Symbols

The following symbols are used in the tables:

A : adopted since January 1974;

P : planned and likely to be adopted in the near future. Measures are cited even if the proposal is a departmental rather than a Government proposal.

x : indicates the changes which have occurred between July 1975 and July 1976 (either new measures proposed in 1975 and adopted after that date, or new measures proposed or adopted after 1975).

A. THERMAL INSULATION

Measures	Country							
	B	D	DK	F	I	NL	IRL	UK
1) Measures to promote higher standards in new buildings								
viz. : Revised building regulations :					A(3)			
compulsory	P	P	A*	A	A*(4)	A	A	A
advisory	A	A	-	-	-	A	-	-
Revised monitoring and control systems	-	-	-	P	A*(4)	-	-	-
Development of residential buildings to meet higher standards	A	A*	A	A	A*(4)	A*	A*	A
2) Measures to promote higher standards in existing buildings								
viz. : Tax relief on approved work :								
residential	-	A	-	A	-	-	-	-
industrial	-	-	-	-	-	-	-	A
Grants, subsidies for approved work:								
residential	A	A	A*	A(1)	-	A	A*	A*(1)
other	(A)(2)	-	A*	-	-	A	A*	A*(1)
Relaxation of rent control	-	-	A	-	-	-	-	-
Publicity campaigns	A	A*	A	A	A*(5)	A*	A	A
Competitions for ideas	-	A	-	A*	-	-	-	-
Measures to ensure minimum standards of workmanship and professional advice	-	-	-	-	-	A	-	-
Development of means of improving thermal efficiency in residential buildings	-	-	A	A	-	-	-	A
3) General measures								
Professional training	-	-	A*	P	-	-	-	A*

Notes :

(1) For certain narrowly defined categories only.
(2) For certain public buildings only
(3) Ministerial order of 5.7.75 reducing the minimum underceiling height to 2,70 m. for dwellings-space and to 2.40 m. for storage and service facilities.
(4) Law 373 of 30.4.76 (awaiting implementing regulation) on heating systems and thermal insulation of buildings.
(5) Law 373, Art. 23, provides for financing of publicity campaings on domestic heating.

B. HEATING SYSTEMS

Measures	Country							
	B	D	DK	F	I	NL	IRL	UK
Mandatory installation standards	P	P	A*	P	A(2) A*(3)	-	-	-
Tax relief for approved work to improve heating systems	-	P	-	A	-	-	-	-
Grants, subsidies for approved work to improve heating systems	A*	A*	A*	A	-	A	A*	-
Relaxation of rent controls	-	-	A	-	A(1)	-	-	-
Control of the servicing of heating systems	A	P*	P*	A	A*(3)	-	-	-
Reform of contracts encouraging waste	P*	-	-	A	A*(3)	-	-	-
Compulsory installation of heatmeters	P*	P*	-	A	A*(4)	-	-	-
Promotion of district heating schemes (see also G)	P*	A	A*	-	A*(5)	P*	-	-
Publicity campaigns	A	A	A	A	A*(6)	A*	A	A
Competitions for ideas	-	A	-	-	-	-	-	-

Notes :

(1) Bill 841 of 22 December 1973 for the prolongation of tenancy contracts. (Art. 6 relating to the administration of heating systems)
(2) Ministerial order of 5 July 1975 on inside temperatures (18-20°C) and the absence of permanent condensation.
(3) Law 373 of 30 April 1976 awaiting imdementing regulation.
(4) Law 373, Art. 7, governs only new hot water production installations.
(5) Law 393 (Art. 1) of 2 August 1975 authorizes local public authorities to generate electricity and heat, and ENEL to sell heat.
(6) Law 373, Art. 23, for the financing of publicity campaigns on domestic heating.

C. MEANS OF TRANSPORT

Measures	Country							
	B	D	DK	F	I	NL	IRL	UK
Information campaigns for the general public	A	A	P*	A	A(2) A*(3)	A	A	A
Measures to promote the installation of gauges indicating the "performance" of the driver	-	-	-	A*	-	-	-	-
Measures to encourage vehicle tuning tests	-	-	-	A(4)	-	-	A*(4)	P*
Control of publicity on use of fuels Standardization of fuel consumption tests	-	-	-	A	-	-	-	P*(5)
Tax favourable to diesel engines	A	A*	-	-	A(1)	A	A*	A(6)
Approving of fuel savers	-	-	-	A	-	-	-	-

Notes :

(1) (a) Duty of 46 % of pump price for gasoil and 68 % of pump price for ordinary or super petrol
(b) 20 % lower circulation tax for diesel cars than for those run on petrol.
(2) Information campaign concerning highways (lower speed, lower consumption).
(3) Law 373, Art. 23.
(4) Voluntary or non-compulsory tests.
(5) Bill.
(6) VAT on diesel at standard rate of 8 %, on petrol 12,5 %.

D. TRANSPORT STUCTURES

Measures	Country							
	B	D	DK	F	I	NL	IRL	UK
There is a whole series of measures of a generally energy-saving character, but which are essentially a continuation of pre-1974 policies								
Measures adopted or proposed principally or partly for energy conservation reasons since the 1st January 1974 are :								
increased tax on petrol	A	-	-	A	A*(4) P*(5)	A	A	A
legislation to remove obstacles to car-pooling	P*	-	-	-	-	-	-	-
increased parking charges and fines	A*	-	-	A	A	A	-	-
additional investment in public transport	A*	-	-	A	A(1) A(2)	A	A*	-
reduction of taxes on public transport	-	-	-	A	A(7)	-	-	-
information campaigns on drivers' behaviour	P*	A	A*	A	A(6) A(3)	A	A	A

Notes :

(1) Buses: 30 000 in 5 years.
(2) Investment plan of Lit. 4 billion (4×10^{12}) of which Lit. 2 billion relate to 1975-80.
(3) Law 373, Art. 23.
(4) New increases in 1975/76.
(5) A bill provides for a new price increase in Oct. 76, except for limited quantities for vehicles having tax and insurance premium paid up.
(6) Information campaign concerning highways.
(7) Price policy in favour of public transport.

(ω)

E. INDUSTRIAL PROCESSES - HEAT

Measures	Country							
	B	D	DK	F	I	NL	IRL	UK
Tax relief for approved work resulting in energy savings	A*	A	-	-	-	-	-	A
Grants, subsidies for approved work resulting in energy savings	A	A(2)	A*	A(1)	-	A*	A	A
Training programmes	A*	-	A	A*	-	-	A*	A*
Information campaigns	A	A*	A	-	A*(5)	A*	A	A
Combustion control	-	-	-	A(3)	A(6)	-	-	-
Parafiscal tax on heavy oil	-	A	-	A*(4)	-	-	-	-
Demonstration operations	-	-	-	A	-	-	-	-

Notes :

(1) Relaxation of credit controls.
(2) For heat pumps, regenerators, heat recovery equipment only.
(3) Minimum efficiency levels for combustion heat generators.
(4) Tax of 150FF/t on average consumption > 87 % and < 112 % of those of 1973, with some exceptions.
(5) Law 373, awaiting implementing regulations.
(6) A.N.C.C. regulations.

F. MOTIVE POWER

Measures	Country							
	B	D	DK	F	I	NL	IRL	UK
Labels for energy consumption	P*	P*	-	A	A*(2)	P	-	P
Information campaigns	A	A	A	A	A*(3)	A	A	A*
Financing for research work	-	A	A	-	P*(1)	-	-	A*

Notes :

(1) See CNR "Progetto Finalizzato Energetica" of 24.2.2975, partially approved but not as regards motive power.
(2) Applied individually by several manufacturers.
(3) ENEL campaign and Law 373, Art. 23.

G. CONVERSION IN POWER STATIONS

Measures	Country							
	B	D	DK	F	I	NL	IRL	UK
Tariff changes designed to obtain a better loading factor	A	A	-	A	A(1)	A	A	A
Campaigns to inform small and medium-sized firms of the benefits of combined heat and power production	-	A	-	-	A* (2)	-	-	-
Cooperation between public utilities and own producers in regard to combined production	A	-	-	-	A* (3)	-	-	-
Inventory of boilers (industrial)	-	P	-	A	A* (4)	-	-	-
Consulting engineering services (small and medium-sized firms)	-	A	-	A	-	-	-	-
Measures to encourage the combined production of electricity and heat in industry and for district heating	P*	A	A*	-	A* (5)	-	P*	-
Measures to relax barriers to the private transport of electricity from combined heat-and-power stations	P*	P	-	-	-	-	-	-
Measures to reserve appropriate sites for nuclear power stations with associated industrial complexes, requiring process heat	P	P	-	P	A* (6)	-	-	-

Notes :

(1) CIP Decision 34/74, 38/74, 1/75 and Law 391 of 17 July 1975.
(2) Law 373, Art. 23.
(3) Encouraged by Law 393.
(4) Existing inventory according to A.N.C.C. regulation.
(5) Encouraged by Law 393.
(6) Law 393, Arts. 10 & 23 and National Energy Programme approved by CIP on 23 December 1975.

H. CONVERSION IN REFINERIES

Measures	Country							
	B	D	DK	F	I	NL	IRL	UK
Government measures adopted	-	-	-	-	$A^{x}(1)$ $A^{x}(2)$	-	-	-

Notes :

(1) One objective of the 1974 national petroleum plan is to optimize refining systems, transport and distribution from the energy-saving standpoints; the plan is incorporated in the National Energy Programme approved by CIP on 23 December 1975.

(2) Presidental Order 518 of 29 April 1975 on "Technological modernization of refinery installations".

Annex 2

SECOND INTERIM REPORT BY SUBGROUP A ON THE THERMAL INSULATION OF BUILDINGS

I. INTRODUCTION

The first interim report on the work of Subgroup A on the Thermal Insulation of Buildings was examined by the Coordinating Committee at the meeting held on 17 and 18 July 1975.

Since then, important steps have been taken and further action planned.

1. On 4 May 1976 the Council adopted a Recommendation on the promotion of thermal insulation of buildings.(1)

2. In December 1975 the Scientific and Technical Centre for the Building Trade (CSTC) sent the Commission the report on the study comparing the rules on thermal insulation of buildings applied in the Member States.

3. The Subgroup held two further meetings on 22 December 1975, and on 29 April 1976. Part of the latter meeting was held jointly with Subgroup B "Heating Systems".

II. RECOMMENDATION ON THE THERMAL INSULATION OF BUILDINGS

This recommendation comprises three separate parts concerning:

1. Organization and support of information campaigns to stimulate public interest in thermal insulation. The RUE (2) Working

(1) OJ No L 140, 28 May 1977, p. 11.
(2) R.U.E. : Rational Utilization of Energy.

Party on Information and Advertizing would seem to be the most suitable body for observing and assessing the impact, especially from the economic viewpoint, of the action in progress or in preparation in the Member States.

2. Improvement of the thermal insulation of existing buildings, housing being the first priority. This objective cannot be achieved without fuller knowledge of the condition and nature of existing buildings, type by type, and greater practical experience of possible technical solutions and their economic viability.

3. Adoption of harmonized thermal insulation standards for use in laws, regulations and administrative procedures. This entails the adoption of common Community standards for thermal insulation terminology, methods of computing thermal performance, measurement and test methods, and product specifications for the principal insulating materials, to be used by member countries in their building rules and regulations.

   This relates particularly to buildings to be built from now onwards. The study made by the CSTC at the request of the Commission constitutes one of the bases on which such standards could be drawn up.

III. IMPROVEMENT OF THE THERMAL INSULATION OF EXISTING BUILDINGS

1. To obtain better insight into the condition and nature of existing buildings, as agreed at the meeting of Subgroup A held on 29 April 1976, a questionnaire was sent to the experts, based mainly on ten papers read at the symposium on Energy Conservation in a Built-up Environment held by the W 67 Working Party of the International Building Council on 6-8 April 1976.

   From the answers received the Commission will compile a report giving an overall picture of the situation in the Community's housing sector; it will then be easier to see what needs to be done.

   It is intended that this situation paper will be updated periodically to keep abreast of developments and progress in the Member States in the rational utilization of energy for

the heating of buildings.

2. If any notable progress is to be achieved in the heating of existing buildings, large-scale improvements must be made in thermal insulation. Economically viable, operational solutions must be researched and developed. This is why all the current projects in various Member States are so important. As soon as the results of those projects are available - and this could take over a year - the experts will inform the Commission departments, which will draw up a consolidated report.

   This will take longer than the list mentioned under paragraph 1, but it will likewise be updated periodically (e.g. every two years). This document will indicate the nature (type of solution), scale (number of dwellings and cost) and possibly the economic viability and consequences of the measures programmed in each Member State, as well as the method of financing them.

IV. THERMAL INSULATION OF NEW BUILDINGS

1. Regulations and standards in respect of the thermal insulation of new buildings exist in all the Member States of the European Community. In some cases they are still only in draft form, while in others the existing provisions are being revised. In most cases the rules relate mainly to the calculation of heat losses through the outer wall of buildings.

2. The study carried out for the Commission by the CSTC (1) contains a comparison of the regulations on thermal insulation in force in the Member States. The study, published in December 1975, takes stock of the situation prior to that date. The information on the national provisions needs to be updated; but the methods used and the points requiring further study if a Community model is to be created are still valid. The Subgroup agreed that most of the report and its findings provide a useful basis for further detailed studies.

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(1) See page 38.

3. Consequently, in the light of this document the Commission departments have:

   (a) concluded a new contract with the CSTC for the preparation of a study showing:

   - all the parameters influencing energy consumption in the heating of buildings;
   - an estimate of the "weight" of each of those parameters.

   For the purpose of making comparisons a common method of calculation already exists for certain of those parameters, for instance the average coefficient of transmission through the outer wall of buildings.

   For other parameters such as air leakage and the average indoor temperature in relation to external climate, methods are still being developed and only recommendations or estimates can be made. Finally, it might be advisable to plan at the Community level a research programme on the heat inertia of buildings and the assessment of heat gains, based on the work going on at the national level.

   (b) asked to be associated as A members with the work of ISO/TC (1) 163, the technical committee on Thermal Insulation, which held its first plenary meeting in Stockholm on 5-7 April 1976;

   (c) as a consequence of the joint meeting of Subgroup A and B (Heating Systems) held in April 1976, proposed the formation of a mixed working party. One of its tasks will be to examine the economic validity of levels of insulation in the various member countries and another will be to devise a method for dimensioning heating installations in relation to the thermal insulation of the building fabric and the external climate.

4. Lastly, in the context of the removal of technical barriers to trade a Working Party on Building Materials, considering glass products for use in the building industry, studied methods for calculating the transmission coefficients of windows.

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(1) International Standards Organization-Technial Committee.

V. CONCLUSIONS

In the light of the foregoing, and of the Commission's expressed desire to present proposals for future action going beyond recommendations, the proposed work programme is as follows:

1. To take stock of the type and condition of existing buildings, the first priority being that of housing. To update the information periodically, if possible every year.

2. To take stock of the research and development of operational solutions to improve the thermal insulation of existing buildings. To update the information periodically, preferably every two years.

3. To define the basic principles and work out methods of calculation and measurement for reducing energy consumption in the heating of buildings. This will involve:
   - determining the paramaters that influence energy consumption;
   - estimating the "weight" of each of those parameters;
   - if possible, working out a common method of evaluation based on the existing information (average coefficient of transmission through the outer wall);
   - if the existing information is insufficient, selecting agreed values provisionally;
   - if no information is available, deciding on a research programme designed to produce such information.

SUMMARY OF THE STUDY "COMPARISON OF THERMAL INSULATION REGULATIONS IN THE MEMBER COUNTRIES OF THE EEC"

This study examines the existing regulations and those in preparation in the different member Countries of the EEC, concerning the thermal insulation of buildings and intended to reduce wastage of energy consumed in heating buildings.

The study concentrates on the thermal characteristics of the outer wall of buildings and, in particular, on transmission losses through this wall.

Other characteristics of buildings are clearly also relevant to energy consumption, e.g. thermal inertia, temperature without heating and temperature without air conditioning. These parameters are not yet sufficiently well known, however, and are not generally considered in current standards.

Where possible, the study also tries to mention each country's requirements concerning allowable air infiltrations. In the last part of the study, reference is made to the main obstacles to better concordance (such as technical barriers), and an attempt is made to specify the points to be considered in order to achieve greater uniformity.

The above-mentioned study can be obtained from the following address :

Commission of the European Communities
Directorate-General for Energy
XVII/A
200, rue de la Loi
B-1049 BRUSSELS

SUMMARY OF THE SECOND INTERIM REPORT OF SUBGROUP B ON HEATING SYSTEMS

The report covers possible measures concerning new buildings and systems; the main points are as follows:

- new heating installations - performance, maintenance, control and adjustment;
- distribution of the requisite load over two or more generators;
- regulation of heating in new buildings;
- heat metering;
- production of domestic hot water in newly constructed dwellings.

These measures are the subject of a Commission proposal for a Council directive, given in full in the general section of this publication.

The final section of the report includes a number of ideas put forward as possible guidelines for future work.

The activities of the Subgroup have until now been concerned with the examination of possible improvements to traditional heating systems, but in the longer term they will also cover questions of energy supply and will fit in with the energy policy guidelines of the Community. The subjects dealt with will include:

- electric heating
- district heating
- utilization of solar and geothermal energy
- utilization of heat pumps.

The above-mentioned report can be obtained from the following address :

Commission of the European Communities
Directorate-General for Energy
XVII/A
200, rue de la Loi
B-1049 - BRUSSELS

SECOND INTERIM REPORT OF SUBGROUP C ON ROAD TRANSPORT VEHICLES

1. SUMMARY OF CONCLUSIONS

1.1. Speed limits

The drivers' handbooks issued by car manufactuers should state clearly that moderate speeds save energy (see first report, paragraph 3.1.1.).(1)

Reductions in existing speed limits solely for economy reasons are not recommended except as a special short-term measure in response to a fuel crisis.

