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REPORT

drawn up on behalf of the Committee on Energy and Research  
on the encouragement of combined heat and power production

Rapporteur: Mr Robert MORELAND

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On 25 March 1981 the motion for a resolution tabled by Mrs LIZIN and Mr LINKOHR (Doc. 1-51/81) pursuant to Rule 25 of the Rules of Procedure of the European Parliament on the encouragement of combined heat and power production was referred to the Committee on Energy and Research.

On 25 June 1981 the Committee appointed Mr MORELAND rapporteur.

It considered the motion for a resolution at its meetings of 29 April and 24 June 1982, and at the latter meeting unanimously adopted the motion for a resolution together with explanatory statement.

The following took part in the vote: Mrs Walz, chairman; Mr Gallagher, vice-chairman; Mr Normanton, vice-chairman; Mr Moreland, rapporteur; Mr Beazley, Mr Calvez (deputizing for Mr Pintat); Mr Karl Fuchs, Mr Markopoulos, Mr Nielsen, (deputizing for Mr Galland), Mr Petersen, Mr Petronio, Mr Rogalla, Mr Sassano, Mr Seligman, Mr Vandemeulebroucke (deputizing for Mr Capanna), Mr Veronesi and Mrs Viehoff (deputizing for Mr Schmid).

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Annex : Motion for a Resolution tabled by Mrs LIZIN  
and Mr LINKOHR on the encouragement of  
combined heat and power production (Doc. 1-51/81)

The Committee on Energy and Research hereby submits to the European Parliament the following motion for a resolution, together with explanatory statement:

MOTION FOR A RESOLUTION

on the encouragement of combined heat and power production

The European Parliament,

- A. having regard to the motion for a resolution tabled by Mrs LIZIN and Mr LINKOHR (Doc. 1-51/81),
  - B. having regard to the Resolution of 14.5.1982 of the European Parliament on investment in the rational use of energy<sup>1</sup>,
  - C. having regard to need to economise on the use of fuels particularly from imported energy sources,
  - D. noting the diversity in the use and experience of combined heat and power schemes between Member States,
  - E. noting that modern power stations convert only approximately one-third of their energy content of its fuel into electricity,
  - F. recalling the Council recommendation on combined and heat power of 25 October 1977<sup>2</sup>,
  - G. having regard to the report of the Committee on Energy and Research (Doc.1-433/82);
1. Believes that the increased use of combined heat and power schemes in the community offers considerable potential for both domestic and industrial energy users.
  2. Stresses the benefits of combined heat and power schemes in:
    - a) conservation of primary fuels,
    - b) the creation of an option against the depletion of gas,
    - c) the provision of a further energy option for an uncertain energy future,
    - d) cheaper and more plentiful heat for all users.
  3. Agrees with the view of the Commission (Com (81) 64) that the advantages of district heating can include:
    - a) the ability to distribute heat from a variety of low value heat sources,
    - b) the optimum way to increase the use of coal for domestic heating in urban areas,

<sup>1</sup> OJ No C149 of 14.6.1982, p.137

<sup>2</sup> OJ No L295 of 18.11.1977, p.5

- c) the only way to use geothermal heat and waste heat from industrial processes (including electricity generation).
4. Notes that the development of combined heat and power schemes, especially for district heating, has been slower in countries which have had cheap supplies of gas and where the distribution of gas and electricity is handled by monolithic corporations.
5. Believes the emphasis by the community on realistic energy prices will encourage the use of combined heat and power.
6. Calls on the Commission to emphasise and advertise that the community's demonstration projects programme can include combined heat and power projects and to ensure that all energy audit programmes take full account of it.
7. Recommends that the Commission should propose a directive on combined heat and power covering:
  - (a) the removal of any legal barriers which prevent electricity undertakings from selling heat in addition to power;
  - (b) an obligation on electricity and gas organisations to provide a quotation when requested on heat and power from combined schemes;
  - (c) an obligation on all electricity organisations to buy back surplus electricity at a reasonable price from combined heat and power schemes;
8. Draws attention to the potential use of wasteheat for horticulture and aquaculture and calls upon the Commission and the Member States to examine and encourage the further uses of waste heat in this area.
9. Calls on the Commission to draw up a report on the extent and use of combined heat and power in Member States with particular attention to the effectiveness of existing programmes and to the economies of and obstacles to the development of combined heat and power schemes but emphasises that such a report should not be used as an excuse for delaying other action proposed in this resolution.
10. Calls on the Commission and the Member States, in accordance with Parliament's resolution of 14 May 1982 (see second recital above), to begin negotiations on the introduction of additional financial aids such as the NCI, interest rebates, subsidies and loans as incentives for the investments which the development of combined heat and power production requires.

