PLANIFICATION ENERGETIQUE DANS LES VILLES ET CONTRAINTES LIEES A L'ENVIRONNEMENT

URBAN ENERGY PLANNING AND ENVIRONMENTAL MANAGEMENT

SIES, Roma

Commission of the European Communities
Directorate-General for Energy

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Direction Générale de l'Energie

ESI-VU, Amsterdam

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Actes du séminaire qui s'est tenu à l'Institut Diplomatique

Proceedings of a Seminar as the Diplomatic Institute

Edité par

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Preface

The present volume reports on European-wide experiences in the area of energy systems management at a local level. The design and implementation of efficient energy systems - at both national/international and local/regional levels - is a focal point of policy interest in all countries of the European Community. The increasing awareness of the strategic role of energy is not only caused by its potential contribution to an improvement of economic efficiency and of (inter)national or (inter)regional competitiveness, but also by its close connection with environmental quality management at a local, regional or even national scale.

In the framework of activities of the Regional Energy Planning Division of the Directorate General for Energy (DG XVII) of the Commission of the European Communities the need for an efficient and effective energy management at a decentralized level has strongly been emphasized in the past years. In close collaboration between regional energy authorities and DG XVII, a wide variety of new regional energy planning experiments and programmes has been stimulated and undertaken in all member countries of the European Community. The experiences thus far have convincingly demonstrated that decentralized energy planning - based on a diversification of local and regional energy sources - is beneficial for all actors involved.

In recent years the insight has grown that in particular urban energy planning may generate many economic and environmental advantages. So far, however, there has been no systematic evaluation of urban energy programmes or experiences in different European countries. The experiences gathered in the past from regional energy planning studies sponsored by the Commission might be important here, even though manifest differences (e.g., in terms of institutional competence and forms) do exist. There is certainly a need for more constructive and strategic reflections on the feasibility of urban energy planning.

In order to arrive at a systematic and comprehensive judgement of the state of urban energy planning in various member countries, an international symposium on urban energy planning has been organized in Rome from December 19-21, 1988, by the Commission of the European Communities in close cooperation with SIES (Roma) and ESI-VU (Amsterdam) (see the programme at the end of this volume).

The following issues were discussed in greater detail at this meeting:

- the economic, institutional and technical potential of decentralized (urban) energy planning;
- the range of applications of urban energy planning to different sectors

(residential, industrial, transportation, environmental);

- the methodology of evaluating European-wide experiences in the area of urban energy planning;
- an exploration of the potential of a cross-national comparative Community support for stimulating urban energy planning.

The symposium was meant to be a brainstorm meeting which served to find useful information regarding the above mentioned issues. The symposium has given a clear indication that there is a role the Community could usefully play in stimulating urban energy planning. Next, the symposium has indicated which flaws and bottlenecks may be expected in the practice of urban energy planning, as experienced in case studies from various countries in the past years. Besides, the reports presented at the symposium have also outlined and illustrated new practical approaches and methodologies which may potentially be used in new urban energy planning initiatives in the near future.

The present volume contains a systematic collection of papers and reports presented at the symposium. It is our hope that the dissemination of these results will stimulate a further development of urban energy plans in the European Community.

We wish to thank SIES , Rome, and in particular its President Dr. A. Ramasso-Valacca, for hosting the seminar so effectively and to ESI (Free University of Amsterdam) for ensuring the technical and scientific coordination of the contributions. The editors would also like to thank Mr. Clive Jones, Deputy Director-General for his direct participation and contribution to the seminar and Messrs. C.S. Maniatopoulos, Director-General and J.C. Guibal, Director, for their support and encouragement to the idea of the seminar.

Such a seminar would however not have been so successfully carried out if it were not also for the great help from the secretarial staff: Mrs. F. Henalla, Directorate-General for Energy, Miss. D. Rea and Mrs. Sanna of S.I.E.S., Rome, and Mrs. Rita Hittema and Mrs. Margaret van Koll, Free University, Amsterdam.

Brussels, March 1989

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1. EXPLORATIONS IN URBAN ENERGY PLANNING

P. Nijkamp
A. Perrels

1. Prologue

Since the beginning of the 1970s governments, energy producers, businesses and consumers have implemented - mainly with considerable success - a great diversity of energy conservation plans. This has led to significant reductions in energy needed to heat dwellings, drive cars or produce agricultural or industrial products. In a recent report of the IEA (1987), it was assessed that the amount of energy used to produce one unit of gross domestic product (being an indicator for energy intensity) fell by approx. 20% between 1973 and 1985. Especially in the industrial sector the energy efficiency increased considerably, whilst also the residential/commercial sector achieved a much higher efficiency of energy use than in the past. However, the efficiency of electricity generation did not rise very much. Moreover a part of the increase in energy efficiency should not be attributed to energy saving policies but to structural changes in the economy, which generally constitute a shift from basic to non-basic industries and services. This notion exemplifies the savings potential yet to be tapped.

A significant part of the success of energy conservation policies can be attributed to various <u>financial</u> incentives programmes. Examples in various sectors are:

* industry:
  - grants to stimulate discrete conservation investment
  - tax incentives to encourage energy efficient production processes
  - loans to stimulate less energy intensive capital investments
* residential/commercial sector:
  - grants to help develop energy conservation schemes
  - tax incentives to induce building insulation
  - loans for specific energy conservation purposes

In addition, in various countries <u>information</u> programmes (e.g., publicity campaigns, residential and industrial energy audits, appliance labelling or transportation fuel efficiency information) and <u>regulation/standard</u> systems (e.g., building codes, appliance efficiency standards, fuel economy standards for new passenger cars) have been introduced as a policy tool to increase energy awareness.

Despite the improvement of energy efficiency in the past fifteen years, there is still much scope for further energy improvements in all end-use sectors. According to the above mentioned report, it is quite well feasible that, if energy conservation measures which are now economically viable were fully implemented by the year 2000, energy intensity would even fall down to 30% below the current levels.

However, the current relatively low energy prices are not in favour of strict energy conservation programmes, mainly because market prices are more affected by short-term influences, whilst they also tend to overlook social costs caused by environmental decay (energy prices do usually not internalise environmental externalities).

Nevertheless, it is important that - even in a period of low energy prices - due attention be given to energy efficiency and conservation programmes for various reasons:

- economic efficiency: energy is a cost factor which in any case has to be minimised in order to increase competitive efficiency; industries or countries which have managed to implement energy efficient programmes are able to operate at favourable competitive prices.
- resource management: the careful treatment of scarce and depletable natural resources is a meaningful risk strategy which will make the industry or countries less vulnerable.
- environmental sustainability: a lower degree of energy intensity will reduce the social costs of environmental damage at both local scales (e.g., solid waste) and global levels (e.g., acid rain, ozonisation).

Thus in all these cases energy conservation and energy efficiency programmes are aimed at increasing socio-economic benefits (broadly interpreted) of our societies (see Nijkamp and Soeteman, 1988). In this context new technologies may also play a decisive role, for instance, in the design of efficient heat recovery systems, efficient heating and cooling systems, energy efficient high speed vehicles, and flexible cogeneration systems, whilst also microelectronic sensor and control systems may effectively be used to improve the matching between supply and demand of energy. Especially at a more decentralised level such policies are likely to be more successful. The regional energy programme of the European Community has been very instrumental in favouring energy planning at regional and sub-national levels.

2. Decentralised Responsibilities for Energy Planning

The structure of energy production, supply and distribution exhibits - in terms of ownership, organisation and regulation - a remarkable variety among European countries. For instance, the ownership structures range from wholly publicly owned energy systems to those where privately owned utilities dominate (see Helm and Gowan, 1987). Similarly, depending on the specific fuel source and political structures in a given country, one finds organisational configurations ranging from nationalisation/centralisation to privatisation/decentralisation. Centralised energy systems used to exist in the UK and France, whilst decentralised systems used to be present in the Netherlands (with a strong influence of communal authorities) and Germany (with a strong influence of regional authorities). Mixed structures can be found inter alia in Sweden. In recent years there is a tendency in several European countries to separate electricity production from distribution, in order to gain economies of scale in production as well as to reorganise distribution at the regional or local level. The separation aims at an increase of competition in production and an increase of customer orientation among distribution companies.

In view of the trend toward a stronger market orientation and more deregulation/privatisation (seeking to use the market mechanism as a competitive tool for increasing efficiency), there is in most countries an increasing tendency toward more flexibility regarding energy supply and distribution at a local level. Private-public oriented district heating systems, privately based industrial co-generation systems and private solar and wind energy systems are increasingly emerging. Consequently, public-private partnerships as new organisational forms for local energy provision and distribution appear to become rather popular nowadays. Thus it seems plausible to assume that at the local (urban or communal) level where the institutional structures are in general less complex and less multi-faceted than at country/provincial levels, there is much scope for well focussed and tailor-made energy programmes at a decentralised level. Since most people live in cities and since most economic activities take place in urban areas, it goes without saying that urban energy conservation plans are an important component of energy policy aimed at a further improvement of energy efficiency.