1.2. The diesel engine

Active intervention by governments to promote the diesel engine in its present form is not advisable; but if favourable or at least stable fiscal policies can be maintained over an extended period, increased use of the diesel engine can be expected in the areas where it is most appropriate, with modest but appreciable effects on overall fuel economy.

1.3. Vehicle taxation

The rates of motor taxation are usually determined by broad fiscal considerations rather than by technical factors such as the rational use of energy. There does, however, appear to be scope for using taxation as an incentive to energy economy without interfering with the total revenue received.

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(1) This report can be obtained from the following address:
Commission of the European Communities
Directorate-General for Energy
XVII/A
200, rue de la Loi
B-1049 Brussels

The most important taxes from the standpoint of energy economy are:

(a) the annual tax on ownership and (b) the fuel tax, both of which could be used to reduce consumption and to promote more economical vehicules, including diesel-engined vehicles in appropriate sectors.

Stabilizing fiscal policies over an extended period could also help to promote more economical vehicles, including diesel-engined vehicles in appropriate cases.

Fiscal policy on alternative fuels such as LPG should also be examined.

Subgroup C recommends that the suggestions on taxation in this report should be examined by an ad-hoc committee of representatives of the competent Commission departments and of experts from Member States, with a view to preparing concrete proposals.

1.4. Research and Development

The group's recommendations for improving energy economy in motor vehicles should be pursued in a combined R&D programme. It is proposed that the outlines of this programme and the main priorities be established in a recommendation to the Council in time for discussion in November 1976.

2. INTRODUCTION

Subgroup C's interim recommendations were adopted by the Council on 4th May 1976 as a recommendation to all Member States. (1)

Since the production of the first report, the group has continued with the programme of work outlined in Section 4 of the report, concentrating mainly on the following subjects:

2.1. Speed limits and their effect on fuel economy;

2.2. Further examination of the possibilities of promoting the diesel engine;

(1) OJ No L 140 28 May 1976, page 14.

2.3. A preliminary study of the effects of taxation on the rational use of energy in private cars;

2.4. A joint research project with CEC, CCMC and Stichting CONCAWE (1) on a range of engine and fuel combinations to determine the optimum match of engine and fuel specifications for private cars. The results of the first stage of this project should be available for the group's next periodic report.

The group has also invited the CLCA (Comité de liaison de la construction automobile) to participate in its work so as to ensure close cooperation with the motor industry in implementing the recommendations.

A final report on the diesel engine and a memo on specific taxation of motor vehicles are available on request. (2)

3. SPEED LIMITS

3.1. Speed limits and fuel economy

No mention was made in the previous report of the effect of speed limits on fuel consumption. It is well established that fuel consumption rises rapidly with increasing speed, most of the additional energy being used to overcome the higher aerodynamic drag. Recent road tests have shown that, for private cars, the air resistance absorbs roughly half the energy output at 60 km/h and generally more than two-thirds at 100 km/h depending on the quality of the aero-

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(1) CEC - Co-ordinating European Council for the development of performance tests for lubricants and engine fuels
CCMC - Committee of Common Market Motor Vehicle Manufacturers (CCMM)
CONCAWE- The Oil Companies International Study Group for conservation of clean air and water (Western Europe).

(2) It can be obtained from the following address:
Commission of the European Communities
Directorate-General for Energy
XVII/A
200, rue de la Loi
B-1049 Brussels.

dynamic design. Driving at moderate speeds on the open road can therefore make a valuable contribution on fuel economy.

The split between town and open-road driving in the Community is about 50/50 and it seems unlikely that more stringent speed limits in towns would lead to useful energy savings; in fact, if lower speed limits were to result in reduced average speed of traffic flow, energy consumption might actually increase.
Furthermore, maximum speeds on ordinary cross-country roads have been substantially reduced in recent years for safety reasons and it is probably only on motorways and some fast cross-country roads that any significant fuel-saving from reduced speed limits is still available.

There is also the problem of enforcement and of public cooperation in observing speed limits. The primary reason for speeds limits is road safety and it would be difficult to enforce lower limits solely in the interest of fuel economy.

More rigorous enforcement of speed limits in recent years for safety reasons may also be helping to influence the motorist's choice towards reliability and economy and away from excessive speed and performance.

The study on driver behaviour has shown that the driver selects his speed in terms of the value the car occupants place on their time and the degree of risk. The calculations show that this speed may in some cases reach 120 km/h, which is substantially higher than the most economical speed.

3.2. Conclusion

The Group does not recommend a general tightening of the present speed limits simply for energy-saving reasons, but the fact that driving at moderate speed helps to save fuel should be included among the information on economical driving in the vehicle handbooks supplied to car owners by manufacturers.

On the other hand, temporary speed limits on motorways and other fast roads can be a moderately effective measure in the event of a fuel crisis such as occurred in the winter of 1973/74 when an overall fuel saving of some 5 % was observed.

4. PROMOTION OF THE DIESEL ENGINE

The group's first report on the possible wider use of diesel engines noted that :

- because of its durability, reliability and low consumption the diesel engine is already used in practically all vehicles over 3.5 tonnes gross weight;
- the most promising areas for expansion are, first, commercial vehicles of 1.5 to 3.5 tonnes gross weight, secondly light vans and taxis, and thirdly medium-sized family cars.

The potential fuel savings resulting from such expansion have been estimated at 2.5 to 5.9 million tonnes per annum, depending upon vehicle usage and the level of diesel penetration achieved.

The advantages of the diesel engine are partly offset by its greater weight and higher initial cost as compared with a similar gasoline engine. The noise and smell of a diesel engine also make it less attractive to the private car owner and, bearing in mind the relatively low average annual mileage covered by this class of motorist, and hence the small fuel savings achievable, large-scale penetration of diesel-engined cars is not a likely prospect.

The development of a small diesel engine, with a better fuel economy than the types available today, might change this position; further research and development of this type of engine should therefore be encouraged.

For owners of fleets of cars, business users and public authorities, however, the position is different. Here the large distance covered each year and the good reliability and long life of the diesel engine outweigh its disadvatages and a more rapidly rising demand for this type of vehicle is foreseen. Increased production of small diesel engines suitable for private cars and light vans would require a substantial capital investment by the motor manufacturers and would commit them to the production of diesel engines for a period of up to 20 years. During this period demand for diesel vehicles might fluctuate considerably if the price of diesel fuel varied significantly and often. There would therefore be a high risk attached to this investment unless the price of diesel were stabilized by fiscal or other means.

4.1. Commercial vehicles of 1.5 to 3.5 tonnes gross weight

At present only a third of the 2.75 million vehicles in this class in the Community have diesel engines, although

the proportion in Germany and Italy is much higher (85 % and 74 %). The main obstacle to further penetration of the diesel engine appears to be limited production capacity, but efforts are being made to expand to meet the growing demand.

4.2. Light vans, taxis and fleet cars

For vehicles in these classes covering 50,000 km a year or more, the reduced fuel cost can cover the higher initial cost of the diesel vehicle within one to two years. The greater reliability and durability of the diesel is also important for this class of user. Apart from purpose-built taxi-cabs, most taxi and light van designs are derived from private cars, very few of which are as yet available in a diesel version; but new models incorporating a diesel option are gradually being introduced and, provided there is a clear economic advantage in using them, will find a ready market within the business vehicle field.

4.3. Conclusion

The Group welcomes the gradual extension of diesel engines into appropriate vehicle categories such as light goods vehicles, vans and taxis, already being undertaken by the motor industry.

Further active promotion of the diesel engine would require major capital investment at considerable risk to the industry. The Group suggests that these risks could be greatly reduced if Governments would stabilize fiscal policies on diesel fuels and diesel-engined vehicles, and proposes that such policies be examined in depth by an appropriate working group (see section 5.4).

5. VEHICLE AND FUEL TAXATION - PRIVATE CARS

5.1. Introduction

A document, available on request (1), contains a full analysis of comparative tax rates in Community countries, with observations on the probable effects of vehicle and fuel taxation on fuel consumption and on vehicle design.

Decisions on vehicle taxataion will inevitably be influenced by a number of factors other than the rational use of energy, including transport, industrial and social policies. The group's aim in this report is therefore to identify the possible influences of taxation on energy economy so that they may be taken into account in the wider context of fiscal policy.

5.2. Effects of taxation

The effects of vehicle and fuel taxation and, in particular, of increases in taxation may be:

- in the short term, to reduce fuel consumed by the existing car population;
- in the medium term, to reduce the number of cars sold or possibly to favour diesel cars, without necessarily reducing the size of the car population;
- in the longer term, to favour the development of cars which are relatively cheap to buy and more economical in use.

There is strong evidence that total fuel consumption is virtually unaltered by changes in fuel prices; only major increases in fuel taxation are likely to have a significant effect. Changes in purchase tax have an immediate effect on sales of new cars and differential purchase tax could be used to favour the diesel car; but the total car

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(1) It can be obtained from the following address:
Commission of the European Communities,
Directorate-General for Energy
XVII/A
200, rue de la Loi
1049-Brussels.

population, and hence fuel consumption, may not be affected until the old cars have been changed for new in the course of time.

Consequently only the long-term effects of taxation are likely to be significant from the standpoint of energy economy.

Methods of raising revenue on motor cars vary widely from one Member State to another. This diversity, combined with the relative resilience of vehicle ownership and use to taxation rates, suggests that taxation policy could be adjusted to favour energy economy without altering the total revenue.

5.3. Categories of taxation

Vehicle taxation falls into three main categories:

- taxes on purchase;
- taxes on the vehicle;
- taxes on use.

The possibility of using each of these as a spur to energy economy is analysed below:

5.3.1. Taxes on purchase

Purchase taxes include all taxes associated with the purchase including VAT. They are of two types:

- taxes on transactions, which are paid when a new or second-hand vehicle is purchased and may exceed the levels of taxation on other goods, i.e. may be partly specific;
- taxes on registration, which are charged exclusively on motor vehicles and are therefore entirely specific.

These taxes are levied as a proportion of the vehicle price and have no direct influence on consumption, although they may marginally reduce the number and size of cars in the total population and could, if differentiated, be used to favour the diesel engine. High specific taxes as applied, for instance, in Denmark may also reduce spending on cars in relation to other consumer goods.

5.3.2. Taxes on the vehicle

The vehicle tax is payable annually whether the car is used or not. A flat rate is applicable in the United Kingdom, but in other Community countries factors such as weight, cylinder capacity and fiscal horsepower are taken into account.

For new cars the first annual tax is normally paid at the time of puchase. This can influence the buyer's choice towards a car with favourable characteristics from the taxation point of view, for instance, a low cylinder capacity. The tax penalty on larger-capacity engines in certain countries has promoted smaller, fast-running engines, with adverse effects on energy economy. This could be corrected by relating the tax rate to a standard consumption test. The vehicle tax could also be lowered to encourage use of the more economical diesel engine.

5.3.3. Taxes on use

These are mainly fuel taxes, which represent the bulk of tax revenue from motor vehicles. This tax is charged directly on consumption and should be a spur to energy economy. Like the annual vehicle tax, fuel tax rates can be adjusted in favour of the diesel engine.

However, although fuel tax represents the biggest outlay for the private morotist, he appears rather insensitive to it and, having once purchased a car, seems thereafter little inclined to reduce his annual kilometrage in order to save fuel.

Fleet owners and commercial users, on the other hand, are much more likely to be interested in annual fuel costs and to invest in diesel-engined vehicles if the differential between petrol and gas oil compensates for the higher purchase cost of a diesel vehicle.

5.4. Conclusions

It is difficult to draw any firm conclusions from a comparative study of tax rates in the different Member States but, on balance, it appears that the taxes most likely to influence fuel consumption and promote more economical design features are:

- the annual vehicle tax;
- fuel taxes.

A high tax on purchase such as that applied in Denmark almost certainly leads people to buy cheaper and therefore smaller cars which are generally more economical.

The vehicle tax, now related to engine capacity or fiscal horsepower, could promote sales of more economical cars if it were based instead on fuel economy, using for instance the standard consumption test recommended in the group's previous report.

Fuel tax is probably a secondary consideration in the private motorist's decision to buy a car; but in practice it is a major item of expenditure and likely to influence the buying decisions of fleet owners and commercial users. It could therefore be used to promote the use of more economical vehicles, including diesel vehicles, in those sectors where they appear most appropriate.

Apart from diesel fuel and petrol, there are other fuels suitable for road transport and readily available in the Community, for example LPG. The future adoption of these fuels will also depend on taxation policy.

The group recommends that these problems be examined by an ad hoc working group consisting of Commission officials competent in the various fields of taxation policy and experts from the Member States, with a view to preparing concrete proposals.

6. RESEARCH AND DEVELOPMENT

6.1. Introduction

The Community's effort in the field of research and development falls under three main headings:

- coordination of the R&D programmes in individual Member States,
- Community support for joint R&D programmes carried out in the Member States and in non-member countries,
- R&D programmes wholly or mainly financed by the Community, including work in the Community's own research establishments.

All R&D work is supervised by the Directorate-General for Research Science and Education (DG XII) in cooperation with the other Commission departments concerned.

The Council votes funds for R&D work on the basis of proposals from the Commission; at present the funds available in any particular field are strictly limited.

6.2. Existing R&D programmes

The existing programmes into which projects concerning the rational use of energy in motor vehicles could be introduced are:

6.2.1. The R&D programme for energy conservation

The initial list of recommended projects (details of which are still confidential) includes:

- development of no-coolant diesel engine;
- analysis of performance of petrol engines at part load;
- use of variable compression chamber in diesel engines for cars.

A total fund of 2 million units of account has been voted for the first phase of this programme (1976-1977) of which up to 20% may be employed for transport projects. Proposals for projects in the second phase (starting 1978) should be made in the course of 1977.

6.2.2. Proposal from the Commission to the Council: Objectives, priorities and resources for a Common Research and Development Policy (COM (75) 535 29th October 1975)

The Commission's proposal is scheduled for discussion by the Council in November 1976. It includes a section on the rational use of energy in transport, based on the initial findings of Subgroup C and briefly mentioned by the Secretary last year. The proposed projects were:

1) feedback system to show drivers their fuel consumption vs. speed;
2) quick tests for checking and tuning petrol engines;

3) certain vehicle and engine design improvements;
4) new types of propulsion - diesel/petrol/electric combinations;
5) certain improvements to the diesel engine;
6) improved heating of public transport vehicles.

The proposed appropriation for these studies is about 30 million u.a. for research and development over the period 1977-1982, and if the Council approved the proposal the research work could start in 1977. There would prohably be scope for changing the projects within the agreed budget in order to promote whichever effort appears most appropriate from the Community's point of view.

Neither of these programmes offers any firm prospect in the short term for R&D projects recommended or directly controlled by Subgroup C. However, in the medium term (say mid-1977 onwards) there is some prospect of a coordinated R&D programme on rational use of energy in motor vehicles, based on the Subgroup's recommendations.

6.3. Proposed course of action

Limited by its terms of reference, Subgroup C was not able to conduct an exhaustive review of all R&D projects in the Community and elsewhere relating to energy-saving in motor vehicles. The following action can, however, be recommended:

6.3.1. Defining topics of particular interest

Potential topics for R&D effort which can be classified under the original main topics adopted by the Subgroup include short-term, medium- and long-term measures.

Short-term:

1. Influencing the behaviour of the motorist:
   - influences on buying habits, including fiscal aspects;
   - influences on driving habits, including apparatus fitted to the vehicle.

2. Improving the performance of existing vehicles:

   - equipment to improve the tuning of petrol engines;
   - other improvements applicable to existing vehicles;
   - new fuels, including methanol mixtures and LPG.

Medium-term:

3. Improvements to conventional cars and engines:

   General topic:

   - achieving the best balance between environmental, safety and energy-saving characteristics

   Other topics:

   - improved petrol engines (e.g. better part-load running, fuel-injection);
   - improved transmission (continous transmission);
   - electrical equipment, ignition, etc.;
   - aerodynamic design;
   - vehicle weight;
   - studies of engine/fuel matching such as the present joint CEC, CCMC, Concawe study.

4. Use of the diesel engine:

   - development of a wider range of light diesels for passenger cars, etc.;
   - spark-assisted diesel;
   - improving the acceptability of the diesel: noise, fumes, etc.

5. Improved use of space heating, sound insulation, etc. in public service vehicles

6. Improvements to heavy goods vehicles and buses:

   - engines (turbocharging etc.);
   - gears and transmission;
   - tyres and suspension;
   - aerodynamic design;
   - hybrid engines.

Long-term:

7. Promotion of more advanced types of engine

   - engines using wide-cut and other fuels;
   - stratified charge engines;
   - no-coolant engines;

- electric propulsion, fuel cells, etc;
- the Stirling engine, gas turbine etc.

Other topics still have to be discussed by Subgroup C; if appropriate, they could also be introduced into the programme.

6.3.2. Selecting recommended projects for R&D effort

From their knowledge of R&D projects or programmes in their own countries and elsewhere within the defined range of topics, the members of the Subgroup will be able to:

1) define areas where more R&D effort is needed;

2) draw attention to existing projects or programmes which are relevant to the work of the Subgroup or can help to implement its recommendations;

3) draw up a priority list of short-, medium- and long-term R&D projects and define the appropriate degree of Community support and the potential benefits.

7. PROGRAMME OF WORK

Subgroup C has now completed its first examination of the six points in its original terms of reference. Recommendations have been made on most of the measures available in the short term, say up to 1985, to promote greater economy in existing types of cars. The group is cooperating with the oil and motor industries on an R&D project on engine/fuel matching, the first results of which should be available shortly.