11. Calls on the Commission to establish a system for the exchange of information on technology, operating experience and costs of combined heat and power programmes with the framework of the international energy agency.
12. Calls for the Commission to propose Community sponsored research to develop reliable and economic heat meters and to propose a directive on metrology relating Community standards to the model regulations of the international organisation for legal metrology.
13. Instructs its President to forward this Resolution together with the Explanatory Statement to the Council and the Commission of the European Communities and the Parliament and Governments of the Member States.

## EXPLANATORY STATEMENT

Introduction

1. The notion of combined production of heat and power (CHP) occupies an unusual place in the spectrum of possibilities for meeting society's energy needs. On the one hand, the technology is well-known and the potential savings are enormous. On the other hand, there are administrative and economic obstacles to its wider use which cannot be lightly disregarded or overcome.
2. The efficiency of conventional power station for generating electricity (be it coal-fired, oil-fired, nuclear or whatever) is in the range of 30 to 40% ; around 10 per cent of the energy content of the fuel is lost in the chimney gases and 55 per cent passes into the condenser cooling water. This water is around 15-20°C above ambient temperature, and such low-grade heat is useful only for a few specialised applications such as fish farming and horticulture. The range of possible uses becomes much wider if the coolant water can be tapped at, say, 120°C but that reduces the efficiency of electricity production. With CHP, the aim is to produce the maximum amount of usable heat-plus-electricity, rather than concentrating on squeezing out the last drop of electricity alone. An indication of the savings possible is given by the calculation that the reject heat from a 2000 MW generating station could meet the heating requirements of about 1 million people. The Commission has estimated that the potential savings due to CHP at the beginning of the next century could amount to 100 mtoe. (about one-third in industry, and two-thirds in the domestic sector).



3. In short, therefore, combined production of heat and power offers the potential for large energy savings and a reduced dependence on oil (but see below). On the other hand, long and massive investment is needed, and that in turn requires assumptions about the long-term development of the energy market (in particular the supply of gas). It is unlikely that CHP will develop its full potential without a strong lead from central government.

#### Definitions

4. Combined generation of heat and power can be manifested in a number of ways, and confusion over terminology is to be avoided. The categories are inevitably simplified.

- CHP. In its simplest form, the operation of a prime mover to provide both power and heat. In most cases the power is used to drive generators to produce electricity; most CHP schemes are thus electricity-plus heat schemes but smaller industrial schemes producing mechanical power plus heat are known.
- CHP/I (Industry). In this case, the customer for the heat is some industrial plant. For example, steam heating may be required to some chemical process. The plant may buy both its electricity and heat from a separate or public producer, or it may run its own plant.
- CHP/DH (District Heating). Here, the heat is supplied to the domestic sector, usually for space heating. A large number of individual customers are supplied and a district heating network of insulated pipes is necessary. Such networks are expensive and require high housing (and hence heat load) density to be worthwhile.
- DH (District Heating). This need not be linked with the simultaneous production of power, but can be operated alone using heating boilers only. Note that it can take time to build up a heat load sufficient to justify CHP; the development of DH networks in the meantime can be a useful stepping stone.

5. CHP can therefore encompass - at one end of the scale - schemes based on major power stations providing electricity and heat for whole cities or important industrial complexes, and - at the other end - individual pieces of plant such as spray driers in the dairy industry. Combined production of heat and power is thus not limited to large generating stations producing electricity for the public network. It can be applied at any scale, although the economic case for smaller schemes may be more questionable. In addition, combined heat and power schemes can be used in many industrial plants which require both electricity and heat for, say, chemical processes, be they large or small. In fact, the higher incidence of CHP schemes in industry underlines the attractiveness of the technique when (a) there is some stability in the heat load and (b) there are no arbitrary divisions between supplier of electricity, supplier of heat, and final consumer.