This observation makes even more sense, if we realise that according to recent estimates (see IEA, 1986) 34% of total final energy consumption is caused by the maintenance and use of commercial, public and residential buildings most of these being located in urban areas. Both Individual Dedicated Control (IDC) technologies (e.g., heat production, air conditioning control) and Comprehensive Energy Management and Control Systems (CEMCS) technologies (e.g., load management, remote energy monitoring and control, district heating) may be used here as effective vehicles for further energy savings.

There is another reason why decentralised energy systems seem to gain popularity, viz. the interrelationship between energy and environmental conditions. The generation, conversion and use of energy has usually very detrimental effects on the environment (e.g., due to emission of SO_2, NO_x, CO, PCB and particles). The environmental awareness at local levels has led to much resistance at expansion programmes of energy power plants in the vicinity of urban areas. And there is an increasing trend toward setting strict emission standards for combustion plants, cars etc. (e.g., limitations of sulphur content in fuel oils and lead content in gasoline). In this respect, efficient local energy planning and effective local environmental management have similar interests. This also explains the broad support for district heating systems and combined heat/power systems at the level of urban agglomerations. Especially at a decentralised level a reconciliation and coordination of energy and environmental policies is likely to become an effective and appropriate policy strategy. This observation is also supported by information from a broad international overview of energy policies and programmes in various member countries (see IEA, 1988). The issue of energy planning and environmental management at a local level will be further taken up in Section 3.

3. Energy Planning and the Environment

Energy planning at a decentralised level requires a coherent view on a multiplicity of relevant socio-economic, institutional, physical planning and environmental factors. Each energy programme (e.g., direct conservation measures, diversification of fuel supplies, mobilisation of indigenous energy resources) has clearly a wide variety of impacts, ranging from cost reductions to environmental decay. An example of a multi-faceted configuration regarding the linkages between energy planning and environmental improvement in the framework of an urban/regional development strategy can be found in Figure 1 (derived from ARP et al., 1987).

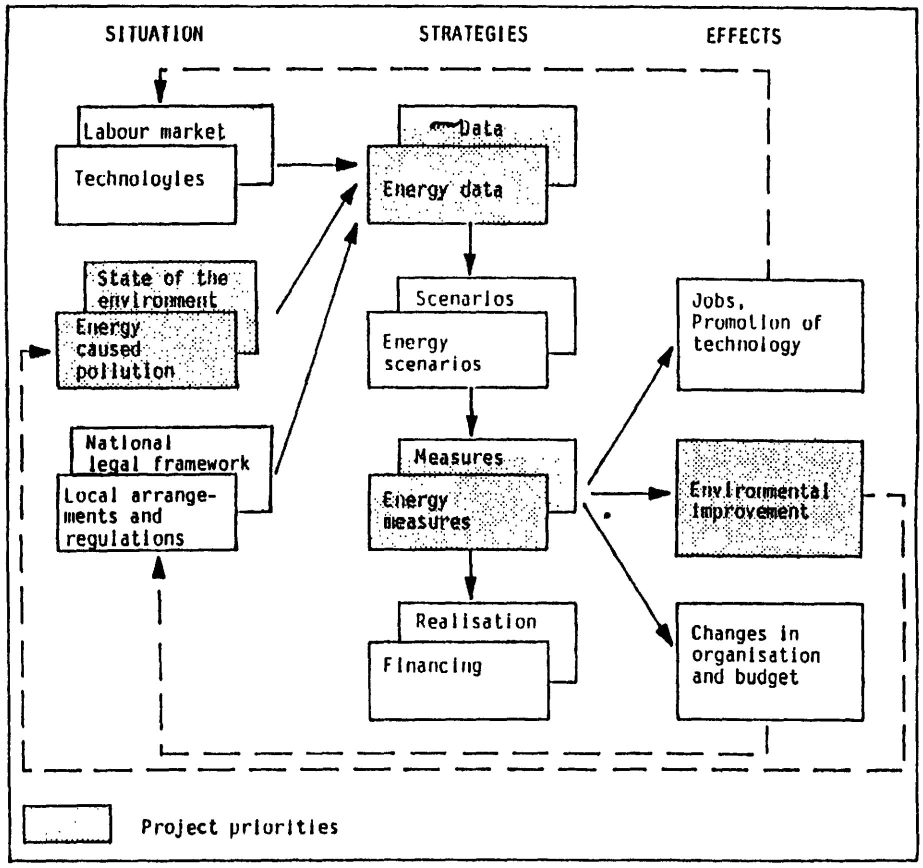


Figure 1. Energy Planning and Environment in a Spatial System.

As mentioned above, in the recent past, an increasing need for a stringent environmental control at both local and national levels has emerged. In this respect, energy flow analysis, (e.g. in the form of energy balances) may be linked to environmental emissions. An example of such an integration of technology, energy and the environment can be found in Figure 2 (derived from Volwahsen and Nijkamp, 1988).

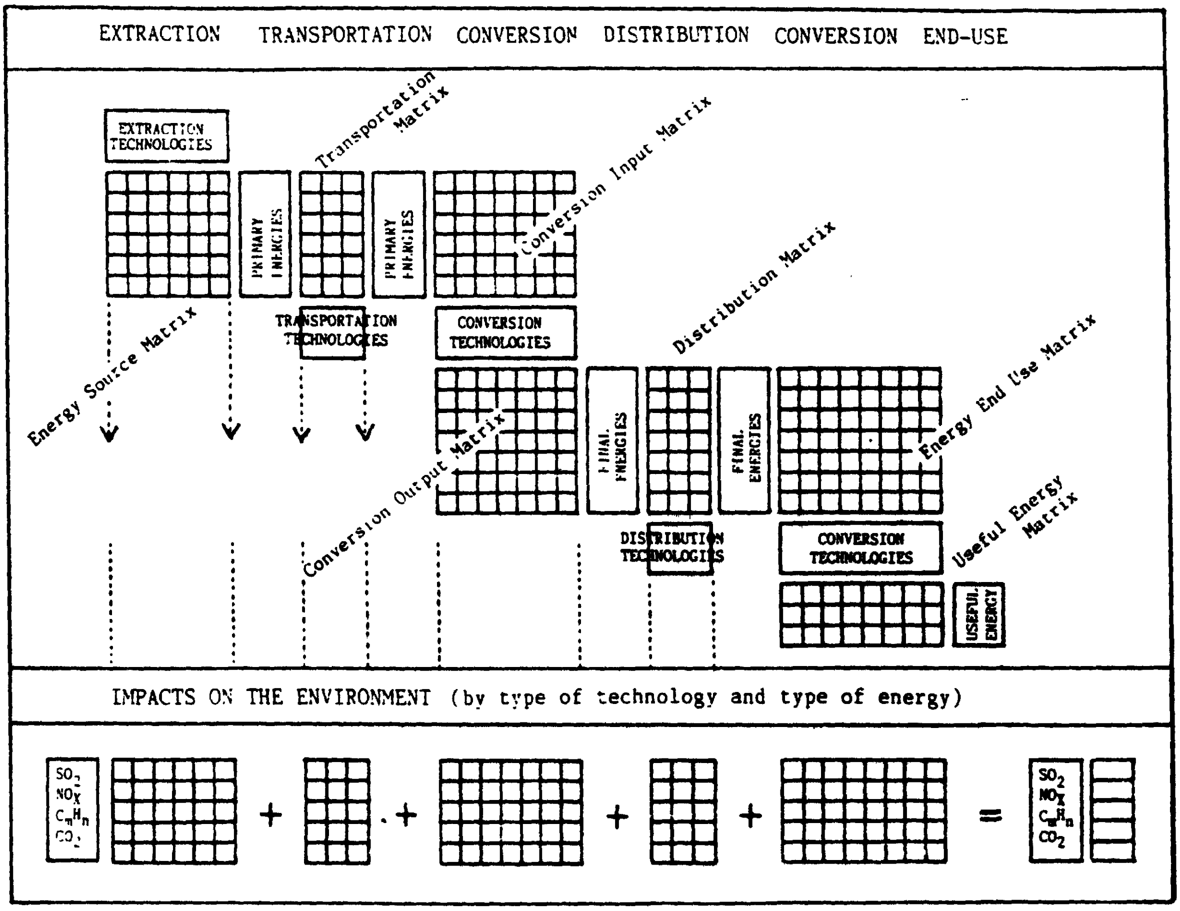


Figure 2. Environmental Impact Analysis Based on Various Technology and Energy Systems.

The latter system contains the major important interactions between energy and the environment, starting from energy extraction technologies and ending up with useful energy output. Such a system can be applied to all geographical levels, but it is obvious that in open regional and urban systems the influence from the external world is relatively high. In this way impacts of changes in technologies or of energy conservation measures may be traced.