The group's present objectives are to:

7.1. Study methods of implementing its recommendations in cooperation with national authorities and with the motor industry.

7.2. Study the opportunities for greater energy economy in the field of commercial vehicles.

7.3. Promote suitable research and development projects in the field of energy economy in motor vehicles, in a report to be sent to the Council.

7.4. Continue with the CEC, CCMC, Conwawe study on the best engine/fuel combinations.

7.5. Continue the investigation of longer-term developments, including the market penetration of electrical vehicles and of new types of thermal engine.

SECOND INTERIM REPORT OF SUBGROUP D:

ON TRANSPORT STRUCTURES

INTRODUCTION

1. The Subgroup's task was to examine the scope for saving energy within the next ten years by using it more rationally in transport, with special reference to passenger movement in urban areas. The Subgroup's concern is with how vehicles are used rather than with their physical characteristics, which is the field of interest of Subgroup C "Road transport vehicles".

2. Before specific energy-saving possibilities are discussed in detail there are several general remarks to be made.

3. By definition, the measures to be examined should consist only of those which would have no adverse effect on the economy or on personal welfare. Some of the measures we discuss might be thought by some to involve a reduction in personal freedom inconsistent with the principle of not adversely affecting personal welfare. But this is largely a matter of judgment, and it seems only realistic to discuss these possible measures here.

4. Measures to promote energy-saving often entail expense and may be accompanied by desirable or undesirable consequences in other fields. For example, it might save energy if bus operators ran smaller buses off-peak than during peak periods. But such a policy would involve operators in a number of cost, operating and maintenance problems. On the other hand energy-saving driving techniques would probably enhance safety and slightly reduce noise and fumes. There is no doubt a tendency when pursuing a particular objective, in this case energy-saving, to underestimate the importance of the side-effects of the policies advocated - a kind of professional distortion. The group tried to guard against this, but is conscious that these side-effects have not been fully explored.

5. In the field of urban passenger transport the general policies which were being pursued before the new energy situation arose tended already, as it happens, to be of an energy-saving nature, although that was not the deliberate intention. This applies, for example, to the major related aims of improving public transport and reducing road traffic congestion. What is required from the viewpoint of a more rational use of energy may often therefore amount to no more than an acceleration or reinforcement of existing lines of action.

6. It is particularly difficult to estimate the likely energy savings from measures proposed or adopted in regard to transport structures. This makes it difficult in turn to decide the order of priority of measures, since while it may be possible to form some idea of their cost it may be most unclear what energy saving they would permit. One may attempt to estimate how much less energy in total is being consumed in town transport compared with what would probably have been consumed without a whole package of measures, but it is much more difficult to distinguish the particular contribution of individual measures and the effect of external factors (e.g. the general state of the economy). The Subgroup did not succeed in obtaining much information on the cost of energy-saving measures already adopted in the field of urban passenger movement or on the amount of energy actually saved by these measures. In the end it confined itself to listing the measures adopted or under consideration in Member States and likely to reduce energy consumption in urban passenger movement, indicating which of them were introduced for general urban transport policy reasons rather than specifically in order to save energy.

7. In any event one cannot expect rapid change in the way passenger movement in towns is organized. While the present situation of urban transport is no doubt unsatisfactory from the energy-saving viewpoint as well as from many others, experience has shown that significant improvement can take place only gradually, and often at considerable cost in money terms or in terms of encouraging people to adopt solutions which seem to them second-best. In particular, those who transfer from private to public transport may often suffer a sense of personal loss at abandoning the advantages of private transport: public transport is only regarded as a superior alternative in rather special circumstances. In any case, it often has only limited spare capacity available for those transferring to it from private transport.

8. Responsibility for urban transport is exercised in the main at local and regional level (local and regional authorities and public transport operators) within a general policy and financial framework set at national level. There is in the group's view little scope for formal Community-level legislative action in relation to the rational use of energy in urban transport. It is hoped, however, that this report will be useful to those at local, regional and national levels who must decide what package of energy-saving measures is most appropriate to their particular circumstances.

9. Various energy-saving possibilities in urban passenger movement are divided before into five main fields. This sub-division is, however, in no way rigid, and several measures discussed would have beneficial effects in more than one field.

WAYS OF USING PRIVATE VEHICLES WITH LESS CONSUMPTION OF NON-USEFUL ENERGY

10. Since with their many advantages private vehicles will inevitably continue to be used on a large scale in urban areas, it is surely important to consider ways of reducing the energy consumption involved in a given number of journeys by private car. Three main kinds of action seem available in this context:

a) reduce the incidence of stop-go driving situations

11. A wide range of action can be considered here, most of which can be categorized as traffic management measures: more efficient phasing of traffic lights, including "green wave" arrangements; better signposting of routes, destinations and parking areas; reductions in on-street parking; introduction of flexible working hours; and staggering of working and school hours. There is the danger here that these arrangements, by easing the traffic flow, would increase the relative attractiveness of the private car unless bus and tram services benefited from them at least equally. Moreover, the staggering of working hours could reduce the scope for such energy-saving measures as car-pooling (though it might help the economics of public transport operations by spreading demand). It could also, of course, tend to increase the amount of energy required for heating and lighting workplaces.

12. Stop-go situations can also be reduced, at a price, by improved road infrastructure, though this is clearly a dangerous tool in the energy-saving context.

b) encourage more rational driving techniques

13. An information or propaganda campaign might be mounted by the public authorities to draw to drivers' attention the scope for saving fuel by more moderate acceleration and more gradual deceleration, by turning off the choke as soon as possible and by swiching off the engine in traffic holdups. Worthwhile savings may well be possible here. At the same time driving schools could give more attention in their instruction to economical driving techniques.

c) speed limits

14. Speed limits in towns are for the most part no doubt already at or below the optimum energy-saving level. There may, however, be some limited scope for reducing speed limits on urban motorways for energy-saving purposas.

WAYS OF RATIONALIZING THE USE OF PRIVATE VEHICLES (measures of restriction, investment etc.)

15. Measures involving restrictions on the use of the private car come close to the category of measures involving a reduction of personal welfare or freedom. But there are good grounds for examining this aspect of the matter, in view of the probably limited scope for reducing energy consumption in urban transport by purely voluntary measures, and the fact that the public authorities have anyway been trying for years now - with the aim, inter alia, of securing a more satisfactory relationship between public and private transport - to control private transport in towns by measures involving the actual restriction in various ways of its use, especially for the journey to and from work. The new energy situation has increased the need to do this.

16. Here a number of related measures could be considered. The first is to encourage a higher average occupancy of private vehicles, an energy-saving measure provided that it actually reduces the volume of private car traffic. In this context existing legal and other disincentives to car-pooling arrangements need to be reviewed. For example, in several Member States there are problems about passengers contributing to the driver's costs, which may cause insurance difficulties or infringe bus licensing law. Whilst it may be true that the contribution of voluntary car-pooling to energy-saving would probably be only marginal, and that a proportion of those who take part in car-pooling arrangements may have transferred from public transport rather than from the private car, nevertheless Member States should examine the case for removing these impediments so far as possible. (In at least one Member State they were in fact removed during the acute stage of the energy crisis.) There may also be scope for the encouragement by employers of car-pooling by their staff (e.g. through privileged parking arrangements); and it might be advantageous to allow full cars to use bus lanes, provided that enforcement posed no serious problems and bus movements were not unduly impeded.

17. Turning now to measures involving restraint on the use of the private car, two kinds of action have classically commended themselves. The first has been to reduce the scope for using private cars by restricting parking possibilities, especially for all-day parking by people working in the town centre. This could involve controlling not only on-street but also off-street parking and, in the latter category, not only publicly-owned but also (though this presents obvious difficulties) privately-owned parking, including parking in office buildings. Another way of limiting the use of private cars in towns without using the price mechanism is to oblige vehicles which wish to enter certain areas to wait, perhaps for several minutes, before being allowed in. This can be done by traffic-light control.

18. The second classic method of restraining private car use has been to bring home to drivers the cost of their presence in town. In this context the Commission has proposed that all users of transport infrastructure should meet the marginal social costs of their use of it. These costs are no doubt considerable in many urban situations. While this proposal has not been implemented in a wholesale way, and presents special problems in urban areas, Member State authorities are tending to move in that direction, and the need to do so is increased by the new energy situation. Among the tools available or in prospect here are increased parking charges, supplementary licensing and

road pricing. It would, however, be dangerous to overestimate the likely impact on private car use of even major increases in its perceived cost to the user. The relatively slight effect of increased petrol prices on the volume of private car use in towns confirms that the price elasticity of demand for private transport is low, at least in the urban situation, where the true cost of using a private vehicle is no doubt already considerably greater than that of public transport for a given distance. Increased petrol prices can nevertheless contribute to a reduction in the use of the private car.

19. In this context of financial disincentives to the use of private cars in towns we should like to draw attention to certain cases where national taxation systems seem to encourage the use of private rather than public transport. In one Member State, for example, the tax system encourages car owners to use their car rather than public transport for the journey to work. More generally, fiscal arrangements may lead employers to provide some of their employees with cars. While conscious of the complexity of this field and of the fact that the energy aspect is only one of many, the group nevertheless believes Member States should re-examine, in the light of the new energy situation, the impact of their tax arrangements on the use of the private car.

20. Other possible measures in this field might include propaganda in favour of voluntary restraint in the use of private cars for short distances, perhaps with a reminder of the benefits of physical exercise. Secondly, pedestrian-only areas may be costly to institute but save energy as well as bringing substantial environmental and safety benefits. Lastly, deliberate failure to improve road infrastructure deters some drivers, who then resort to public transport; but many drivers are willing to put up with high levels of energy-wasting congestion before abandoning their cars, so it is probably better (though difficult) to restrain the use of private transport while at the same time improving conditions for the vehicles which remain in use.

WAYS OF USING PUBLIC TRANSPORT VEHICLES WITH LESS CONSUMPTION OF NON-USEFUL ENERGY

21. A number of measures are possible here, most of them requiring cautious use in order to minimise undesirable side-effects in other fields. The main possibility in the field of bus transport

may be to reduce the incidence of stop-go situations, for example by providing bus-only lanes, privileges for buses at traffic lights and elsewhere and control of on-street parking. Here it is clearly necessary to avoid hampering private vehicles to such an extent that total energy consumption increases. Careful scheduling may reduce the amount of empty-running, and operating staff might be encouraged to drive in a more energy-saving manner - this would include a greater readiness to switch the engine off, a point applying also to diesel locomotives.

22. At the operating level there may remain some scope in some urban areas for reducing unnecessary competition between bus operators on the same or similar routes.

23. Some forms of public transport offer of course the advantage of a non-oil-based power supply. Favouring these forms could lead to a more rational use of energy even if it made little difference to the actual quantity of energy consumed.

WAYS OF MAKING PUBLIC TRANSPORT MORE ATTRACTIVE TO THE USER

24. The qualities which make public transport attractive are frequency and convenience, regularity and reliability, speed, comfort and cheapness - possibly in descending order of importance. Those responsible for public transport naturally try to make their services correspond as closely as possible to these ideals, quite apart from the new energy situation. That situation simply strengthens the case for making public transport as attractive as possible, and here again the measures available are those which have been classically employed in the past: increasing regularity and reliability by traffic management, including bus lanes, privileges at traffic lights and other priorities, and parking control ; increasing convenience by seeking to give to public transport, for instance through "dial-a-bus" and other "demand-responsive" systems, some of the attractions of the private car or the taxi. Efficient "park and ride" arrangements may allow the different advantages of both public and private transport to be brought to bear for the same journey; in this context it may well be justified to depart from the general rule that car-parks should not be provided on a subsidized basis.

25. Public transport operators will no doubt consider the scope for giving more publicity to the stronger points of public transport.

26. Whilst one should not exaggerate the importance of the price of public transport as a factor affecting users' choice between public and private transport, nevertheless the responsible authorities ought to bear the new energy situation in mind when making the financial and fiscal decisions which in practice decide the fares that public transport operators must charge.

27. Convenience may also be improved by various kinds of coordination between different public transport operators in the same area, which might go as far as the setting-up of single conurbation or regional traffic and transport authorities. The coordination may be physical (better interchange arrangements) or organizational (for example coordinated timetables, and charging arrangements allowing a single payment to be made for a journey involving more than one vehicle.)

28. It may be admitted that some measures here - for example those aimed at providing a more convenient service by such means as "dial-a-ride" buses - may not always directly save much energy. However, they are doubtless justified in a more general way in the interests of the long-term preservation and improvement of public transport, the use of which instead of private transport is certainly energy-saving in general.

WAYS OF REDUCING THE NEED FOR URBAN PASSENGER MOVEMENT IN POWERED VEHICLES

29. The two main ways of reducing the need for people to move in urban areas are no doubt changes in urban land use and developments in telecommunications. But there is limited scope for action here within the next ten years and it does not seem possible to do more than draw planners' attention to the increased importance of the energy factor here. There may, however, be scope for action of a more limited kind by encouraging cycling and walking through propaganda and through minor infrastructure changes designed to make them pleasanter and safer. It may also be possible, without changing fundamentally the typical physical relationship between home and work, for employers to arrange for part of their employees' work to be done at home rather than at the workplace.

RATIONAL USE OF ENERGY
Subgroup D - Transport Structure

SURVEY OF MEASURES TAKEN IN MEMBER STATES AND LIKELY TO REDUCE ENERGY CONSUMPTION IN URBAN PASSENGER MOVEMENT

A = Measures adopted
P = Measures under consideration

Note : Several of these measures apply not only to urban passenger movement but also more generally. The measures may have been introduced at national, regional or local level.

	B	DK	D	F	I	IRL	NL	UK
1. Measures aimed at reducing the consumption of non-useful energy in the use of private vehicles								
- Information on economical driving	A	A	A ×⊕	A ×⊕		A ⊕	A	A ⊕
- Generalization of speed limits (1)	A	A			A		A	
- Synchronization of traffic signals (green waves etc.)	A	A ⊕	A ⊕	A ⊕	A ⊕	A ⊕		A ⊕
2. Measures aimed at restricting the use of private vehicles								
- Periodical bans on driving (1)	A ×⊕	A ×⊕	A ×⊕		A ×		A ×⊕	
- Encouragement of the use of public transport	A	A	A	A ⊕		A ⊕	A	
- Limitations on parking time or increased parking fees	A ⊕	A ⊕	A ⊕	A ⊕	A ⊕	A ⊕	A ⊕	A ⊕
- Creation of pedestrian zones or streets	A	A	A	A	A ⊕	A ⊕	A	A ⊕
- Creation of transit parking areas and other ways of improving the transfers from public to private	A ⊕	A ⊕	A ⊕	A ⊕	A ⊕	A ⊕	A ⊕	A ⊕
- Road pricing				P ⊕			P ⊕	

(1) Measures aimed at energy savings, but not specifically RUE measures.

	B	DK	D	F	I	IRL	NL	UK
3. Measures aimed at improving public transport								
- Instruction of operating staff	A⊕		A⊕	A⊕		A⊕		
- Rationalization of networks	P	P⊕	A⊕	A⊕				
- Traffic lanes for priority or sole use by public transport	A⊕	A⊕	A⊕	A⊕	A⊕	P⊕	A⊕	A⊕
- Improved operating equipment (rolling stock etc.)	A⊕	P⊕	A⊕	A⊕	P⊕	A		A⊕
- Improvement of infrastructures	A⊕	A⊕	A⊕	A⊕	A⊕	P	P⊕	A⊕
- Creation of new infrastructures	A⊕	A⊕	A⊕	A⊕	A⊕		A⊕	A⊕
4. Reduction of demand for movement								
- Modification of urban structures; telecommunications developments	P	P						P
5. Increase in fuel prices by higher taxation	A⊕			A⊕	A	A	P	A
6. Miscellaneous measures								
- Maintaining or raising the permitted level of lead in petrol								A

⊕ These measures were or would be adopted independently of the energy crisis but have nevertheless an energy-saving effect.
× Temporary provisional measures adopted during the oil embargo of 1973.
×⊕ Implies that the measure was originally imposed as an immediate consequence of oil supply difficulties but was then kept in operation for wider reasons

SECOND INTERIM REPORT BY SUBGROUP E
INDUSTRIAL PROCESSES - HEAT

I. INTRODUCTION

Subgroup E decided to hinge its work on three main pivots and to examine:

1. energy savings achievable without making costly modifications to present industrial structures, installations and processes;

2. savings that would be possible by making costly modifications to present structures, installations and processes;

3. research into and development of new processes which had shown positive results at the laboratory stage and which were suitable for trials at the industrial level.

At Subgroup E meetings held at the end of 1975 and in 1976 the experts had first of all concentrated on gathering all information available on public or private steps taken to reduce waste in industry as a whole.

This gathering of data made it possible to put together an information leaflet (Annex) containing measures and recommendations aimed at limiting the waste of energy in industry.

At the sectoral level the experts had agreed to gather all information of importance on:

(i) known techniques and processes, whether costly or otherwise, which had made it possible to achieve appreciable energy savings;

(ii) new processes and techniques introduced since 1973 to reduce energy consumption;

(iii) any processes and "know-how" which could be pooled by undertakings, against payment or otherwise, which would lead to a more efficient use of energy. Work in these fields particularly concerned the following industries:

(a) sugar - because of the homogeneous nature of the product:
(b) textiles - because of the size (small and medium-sized) of most firms in the industry;
(c) paper and paperboard - for the same reason.

The work also covered a horizontally-organized sector:

- high temperature furnaces: this sector, which covers widely differing branches of industry (briquette works, cement works, glass and ceramics, heat treatments, smelting and refining by melting down, etc.), includes all processes which require high temperatures (approximately 1,000°C and over).