6. One of the Community's major objectives is to reduce its dependence on imported oil. To the extent that CHP/DH offers greater energy efficiency and there is a swing towards using nuclear power and coal for generating electricity, CHP can contribute to reduced oil dependence. On the other hand, CHP stations need to be near their heat load (the allowable separation varies from case to case, but is rarely more than 20 km); this is not always acceptable with nuclear plant. In addition, smaller CHP/I schemes tend to burn "easy-to-use" fuels such as oil and gas in order to avoid handling and environmental problems of coal. Care has to be taken in encouraging small-scale CHP/I so that increased energy efficiency does not lead to greater dependence on oil.

### Economic obstacles

7. The central problem of CHP is that of matching the demand for heat with that for electricity. In CHP/DH for example, electricity demand over the year is reasonably stable, but space heating is required only for part of the year. Similarly, a CHP/I plant is unlikely to be perfectly matched to its electricity and heat loads, either overall or over the daily cycle of operation; in general this mis-match will take the form of an electricity shortfall or surplus which has to be made up by or disposed of to the public grid . As with so many energy technologies, the long-term solution is to find an efficient method of storing energy.

8. This interdependence of heat demand and electricity demand does, incidentally, raise difficult problems of fair pricing.

9. CHP requires a high level of localised heat demand. The economic attractiveness of a scheme depends crucially on the density of heat demand, especially where a distribution network has to be set up. In this case the presence of existing networks (especially of gas) undermine the financial case for CHP. A system may well be profitable once installed, but the losses in the build-up period can more than outweigh that. This problem affects CHP/DH. Strategic decisions are necessary concerning the role of CHP and gas, both on regional planning questions and on the long-term availability and price of gas.

10. CHP is not cheap. Plant is more expensive than that for producing electricity only, and the investment required for heat distributing networks large. This raises two problems:

- (a) the efficiency of energy supply is not simply a question of efficiency in burning fuel. The extra capital needed, and its cost, have to be considered.
- (b) CHP /DH projects can take many years to reach maturity; the pay-back period is consequently long and the attractiveness of projects depends crucially on the cost of capital. Interest-rate subsidies are thus particularly useful for promoting CHP /DH.

Even for industrial CHP, the concern of industry to have short pay-back periods is a constraint to its further development.

11. In its "Review of energy policy objectives for 1990 and Member States' Investment Programmes" (COM (81) 64), the Commission had the following to say on the subject of 'heat'; its comments on district heating apply equally well to combined production of heat and power:

"The economics of district heating raise special problems. A satisfactory rate of return on investment can be obtained in the long term in many cases, especially where the marginal cost of heat production or recovery is low. But the initial investment in distribution is costly, penetration of the heat market after a network is installed is slow, and it may never reach an economic level in the presence of a low-price competitor such as natural gas. For all these reasons most Member States recognise that government support is normally necessary to launch a district heating investment.

"But the advantage of district heating goes beyond pure economics, since it is the only technique so far developed for the commercial distribution of a wide variety of low-value heat sources. It is the best means of increasing the use of coal for domestic heating in urban areas, and the only practicable way of using low-grade geothermal heat and waste heat from industrial processes including electricity generation. District heating therefore provides a flexible insurance policy for an uncertain future through its unique ability to harness a wide range of forms of energy which would otherwise be wasted. Denmark, France and Germany have strong district heating programmes; the Netherlands and Italy have ambitious plans that have yet to be translated into effective action and in these and other Member States there is scope for a marked acceleration of investment plans."

#### Administrative obstacles

12. The structure of the traditional energy market is fairly straightforward. The consumer usually has the full range of fuels available; each organisation supplying energy usually deals only with one form (i.e. electricity, gas, oil, etc.). Combined production of heat and power does not fit into this market and administrative structure; although it is clear that the technique offers overall energy savings, its use will remain limited as long as administrative as well as economic problems prevail. Some of the problems are outlined in the following two examples:-

13. Public electricity supply. Authorities at present concentrate on providing secure supplies of electricity at minimum cost; there is little incentive for the authorities to pursue a broader objective of efficient energy use, and to promote heat use is to promote competition for their primary product. Even if electricity authorities are oriented towards supplying both electricity and heat, it is by no means simple to set prices for such interdependent products, especially with the heavy investment needed - new plant (modifying existing plant is not generally economic) and in building up a heat-distributing network.