In any case, in the recent past it has become evident that energy production, conversion and use contributes significantly to environmental decay (e.g., noise, air pollution, water pollution and soil contamination). Only effective policy measures will ensure that urban areas will remain the productive sources of our economies (see Small, 1980 and Solomon, 1980). Thus local and regional energy planning has to include necessarily environmental quality factors. Especially, further developments concerning the combination of solid waste collection and disposal and the generation of electricity or biogas is a promising policy option.

Secondly national energy policy goals will be increasingly influenced by national environmental policy goals and restrictions. Increasingly strict emission standards with respect to SO_2 and NO_x will have their impact undeniably on the mix of primary fuels. Consequently the use of (more) coal will become problematic, while for instance the use of natural gas, notably in CHP-capacity such as in district heating systems, will become increasingly attractive from an environmental point of view.

4. Towards Urban Energy Planning

The implementation of efficient and ecologically sustainable energy systems - at both national/international and local/regional levels - has become a focal point of policy interest in many countries in Europe. The strategic role of energy is not only caused by its potential contribution to an improvement of national or regional economic efficiency and of (inter)national or (inter)regional competitiveness, but also by its close connection with environmental quality conditions at a local, regional or even (inter)national scale.

In the framework of activities of the Regional Energy Planning Unit of the Directorate General for Energy (DG XVII) of the Commission of European Communities the need for an efficient and effective energy management at a decentralised (i.e., regional) level has been strongly emphasised. In close collaboration between regional energy authorities and DG XVII, in the past years a wide variety of new regional energy planning experiments and endeavours have been undertaken in all member countries. The experiences thus far demonstrate convincingly that decentralised energy planning - based on a diversification of local or regional energy sources - may provide a strong support to the welfare levels of the regions under consideration, not only in the prosperous parts of the Community, but also in less favoured areas. In this context, it is noteworthy that one of the Community's energy policy objectives at a regional level is "....the implementation, in appropriate frameworks, for those regions which are less-favoured, including those less-favoured from the point of view of energy infrastructure, of measures designed to improve the Community's energy balance......" (Energy in Europe, 1987, no. 7).

One of the general lessons drawn from the regional energy planning activities in many member states is that decentralisation of energy planning towards a regional level is a meaningful and feasible policy strategy which may increase energy efficiency through a direct involvement of the 'workfloor' of energy planning. It leads to more flexible institutional configurations in the field of energy planning, enhances the diversification in the production and use of energy sources. It also reduces environmental stress caused by energy production, conversion and consumption as a result of a higher local awareness of environmental quality conditions.

In the recent past, several discussions have taken place on new directions in regional energy planning. Given the favourable achievements so far, an extension of the scope of regional energy planning seemed to be a plausible and potentially promising strategy. Some examples of such an extension are: the desire to incorporate simultaneously environmental decay in relation to energy production, conversion and/or consumption, and the desire to focus more specifically on the potential of urban energy planning.

There are various reasons why a well focussed energy planning strategy toward the urban level is a potentially valuable activity in the framework of regional energy planning.

First, there is the obvious reason that most production, consumption and transportation activities take place in urban areas. It is noteworthy that in all countries of the Community the urbanisation phenomenon is of paramount importance, whilst the number of activities in urban areas is still increasing, not only in prosperous regions but also in less favoured areas of the Community. Thus a clear focus on urban energy planning may enhance the effectiveness of energy strategies in many countries.

Next, decentralisation of energy policy has become a major device in current policy-making in most member countries. The city is of course a natural institutional decision unit in this context, as it covers a well focussed study area without running the risk of a heterogeneous policy structure with many horizontally organised planning agencies (and related competence questions). Thus the involvement of one identifiable decision-making agency at the urban level is of major importance and may enhance institutional effectiveness of energy planning.

A related obvious advantage may be the direct local involvement, based on a bottom-up strategy for new energy saving programmes and related environmental management programmes (for instance, in the case of district heating). This may increase the support of the general public for changes in energy production and/or consumption patterns.

Finally, in terms of efficiency of data gathering and/or availability, the city is usually a more suitable statistical entity providing systematic data sets on environmental energy and socio-economic indicators.

Thus, the foreseeable advantages of regional energy planning at the urban level are: (1) more effective actions from municipal energy agencies and (2) a closer involvement of urban inhabitants/entrepreneurs in the triangle of energy, environment and economy.

5. Various Options for Urban Energy Planning

There are various ways of saving energy in the urban built environment. Household activities and consumption, industrial and commercial activities, and transportation are - in addition to electricity production - the main sources of energy use (see also Figure 3).

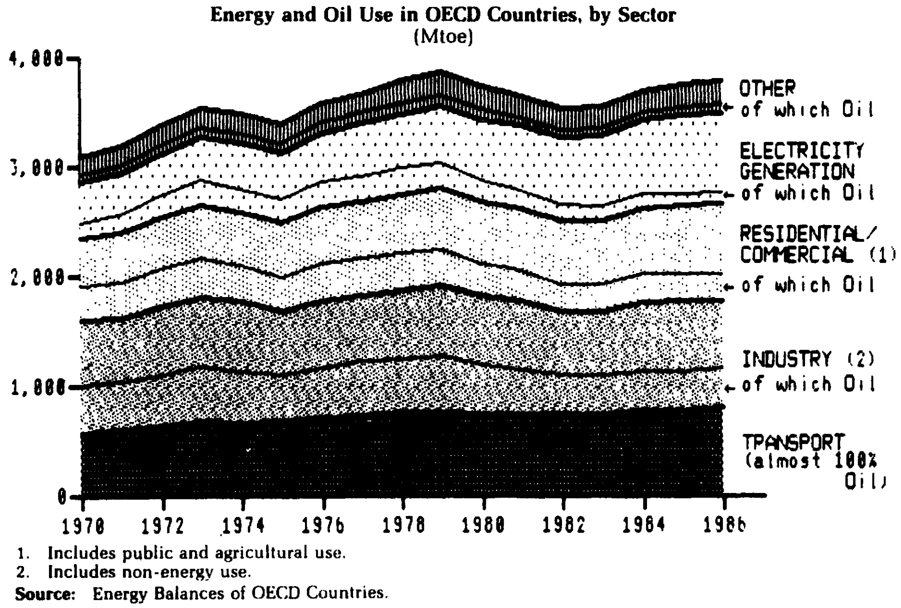


Figure 3. Evolution of Energy and Oil Use in IEA Countries (Mtoe). Source: IEA (1988).

In all sectors from Figure 3 considerable savings are still possible (see also RPD, 1983). In the industry new technologies and better insulation of buildings may lead to a considerable rise in energy efficiency, although this has normally clearly a long lead time. In the residential sector, housing insulation programmes may also lead to drastic energy savings (for both space heating and air conditioning, e.g., by means of better insulation, 'heat pumps', solar energy installations, wind turbines, and economisers for central heating systems). Also in the transport sector considerable savings are in principle possible (e.g., through more energy efficient engines, vehicle weight reduction or - in the long run - through a more energy-efficient physical planning aimed at a reduction of commuting distance and/or a shift of the modal split in favour of public transport).

In a more integrated and meso level of urban energy planning, various possibilities are offered by central heat distribution, recycling of energy from heat, sink of electricity generation (district heating, e.g.), from industrial heat sink (co-generation, e.g.) or from using urban/industrial waste as a fuel for generation plants. Especially at a local level these energy savings options are likely to be more efficient than at a more region-wide level, as in general, such options require fairly high densities of energy demand.

The potential contribution of decentralised energy supply systems is high, but their benefits will depend on individual, tailor-made adjustments to specific segments of end users. An illustration of the way the suitability of decentralisation of energy systems may be assessed is exemplified by means of Figure 4 (derived from Thabit and Stark, 1985).