The purpose of this exchange of information was to find out why the methods recognised as most efficient had not been made generally known, and what steps could be taken at Community level to make their use more general.

II. PRELIMINARY RESULTS

One of the main results obtained on the basis of the work schedule described above was the exchange of information on experience and activities in various Member States.

A further, equally important, result was the study of several technical problems related to the rational use of energy in the textile and sugar industries. Here, however, the exchange of information ran into a major difficulty, namely that of putting the information gathered to the best possible use. Often this information was very technical and highly specific and was only useful if passed on directly to the undertakings concerned.

Also it had proved very difficult to obtain figures which would make it possible to compare progress in each industrial sector in all the Member States.

This is a good occasion to make use of the Community's political, legislative and administrative resources, which are not available to private international bodies, to initiate projects of common interest at Community level, to ease the way for national and industrial activities, and to give them a Community framework in which they can develop harmoniously.

In view of the foregoing the experts realized that rational use of energy in industry has to be achieved with due regard for each industry's own economic objectives. The opportunities differ according to the size of the undertaking, its locality, its manufacturing processes and its products.

From this point of view one of the more profitable Community methods is the systematic and regular dissemination to Community undertakings, particularly small and medium-sized firms, of knowledge gained on the subject of energy-saving processes. But do this effectively one would have to set up widely ramified information networks to try to reach every one of the energy officers in the firms, and input centres to feed the networks.

As it is also necessary to be able to see how much the firms are contributing towards the achievement of the Community's 1985 RUE target and to appraise their difficulties, the experts felt that it would be appropriate to:

1. extend to other undertakings the practice already adopted by some, namely that of assigning to an "energy officer" the task of drawing up and supervising an energy conservation programme based on objectives and procedures akin to those suggested for guidance in the Annex to the Recommendation;

2. invite the same undertakings to communicate to their national authorities annually the result of their energy-saving arrangements on the basis of common evaluation criteria so that a check can be kept on progress made, and to inform the Commission of the European Communities thereof;

3. invite sectoral and general trade organizations to ascertain from these energy officers what experience has been gained and what difficulties encountered in carrying out the energy conservation programme, so that they can exchange information at Community level and thereby give all Community industries the experience thus gained;

4. invite the same associations to set up machinery to enable energy officers to exchange the information available and to discuss systematically industry's role in saving energy.

The two first proposals were the subject of a Draft Council Recommendation to the Member States. The text is given in the general section of this document.

III. SITUATION REPORT ON WORK AT A GENERAL LEVEL AND IN THE SECTOR SUBGROUPS

a) "Anti-wastage measures"

A draft leaflet containing a summary of methods for counteracting wastage in general and one on company organization structures has been prepared. It has two annexes:

(i) a list of operating instructions for wastage prevention(1);

(ii) a bibliography of publications having a bearing on energy conservation (1).

These texts are available to the experts of the subgroup and to the specialists who participated in other working groups on the industrial sectors now being examined.

b) Sugar industry

The information received from member countries confirmed that the sugar industry is the heaviest consumer of energy in the food sector, particularly of fuel oil.

The companies, ever aware of the effect of energy prices on their production costs, have for some years been cutting back energy consumption wherever possible by means of technological improvements and by restructuring the sector.

Information in this sector is freely available and information on improvements accessible to all. The inexpensive measures for saving energy have generally already been taken and any further reductions in energy consumption would entail new and sometimes heavy investments.

Nevertheless the report on this sector (1) made it possible to pick out a number of ways of reducing the specific energy consumption in sugar production.

It would also be possible to reduce the energy requirements of this industry considerably by reintroducing the production of second and third grade sugar. This question, of interest to both sugar producers and industrial and private users of sweetened products, is a matter for the Community's agricultural and energy policies and will have to receive further attention.

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(1) See page 85.

This report contains additional information on the subject and data on the cost of energy and on measures already taken or recommended.

c) Textiles (1)

Energy savings can be made in the textile industry by

- avoiding wastage and making more rational use of existing installations,
- converting firms' equipment,
- developing new techniques.

The first point is immediately applicable to all stages of textile production, where simple waste prevention measures and good management could produce substantial results.

Equipment conversion can be carried out only gradually, after the capital investment cost of the installation in service has been paid off; this is a medium-term solution.

The development of new techniques is generally a long-term solution. For some of these problems an inter-disciplinary approach would be desirable: concerted action and cooperation with the machine manufacturers, the producers of auxiliary materials, and so on.

Significant energy savings can be expected in the heating, air-conditioning and lighting of buildings or workshops, by modifying existing buildings and improving the design of new ones, and by making better use of machines.

Energy savings can be made in every operation from the obtaining of the raw material onwards. Substantial savings are possible in the stages of preparation, weaving, finishing and dyeing. The highest energy savings can be expected in the finishing and dyeing sectors.

d) High-temperature furnaces

The experts discussed the various types of action that could be undertaken in this field.

In particular they agreed on the need for a recommendation concerning:

(1) See page 85.

- the appointing of an energy manager in energy-intensive undertakings;
- the need for such undertakings to keep account of their energy consumption.

The experts also emphasized the importance of:

- installing meters (for gas, fuel oil, electricity) on equipment that consumes large amounts of energy;
- indicating what is the normal yield for different processes and machinery;
- making public the energy content of the various industrial products.

The following papers were distributed:

- a model for the drafting of proposals for technical and economic studies, to make it easier to compare them;
- a questionnaire prepared with a view to drawing up a table of specific consumption for each of the industrial sectors;
- the programme of the French Energy Saving Agency which is concerned with the possibility of setting up in France pilot versions of plants that have been recognized as more economic.

e) New technologies

The activities of this Working Party have to run parallel with those of DG XII, Research, Science and Education.

Following a suggestion by the latter, the Commission issued invitations to tender for R&D subjects, particularly on energy conservation.

At interdepartmental meetings a certain number of subjects were chosen from the 250 proposed and these have now been forwarded to the ACPM (Advisory Committee on Programme Management).

The choice was based on numerous criteria such as: price, research already under way, amount and nature of possible energy savings, dissemination and general applicability of the results, etc.

In view of the limited funds available it is not possible to work on all the subjects of direct interest to the industrial sector. The experts in the working party on Industrial

Processes - Heat are therefore to prepare a list of the other subjects regarded as promising.

IV. THE POSITION IN OTHER INDUSTRIAL SECTORS

a) Paper and Paperboard

This sector was not included in the work of the Subgroup, in order not to duplicate work done by the OECD. (1) The following conclusions can be drawn from the provisional report which the OECD (1) recently distributed:

1. there is a need to set up a system for disseminating information on both technological and technical-economic matters so that (a) each undertaking can compare its energy situation with that of others and (b) national and Community solutions can be found;

2. the report reflects the situation in those countries where a firm's production is more or less homogeneous, which is not the case in most of the Community countries.

   That shows that for this sector, too, the proposed recommendation would be of significant value.

b) Chemicals

In the light of the interest shown by the trade, Subgroup E examined the possibility of including the sector in its work programme. It can be said that the chemical industry is highly aware of the cost of energy and the need to use it rationally, since energy plays an important financial and technical role.

The main problem concerns the combined production of heat and power, which has been examined by Subgroup G on Conversion in Power Stations, and the rational use of energy in manufacturing processes. In Europe, however, account has to be taken of the reluctance of firms to provide specific information which might reveal manufacturing secrets.

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(1) Organization of Economic Cooperation and Development.

The CEFIC (1) has already begun work and has formed working parties to look into this problem. The working parties have been gathering information on any studies under way concerning advantages to be gained from the use of certain substitute products, and considering the new machinery they would require.

A survey has also been started on the specific consumption of different manufacturing processes, the aim being to obtain statistical information on energy and to draw comparisons.
The results will be communicated as soon as they are available.

c) Iron and Steel

Energy conservation in the iron and steel industry has already been dealt with by the Iron and Steel Manufacturers' Club which has written a report on the position of the industry as regards this question.

In brief, it can be said that this energy-intensive sector, having to secure its fuel supplies and to remain competitive in the wake of the rise in fuel prices, is keenly aware of the need to find ways of cutting down consumption.

In view of its dependence on outside sources for over 50 % of its coke supplies and the high proportion (14 %) of electricity in certain manufacturing processes, the sector can only approve of the energy policy adopted by the European Community.

As regards energy conservation, and taking present techniques into account, the sector has concentrated on recovering as much energy as possible in the form of gaseous sub-products and medium-temperature heat.

Beyond these first efforts, more notable savings cannot be made without making fundamental technical changes.
At present, however, some of these new techniques are still undergoing trials.

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(1) Comité européen des fédérations des industries chimiques (European Council of Chemical Manufacturers' Federations).

In its conclusion the report draws attention to the costly investment which would be necessary in order for the sector to join in the effort to save energy and to the need for undertakings to have easy access to sources of finance.

d) Recycling and recovery of materials

Subgroup E's terms of reference include "recycling and reclamation of materials". After holding consultations, the RUE Steering Committe agreed that the Subgroup should not only include experts on industrial wastes but also experts from outside the industry qualified to deal with the field of collection, sorting and treatment of other waste matter, in particular household refuse.

The experts in the Steering Committee were therefore asked to nominate such experts for a meeting of Subgroup E (recycling and reclamation of materials) with a view to taking stock of the situation in this field in collaboration with the Directorate-General for Research, Science and Education's environment services which had drawn up an action programme which included energy.

The experts agreed that the work of the subgroup should not duplicate other work going on in the same field, namely the programme established by the CREST sub-committee on Primary and Secondary Material, the one run by the Environment service dealing with waste recovery, and the strategic studies on supply of raw materials made by the Directorate-General for Industrial and Technological Affairs (Paper, ferrous and non-ferrous metals).

Consequently the RUE subgroup on Recycling of Materials, working closely with the other groups and mainly the Environment service, will adopt a three-fold strategy, tackling the recycling and recovery problems from the angles of environment, recovery of materials, and energy.

This means that action must be directed first of all towards stopping wasteful uses and then towards methods of recovery in combustion energy to achieve the least possible waste.

Amongst the possible measures at Community level, the subgroup examined those which would be the most appropriate at present, such as giving preference, in public contracts, to products or materials containing recycled materials, provided that the quality is equal; promoting pools among the enterprises for products that

are worth recycling (plastics, textiles); studying the various types of subsidies for regional projects, and so forth.

As a first essay the subgroup will work on three or four different recycling materials for which data are already available. After examining the quantities recycled or recyclable or perhaps non-recyclable, the experts will look for ways of improving the energy situation, taking into account technical and economical aspects. Lastly, the measures capable of producing worthwhile improvements will be examined.

Annex

INFORMATION LEAFLET TO LIMIT ENERGY WASTAGE IN INDUSTRY

I. BASIC ORGANIZATION REQUIRED TO ACHIEVE ENERGY SAVINGS AND SPECIFIC MEASURES

The problem of organizing the campaign against waste and the choice of measures to be taken at Community level involves dealing with a wide diversity of situations in the individual countries while referring to common principles. It is deemed advisable, however, to present a general framework embracing the main individual measures adopted or suggested, without going into too much specific or purely illustrative detail, so as to provide a useful and adequately comprehensive framework on the basis of which individual measures may be assessed.

The general criteria of the measures under study or adopted are basically the same for the various types of undertaking, but are considerably more differentiated and thoroughgoing for the large industries.

1. Basic organization to ensure better utilization of energy consumed for industrial processes.

   1.1. General measures, namely standards, specifications, mandatory provisions, recommendations, economic and technico-economic incentives.

   1.2. Specific measures, adopted for particular industries, such as standards and procedures for operation and behaviour, and systems of administrative control.

   1.3. Operational organization, assigning responsibilities for tasks inside the industries and as regards the supervision of energy consumption. Responsibilities must be well defined and the various tasks co-ordinated according to a predetermined system.

1.4. Measurement of specific quantities of resources associated with all phases of production, processing, distribution, consumption and recovery, including the manufacturing cycles, in the context of the energy crisis:

- fuels of different types (excluding petroleum and derivatives, to be considered later);
- raw materials of all types especially those of high energy content, and intermediate materials of petroleum origin;
- various byproducts such as gas, steam, liquid and solid products (considered from the point of view of heat content);
- electrical energy;
- heat and energy from chemical reactions and physical changes;
- steam;
- other vector fluids (water under pressure, superheated water, compressed air etc.)
- thermal energy at low and super-low temperatures (negative calories);
- energy recoverable from cooling systems.

1.5. Improvements

1.5.1. Short-term measures, mainly adminsitrative; ie. "good housekeeping"

1.5.2. Medium-term measures) These concern programmes
) subsequent to this report
1.5.3. Long-term measures)

2. Objectives

2.1. Better utilization of energy for heating, lighting and power supply in offices, workshops and service premises (including storehouses) attached to industrial plants.

2.2. Improved utilization of energy in industrial processes (electricity, heat, other energy sources).

2.2.1. Improvement of systems of recovery of heat not directly used in industrial processes (recovery from expansion of steam or other fluids; recovery from sensible heat of discharged fluids; recovery of condensates or at least a good proportion of their heat; utilization of fuel gas by-products; use of sewage and wastewater, even of low calorific

value; utilization of solid industrial waste or waste suspended in water and other fluids).

2.2.2. Development of optimum operating conditions and constant maintenance of such conditions in time, with reduction of transitional regimes to a minimum (idling, low-load running, shutdowns and startups), and limitation of fluctuation or deviation of operating parameters.

2.2.3. Improvement in efficiency of individual machines and apparatus and processes in the system (reduction of energy losses due to friction; elimination of wastage of process materials; incomplete utilization of consumer materials).

2.2.4. Elimination or reduction of various losses (heat or steam dispersal; ohmic drops and reactive variations in electrical circuits; losses of liquid fuels through purgers, drains and safety valves) or recovery thereof if possible.

2.2.5. Alternative use of less expensive energies, taking into account particular or temporary local conditions (substitution of fuels; elimination of electrical heating; choice between turbines and electromotive power, between ejectors and aspirators or various pumps).

2.2.6. Adoption of the lowest acceptable temperatures for heating fluids and reduction of pressures for thermal utilization of steam (better use of utilizable temperature differences, also electricity production from back-pressure plant, downstream of the network of distribution to the processes).

2.2.7. Adoption of all possible means and measures to improve the load factor and reduce peaks (steam accumulators, electric capacitors, buffer tanks).

2.2.8. Improvement of systems and handling of the various materials between entry to and exit from works).

2.2.9. Recycling of cooling water and, where possible, of process materials.

2.2.10. Utilization of fluid pressures (lamination of fluids reduced to a minimum or used to drive

turbines; adoption of variable-speed pumps and fans to regulate rates of flow).

3. Means and measures adopted

3.1. Implementation of measures referred to in Sections 1.1 and 1.2.

3.2. Development and improvement of instrumentation for monitoring and regulating plant operations, with extended use of electronic programmers and computers.

3.3. Preventive maintenance and systematic overhaul of machinery and apparatus.

3.4. Testing and checking of insulation, plus revision of the efficiency calculations and consequent reinforcement.

3.5. Modification or correction of the operating conditions of industrial plants, with particular reference to the energy problem.

3.6. Small modifications, incorporation or substitution of various plant components or alteration of assembly.

3.7. Meetings, talks, round tables for discussing the problem, and exchanges of information between the various undertakings and above all their operators.

3.8. Operational organization within the firm, as mentioned in Section 1.3.

II. RESULTS OBTAINED BY APPLYING THE FIRST MEASURES (SPONTANEOUS, VOLUNTARY, MANDATORY).

The various Community countries have adopted measures to cope with the energy crisis in independent ways and according to their own criteria. However, both in the case of the temporary measures adopted in the early days - particularly reduction of volume and speed of motor traffic, adoption of statutory working hours, restrictions on public lighting and illuminated signs - and in the case of voluntary or mandatory permanent measures, the measures have proved to be very similar. In industry the initial voluntary measures, which were essentially a matter of management, were left

- in order to obtain practical results quickly - to the discretion of individual operators who all took much the same actions. This explains why the results obtained (with the necessary corrections taking account of the drop in consumption due to restricted production as a result of the crisis) are substantially fairly similar.

Thus, a U.K. report mentions two widely distant countries with the same overall reduction in energy consumption of 7 % (between December 1974 and February 1975) in relation to the corresponding period in the previous two years; half; or 3.5% being attributed to energy conservation (in industry). An Italian report mentions a 3 % reduction since the start of the energy crisis up to the end of 1974 and forecasts a further saving of 1.5-2 % during 1975.

By comparison with the savings achievable in industry, total savings are far greater since they are affected by the rationalization of domestic consumption which, in all countries, can be altered and improved and represents the largest share of energy consumption, although scattered among countless small installations. Table 1 shows final energy consumption in the E.E.C. countries in 1972, in the domestic, industry and transport sectors. Table 2 shows the estimated energy consumption of various industrial sectors in the Community.

III. TENTATIVE ASSESSMENT OF POSSIBLE DIFFICULTIES ENCOUNTERED BY INDUSTRY

The measures described in the previous chapter mainly consist of administrative measures (anti-waste campaign) not involving any outlay beyond normal maintenance, but requiring a certain amount of time, first to determine the best operating conditions in the present situation of the fuel and raw material market, and then to select the most suitable juncture for applying them without disturbing the rhythm of production of the plant. The adoption of measures is greatly influenced by the action of the staff responsible for operating the plant, whence the necessity for appointing delegates with special responsibility, as illustrated in the following chapter.

It is obvious that rationalization of the use of energy means not merely combatting waste but also improving the processing and industrial operations.

It also means choosing (given equal performance) materials which require the least energy for their manufacture.

The reports received from various countries make no special mention of difficult cases; on the contrary, they give valuable exemples of rationalization, with the relevant economic figures.