14. It must be emphasised that electricity generating authorities are much readier now to sell heat than they once were. In some countries this is enshrined in legislation (e.g. in Italy, where ENEL can be required by the Ministry of Industry to sell heat or cooperate with municipalities). Authorities in other countries are prepared to quote, formally or informally, for the supply of heat.

15. Nevertheless, there is a need to institute decision-making and marketing which takes account of the advantages of combined production. Where electricity supply tends to be under the control of local authorities, for example, which also arrange heat-distributing networks for housing developments, planning is easier to coordinate. Countries like the United Kingdom, on the other hand, have much more centralised electricity supply, and the Marshall report prepared for the U.K. Government foresaw the eventual setting up of an organisation to market heat, buying it in bulk from the electricity generating organisation in the same way as the electricity marketing organisations buy their supplies.

16. Industrial CHP This has made faster progress for a variety of reasons, but partly because there is but one decision-making body which can also optimise the conditions of both production and consumption. Further progress is hampered by the harsh climate for long-term investments but also because it is rare for an industrial plant to take exactly the electricity output and heat output of a CHP stations and to do that all day long. In particular there may be occasions when, for overall energy efficiency, the CHP/I scheme will need to sell some heat (difficult in the absence of infrastructure) or - more particularly - electricity.

17. The public electricity network cannot be expected to be an enthusiastic purchaser of excess electrical production: it cannot usually be guaranteed (although, because it is a function of heat requirements, it is usually available at convenient times of the year). Investment in plant therefore has to be duplicated and the load on the public generation system fluctuates more than otherwise. In addition, there are difficulties in setting a fair price when the purchase is probably the only possible outlet. The conditions under which the public system accepts excess supplies from private CHP need careful review to ensure that energy-efficient production is not unnecessarily discouraged, although a more enlightened view is perhaps emerging (and needs to be encouraged).

18. Firstly, the principle of buying-back needs to be confirmed. Secondly, a fair price will take into account not only the cost of fuel saved by the public producer, but also of reduced capacity needs (it is unrealistic to duplicate capacity totally; not all sellers are going to stop selling simultaneously). Thirdly, it should also be possible - as is the case in France - that surplus electricity is sold to a third party rather than the public producer, but transported on the public network.

19. The motion put down by Mrs LIZIN and Mr LINKOHR (Doc. 1-51/81) refers not only to the encouragement of combined heat and power, but also to the discouraging of electrical resistance heating. It is suggested that these two subjects should be looked at separately and that this report should concentrate on CHP.

20. The alleged inefficiency of electrical resistance heating can be questioned. Electrical heating may well have a role to play in remote locations (where CHP would be totally uneconomic) and in smoothing demand by using off-peak power. High-frequency resistance heaters are also competitive for some industrial applications. Greater use of electricity can reduce the problem of oil dependence in some Member States. It is also by no means clear that it is less efficient overall to use coal to generate electricity, which can be transported and converted with low losses, than it is to distribute coal (with high transport costs, using oil) and burn it locally in a multitude of small, less-efficient and more-polluting boilers.

21. In preparing its action on "The Rational Utilization of Energy", the Commission did set up a Sub-Group on energy conversion in power stations. This Sub-Group dealt with CHP and reported in 1976. One recommendation of this Sub-Group was the setting up of advisory committees in Member States, these committees to promote CHP, commission studies, provide information to small and medium-sized enterprises. This Recommendation was adopted by the Council on 25 October 1977. Eight Member States did set up such committees although not all are still active.

22. As observed above, CHP technology is mature and well-understood. On the other hand, unconventional approaches are being investigated; one such uses fluids other than water, another heat pumps - the aim being to reduce the need for expensive insulation of the distribution network. The Community is also supporting research into energy storage as well as four CHP demonstration projects and ten DH demonstration projects. There does not appear to be any need for a major initiative in this area, in addition to the useful work already done.



23. The Community has funded via the EIB a small number of district heating schemes. In its communication on "Investment in the rational use of energy" (Doc 1-1063/81), the Commission did consider that "special incentives from the public authorities are justified in order to speed up investment to promote heat production for remote heating systems". It appeared to envisage systems using industrial waste heat rather than CHP proper. Parliament gave its opinion on this communication on 14 May 1982.