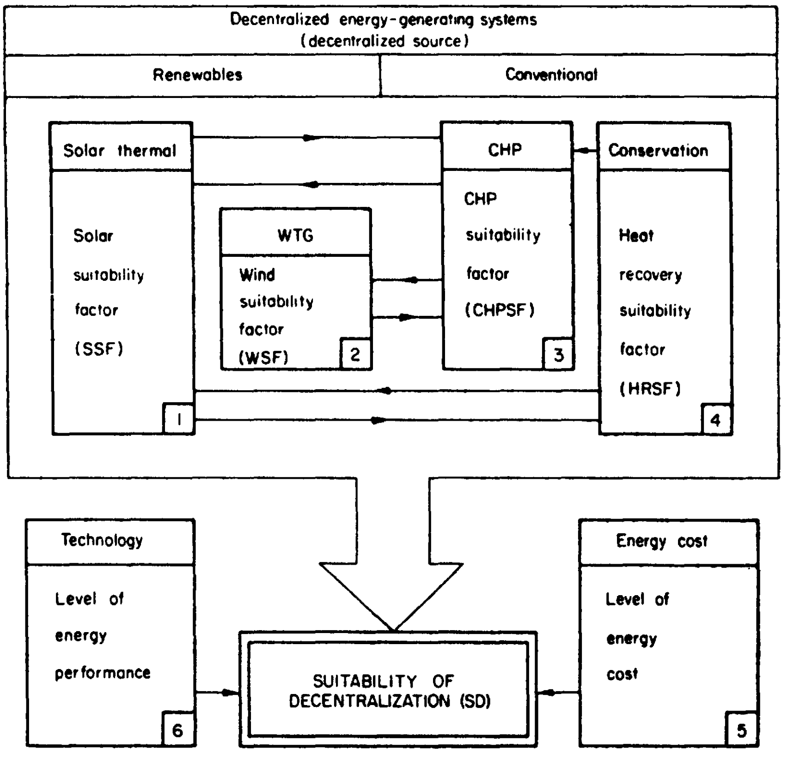


Figure 4. Assessment System for the Suitability of some Decentralised Energy Supply Systems.

In this approach suitability factors are assessed (on a scale ranging from 0 to 100), followed by weighting the decentralised sources by their thermodynamic contribution relative to the demand of a specific user segment. Similarly, a heat recovery suitability factor is estimated. In this way, it appeared to be possible to evaluate the suitability of decentralised energy sources for specific market segments. In any case, this methodology illustrates once more that decentralised energy supply is not a panacea for meeting all local energy demands, but has to be geared to specific circumstances of the market demand.

Having indicated now in a compact way the scope of energy planning at a decentralised or urban level, we will in subsequent sections briefly sketch some actual case studies and some energy technologies in the field of urban energy planning. Clearly, this sample is by no means meant to be exhaustive nor representative. It serves mainly for illustrative purposes.

6. Integrated Urban Energy and Environmental Planning: the Case of Berlin-Neukölln.

In this case study for a district of Berlin a set of instruments is developed for a policy-oriented way of processing data on energy-related and non-energy-related environmental pollution. In this way a comprehensive pollution emission-concentration model at a local scale can be developed. The structure of the model used is outlined in Figure 5 (see ARP et al., 1987).

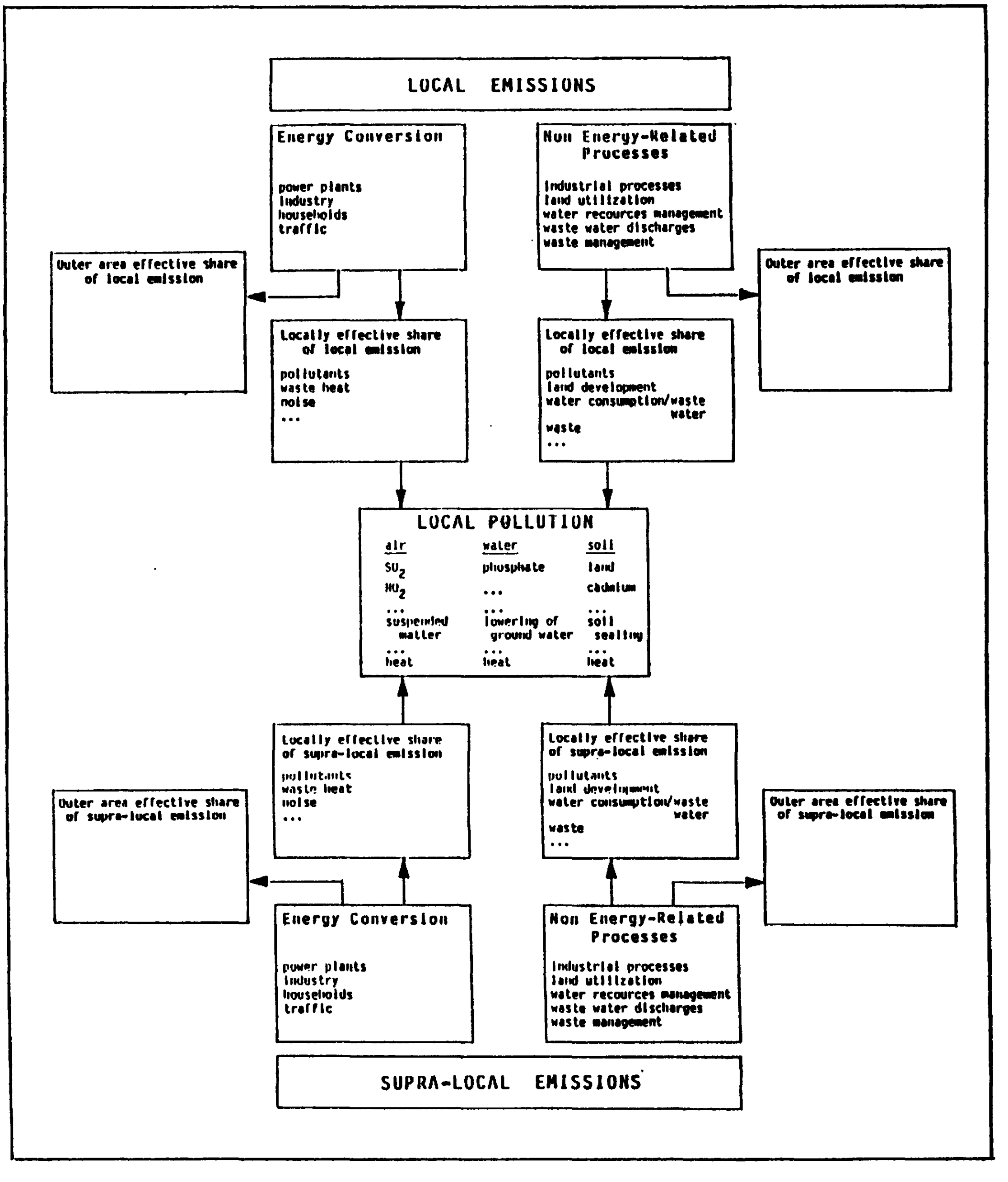


Figure 5. Structure of a Comprehensive Energy-environmental Planning Model.

The urban district under consideration comprises many industrial firms and households which contribute substantially to various kinds of pollution. Clearly, cross-border pollution is also an important source of environmental decay. The various linkages between the energy-related and non-energy-related pollutants were described by means of a 'pollution path analysis', among others for gaseous air pollutants, dustlike air pollutants, noise, process heat, waste water, surface water, solid waste, ground water, soil etc. A schematic representation of the successive steps undertaken in this analysis is contained in Figure 6 (see ARP et al., 1987).

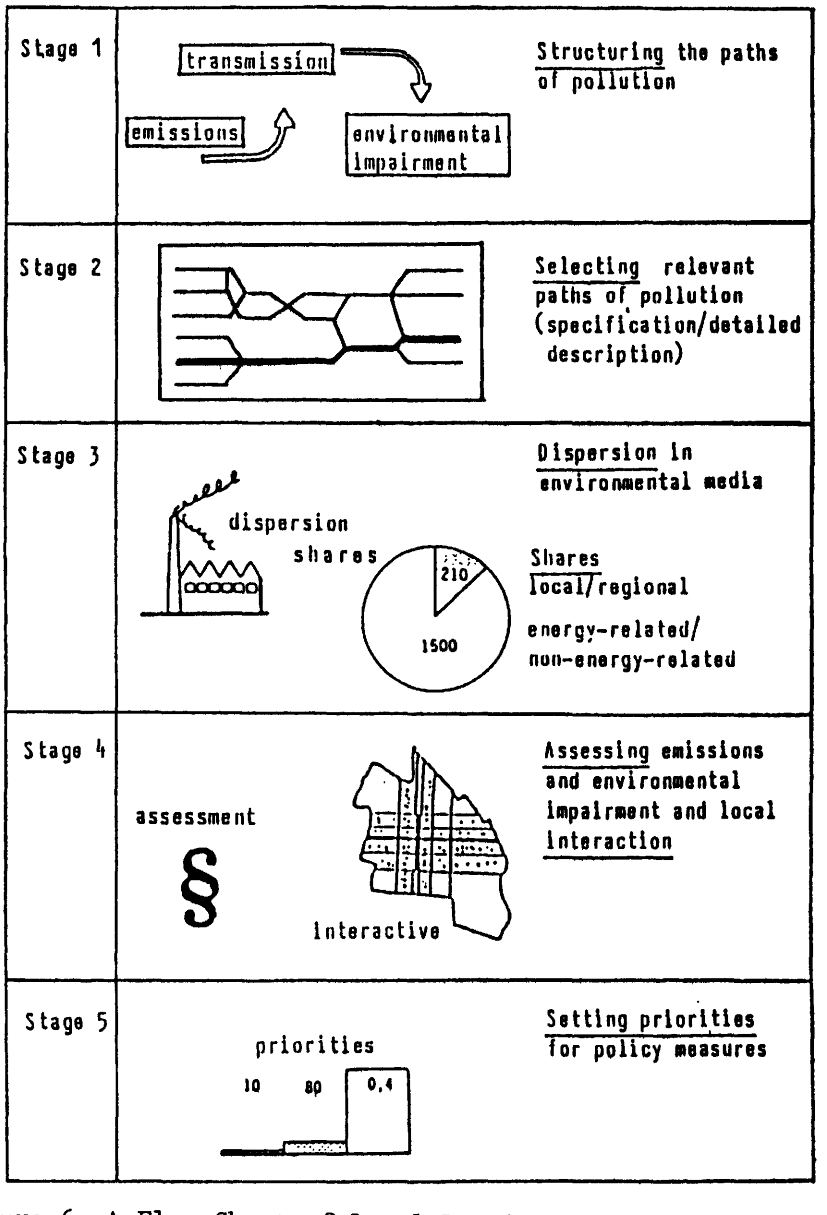


Figure 6. A Flow Chart of Local Level Energy-environmental Analysis.