IV. RECOMMENDATIONS OR SUGGESTIONS FOR MEASURES TO BE ADOPTED BY INDUSTRY

As already pointed out, it is essential to give some responsibility to the workers themselves. This principle has been stressed by various countries. It is therefore considered advisable to make a specific recommendation with a view to organizing energy management within each undertaking.

1. The organizing staff may be limited to one or two persons in the smaller firms (possibly including the "boss" himself where he also acts as the manager); it will be larger in big industrial undertakings. The most complete case will be structured as follows:

   a) in each peripheral unit (branch): a committee responsible for energy problems, composed of qualified representatives from the various sections of the plant (production, engineering, auxiliary services, safety, pollution abatement, maintenance, distribution, etc.); a co-ordinating Branch Energy Manager appointed to keep a record of the costs entailed by energy measures;

   b) in each division (encompassing one or more plants): a Division Committee responsible for energy problems, comprising the energy managers from the various branches, with participation by representatives from other departments when they are concerned in the matters at issue;

   c) in the Group management team (i.e. the team assisting the company chairman): a Group central committee, comprising the heads of divisions and branch energy managers.

   Basic and executive tasks are entrusted to the branch energy manager who supervises the operations directly and is advised by the representatives of the other departments directly or indirectly concerned with the problem. The responsibility for any initiative must lie with the head of the branch.

2. Since the fundamental question for undertakings is the economic return, it is important that the company's annual report, presenting the balance sheet, should show the energy consumption figures, under two or three appropriate headings.

   These could be as follows:

   2.1. in the annual report or financial statement, separate headings should be entered under "opening stock and costs" for purchases of electrical energy and all fuels, and under "receipts and closing stocks" for the reductions in specific consumption compared with the previous year, calculated from the sum of the energy costs of the various sections and branches of the company;

   2.2. in the accompanying report there should be a special section on energy, stressing the criteria used for choosing the materials and machinery which have contributed towards the results achieved.

   2.3. in the statement of assets and liabilities, an energy section could perhaps be included.

3. It would seem very important to draw attention to management errors (e.g. machinery out of use and consequent unjustified losses). This should be done inside the undertaking, and only very cautiously and with due moderation.

   It is also advisable to inform those concerned of the cost items - such as the actual cost of steam - which are listed in the account of total energy consumption in the system in which they are working.

Table 1 - END CONSUMPTION OF ENERGY IN EEC COUNTRIES IN 1972

Sector	Total consumption	Losses		Effective consumption	
	Mtce	Mtce	%	Mtce	%
Domestic *	388	214	55	174	45
Industrial	347	156	45	191	55
Transport	162	135	83	27	17
TOTAL	897	505	56	392	44

* Including commerce, crafts and office premises.

Table 2 - ESTIMATED ENERGY CONSUMPTION OF VARIOUS INDUSTRIAL SECTORS IN THE COMMUNITY, 1972

	B		DK		D		F		IRL		I		L		NL		UK		EUR.TOT.	
	% Ind.	% Electr.	% Ind.	% Electr	% Ind.	% Electr.	% Ind.	% Electr.	% Ind.	% Electr.	% Ind.	% Electr.	% Ind.	% Electr.	% Ind.	% Electr.	% Ind.	% Electr.	% Ind.	% Electr.
NON-FERROUS METALS	33.4	23.4	5.6	5.8	25.0	16.4	21.4	15.8	2.3	3.4	17.3	18.0	91.4	61.8	13.7	9.7	20.8	14.6	22.2	15.4
IRON AND STEEL	2.4	6.1	-	-	2.9	8,2	6.1	14.5	-	-	2,5	5.7	-	-	3.1	12,6	1.7	6.0	3.1	8.5
CHEMICALS	24.1	30.6	18.1	24.0	23.4	31.5	21.3	24.8	5,5	6.8	33.8	25.6	2.7	5,5	42,5	38.8	22.8	21.9	25,2	27.1
NON-METAL MINERALS	10.2	8.2	1.1	0.6	9.6	7.0	9.2	7.1	13.7	15.9	13.9	9.9	1.9	1.6	4,9	4.9	5.1	5.8	8.9	7.3
METAL & MEC. ENGIN.	5.1	9.2	9.6	19.4	10.2	15.6	9.7	12.1	6,9	16.9	9,1	12.6	0.3	1.8	4.6	9,7	10.0	20.1	9.0	14,7
FOOD, BEVERAGES AND TOBACCO	4.4	6.1	22.4	17.4	4,8	4,1	7.2	5,3	18.3	16.9	4,7	5.1	0,3	1.8	8.4	9,7	5.8	7.0	6.0	5.7
TEXTILES, LEATHER AND CLOTHING	2.7	6,1	3.4	5,1	2.9	4.3	5.6	5.0	3.2	5,1	5.1	8,4	0,3	1.8	2.2	2.9	4,9	6.8	4.1	5.7
OTHER INDUSTRIES	17.7	10.3	39.8	27.7	21.2	12.7	19.5	15.4	50.2	33.9	13.5	14.4	3.2	5,5	20.6	11,7	28.9	17.8	21.5	14.6

EEC own sources.

1) Anti-waste check-list

This list shows the points that can have a significant effect on fuel efficiency and conservation in the following sectors:

- furnaces
- fuel storage and distribution
- boilers
- steam and condensate
- hot water
- process heat
- electric power consumption
- space heating
- lighting
- training.

2) Bibliography of important publications on the reduction of waste in industry, supplied by member countries.

3) Report on energy conservation in the sugar industry

This report contains a number of methods of specific energy consumption in the production of sugar.
It also contains data on energy costs and on measures already taken or recommended.

4) Energy conservation in the textile industry

This is a conspectus of documents supplied by member countries. It shows that energy savings can be made in the textile industry by avoiding wastage and by making a more rational use of existing installations, altering firm's equipment and developing new techniques.

The above-mentioned document can be obtained from the following address:

Commission of the European Communities
Directorate-General for Energy
XVII/A
200, rue de la Loi
B-1049 BRUSSELS

SECOND INTERIM REPORT OF SUB-GROUP F ON POWER

1. The activities of Subgroup F were relatively reduced during the second half of 1975 and the first half of 1976 owing to the need to know what procedures would be laid down in the final text of the Council Recommendation on the rational use of energy for electrical household appliances. The final text was adopted by the Council of Ministers on 4 May 1976.(1) These procedures are necessary to standardizers, in the Commission as well as in external bodies such as CECED (European Council for domestic electrical equipment), in order to establish a harmonized standard within the Community which will lay down the procedures for measuring the use of household appliances and for presenting such information to the consumer.

2. Even before the Community Action Programme on the rational utilization of Energy (COM(74) 1950 final/2) was set up, the Commission had launched a programme of standardization of household appliances intended for use within certain voltage limits, with safety as the main goal. A Directive on low voltage appliances, which regulates various design characteristics of appliances, was adopted on 19 February 1973 by the Council (2) (73/23/EEC).

3. In order to provide information to consumers about certain characteristics of appliances, it is necessary to harmonize the manner of presenting the data, so that any labelling will give the same basic data measured by uniform methods.

4. Apart from the safety goals which are taken care of by the Directive on low voltage appliances, it appears that standardization alone (harmonized among the Member States) ought to be sufficient, and such would be the case if no country added any national rules or made certain standards mandatory.

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(1) OJ No L 140, of 28 May 1976, page 18.
(2) OJ No L 77, of 19 February 1973, page 29.

5. But the energy crisis and consumer protection policy had already led some governments to draft orders which were duly notified to the Commission.

6. Since the adoption by the Council, on 4 May 1976, of the Recommendation prepared by the Subgroup F on Power, however, it is hoped that governments will be content with the harmonized standards, applying them as they think best.

7. Since the harmonized standards may take some time to prepare, it would be advisable to see whether, in the mean time, technical specifications could be used as a temporary measure.

   If we are to reach the target set by the Rational Use of Energy programme - a 15 % reduction in energy consumption by 1985 - the action called for by the Council Recommendation should be started at once.

SECOND INTERIM REPORT OF SUBGROUP G ON CONVERSION IN POWER STATIONS

1. SUMMARY

Under its terms of reference, covering one year, Subgroup G was to investigate ways of increasing power station efficiency, developing combined heat and electricity production, and utilizing waste heat from condensing thermal power stations by means of existing technological methods. The Subgroup was composed of 17 experts drawn from government offices and industry and electricity producers of eight Member States. One of the experts was unable to concur with the conclusions drawn in this report.

2. In the electricity sector substantial energy savings cannot be effected without some degree of capital expenditure. The concept of rational utilization of energy is inseparable from the concept of rational utilization of capital. Because of the relatively long time needed to change the structure of the existing power generation systems, substantial energy savings can be made only in the long term. Because of the close interdependence between the electricity sector and the other energy sectors, the problem must be tackled as a whole and not sector by sector.

3. Technological and economic constraints rule out any major increase in the efficiency of conventional and nuclear condensing power stations. The scope for energy savings in these stations will therefore remain limited. The measures proposed by the group mainly concern small installations and the management of the power generation systems.

4. But combined heat and electricity production holds out the prospect of far larger energy savings. In favourable conditions it is possible to obtain from a given primary energy input to a combined station a useful energy (electricity and heat) output which is double that of a condensing station generating electricity only. At the same time the amount of waste heat emitted into the

environment is reduced to about one-third. Combined production is employed for supplying heat to industry and to district heating networks where it is gradually tending to replace the boilers used for heat production only. Though it is frequently possible to obtain heat from existing condensing thermal power stations, an optimum combination of electricity and heat production can usually be achieved only if the power station has been designed for this purpose. There are already cases where the demand for heat is sufficiently high and concentrated to make the use of combined nuclear power stations an economic proposition. Heat is expected to become a carrier of nuclear energy and, in certain uses for which electric heating is not particularly suitable, to play a role complementary to that of nuclear-generated electricity: heat and electricity must contribute to reducing the Community's strong dependence on oil imports. The group proposes a series of measures to promote the development of combined production in conventional and nuclear thermal power stations for supplying heat to industry and district heating networks.

5. As regards utilization of the waste heat from condensing thermal power stations, the group's terms of reference were restricted to technological uses only. The biological uses (fish-farming, agriculture) are dealt with by a committee of experts formed to investigate, from the standpoint of environmental protection, the problems raised by discharge of waste heat from power stations. The group concluded that at present there is no prospect of using the waste heat of condensing thermal power stations for space heating except in conjunction with heat pumps and then only if the premises lie in the immediate vicinity of the power station. The possibilities of utilizing waste heat for technological purposes are therefore extremely limited.

The Group's proposals for action are contained in Section 6 of this report, page 121.

2. PRELIMINARY REFLECTIONS ON ENERGY SAVINGS IN THE ELECTRICITY SECTOR

6. Energy savings cannot be made without cost. In many of the everyday cases (e.g. bad regulation of the burners of domestic boilers) modest expenditure (for the regular checking of the burners) is often sufficient to make substantial energy savings within a short space of time. This is not the case with electricity production. The electricity producers are continually optimizing their production methods. An optimum economic situation requires a certain balance between primary energy costs, investment costs and operating costs. A sudden change in one of these three elements - e.g. a considerable rise in the price of primary energy - temporarily upsets the balance. The electricity producers' reactions are twofold: the first is relatively rapid but limited in scope as it depends on the flexibility and diversity of existing production methods; the second involves new investments, the time-scale of which is measured in decades. In the electricity sector "energy saving" means "replacing part of the energy with capital". This is always a long-term operation.

7. In the electricity sector the idea of the rational utilization of energy is therefore inseparable from the idea of the rational utilization of capital. The incentive for energy-saving must not be the number of calories saved but solely the economic viability of the operation.

8. But the concept of economy may take on different meanings depending on one's standpoint, at:

   - producer or distributor level,
   - consumer level,
   - local or regional level,
   - national, Community or even world level.

   In the balances drawn at the local and regional level, elements such as environmental protection, regional development, social aspects, security of energy supplies, a stable balance of payments, commercial agreements with other countries, the optimum management of energy resources etc. assume a significance which they do not possess in the economic considerations of individual undertakings.

9. But when policy factors are introduced, the concept of economy soon becomes subjective and loses its value as a basis for industrial decisions. Though it may not be possible to ignore such factors completely, they should be kept to the minimum possible. The assessment of the economic merits of alternative solutions must therefore be conducted at as close a level as possible to the undertakings which have to implement them.

10. The time factor is a very important element in the economic assessment of the various energy strategies. A solution like district heating may not appear very economic in the short term but can become economically attractive in the longer term. In the industrial sector economic assessments could be falsified by the common practice of treating energy installations in the same way as industrial plant and depreciating them over a relatively short space of time, whereas they are most frequently kept in operation for twenty or more years. It will undoubtedly prove essential in future to revise certain practices with regard to the period of economic operation.

11. Assuming that the average growth rate in the demand for electricity will be around 6% and, furthermore, that this demand will be satisfied mainly by nuclear condensing power stations, the low-temperature waste heat from these stations will increase to around 4 t.o.e. per inhabitant of the Community by the year 2000. At the same time millions of industrial and domestic boilers will be burning a similar quantity of fuel in order to satisfy each firm's and household's low-temperature heat requirements.

12. A development of this type may be perfectly economic among electricity companies or companies supplying hydrocarbons or in industry, as each of these undertakings bases its calculations on limited consumption areas and depreciation intervals. But can it be economic for the community as a whole? Can we base our continent's economy on such a wastage of primary materials in the long term ? Will such a policy not inevitably lead sooner or later to an unprecedented economic crisis? Should the measures to prevent such a development not be taken today? The answer to these questions cannot come from a group of technical experts. It has to stem from public awareness of these problems. The role of the group of experts is to contribute to this growth of awareness.

13. The long-standing difference of opinion between public electricity producers and industrial self-producers shows how an economic argument, however closely reasoned, may lead to incompatible conclusions when applied to different economic spaces and periods. Whenever a separation of two economic sectors leads to a situation that is not judged satisfactory by the public at large, there are calls for action by the public authorities. However, dirigist action - if it should eventually prove inappropriate or wrong - may jeopardize the national economy more than a series of bad decisions made by a few undertakings. This is why it seems preferable for the public authorities to confine themselves wherever possible to creating the framework in which the undertakings could then take their decisions independently on an essentially economic basis and without risk of a conflict of interests with the community.

14. That is the spirit in which the experts meeting in Subgroup G consider their task. In this report they will endeavour to propose ways of abolishing the separation between the electricity and heat sectors - a necessary precondition to the rational utilization of energy and capital in these two sectors.

3. POWER STATION EFFICIENCY

3.1. Existing and new power stations

15. The efficiency of power stations currently in operation amounts to between 25% and 40%. It is only this percentage of the primary energy input which is converted into useful energy. In general the open-cycle gas turbine power stations without recuperators have the lowest rate of efficiency, at around 25%; they are used to cover peak demand. The highest rates of efficiency, 37%-40%, are attained only by conventional thermal power stations with steam temperatures of around 530°C. Because of their low steam temperature (approximately 300°C), nuclear power stations of the currently predominant light-water reactor type have a net efficiency of only 33%. The advanced systems of high-temperature reactors and fast breeder reactors may have a rate of efficiency exceeding 40%. The efficiency

rates mentioned apply where power stations are cooled in open-cycle by surface water; use of wet or dry cooling towers reduces efficiency by 2% and 4% respectively because the condenser cooling-water temperature is higher (see point 30).

16. Improving the efficiency of existing or future power stations is possible in principle; but it is necessary to examine closely various economic and technical problems such as:

- the extra capital costs which must be offset by a reduction in the total consumption of primary energy;
- the dynamic behaviour of the plant, such as rapid start-up and load pick-up;
- the reduction in reliability and thus in availability consequent upon the use of complex technology;
- the choice of fuels according to price and security of supply.

17. Only very few existing power stations lend themselves to any significant improvement in efficiency by means of partial plant renewal, e.g. by adding a topping unit (high-pressure boiler and upstream back-pressure steam turbine, or gas turbine with exhaust-heat boiler) to an existing, relatively low-pressure unit. A solution of this type, owing particularly to the juxtaposition of components with different life spans and the complications this generally causes for the plant, can have a major effect on its availability. With smaller plants it is often possible to save fuel simply by making minor modifications (e.g. better insulation and control systems, checking of burners, better operating procedures etc.). This aim could be attained by systematically questioning and advising their owners.

18. Application of the following techniques can improve the efficiency of new thermal power stations:

- higher steam pressures and temperatures;
- double reheat;
- preheating of feedwater to higher temperatures;
- steam-turbine-driven feed-water pumps;
- combined cycles (gas and steam turbine);
- nuclear power stations equipped with a light-water reactor and a tailing conventional superheater.

It now seems clear that significant improvements in efficiency cannot be attained by the first three methods without penalties in terms of reliability, and considerable capital cost. Turbine-driven feed pumps - which have been in use for many years - become particularly attractive with increasing unit capacity.

19. Efficiency can be increased several percentage points using the combined gas and steam turbine cycle instead of conventional plant, and there is also a reduction in capital cost, particularly if the gas turbine inlet temperature is increased still further and the steam-generator is of the pressurized furnace design.

A major disadvantage, however, is that gas turbines require clean fuel, so that the systematic application of the combined cycle depends on the availability and cost of natural gas or power gas produced by gasifying coal, or alternatively of light fuel oil with a low salt and vanadium content or scrubbed heavy fuel oil. Furthermore, the availability of present plants still leaves a lot to be desired.
It is also possible to reach a high efficiency by combining diesel engines with steam turbines and/or district heating systems.

20. The operation over several years of a nuclear power station with a light-water reactor and a fossil-fired superheater has shown that it compares badly in terms of both economics and availability.