The Commission pointed out in Doc 1-1063/81 that it was "in the closing stages" of an examination of incentive schemes (which exist or have existed to promote heat networks in Denmark, France, Germany and the Netherlands) to determine which additional efforts might be necessary.

24. On tariffs, the Council has adopted a Recommendation on electricity tariff structures (81/924/EEC, OJ L337 of 24.11.81). The thrust of this Recommendation was that tariffs should reflect costs, and that the end-use of the electricity (and by implication the method of its production?) was irrelevant. The stress in the draft motion for a resolution (Doc 1-51/81) on using tariffs to

- buy back electricity at high prices
- supply emergency power at low cost
- discourage electrical resistance heating

is at odds with the requirements of this Recommendation. Nor is it easy to envisage how to structure tariffs to favour CHP - cases do differ enormously so any Directive or Recommendation would have to be either enormously detailed or very vague.

25. Finally, the Commission has indicated that it is carrying out studies in 1982 to determine the extent of CHP and DH use in Member States.

## Summary

26. It is clear that combined heat and power generation offer can massive energy savings, reduced oil dependence some flexibility in fuel choice, plus substantial environmental advantages. It is not a cheap option, however, and in the long run, its progress will probably depend on whether gas supplies remain plentiful and cheap (with synthetic gas from coal, later): strategic choices have to be made in this regard.

27. Developing the infrastructure for CHP/DH especially takes many years and substantial efforts are needed now if the option is to be available when it is needed, towards the end of the century. District heating should be encouraged in its own right and as a stepping-stone to CHP/DH. Industrial use of CHP is more developed but there remains plenty of scope, although there is a risk of small-scale systems relying on oil. The greatest untapped potential lies with the unused heat of generating stations of the public electricity system.

28. As to possible action at the Community level, it seems that:

- a major extra research effort is not really needed, as the technology is well-known, and
- financial aid for investment would be very useful; the case for interest-rate subsidies is stronger for this kind of long-term energy investment than for some others, and CHP /DH projects are particularly sensitive to the cost of capital.

However, the major requirement seems to be the removal of outmoded legal and administrative barriers, so that CHP can compete fairly in the energy market-place. This goes beyond the tariff structures mentioned by the movers of the original motion, and the Directive referred to in Doc 1-51/81 should concentrate on:

- (a) the marketing of heat as a product: this could become the responsibility of a major organisation. In particular, any legal obstacles to electricity producers marketing heat as well should be removed, and the producers encouraged to sell both products actively;
- (b) the setting of fair prices for the sale to the public network of excess electricity production. The generating authorities should be required to buy-back such excess and/or allow its transfer on the network to a third party. The price should include an element related to the reduced capacity required, as well as the fuel cost saved. As the buyer is usually a state or monopoly buyer there should be some form of independent analysis or review.
- (c) the lack of information: adjacent industrial plants may have complementary patterns of energy consumption but they will only come together to build a joint CHP plant by chance. There is a more formal role here for the Committees envisaged in the 1977 Recommendation, or for electricity supply bodies to provide some coordination. Regional energy planning also has a role to play.

MOTION FOR A RESOLUTION (Doc. 1-51/81)

tabled by Mrs LIZIN and Mr LINKOHR pursuant to Rule 25 of the Rules of Procedure on the encouragement of combined heat and power production

The European Parliament,

- whereas the combined production of heat and electricity is the most efficient solution in very many cases where undertakings and other organizations require both heat and power,
- whereas the most significant savings in primary energy can be achieved by encouraging autoproduction in such cases, particularly if combined generator plants are extended by the addition of heating networks,
- whereas this objective can be achieved by means of a tariff system designed to promote the installation of combined generators by electricity users by assuring them that the general network will buy up their surplus power supplies at top prices, particularly during peak periods, and will supply self-sufficient undertakings with emergency power at low cost,
- whereas tariffs should also discourage the heating of homes and premises by means of electrical resistance, which is a particularly inefficient way of using primary energy,
- whereas these measures will bring about a considerable reduction in the need for high-output power stations and will release substantial capital for energy conservation and for the renewed growth of employment in manufacturing industry.

Invites the Commission to submit and the Council to adopt a directive with a view to promoting the combined production of heat and electricity and discouraging the use of electrical resistance for heating purposes by introducing an appropriate electricity premium.