This analysis has been used for actual energy-environmental planning in Berlin, among others by tracing the implications of different types of policy measures undertaken for the district concerned, in the area of both energy and environmental planning and of physical planning and housing policies.

7. A Dynamic Urban Energy Complex Analysis: the Case of Stockholm

This study commissioned by the Stockholm County Council was aimed at an integrated urban energy study, linking together the developments in new residential areas, housing developments, demography, industrial development, urban transportation, and the service sector (see Rogner, 1984). All stages of the energy chain at the urban level (from production/extraction, conversion, transport/transmission, storage, energy and energy-use conversion to the determination of energy services) had to be taken into consideration. The analysis started from the final part of the chain, viz. the energy services (e.g., the square meters heated in private homes and office buildings, the quantities of low and high temperature steam for commercial and industrial processes, or the ton - or passenger - kilometers in freight and passenger transportation). Next the total energy demand was traced (based on information on the age structure of the building stock, the existing and anticipated insulation standards, the efficiency of energy consuming equipment in industries, in the service and transport sectors as well as in private households). Various assumptions were made on the changes in behavioural and technology patterns (e.g., interfuel substitution, decentralised combustion of coal, small block heating plants, the energy distribution systems, environmental quality standards etc).

The Stockholm energy study focussed especially on the techno-economic evaluation of two principal energy alternatives, viz. the Forsmark district heat supply scenario and the Forsmark electricity/Mynäshamn complex scenario. Within this framework various energy supply options were analysed in greater detail. On the basis of a reference scenario describing the current energy infrastructure of Stockholm (see Figure 7, derived from Rogner, 1984) various sensitivity analyses were carried out.

The results were meaningful in that they pointed out the relevance of price measures, housing insulation, district heating, substitution of electricity based heating for oil-fired furnaces, co-generation and load management.

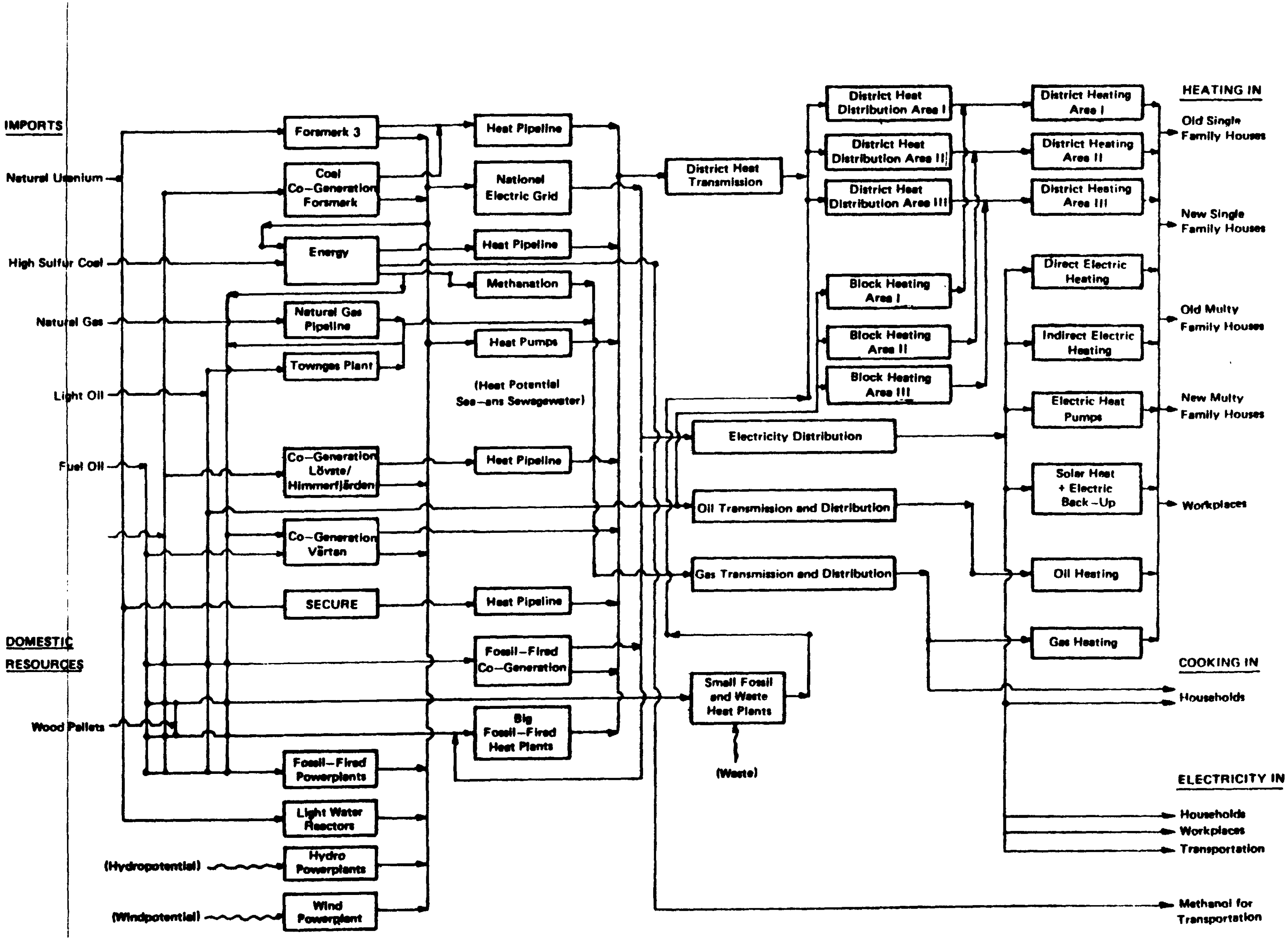


Figure 7. A schematic representation of the energy system of Stockholm County.

8. Urban District Heating

District heating refers to any energy system where heat resulting from another source (e.g., electricity generation, combustion of fossil fuels) is distributed to the domestic sector for heating purposes. By using waste heat the same amount of final energy use could be reached with less primary energy and at lower environmental costs. Clearly, the capital-intensive nature of district heating may make it rather costly, but in general this can be compensated by the decline in energy costs (cf. Wene, 1987). Of course, the economic feasibility of CHP (Combined Heat and Power) technologies depends also on the price level of fuel to be used by CHP companies.

The idea of CHP is relatively simple (see Rüdig, 1986). The heat waste in thermal power stations is very high (generally about 60%). CHP technology consists basically of tapping the steam when it leaves the steam turbine, leading the steam through a heat exchanger and thus heating water that can be provided to households or industries via a network of pipes forming a district heating system.

This technology as such is already fairly old. It was used already in the late 1880s in the USA and Germany, whilst nowadays it can be found in many countries, such as the USSR, Scandinavia, Austria and the Netherlands. Figure 8 (derived from Rüdig, 1986) gives a brief overview of the potential of district heating in various countries.

The energy savings from district heating are in general rather significant. According to Rüdig (1986), there is a long-term saving potential of 26.34 to 38.87 mtoe/year in the EEC as a whole. This impressive amount however, has not yet been achieved, although this would technically certainly be feasible. The central problem is however not technical but social; there is a wide variety of economic, behavioural, organisational and political obstacles to the adoption of such energy conservation technologies. It turns out that in many countries especially the organisation of the energy utilities is detrimental to the broad penetration of district heating. Especially the centralised structure of the electricity supply industry in some countries often impedes a wide spread adoption of CHP technologies. The problem is that district heating systems are mainly operated by municipal electricity companies, so that the large centralised electricity companies regarded CHP as a threat and were not eager to cooperate. Thus the divergence of interests at an institutional level has sometimes reduced the penetration speed of district heating. Moreover in existing residential areas there is often already a fully fledged network for the provision of natural gas (or in some cases like in France, electricity). Switching to a new heat supply system in such areas would imply very substantial depreciation costs with regard to the replaced network as well as the dwelling heating systems. Therefore the introduction of district heating has far better opportunities in new residential areas or in older residential areas that will be reconstructed.