21. The technique of fluidized-bed combustion which is currently being developed does not lead to a direct improvement of efficiency. But it does permit the combustion of coal of extremely different qualities in the same boiler and of fuels which are not economically usable in any other way. It further leads to an appreciable reduction in the size of the boiler and provides also the possibility, at relatively low cost, of binding the sulphur contained in the fuel to dolomite in the fluidized bed. Fluidized bed combustion could therefore improve the economics of conventional thermal power stations.

3.2. Overall improvement of the economy and efficiency of electricity production

22. The main opportunities for achieving an overall improvement of the economy and efficiency of electricity production are as follows:

a) Classification of power stations in the load diagram according to their economic merit, with the inclusion of the greatest possible number of stations of a given region, including industrial power stations.

b) Cooperation of public utilities among themselves and with industrial self-producers

- in the planning of equipment in general and in particular of the mix of machines,
- in pooled use of stand-by and energy storage plants,
- in the coordination of overhaul periods,
- by mutual assistance in the event of unforeseen station outages.

c) Trans-frontier management of power stations (public and private) and interconnecting systems.

d) Improvement of the availability and operational flexibility of base-load power stations by appropriate maintenance procedures.

e) Improvement of the regularity of the demand.

f) Optimum use of high merit base-load plants and nuclear stations by regular use of their maximum possible capacity and by the development of storage plants.

23. With reference to point a), utilities generally run their generating capacity with an eye to maximum economic efficiency. With some exceptions, e.g. in Belgium, industrial self-producers have not so far been included in the load diagram. Elsewhere in certain cases cooperation between neighbouring utilities could also be improved.

24. Though common among public utilities, there have been few examples of the type of cooperation with private self-producers referred to in point b). In addition to the obvious advantages of joint planning of equipment and overhaul periods and of mutual assistance, problems concerning the maintenance of reserve capacity could also be eased.

25. Widespread international management of power stations and systems at Community level does not seem appropriate at present since, despite the advantages of greater installed generating capacity and network size, increasing transmission losses make additional savings insignificant once the grid area exceeds a certain size. On the other hand, trans-frontier networking on a regional basis can still produce considerable improvements.

26. General improvements in power station economics can also be achieved by plant optimization and better operational flexibility, taking into account all relevant parameters. Fuel can be saved by going over from periodic to "condition" maintenance. Before all this can be achieved comparable data are needed on the availability and reliability of all power stations in operation and their components. The data published by UNIPEDE (1) and UCPTE (2) for Europe and EEI (3) for the USA are very useful for this purpose.

27. Greater regularity of electrical energy demand and, in the case of combined production, of heat demand, would reduce the number of peak-load stations to be maintained in service and would also decrease their annual utilization. These plants often have a lower efficiency than base-load plants: thus the use of peak-load stations generally leads to a higher fuel consumption. Since the Second World War the annual utilization of supplied electric power has been rising all the time. Although the daily load curve has been considerably smoothed by the introduction of off-peak and night tariffs and by the use of pumped-storage schemes the weekly and seasonal variations of the demand are still as wide as ever. Of particular importance, therefore, is the development of large storage plants that allow the weekly load curve of the base-load plants to be similarly smoothed. Then again, power plants are often operated at their nominal

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(1) UNIPEDE = Union internationale des producteurs et distributeurs d'energie électrique.

(2) UCPTE = Union pour la coordination de la production et du transport de l'électricité.

(3) E.E.I. = Edison Electric Institute.

capacity even though their maximum capacity generally exceeds this value by a few percentage points. With regular recourse to the capacity band lying between the nominal and the maximum value there could be less need to use the peak-load thermal stations.

28. In summary, improving the efficiency of existing or new condensing power stations by technical means is possible only within a very limited margin. The improvements often entail high additional investment or a reduction of plant availability; this leads once more to a lowering of general economy. It does, however, appear opportune to give systematic advice on fuel saving to small and medium-sized undertakings. In most cases a slight adjustment of their installations or of their operation procedure may lead to appreciable fuel savings.

29. The possibilities of an overall improvement in the economics and efficiency of electricity production have not yet been fully exploited. Greater cooperation between public utilities and industrial self-producers in both the technical and economic fields could make a substantial contribution.

4. COMBINED ELECTRICITY/HEAT PRODUCTION

4.1. Principle and characteristics

30. To convert heat into mechanical energy, conventional and nuclear power stations make use of a thermodynamic process in which a heat-carrying fluid circulates from a heat source (e.g. a boiler) through the 'engine' to a heat sink (e.g. a condenser). The proportion of heat converted is the 'efficiency', and according to the principles of thermodynamics it is never possible to convert all the heat. The theoretical upper limit to the efficiency rises as the source temperature is increased and also as the sink temperature is decreased. The efficiency achieved in practice is similarly influenced by these two temperatures. The possibilities of raising the temperature of the heat source are limited by the strength of the material at high temperatures and the high cost of such technologies.

The temperature of the heat sink depends on the medium (surface water or atmosphere) into which the power station can dump its thermal discharges. This temperature difference thus determines the efficiency of the conventional and nuclear condensing power stations. It is generally between 30% and 40%; the latter value is rarely exceeded (see also point 15). The pure electric power stations with gas turbines have an efficiency of approximately 25%-30%; diesel engines can reach an efficiency as high as 40%. Hence under the laws of thermodynamics 60%-75% of the primary energy consumed by the pure electric power stations is discharged into the environment in the form of low-temperature heat.

31. Space heating and most industrial processes require large quantities of low-temperature heat (< 200°C). They are normally produced in boilers using a flame which, with its temperature of approximately 1800°C, is a source of high-temperature heat. This process may seem rather irrational since it involves high degradation of the energy employed. However, the large difference between the source temperature and the required temperature has the advantage of allowing smaller heat-transfer surfaces and cheaper equipment. The economic end justifies the means.

32. The production of electricity (or motive force) and the production of low-temperature heat therefore appear to be complementary processes which it is logical to combine: the high- and medium-temperature range in the thermodynamic cycle would be used for the production of mechanical or electrical energy and the low-temperature range for the supply of heat. The possibilities offered by combined production were recognized at a very early stage; it is in common use in industry and for district heating.

33. The main advantage of combined production is that it leads to a more rational utilization of primary energy. Where there is complete coupling of the processes (back-pressure turbines) it is thus possible to obtain twice as much useful energy (electricity and heat) from a given quantity of primary energy as from a pure electric condensing power station. The efficiency of such plants may rise to 80%-85%. However, electricity

and heat requirement do not always coincide. In such cases partial coupling is preferable (bleeding-off steam) which gives greater flexibility of operation. Although these plants are generally more expensive, they are less efficient: annual averages of 50%-70% are common.

34. The advantages as regards environmental protection are no less important. In the power stations with integral coupling (back-pressure turbines), the only thermal discharges put into the environment emanate from the chimney and the ventilation systems. No waste heat is discharged into the surface water or - through cooling towers - into the atmosphere. The choice of sites is therefore easier. Power stations with partial coupling (with bleeding-off) offer this advantage only to a partial extent. Combined power stations used mainly to produce heat for space heating, i.e. providing little heat during the summer months, must normally be fitted with equipment for evacuating the waste heat. It is in summer that the surface water is least able to receive thermal discharges and that the problems of disposing of such discharges are the most acute. Combined production eases the problem of thermal discharges from power stations but cannot solve it completely.

35. Another advantage of combined production is the reduction of the quantities of harmful substances, such as SO_2, NO_x and dust, emitted. Not only are the quantities of fuel burned smaller than when electricity and heat are produced separately, but the combined power stations are larger and can therefore be fitted with more efficient protection equipment. This is particularly important in the case of district heating where thousands of individual heating systems, often badly regulated, emitting harmful products not far from the ground in residential areas, are replaced by a central unit that has proper purification equipment and a tall chimney.

36. Just like electricity, heat may be used to convey energy from sources which are difficult to use directly, e.g. nuclear fuel, coal and lignite and industrial and domestic waste. The combined power stations can thus help to reduce the Community's dependence on imported oil and improve the security of its energy supplies.

37. Combined production also has a number of disadvantages:

- at times when heat is being produced by a combined power station, its electrical capacity is often reduced;
- a certain lack of flexibility of operation appears when, in a back-pressure power station, the electric load does not coincide with the heat load or when, in a power station with bleeding-off facilities, peak demand for electricity coincides with a high demand for heat; unless the thermal inertia of the heat distribution system is sufficiently high, heat storage facilities are then needed;
- in some periods of the year, for instance when there is a high demand for space-heating, a large proportion of combined power stations in an electric grid system could put a strain on the base-load nuclear power stations and lead to frequent stopping and starting of large condensing power stations. Combined nuclear power stations must therefore be introduced, but this means that one must be able to site them close to the heat consumer centres;
- the heat distribution networks require very considerable investments;
- in order to prevent the cost of transporting heat from being prohibitive, the combined power stations must be constructed near the demand centres.

Difficulties also regularly appear when an objective separation of heat and electricity production costs has to be made.

4.2. Current state of development of combined production

38. Today almost 15% of the electricity produced in the Community comes from combined power stations which generate both electricity and heat for industrial or domestic heating (see Table I). The exact quantities of heat produced by these plants are often unknown and are not always mentioned in the statistics available. Where statistics do exist, they are often compiled on different bases and published well after the event. It is difficult to assess the present and future state of development of combined production because of the fragmentary and inconsistent nature of the statistics available. Subgroup C therefore considers it necessary to take steps to improve the compilation of statistical

data on the production of heat in industry and for urban heating. Electricity production, for which reliable statistics are available, could serve as a model.

39. The principal methods used for combined production of electricity and heat are:

- back-pressure steam extraction (approximately 43 % of the electricity produced by the combined power stations comes from such plants) (see Table II);
- bleeding-off steam extraction (approximately 55%);
- the recovery of exhaust heat from gas turbines and gas engines (approximately 2% in 1972);
- the recovery of heat from diesel engines (negligible proportion).

Gas-turbine power stations with exhaust-heat recovery have developed fast during recent years. This is due partly to the flexibility with which such plants can be operated and partly to the relatively low investment costs involved and the short time required to build them. The drawback of gas turbines is that they burn a premium fuel - either natural gas or a refined oil product.

40. Information on the operators of combined plants is fragmentary and is obtained mainly from the electricity production statistics. The most important categories are:

- public producers/distributors of heat;
- the chemical industry (approximately one-half of the electricity produced in the industrial combined plants comes from power stations belonging to the chemical industry);
- the paper industry (approximately 15%);
- mines and collieries (approximately 12%).

41. It may be stated in conclusion that the statistics on the quantities of heat produced by industry and the distributors of district heating, on the plant types used and on the industrial sectors operating these plants are fragmentary, inconsistent and available only after the event. The complilation of statistical data must be improved before the current state and development of

Table I - NET AMOUNT OF ELECTRICITY PRODUCED IN COMBINED THERMAL POWER STATIONS IN 1972

Country	A. Industrial producers		B. Public producers		Total A + B	
	TWh	% of national production	TWh	% of national production	TWh	% of national production
B	2.054	5.8	8.330	23.3	10.384	29.1
DK	0.3	1.5	6.6	34.0	6.9	35.5
D	40.018	15.3	13.0	5.0	53.018	20.3
F	18.685	16.3	0.429	0.4	19.114	16.7
IRL	0.16	2.2	0	0	0.16	2.2
I	15.619	17.9	0	0	15.619	17.9
L	0	0	0	0	0	0
NL	5.854	12.3	1.0	0.5	6.854	12.8
UK	14.0	7.0	0.135	0.07	14.135	7.07
Community	96.690	10.9	29.494	3.3	126.184	14.2

Table II - NET AMOUNT OF ELECTRICITY PRODUCED IN THE VARIOUS TYPES OF COMBINED POWER STATIONS IN 1972

Country	Back-pressure		Bleeding off		Recovery from gas turbines		Recovery from diesel engines	
	TWh private and public	% of national combined production	TWh private and public	% of national combined production	TWh private and public	% of national combined production	TWh private and public	% of national combined production
B	1.367+1.465	27.1	0.407+6.674	68.4	0.280+0	2.8	0+0.191	1.7
DK	0.3 +0.4	10	0 +6,2	90	0	0	0	0
D	22.870+2.400	47.6	16.719+10.100	50.6	0.424+0.500	1.7	0.005+0	0.1
F	5.682+							
IRL (2)								
IT	6.676+0	42.7	8.930+0	57.2	0.014+0	0.1	0	0
L	0	0	0	0	0	0	0	0
NL	2.093+0	31.0	2.697+1.0(1)	54	1.064+0	15	0	0
UK (2)								

(1) estimated.
(2) not available.

combined production and the possibilities of rationalizing heat production can be assessed.

4.3. Rationalization of the supply of heat to industry

42. There are 120 000 to 150 000 industrial boilers in service in the Community countries. The average output of each boiler is 5 to 7 tonnes/h of steam. Only a small proportion of these boilers are installed in combined heat/electricity plants. Although it is impossible to give a detailed assessment of the situation because of a lack of adequate statistics, it can be said that the supply of industrial heat in the Community is marked by the following features: high decentralization, small production units and relatively modest use of combined production.

43. It would be difficult and even impossible to rationalize the numerous small installations in remote sites by converting them to combined productions. Many boilers, however, are - or will be - installed in industrial zones or complexes. In such cases the supply of heat can be rationalized in two ways:

- supply of heat from the electric power stations;
- concentration of heat production and greater use of combined production.

44. The supply of heat from electric power stations would undoubtedly provide the greatest energy savings in the long term. These savings could be drawn in the main from the enormous reserves constituted by the thermal discharges from present and future electric power stations. Given the expected growth in electricity production from now until the end of the century, it should be possible to supply industry with the heat it needs without meeting insurmountable problems.

45. The supply of industrial heat from electric power stations also provides the best long-term possibility of replacing oil products by nuclear energy and fossil fuels. The Community aims, through its energy policy, at reducing its dependence on imported energy from the current figure of 60% to 40%-50% in 1985. Except perhaps in the case of some large chemical industries, industry

will not generally have access to nuclear energy supplies unless it enters into fairly close cooperation with the electricity producers. The supply of industrial heat from nuclear and coal-fired power stations would therefore be a means of fulfilling one of the objectives of the Community's energy policy.

46. In industry energy plants are often regarded in the same way as other industrial production equipment. It is common practice to amortize a boiler or industrial electric power station in only a few years, even though it may be kept in service for 20 years or more. The profitability of these installations is normally calculated only over the period of amortization. When inflation is running at a high rate, i.e. capital charges are high, the installation chosen in an economic assessment of the various alternatives is often that requiring the least investment, and this is almost always the one with the highest energy consumption. If the profitability of an installation were calculated over the actual working life, more economical plants would be chosen in many cases. For this reason it is essential to place industrial energy units in their natural economic context. This can be done by entrusting specialist energy undertakings with the task of supplying industry with heat. These would be primarily the public electrical utilities, but could also be joint undertakings set up by industry, the electricity producers and, possibly, the heat distributors.

47. Public electrical utilities are often limited by their company articles and their long tradition as electricity producers - even if they are not prevented by national laws - from extending their activities to heat supply. And yet, heat and electricity are complementary forms of energy which are produced in the same plants; they are destined for different uses and will hardly compete against each other in the real sense of the word. It is unlikely that, in the chemical industry for example, electric heating will compete with process steam, especially since process steam will be produced by combined nuclear plant. The legal obstacles which may still exist in one or other of the Member States must be abolished before electricity producers can be encouraged to embark on the marketing of heat seriously

48. The industrialists who are accustomed to providing their own heat, may find it difficult suddenly to reply on the electricity producers to supply the heat they require. This difficulty could be solved by joint ownership or setting up joint companies, since this would ensure the industrialist some control over his energy supplies and help the electricity producer in the financing and, possibly, the siting of these power stations. This is particularly important in the case of nuclear power stations. Legal obstacles may prevent electricity producers from working together with industry on joint projects. Steps should be taken to overcome these difficulties.

49. Because of the difficulties involved in the transportation of heat, the nuclear power station and the industry using the heat must not be situated very far from each other. In order to guarantee the industry a continuous supply of steam, the power station must have at least two or three interconnected units. The construction on one site of a large nuclear power station and a large industrial complex gives rise to planning and regional development problems which cannot be solved without the active participation of the public authorities. If the industrial complex is to have at its disposal the necessary manpower for its construction and operation, it must necessarily be situated close to a population centre of some size. The authorities responsible for the use of land ought to begin searching now in order to find sites - and there certainly will not be very many - suitable for the building of both large industrial complexes and nuclear power stations, and take the necessary measures to see that they are reserved for that purpose. A recommendation in this connection should be sent to the Member States.

50. Where industrial heat cannot, for technical or economic reasons, be supplied from a public power station, other rationalization measures can and must be taken. These consist primarily of concentrating the production of industrial heat and greater use of combined production.

51. Appreciable savings could be made in small and medium-sized undertakings in particular, by rationalizing the existing industrial boilers. These undertakings often lack information on the technical and economic aspects

of possible rationalization measures. An information brochure on the possibilities of improving the energy production of small and medium-sized undertakings - which other Subgroups in the Rational Utilization of Energy Programme have proposed compiling - should also contain a chapter on the concentration of heat production and combined production. Small and medium-sized undertakings should also be encouraged to consult technical advisers more often on energy matters.

52. Several industrial undertakings situated in the same area may thus find that instead of having separate small boilers it pays them to build one or two shared boilers of higher efficiency, on which even greater savings could be made if a generating set were added. The undertakings can only decide to adopt such a solution, which is certainly rational from the point of view of energy savings, if national laws do not prohibit them from building and operating combined-production units and sharing the heat and electricity produced in their joint generating station. Where it is not possible for the public electricity producers to supply that group of industries with heat on the terms required, the legal obstacles should be abolished in order to enable joint industrial power stations, designed primarily to produce industrial heat on economic and energy-saving terms, to be built and operated.

53. However, even if the industrialists are convinced of the fact that combined production will lead to savings, both for their company and for the community, they may hesitate in the face of difficulties such as

- the extra investment required for a combined power station as against a simple boiler;
- negotiations with the public electrical utilities to obtain fair terms under which they will supply reserve and emergency power, purchase any surplus energy produced and permit operation in parallel with the public network;
- less flexibility in the operation of a boiler as a result of the addition of a generating set.

A number of these problems can be overcome by active cooperation between industry and electricity producers. Such cooperation cannot develop in a competitive climate;

it will be possible only if both partners derive benefit from it. It can extend to the siting and operation of a combined heat/electricity power station by a public utility on the site of the industrial undertaking. The development of combined production in power plants - conventional at first, nuclear later on - in the industrial sector and the large-scale energy savings which can result depend entirely on the establishment of active cooperation between public utilities and industrial consumers of heat. Every effort must therefore be made to encourage this cooperation.

54. The combined production of heat and electricity in nuclear or coal-fired power stations is in line with the threefold objective set by the Member States at the national and Community levels: energy savings and the rational use of energy, the reduction of dependence on oil imports, and protection of the environment by reducing the emission of harmful substances and thermal discharges.

In order to achieve certain targets of their energy policies, Member States have in the past often granted concessions to one or other industrial sector. A deliberate Community energy policy cannot be implemented without such measures. It is therefore proposed that the Community and the Member States examine measures to encourage combined production and heat transport in the industrial sector. Such measures should be taken under a common policy to finance investments enabling energy savings to be achieved; they should in the first instance cover projects which are of economic benefit to the community.

55. Advisory bodies should be set up, composed of experts from the electricity-producing and the heat-consuming industries, to inform and advise national authorities on combined production in the industrial sector. Such bodies already exist in some Member States. The other Community countries should be encouraged to set up similar bodies.

56. The task of these advisory bodies would be to undertake or to continue technico-economic studies - taking into account the particular conditions prevailing in each country - on the various methods of combined production

to supply industry with heat. They would also have the important task of preparing the ground for the introduction of combined production in nuclear power stations. They could also be responsible for implementing certain measures which were considered necessary on the national level (e.g. the compiling of a systematic inventory of industrial boilers).

57. A Community framework should be created to enable the national advisory bodies to meet and discuss their findings. Certain projects of international scope - such as the definition of standard steam-pressure levels for industrial processes, with a view to rationalizing the turbine design - should be carried out jointly at Community level.

58. Summary

The supply of industrial heat can be rationalized by:

- increasing heat supplies from public electrical power stations;
- and, where that is not feasible, by concentrating heat production and making greater use of combined production in industry.

The following measures are proposed to achieve this objective:

- the extension of cooperation between public electrical utilities and heat-consuming industries;
- the abolition of legal obstacles to the development of combined production to supply industry with steam;
- the reservation of single sites on which industrial complexes and combined nuclear power stations can be built;
- the provision of financial encouragement for combined production and the transmission of heat in industry;
- the adoption of certain technical improvements which will reduce the primary energy consumption of industrial energy-producing installations;
- the provision of better information to small and medium-sized industrial undertakings;
- the creation of national advisory bodies on combined production in the industrial sector.

4.4. Heat distribution and district heating

59. The various installations comprising a district heating system are:

- heat generators, which may be either simple low-pressure boilers burning fossil fuels or domestic waste, or combined stations producing heat and electricity;
- coupling equipment and pumping installations;
- heat-carrying mains and the sub-stations linking them to the distribution networks;
- heat-distribution networks;
- equipment connecting users to the network;
- conventional central-heating systems of houses and buildings.

The heat-carrying fluid in the case of district heating is usually hot water; particularly over long distances this has advantages over steam which is mainly used in industrial systems. A mains pipe carries the hot water at temperatures between 90° and 140°C (and sometimes up to 180°C) to the users; a second main returns the cooled water at a temperature of 50°-80°C. The Berlin heat distribution system has two supply mains for hot water: in one the temperature is maintained at 90°C in summer and 110°C in winter and provides the domestic hot water supply; in the second the temperature varies depending on the outside temperature and provides space heating; it is not used in summer. A third main returns the water from the two circuits.

In Berlin the production of electricity and heat attains an overall efficiency of 60% and 74% when the outside temperature is + 2°C and -15°C respectively. The electric output of the combined stations is reduced by 9% when there is a demand for the maximum thermal power of 360 Gcal/h. The thermal inertia of the heat distribution system is such that in case of necessity the production of heat can be interrupted for an hour or two without the consumers being aware of it.

60. The higher the temperature chosen for the hot water, the higher the investment and operating costs for a heat distribution system. Moreover, the electric power of combined stations with steam turbines is reduced when

the temperature of the hot water supplied is increased. An effort is therefore made to keep the input temperature of the hot water fairly low. The result is that a considerable proportion of industrial customers is eliminated since they often require higher temperatures for their industrial processes. At present the chief role of heat distribution networks is space heating in the domestic, tertiary and industrial sectors and the preparation of domestic hot water.

61. The amount of heat contracted for is never drawn from the network all at the same time; the maximum demand during the peak hour of a year is generally only 50% to 70% of the total contracted heat load. Depending on the climate in a given area and year and on the local consumer pattern, the utilization period of the maximum heat load for space heating and preparation of hot water is between 2500 and 4500 hours/year.(1) By comparison, the utilization period of the maximum electrical demand is currently around 5000 to 6000 hours/year; ten years ago it was only 4000 to 5200 hours/year. Compared with electricity there is thus a lower base load and a higher peak load in district heating. Specialized base-load plant (having low fuel costs, i.e., combined production stations), peak-load plant (having low capital costs, i.e. low-pressure boilers) and storage schemes (daily, weekly, seasonal) will therefore be even more important than in the production of electricity. If, for instance, we assume the separation between base and peak to be about 50% of the maximum heat load, about 90% of the annual heat production would come from base-load stations (where the steam-raising capacity would be used for some 5000 to 6000 hours/year) and the remaining 10% from peak-load boilers (used for less than 1000 hours/year).

62. The influence of different climates on the annual quantity of heat required for space heating is less than one might have thought. Except for the coastal regions of the Mediterranean and the Adriatic, the number of degree-days, based on an inside temperature of 19°C, generally lies, for a normal year, within the 2800 to

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(1) For the 99 district heating systems of the Community countries, referred to in the UNICHAL statistics 1973, the average yearly utilization of maximum load was 3394 h and the standard deviation was 991 h.

3700 bracket (1). In regions with a maritime climate, temperatures are not as low in winter as in regions with a continental climate but often the annual period during which heating is left on is longer. In the Mediterranean region the development of air conditioning based on absorption devices could mean an additional summer load for the heat distribution system. Another idea considered in Italy is the use of excess capacity in the summer for producing heat to be used in desalinating sea water. Where studies on the economic viability of district heating systems are concerned, no region should therefore be excluded simply on grounds of climate.

63. Whilst combined industrial production is practised in all Community countries, only a few Member States have developed any sort of public heat distribution system. For want of proper statistical data it is impossible to form a complete detailed picture of the situation in the Community. The only statistics generally available are those published by the national federations of heat distributors and the Union internationale des distributeurs de chaleur (UNICHAL). This organization currently includes 53 out of some 600 heat distributors operating in the Community. Table III gives an extract of the latest statistics published by UNICHAL. The figures have not always been established on the same basis and are therefore not directly comparable. If we are to have the information needed for assessing the trend in district heating, the methods used in preparing the statistics will have to be improved.

64. In 1974, according to a rough estimate, 600 companies distributed approximately 70 000 Tcal in the Community countries through about 1000 district heating networks comprising a total of almost 8000 km of mains. Approximately one-half of this heat was distributed in the Federal Republic of Germany, one third in Denmark, and the remainder in France, the Netherlands, Belgium, Italy and the United Kingdom. In Denmark, about 40% of the heat required for space heating and preparation of hot water is currently supplied by the district heating networks (public or cooperative) and by large heating stations for concentrated areas of blocks of

(1) For 93 district heating systems of the Community countries, referred to in the UNICHAL statistics 1973, the number of average degree-days (19°C) was 3064; the standard deviation was 453.

Table III - DISTRICT HEATING STATISTICS (1973) FOR UNICHAL MEMBERS * belonging to the Community

Country	Location	Number and type of stations	Quantity of heat to system Gcal/yr	Generation of electricity GWh/yr	Heat/ Electricity Ratio	Contracted heat load Gcal/hr	Degree days (indoor temperature)	Number of heating days	Total length of pipelines km
B	Aalst	1K + 1H	420 719	137	3.57	196	3201 (20°)	238	30.7
	Bresseux	1K	59 061	..		31	3463 (20°)	277	2.2
	Verviers	1K + 1H	496 820	127	4.55	326	3691 (20°)	273	57.0
	Zwevegen	1H	170 297	.		58	-	-	5.1
	Total (members UNICHAL)	3K + 3H	1 146 897			611			95.0
DK	Frederiksberg	2H + 1M	227 676	.		95	2346 (20°)	219	23.7
	København	4K + 4H + 1M	1 720 956	323	6.20	1204	3204 (18°)	262	214.5
	Randers	1K + 2H	336 750	109	3.59	-	3434 (18°)	340	124.1
	Sub-total (members UNICHAL)	5K + 8H + 2M	2 285 382						362.3
	Other distributors not members of UNICHAL but members of the association of Danish district heating systems		12 550 000						
	TOTAL (UNICHAL + others)		14 835 382						

* L'Union Internationale des distributeurs de chaleur (UNICHAL) comprises 76 distributors, 53 of which belong to the Community. The total number of heat distributors operating in the Community is of the order of 600.

Table III - (contd.)

Country	Location	Number and type of stations	Quantity of heat to system Gcal/yr	Generation of electricity GWh/yr	Heat/ Electricity Ratio	Contracted heat load Gcal/hr	Degree days (indoor temperature)	Number of heating days	Total length of pipelines km
D	Augsburg	1K	194 635	48	4.72	100.4	3798 (19°)	231	33.7
	Berlin	7K + 2H	2 265 012	1075	2.45	1218	3400 (19°)	269	207.0
	Bielefeld	1K + 2H	384 550	112	3.99	198	3166 (19°)	225	71.5
	Dinslaken	16H	854 670	.		445.6	2840 (19°)	217	248.0
	Dortmund	2K + 2H	1 543 178	164	10.94	600	3088 (19°)	227	72.1
	Essen	4H	1 829 471	.		718	3169 (19°)	224	182.5
	Frankfurt/M	5K + 2H + 1M	1 169 859	437	3.11	420	3507 (19°)	250	46.2
	Hamburg	7K + 1H	4 206 997	1336	3.66	1812	3221 (19°)	236	336.0
	Hameln	1K	323 022	21	17.89	156.3	3114 (19°)	224	23.3
	Lünen	1H	45 768	.		28	2720 (19°)	197	12.8
	Mannheim	1K + 2H	981 638	59	19.35	545	3128 (19°)	219	151.0
	München	4K + 2H + 2M	2 719 498	834	3.79	1157	3537 (19°)	229	248.7
	Oberhausen	2K + 2H + 2M	237 685	..		223	3400 (19°)	234	45.7
	Saarbrücken	43H + 1M	537 706	.		301	3269 (19°)	-	110.7
	Stuttgart	2K + 1M	933 709	211	5.15	391	3151 (19°)	210	79.3
	Wolfsburg	-	510 808	..		322	3508 (19°)	365	173.8
	Würzburg	1K + 1H	244 412	57	4.99	166	2870 (19°)	202	41.5
	Sub-total (members UNICHAL)	34K + 80H + 7M	18 982 618			8801.3	arith. mean 3229 (19°)		2083.8
	Other distributors not members of UNICHAL but members of Arbeitsgemeinschaft Fernwärme		~16 000 000						~2700
	TOTAL (UNICHAL + others)		~35 000 000						~4800

Table III -(contd.)

Country	Location	Number and type of stations	Quantity of heat to system Gcal/yr	Generation of electricity GWh/yr	Heat/ Electricity Ratio	Contracted heat load Gcal/hr	Degree days (indoor temperature)	Number of heating days	Total length of pipelines km
F	Chalon-s-Saône	1H	156 758	.		83	2533 (18°)	232	23.9
	Chambery	3H	209 000	.		141	2603 (18°)	-	36.0
	Chartres	1H	67 700	.		37	2542 (21°)	239	5.3
	Clichy	1H	105 100	.		33	2616 (18°)	228	8.0
	Courbevoie	1K	187 000	..		78	2297 (18°)	365	11.4
	Macon	1H	169 914	.		80	2485 (-)	228	29.0
	Mantes Val Fourre	1H	165 450	.		97	2689 (18°)	235	12.5
	Massy Antony	1H	278 800	.		137	2407 (20°)	233	21.4
	Metz	1K	214 400	50	4.99	106	3394 (18°)	354	31.5
	Nancy	1M	67 300	..		17	-	365	1.6
	Nantes	1H	87 920	.		58	2096 (18°)	226	9.5
	Paris	3K + 5H + 1M	4 181 548	..		2162	2349 (18°)	212	206.0
	Rouen	1H	80 680	.		45	2284 (18°)	241	9.3
	Strasbourg	1H	106 500	.		68	2699 (18°)	241	9.9
	Saint-Denis	2H	371 100	.		118	2616 (18°)	228	24.8
	Tours	1H	45 039	.		30	2359 (20°)	228	14.0
	Vitry	2H	161 990	.		68	2617 (18°)	228	12.8
	TOTAL (members UNICHAL)	5K +22H + 2M	6 656 199			3358			467.0
NL	Amsterdam	1K + 1H + 1M	71 100	..		-	-	-	-
	Delft	1H	88 700	.		58	3175 (18°)	365	16.0
	Heerlen	5H	-	.		-	-	-	-
	Rotterdam	1K + 2H	413 721	84	5.73	279	2811 (18°)	257	52.2
	Utrecht	3K + 4H	683 672	230	3.46	467	3106 (18°)	269	94.3
	TOTAL (members UNICHAL)	5K +13H + 1M	1 257 193						
UK	London	1K	51 751	7	8.60				
	Manchester	1H	59 927	.					
	TOTAL (members UNICHAL)	1K + 1H	111 678						

K : combined power station
H : heating boilers
M : refuse combustion plant
..: data not available
. : not applicable.

flats and offices. In the Federal Republic of Germany, this figure is now 7%. In the years before the energy crisis the annual growth rate in demand for heat from district heating networks in these two countries regularly reached 10% or more. This fairly remarkable trend was brought about without special promotion measures by the public authorities and in most instances without making it compulsory to be connected to the district heating systems.

65. There is no doubt that the large increase in prices for fossil fuels has made district heating more competitive: where base-load energy is produced by combined stations the proportion of fuel cost in the selling price for heat remains low. Therefore the prices for heat provided by district heating systems has generally increased less than, for example, the price of oil for central heating. But the wave of inflation which followed the rise in oil prices, and the high capital charges which resulted, are now making it more difficult to invest in the district heating sector.

66. A certain amount of promotion will be required in order to guarantee that district heating not only grows but steps up its growth rate and is able to serve the three-fold aim of the rational use of energy, reduced dependence on oil, and protection of the environment. To begin with, the development of district heating techniques should be promoted in order to make it more economic:

- on the heat production side, the techniques for combining heat and electricity production should be developed. Given their important future role as regards the supply of base-load heat and electricity, a special effort should be made in nuclear power station development. But also the specific cost of peak-load boilers could be reduced by standardizing sizes and main features;
- heat storage will become a most important technique in covering peak demand. The present efforts to develop large-capacity accumulators should be intensified;
- where transporting and distribution heat is concerned, new techniques should be developed with the aim of reducing the cost per km of mains. (The cost is currently of the order of 1.5 - 2 MUC/km for large-diameter mains.)

- the equipment used to connect customers should be standardized and made more compact so that large-series production is possible and prices are reduced. Heat meters and control devices are part of this equipment. (Action to be taken in liaison with Sub-group B: Heating Systems.);
- the whole concept of heating equipment should be rethought. Larger heat transfer surfaces would make it possible either to lower temperatures in district heating systems and therefore the cost of supplying heat, or to make better use of the heat offered by the network by reducing the reflow temperature.

An exchange of information at international level would encourage the economic and technical development of district heating.

67. During the first few years of operation of a new district heating system, when its load is still low, it might be technically and economically difficult to feed this network from a combined station. Here the solution would be to install, right from the start, the peak-load boilers which the network will need later anyhow and to use these during the first few years also for covering the base load. This would give the following scheme for the expansion of a new district heating systeem:

- first few years: partial networks fed by separate non-combined boilers installed as close as possible to the load centres;
- intermediate stage: integration of the partial networks into one network; connection of the network to combined fossil-fired stations providing the base-load heat; the boilers are now used for peak demand coverage and as reserve;
- approaching equilibrium development: interconnection of neighbouring networks; nuclear combined stations are linked into the system to provide base-load energy, fossil-fired combined stations being used at medium and peak load, and boilers at maximum peaks and as a last reserve.

68. It usually takes a decade or more before a new district-heating network can show a profit from the energy savings that stem from combined production. The main feature of this period is heavy investment in the distribution network. Heat distribution companies will

therefore generally find it impossible to recoup their outlay during the first ten years of operation of a new system. To ease the situation during the first few years of operation, legal, administrative, taxation and financial promotion measures might prove necessary. These measures should apply especially to the systematic development of existing networks where the requirements for economic operation are met. In the national laws on energy the development of district heating should be regarded as a public utility. Where compulsory connection to the district heating system proves unavoidable, the national laws should make it possible to take the necessary measures. The possibility of granting temporary tax and financial concessions should be examined by the Member States. Special attention should be paid to the problems of converting existing individual heating installations to district heating. These measures might be incorporated in a common policy of financing investment projects that enable energy savings to be achieved.