In addition to the above mentioned barriers existing tariff schemes are able to create a (sometimes artificially) unattractive financial context for the development of district heating systems.

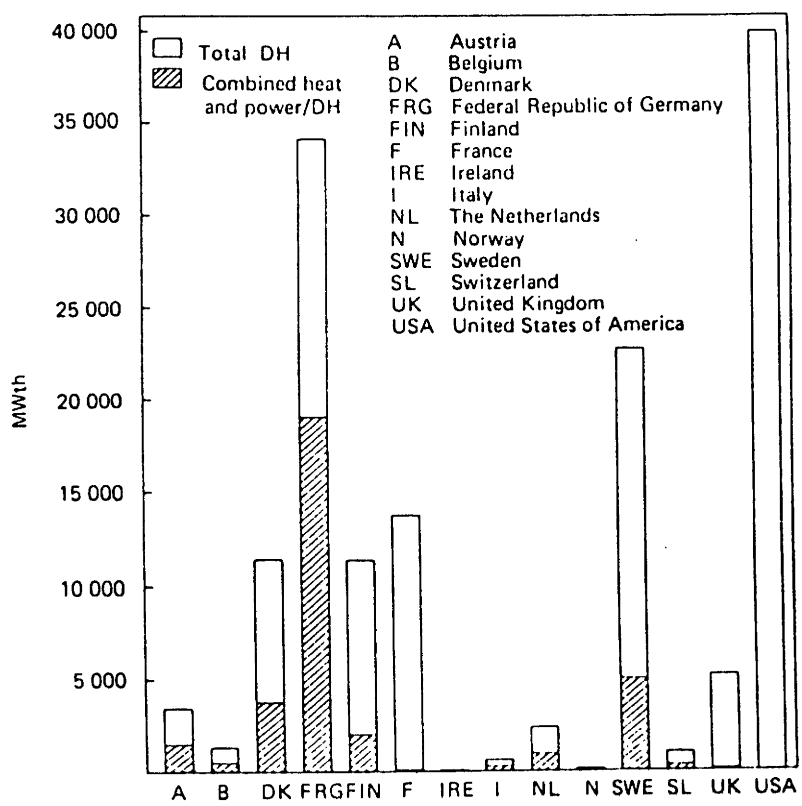


Figure 8. Penetration of the Potential of District Heating (DH) in Various Countries.

9. Industrial Cogeneration

The CHP technology described above can also be used for industrial purposes. In fact, urban areas have usually also a fairly dense industrialised pattern and it is no surprise that the use of waste heat for industrial purposes has gained much popularity. According to Verbruggen and Buyse (1986), cogeneration is a case of economies of scope where the costs of generating outputs, i.e., electricity and heat, in a combined way is lower than the costs of generating outputs separately. Also in the field of industrial cogeneration it has to be realised that such systems are operating on a limited heat market and a broad and strong power market, so that competition between these two systems may be detrimental to cogeneration, unless there are evident cost advantages. Industrial cogeneration can however, also take place within the industrial plant or between industrial plants, so that a private organisation of CHP systems is easier to establish.

In general, a cooperation between utility companies and decentralised energy supply systems is most advantageous. In a study by Becht and Zijlstra (1985) an extensive analysis has been made of the potential of such systems for the densely populated province of South-Holland in the Netherlands. By using different scenarios (e.g., regarding the share of coal in electricity production, institutional reorganisations, price level of oil etc.), the authors conclude that a significant part (approx. 20 percent) of the energy demand in the area concerned can be met by means of CHP systems. Especially the industrial energy demand in the Botlek area near Rotterdam could benefit from the application of cogeneration, especially because in this area cogeneration has already found an extensive application (mainly in the oil refinery and chemical industry). The authors conclude also that the emission of pollution (notably SO_2 and NO_x, as well as thermal water pollution) will considerably decline. Finally, the authors come to the conclusion that the success of cogeneration will be determined to a large extent by institutional rearrangements between the large public utility companies and the decentralised cogeneration units.

A special type of industrial cogeneration - not based on CHP systems - may be a system where urban solid waste is centrally collected and burnt whilst the resulting waste heat may be delivered back for industrial purposes or used for electricity generation. Such recycling systems have gained much popularity in recent years, especially in larger cities (e.g. Rotterdam, Amsterdam). Altogether there are apparently in the area of urban energy and environmental management various possibilities for more efficient and clean technologies which would have to be explored in greater detail.

10. Conservation and Load Management Programmes

In recent years an increased interest in conservation and load management programmes of utility companies has emerged. Efficient load management may be very cost effective, especially because the planning of peak load capacity is very expensive. In order to avoid average over capacity and to spread congestion in demand more evenly, conservation and load management programmes may be a very appropriate vehicle. Such programmes depend of course on time scheduling of activities in both the industrial and the household sector. In Perrels and Nijkamp (1988) an operational model for load management in the Netherlands has been developed. Clearly, effective load management requires detailed insight into the allocation of time of consumers and producers, and into ways of influencing such patterns (e.g., by means of price policies). Such information may be based on individual survey data, energy audits, electricity billing data etc. An example of the structure of an energy load management study can be found in Figure 9, derived from Hirst (1987).

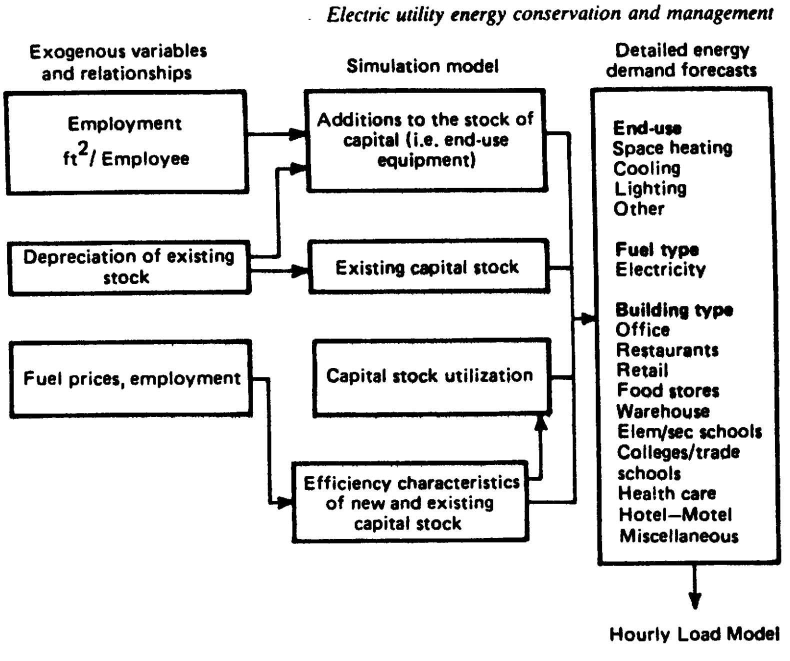


Figure 9. Schematic Diagram of Disaggregated Commercial Energy End-Use Forecasting Model.

A remarkable success with regard to load management in households and greenhouses has been achieved in the Westland area in the Netherlands. The (voluntary) installation of direct control devices on washing machines and growth stimulating illumination in greenhouses had a significant impact on the reduction of peak loads. The combination of a customer friendly approach with a rate reduction created an easy acceptance among households and greenhouse farmers (see van Oortmarssen, 1987; Schieke, 1987). Furthermore, a lot of research on load management has been carried out in the U.S.A. (see inter alia, Sexton et.al., 1987; Train et al., 1987).

It is evident that such energy conservation and load management programmes require very detailed demand forecasting models as well as detailed insight into alternative regulatory treatments of such programmes by public utility companies. Nevertheless the economic benefits of such programmes are likely to be very high, so that further analysis of the potential of such programmes in urban areas is certainly an important research issue.

11. Institutional Aspects

It has been mentioned several times already in the preceding sections that - besides economic and technical considerations - also institutional aspects are of great importance for the success of urban energy planning. Public administrations entrusted with energy planning, regional/urban planning and environmental management are part of complex policy institutions with segmented competences, competing budgets and conflicting objectives. Especially in a decentralised energy supply system the number of actors and interested parties (including the private sector) is increasing. It is plausible to assume that various types of urban energy planning will incorporate also forms of public-private partnership. Apart from competence, also budgetary implications are important here.

In many European countries we observe nowadays an increasing interest in third-party financing. This financial mechanism may be a useful vehicle for ensuring the financial funds needed to accomplish the huge investments in the energy sector that are necessary in order to achieve a further drastic increase in energy efficiency. In a recent issue of 'Energy in Europe' (September 1988, no. 11), published by the Commission of the European Communities, an extensive article has been devoted to third-party financing. From this article we quote the following part (pp. 49/50):

What is third-party financing?

Several novel financial mechanisms have been developed in various countries to accelerate energy efficiency investments. Each type of financing uses different mechanisms, involves various technologies, and can involve more than two participants at the contractual level.

Innovative vendor financing essentially consists of energy equipment vendors either financing the purchase of their equipment in exchange for a share of future energy cost savings, or underwriting the cost for the purchaser by contractually guaranteeing a level of savings. It naturally tends to be focused on the one technology or equipment type offered by the vendor. This method of financing energy-saving investments is already established in several Member States. Energy service company financing or third-party financing is however still little used in the Community. This type of approach consists of an independent energy service company identifying energy-saving investments and providing the client with the finance (and advice) necessary to carry out the investment in exchange for a share of the energy costs saved.

The Commission believes that third-party financing is probably the most promising mechanism for the European Community to mobilize the large amounts of private capital required to carry out discrete energy efficiency investments. This is an application case for the financial engineering approach adopted by the Commission.

As has been explained, this provision of private capital is accomplished by means of an energy service company (ESCO) borrowing from private sources the finance for energy-saving investments and using part of the resulting cost savings to pay off the loan. The energy savings are, therefore, viewed as a stream of income for the ESCO which is, therefore, central to the successful operation of the mechanism: an ESCO must provide a combination of engineering, financial and marketing skills.

The necessary steps to establish a third-party financing investment are outlined in Annex 1. The ESCO carries out a preliminary energy audit to estimate the likely economic level of energy savings. A proposal is then made to the facility owner which outlines a programme for establishing and accomplishing these energy savings. A contract is negotiated, and an energy baseline or average consumption pattern is ascertained. The ESCO then carries out a detailed energy audit, decides what is necessary and installs equipment aimed at accomplishing the potential energy savings. The facility owner and the ESCO share the financial benefit from energy savings made during the term of the contract.

Third-party financing therefore has the significant advantage that the facility owner does not have to provide funds for the conservation measure. He can still make other investments while starting to reap the benefits of the energy saving. Neither does the facility owner have to determine which equipment is most appropriate. The ESCO bears all the risk of energy savings not being achieved. It is usual to arrange that the facility owner owns the equipment at the end of the contract, which can vary from 2 to 10 years' duration.

The experience to date with third-party financing

Third-party financing was originally developed in the United States and Canada and much of the operational experience has come from there. The market for third-party financing in the United States has been developing rapidly. By 1984, the last year for which disaggregated data is available, there were about 150 companies offering 'energy services' and energy-saving investments made through these companies resulted in about USD 350 M being invested.

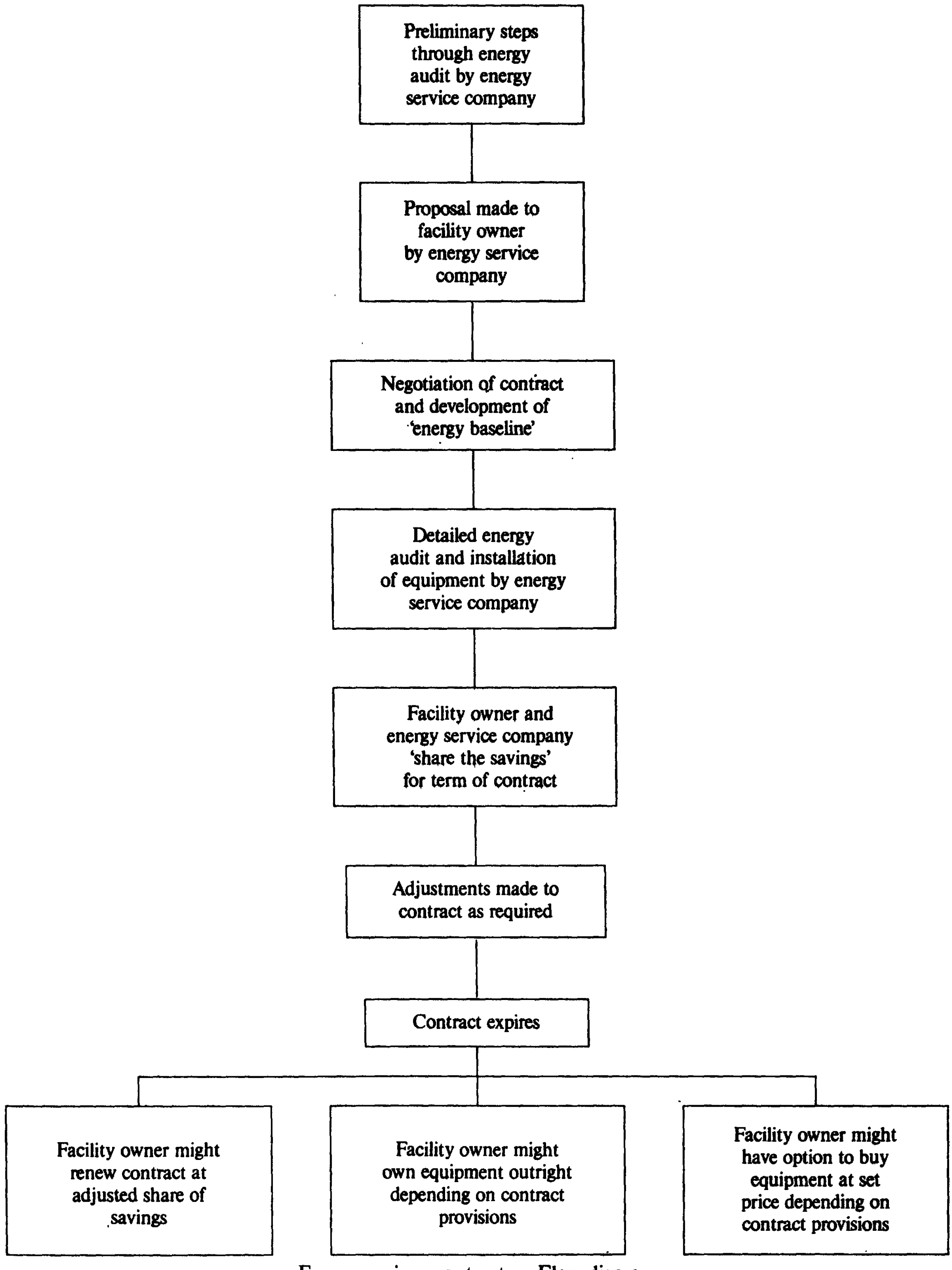
One of the factors which has assisted the growth of the 'energy services' market in the US has been the active role played by government at federal, State and local levels. The active participation of government institutions has led to a situation where by 1985 energy efficiency investments in public-sector buildings accounted for 50% of all third-party financing compared to 20% in 1983. At federal level, the Government has, through its various departments promoted the use of third-party financing in making energy-saving investments in government buildings. The Federal Energy Management Programme has set up a clearing-house on third-party financing, in order to assist government building managers to avail themselves of the technique. Similar arrangements have been made at State level and with many local authorities.

Since the inception of the third-party financing technique in the US, many types of organization have started to provide third-party financing services. They include engineering consultants, engineering firms, subsidiaries of gas and electricity utilities, and in some cases local governments themselves.

In Europe, the concept of third-party financing has been much slower to develop. A study carried out for the Commission in 1985 and published in 1986 found that the technique was not widely known in Europe but estimated the industrial sector market in the Community for third-party financing at 44 000 MECU and the corresponding building sector market at 42 000 MECU. These estimates were established by considering only those energy efficiency investments with payback periods of less than three years and investment values over 60 000 ECU. The achievement of these investments would have a major impact on the attaining of the 1995 energy efficiency objective.

There are also various barriers to third-party financing. Examples are: complexity of financing contracts, lack of European experience in third-party financing, an insufficient number of ESCOs to develop the market, legislative or budgetary constraints in the public sector, and lack of interest from the side of energy utilities.

Annex 1



Energy savings contract — Flow diagram

12. **Methods**

It is evident that a diversity of analytical methods and techniques may be used in urban energy planning. We will only mention here a selected and illustrative set of meaningful tools (see also Guldmann, 1983, 1984, 1985, InnoTec, 1986, Kärkäinen et al., 1982, Rath-Nagel, 1987, and Wene, 1987).

- (computerised) urban energy information systems; such systems may be based on detailed urban energy audits and can be used as monitoring systems for urban energy management;
- detailed urban balances or energy flow models, which also provide information on environmental implications of energy use;
- formal mathematical, econometric or simulation models (e.g., based on input-output analysis or other accounting frameworks) in order to make urban energy forecasts;
- (computerised) cartographic mapping procedures in order to visualise the spatial urban distribution of various types of energy production distribution and consumption;
- evaluation models for both utility companies and public agencies in order to assess the social costs and benefits of alternative energy supply options in an urban setting (e.g., based on multi-criteria analysis, cost-effectiveness analysis, life-cycle cost-benefit analysis, etc).