69. One of the major attractions of district heating lies in the possibility of using nuclear boilers and nuclear power stations for supplying heat. To do this it will be essential to site reactors and nuclear power stations closer to the heat consumer centres, i.e. closer to towns. In the present economic context the cost of transporting heat over a distance greater than 30-50 km is generally prohibitive. Only large quantities of heat, requiring mains of more than 1 m in diameter, could perhaps be transported economically over longer distances. If the present state of development of safety techniques is regarded as insufficient to permit the installation of reactors and nuclear power stations in densely-populated areas, a special effort should be made to develop these techniques. A recommendation to this effect should be addressed to the Member States.

70. Before deciding whether a district heating system might be the most advantageous solution for a given town or area, very thorough preparatory studies should be made. In the first place these should determine the present and future requirements of these regions as regards low-temperature heating. (Under the title of "heat map" the Federal Republic of Germany ic currently carrying out a set of detailed studies on four regions of Germany - the Ruhr, Mannheim-Ludwigshafen-Heidelberg, Koblenz-Bonn Bad Godesberg-Cologne, and Berlin.) Next, the

feasibility of installing nuclear power stations or boilers should be evaluated together with the cost of transporting the heat. Finally, one should assess the potential availability - in the long term and at competitive prices - of other forms of energy, such as natural gas and electricity. The economic pattern thus outlined must then be fitted in with the policies on energy and environmental protection. To stimulate and coordinate these highly complex studies, advisory bodies similar to those proposed for the industrial sector (see Section 55) should be established in the Member States. These bodies should meet at regular intervals to pool their experiences at Community level and should cooperate in various fields such as in establishing evaluation methods.

71. Summary

The development of district heating should be promoted by:

(a) developing the techniques currently used (production and storage, transport and distribution, connecting equipment and heating appliances) and optimizing the techniques of coupling heat production with electricity production;

(b) legislative and administrative measures, and financial and tax inducements;

stepping up the development of nuclear safety techniques with a view to siting nuclear stations close to towns;

setting up national advisory bodies on district heating, to stimulate and coordinate thorough regional studies.

5. UTILIZATION OF THE WASTE HEAT OF CONDENSING THERMAL POWER STATIONS

72. The low level of cooling-water temperature limits the utilization of waste heat from condensing power stations. For space heating applications the temperature would have to be raised by centrally or locally sited heat pumps. Whether that is worth while depends on the conditions in each case. Waste-heat utilization has certain advantages over combined heat/power stations in that

no changes in equipment are needed in the power station; electricity generation is independent of heat requirements and substantial quantities of waste heat can be utilized without affecting station operation. On the other hand there is a major disadvantage: because the temperature difference is far smaller than with district heating by hot water, pipes of very large cross-section and large quantities of water are needed, with correspondingly high cost, chiefly for burying the pipes and pumping the water. Consequently it seldom pays to use waste heat from condensing power stations for district heating, except perhaps where there is a sufficiently large centre of consumption in the immediate vicinity of the power station. But even there it is probably cheaper to take heat from a combined heat/power station at a temperature directly suitable for space heating than to use waste heat from a condensing power station and boost it with heat pumps.

73. Several power stations in the Community use waste heat for fish farming. Waste heat is also used for heating greenhouses, and can appreciably lower their production costs, almost 40% of which is currently attributable to heating costs alone. But only a small proportion of waste heat can be used for such purposes.

74. Conditions appear more favourable for the "Agrotherm" system which is being developed in the Federal Republic of Germany. The Agrotherm technique consists in injecting the waste heat from power stations into the soil by means of a network of underground pipes. The avantages are as follows:

- greater liberty in the choice of sites for power stations as the Agrotherm technique does not require surface water or cooling towers;
- increased yield from the crop areas heated in this way and the possibility of growing crops that are not native to the region;
- improved power station efficiency as compared with those cooled by air cooling towers.

75. This report does not contain any proposal for action as regards the utilization of waste heat for fish farming and agricultural purposes. A special working group in the Environment and Consumer Protection Service is examining those problems.

6. ACTION PROPOSALS OF SUBGROUP G: CONVERSION IN POWER STATIONS

6.1. General proposals

1. Statistical data on heat production

Steps to be taken to improve collection of statistical data on heat production for industry and district heating.

2. Technical measures to reduce consumption of primary energy in power stations

With a view to an economic and technical coordination of electricity production and combined production, such measures as the following should be considered:

- regular recourse to the maximum possible capacity of the most economic plants;
- improving operational flexibility and availability;
- encouraging regularity of demand;
- developing storage schemes;
- improving the thermal insulation of the heat transport and distribution systems;
- optimizing the combined production of heat and electricity.

6.2. Proposals concerning the industrial sector

3. Measures to supply better information and advice to small and medium-sized undertakings

- on the advantages offered by greater concentration of the production of heat;
- on the combined production of heat and electricity;
- on ways of saving fuel in low-power industrial power stations.

4. Broadening of cooperation between public electrical utilities and heat-consuming industries

In regard to process-heat production and with a view to concerted programming and management of their power generation systems.

5. Removal of the barriers to the development of combined production in the industrial sector

Remove the legal or administrative barriers still preventing:

- the construction and operation of combined installations belonging to one industrial undertakings or more, to one public utility or more, or to both jointly;
- the transport of heat and electricity produced in a joint combined power station to the co-proprietors of the plant.

6. Reservation of sites for industrial complexes plus combined nuclear power stations

Recommendation to be sent to the authorities responsible for the use of land in the Member States, proposing that they should look for and facilitate the reservation of suitable locations where combined nuclear power stations and industrial heat-consuming complexes can be sited together.

7. Advisory bodies on combined production in the industrial sector

Encourage those Member States which have not yet set up advisory bodies to deal with the combined production of heat and electricity in the industrial sector, to do so. The task of such advisory bodies would be, for example, to carry out preliminary economic and technical studies on combined industrial production, draw up a systematic list of the industrial boilers, etc..

These advisory bodies should meet regularly to discuss their experiences at Community level, and should cooperate in their work wherever possible.

8. Measures to encourage the combined production in the industrial sector

Examine legal or administrative measures as well as financial and tax inducements for the development of combined production of heat and electricity and the transport of heat in industry. These measures should form part of a common policy of financing investments

aimed at achieving energy savings and should apply to projects offering an economic advantage for the community.

6.3. Proposals concerning district heating

9. Technical and economic development of district heating

Encourage the technical development of district heating systems (production and storage, transport and distribution, connecting, metering and control equipment and heating appliances). Economic studies of the various techniques for coupling electricity and heat production, especially in the case of peak-load power stations and nuclear stations.

10. Measures encouraging district heating

Examine legal or administrative measures as well as financial and tax inducements for the development of district heating systems, and for the conversion of existing heating installations to district heating. The measures should form part of a common policy of financing investments aimed at achieving energy savings and should apply to projects offering an economic advantage for the community.

11. Siting of combined nuclear power stations close to towns

Recommend to Member States that nuclear safety studies and developments be stepped up, in order that combined nuclear power stations may in the future be sited close to towns.

12. Advisory bodies on district heating

Encourage those Member States which have not yet set up advisory bodies to deal with district heating, to do so. The main task of the advisory bodies would be to carry out detailed technical and economic studies for well-defined regional and local conditions. These studies should also take into account the different competing forms of energy (natural gas, electricity, etc.) likely to be available in the locality under consideration.

These advisory bodies should meet regularly to discuss their experiences at Community level and should cooperate in their work wherever possible.

SECOND INTERIM REPORT OF SUBGROUP H ON TRANSFORMATION IN REFINERIES

I. SUMMARY

1. The report examines the results of the two actions undertaken by the Subgroup in the first phase of its activities, and contains proposals for complementary activities based upon the experience gained from such results.

2. A saving of more than 1 600 000 tonnes of oil equivalent (t.o.e.) was indicated in 1974, without involving any heavy capital investment on the part of the oil companies. This saving represented a 4.1 % reduction in own consumption.

3. Investment programmes prepared in 1974/75 in respect of the period up to 1980 suggested a further saving of 6.3 % in own consumption.

4. On the basis of the results obtained, relative to the base year of 1973, the savings would be of the order of 10.5 % and would, therefore, if pursued at the same rate, place the refinery sector within the target of 15 % in energy savings set for 1985.

II. GENERAL INTRODUCTION

The Subgroup's terms of reference involved its examining measures to improve the efficiency of refineries in the use of energy and waste heat.

At the Subgroup's first meeting on 26 February 1975, a programme was adopted which included the following three points:

- to develop an exchange of information and experience regarding measures already applied to reduce own consumption;

- to ascertain the actual situation with regard to the rates of consumption of the refineries, the means adopted to reduce losses and the medium-term investment programmes;
- to define a programme of action.

III. EXCHANGE OF INFORMATION AND EXPERIENCE

III.1. Explanatory Statement

1. The effect of the increase in the cost of crude oil which occurred in 1973 became apparent in the refinery sector before any of the other industrial sectors. The marked increase in the cost of own consumption in determining the prices of products prompted refineries at the end of 1973 to intensify a series of economy measures evolving mainly from the reconsideration of operational measures and of the training of staff.

2. From the information available to the Subgroup at the time of its first meeting it appeared that the measures which had been put in hand had achieved substantial savings of energy, even taking into account the increase in consumption brought about by increases in the intensity of processing and in decreases in the utilization of refinery capacity.

3. The Subgroup felt that it was necessary to put before the whole of the refining industry all the information on the positive results which had been obtained by refineries up to that time in improving operational practices.

III.2. Action

1. After having correlated and then analysed the available information from the various refinery companies, in the form of operating instructions or manuals, the Subgroup drew up a model form of a checklist destined for distribution to all Community refineries.

2. The items in the checklist were classified according to the different plant or particular operation, including:

   - furnaces and boilers:
     control of air to prevent formation of smoke; checking furnace boxes to prevent leakage of air; ensuring that fuel oil temperature is high enough to ensure that its viscosity is optimum for the burner type;
   - heat exchangers:
     control of cooling water rate, utilization of waste heat from one unit in another;
   - insulation:
     provision of insulation on hot base surfaces such as flanges, valves etc.; adequate maintenance of insulation;
   - fractionation:
     operation of columns at the lowest practical pressure to improve relative volativity;
   - steam systems:
     operation of systems at minimum pressure; repair of steam leaks, recovery of condensate for re-use;
   - flares:
     Measures to reduce flaring;
   - electricity:
     reduced reliance on mains electricity by turning off outside lights during daylight hours; by ensuring that the power of replacement equipment does not exceed that which is required; by considering the question of product loading by gravity;
   - storage and handling:
     reduced energy consumption for product blending; control of storage temperatures;
   - hydrocarbon losses:
     control of losses on receipt of crude oil and in storage of the crude and the products.

3. For each instruction the list indicated whether or not the proposed solutions required investment and whether the measures would produce results in the short or the medium term.

4. The Subgroup suggested that at the same time as the checklist was distributed to the refineries a reference should be made to the following measures:

   a) the designation of some person or persons with specific responsibility for monitoring energy savings and for developing capital schemes for energy conservation;

   b) the organization of training courses and retraining exercises with specific emphasis on energy savings;

   c) the encouragement of operators to call promptly for the maintenance of faulty plant;

   d) ensuring that maintenance personnel were as well briefed as operators in the need for quick and effective action to deal with malfunctioning plant.

5. The checklist was distributed in October 1975 to all the refineries in the Community through the kind offices of the national governments of the Member States.

6. At the time of distribution the refineries were invited to comment upon the checklist and forward their observations and suggestions to the appropriate member or members of the Subgroup who had agreed to act as correspondent for their respective countries.

IV. FACTUAL SITUATION

IV.1. Explanatory Statement

1. The savings in energy achieved in 1973 and 1974 were mainly due to the tightening up of operational measures as mentioned above and generally did not involve any appreciable capital investments. In order to achieve supplementary savings on a Community scale the Subgroup felt that it was important to:

   - quantify the savings already realized and to distinguish those sectors where an effort remained to be undertaken;

   - identify the programmes being undertaken or being studied;

- learn about medium-term programmes.

2. The method chosen by the Subgroup to assess these matters was by way of an enquiry using a questionnaire addressed to all refineries in the Community.

IV.2. Questionnaire

1. The enquiry essentially dealt with four points:
   - own consumption in 1973 and 1974;
   - energy-saving measures applied in 1973 and 1974, and the corresponding savings;
   - the measures being applied in 1975 and 1976;
   - the anticipated programmes for 1977 to 1980.

2. The questionnaire was addressed in October 1975 to the various national governments, who in turn forwared them to the refineries in the Member States and at the same time arranged for the collection and return to the Commission of the completed questionnaire.

3. To ensure the confidentiality necessary for reasons of market competition and patents the information received was processed by means similar to those applicable in the case of documents received in pursuance of Regulations 1055 and 1056 relating to investments.

4. The result of the analysis has been submitted for discussion to the Subgroup.

IV.3. Results

1. Of the 131 refineries within the Community 110 provided replies to the questionnaire. However, it was possible to use the replies from only 102 of the refineries because of the incompleteness of the answers in 8 of the replies. The replies processes represented more than 90 % of the distillation capacity of the Community. Similarly, the percentage of crude treated by respondents was in the order of 90 %.

2. Own consumption of these 102 refineries amounted in total to 39 105 567 t.o.e. in 1973 and to 32 977 772 t.o.e. in 1974, the absolute difference being 6 127 795 t.o.e.

3. Own consumption of crude represented respectively 6.28 % and 6.02 % of crude processed in 1973 and 1974, thus showing a reduction of 4.1 %. When expressed in terms of tonnage of crude processed in 1973, this percentage figure represented a theoretical saving of 1 618 970 t.o.e.

4. The actual result of the energy-saving measures applied in the refineries is probably much greater than this figure by reason of the under-capacity (628 663 241 t of crude processed in 1973 as against 553 907 642 t in 1974) and the higher conversion rate of the refineries during the period considered which certainly would have increased specific consumption.

5. The replies from the refineries did not permit the quantification of the influence of these factors.

6. More than 70 % of the savings were obtained by the introduction of improved operating practices. The remainder of the savings were realized mainly by relatively minor modifications to plant, such as better insulation or by changing furnace or boiler equipment. However, using such means had been pursued to the limit of its possibilities and to obtain further savings it would be necessary for refineries to carry out expensive modifications to plant and equipment.

7. The enquiry showed that the refinery investment programmes would lead in 1980 to an additional saving of 6.3 % when compared with own consumption in 1973. The following table indicates the annual distribution of these savings which take into account the specific increases due to such factors as under-capacity and higher conversion rates and to the introduction of environmental standards (in particular regulations for reducing the lead content of petrol and the sulphur content of gas oil):

Year	Savings %
1975 1976	3.4
1977 1978 1979 1980	2.9
Total with reference to 1973	6.3 %

8. In many instances the replies to the questionnaire provided only scant information on the programmes adopted for 1975 and 1976, because at the time the results of the 1975 programmes were not known and those for 1976 were not then finalized.

9. It would also seem from the replies that the tasks of the refineries are likely to be impeded in 1977 and thereafter because of market uncertainties and the structuring of the range of products. Another, although lesser, restraint to the development of the programme arises from the difficulties experienced by the refiners in raising the necessary capital. The enquiry indicated that in the period 1977-80 the average investment necessary to save 1 tonne of oil equivalent per year would be in the region of US $ 105 (based on the value of the $ in 1974. It is, however, impossible to give a weighted estimate because of the degree of variation in the costs as shown in the undermentioned table:

Investment programme 1975 to 1980

Estimated costs of saving 1 tonne oil equivalent

	Range of costs in units of account	
	1975 - 1976	1977 - 1980
Furnaces and boilers	3 - 853	12 - 448
Heat exchangers	10 - 857	3 - 550
Waste heat recovery	11 - 201	33 - 321
Insulation	21 - 375	14 - 189
Steam systems	8 - 198	4 - 239
Flares	5 - 789	7 - 394
Electricity	9 - 514	57 - 1353
Storage and handling	70	47 - 114
Fractionation	5 - 278	29 - 106
Other processes	5 - 210	2 - 580
Miscellaneous	2 - 1611	106 - 536

V. FUTURE ACTION

1. National governments and the Commission should be made more aware of the situation in the refinery industry. It may be appropriate for the Energy Committee to take into account the question of energy savings when considering proposals relating to the future capacity and structure of the Community's refining industry.

2. A large part of the energy lost during refinery processing occurs through air- and/or water-cooling. This problem is one experienced by the electricity industry. A joint action by the refining industry and the electricity producers would appear appropriate.

3. With regard to the development programmes in the refinery sector until 1980, the existing information is based on programmes which were prepared in 1974 and 1975. However, the Subgroup wished to stress that tentative programmes could be subject to variations in company policies leading to increases or decreases in specific consumption. Increased consumption might well arise from a general reduction in investments or on

the other hand from investments which involved the commissioning of new or additional conversion units. Conversely, changes in policy could bring about supplementary efforts to reduce specific consumption by new investment in energy conservation measures or by the abandonment of proposals to install additional conversion units.

In the event the Subgroup felt that it would be useful to know the results of the programmes mentioned above and the extent to which they had been affected by policy changes. Accordingly the Subgroup have drawn up a revised questionnaire in order to discover the outcome of investments made, and of other energy saving measures taken, in 1975 and 1976.

Note : Some of the experts have not yet sent in their comments on the above text.

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