Several of these methods have already been tested and applied at the regional level. It has become clear from previous experiences that such methods are extremely important tools for energy planning, although it has to be realised that energy planning is of such a complex and multi-faceted nature that all relevant aspects can never be incorporated in one - as such ingenious - method. Thus the limitations of scientific tools have to be kept in mind.

13. **Concluding Remarks**

The field of urban energy planning is a potentially promising direction which deserves further exploration on the basis of some illustrative demonstration projects and pilot studies. Special attention would have to be given to:

- institutional arrangements regarding urban energy planning;
- third-party financing schemes in an urban context;
- bottlenecks in urban district heating and cogeneration plans;
- longitudinal urban energy auditing and monitoring schemes;
- R&D efforts necessary for a mature urban energy planning;
- the relevance of urban energy planning as part of the flanking policies in the context of the Structural Funds of the European Community.

Altogether, there is much scope for a European Community initiative in the area of energy planning.

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2. ISSUES IN URBAN ENERGY PLANNING: THE GREEK CONTEXT

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1. Introduction

In all recent efforts in energy planning, efficiency appears as the focal point both at the level of energy systems design and at the scale of their implementation (e.g., national, regional, urban).

Up to date experience in this respect reveals a clear need for a certain overlapping in planning efforts at all levels of spatial disaggregation. This stems mainly from the diversified characteristics exhibited by the patterns of energy production, distribution and consumption as well as by the network structure features in the above spatial levels.

So far regional energy planning has focused attention on new directions which have integrated issues of environmental decay stemming from the energy production and consumption patterns as well as labour market implications which result from the development and the use of new energy systems.

The above achievements though leave certain issues at stake when it comes to the applications of energy planning at urban level, which call for further attention.

The nature of urban scale - given the degree of concentration in production and consumption activities; their environmental problems; the specific characteristics of their transport networks; the energy demand density per km^2; the industrial/residential mix etc. - calls for a new focus on urban energy planning which will allow for energy planning to become an integral part of an integrated national/regional/urban planning approach.

Questions which may arise concerning the appropriateness of the city for a decentralisation of energy planning can be explored in a multilevel/crosslevel approach as follows:

- What is the importance of urban, energy planning in the context of national networks (success and failure stories; see bottom-up, top-down approaches in this field).
- What is the significance of small scale/sectoral interventions at the urban level, in terms of both energy efficiency and environmental

impacts, when compared to the rest of the alternative solutions likely to be adopted in each area.

- How can these solutions be better integrated in the urban/regional planning context?
- If decentralisation of energy planning activities is to be considered, which are the tasks due to be attributed at the urban level? (See sectoral, scale, implementation of policies designed at the national/regional level in the context of urban management schemes, etc.).
- Which are the tasks likely to be involved in a decentralised urban energy planning scheme referring to policy-making on city specific problems?
- Which is the institutional framework likely to be suggested for the implementation of the above tasks?
- Which can be the relevant agencies at the urban level responsible both for the exploration of potential energy plans and systems (hardware question) to be adopted, as well as for the appropriateness of these systems in each particular urban context?
- Which are the most efficient methodological tools to be adopted for the solution of each of the above issues?

The focus of the second part of our paper will be to support the necessity for an urban energy planning approach in the context of a specific country, namely Greece.

2. The Greek Experience

The Greek experience so far exhibits a whole range of energy planning interventions at the urban level which at the stage of their implementation reveal a rather diversified pattern of performance, due to city specific conditions (see building regulations, urban structure, transportation pattern, population density, socioeconomic profile, cultural profile, organisational and management schemes, institutional framework, etc.).

The first part of this section will present an outline of the existing policies which have already been implemented in the energy planning sector in Greece together with the impacts related to the context of our discussion, while in the second part a discussion will follow on two cases (a success an a failure story) - of energy planning at the urban level.

2.1 State of the art of energy planning policies

Tables 1 and 2 are exhibiting a broad range of interventions implemented in the energy sector in Greece together with their energy consumption impacts, environmental impacts (urban and regional), as well as their economic impacts (direct and indirect).

2.2 National energy planning weakness in coping with city specific problems: the case of Thessaloniki

Energy planning efforts in Greece date back as far as 1950 with the founding of the Public Power Corporation (PPC) which had undertaken the monopoly of the generation, transmission and distribution of electricity in the country.

In the context of national energy planning in 1974 PPC introduced certain tariff policies in electricity (low electricity rates between 23.00 and 6.00) for smoothing out the electricity load curve of Greece.

The measure aimed at shifting a series of electricity consuming activities towards the low load night hours (e.g., water heating), but also introducing a number of new consuming activities towards the same time span (e.g., heat storage).

As Figure 1 shows, after a relatively prolongued adoption period, the measure started exhibiting certain partially positive results at the national level, since a considerable part of the low load hours had been progressively covered by electric heat storage.

The implementation of the above policy resulted in a rather diversified range of consumption patterns throughout the country. In the city of Thessaloniki for example - which was highly marked by a number of temporally segmented planning interventions both in its building regulations and housing market - the above measure had a notorious impact with rather adverse effects for the electricity network. Before the introduction of the measure most of the houses and blocks of flats of the city had not been equipped with a central-heating system and the people had tried to satisfy their heat needs by means of individual diesel heaters and electric heat radiators. Electric heat storage heaters were hardly used at the time due to the absence of a comparative economic advantage relative to oil or conventional electric heating.

After the introduction of the low night tariff though, electric heat storage proved to be a very profitable means for space heating and thus it progressively became the major heating system in that northern Greek city, which moved electricity consumption to such levels, during the low rate

TABLE 1. Energy and environmental impacts of energy policies at the urban level: Greek context, 1988.

SECTOR	SMALL-SCALE ENERGY ACTIVITIES	MESO-SCALE ENERGY ACTIVITIES	ENERGY CONSUMPTION IMPACTS				ENVIRONMENTAL POLLUTION IMPACTS			
							URBAN			REGIONAL
			OIL	GAS	COAL	ELECTR	AIR	NOISE	VISUAL	AIR
1 RESIDENTIAL	SOLAR HEATERS		-			-	-		+	-
	BUILDING INSULATION		-				-			
	BOILER IMPROVEMENT		-				-			
	ELECTRIC HEATING		-			+	-			+
		DISTRICT HEATING	-				-			
		NATURAL GAS	-	+			-			
2 COMMERCE	BUILDING INSULATION		-			-	-			
	BOILER IMPROVEMENT		-				-			
	ELECTRIC HEATING		-			+	-			
		DISTRICT HEATING	-			-	-			
3 TOURISM	SOLAR HEATERS		-			-	-		+	-
	BUILDING INSULATION		-			-	-			
	ELECTRIC HEATING		-			+	-			+
	GOOD HOUSEKEEPING		-			-	-			-
		DISTRICT HEATING	-			-	-			
		NATURAL GAS	-	+			-			
4 PUBLIC	SOLAR HEATERS		-			-	-		+	-
	BUILDING INSULATION		-			-	-			
	BOILER IMPROVEMENT		-				-			
	ELECTRIC HEATING		-			+	-			+
	GOOD HOUSEKEEPING		-			-	-			
		DISTRICT HEATING	-			-	-			
		NATURAL GAS	-	+			-			
5 INDUSTRY	SOLAR HEATERS		-			-	-		+	-
	INSULATION		-			-	-			
	BOILER IMPROVEMENT		-				-			
	ELECTRIC HEATING		-			+	-			+
	ENERGY SAVING IN THE PROCESS		-		-	-	-			-
	GOOD HOUSEKEEPING		-		-	-	-			-
		NATURAL GAS	-	+			-			
		INDUSTRIAL COGENERATION	-				-			
		INDUSTRIAL ZONES/AREAS	-				-			
6 SME's	SOLAR HEATERS		-			-	-		+	-
	INSULATION		-			-	-			
	BOILER IMPROVEMENT		-				-			
	ELECTRIC HEATING		-			+	-			+
	ENERGY SAVING IN THE PROCESS		-			-	-			-
		DISTRICT HEATING	-			-	-			
		NATURAL GAS	-	+		-	-			
7 TRANSPORTATION	ENERGY SAVING VEHICLES		-				-	-		
	DIESEL MOTORS		+				+	+		
	GAS MOTORS		-	+			-			
	ELECTRIC MOTORS		-				-	-		
		NEW INFRASTRUCTURE	-				-	-	-	
		NEW TRANSPORT MODES	-				-	-	-	
8 CONSTRUCTION	ENERGY SAVING IN THE PROCESS		-				-			-
	ELECTRIC MOTORS		-			+	-	-		+
	DIESEL MOTORS		+				+	+		

NOTE: Plus sign denotes increases in energy consumption or in environmental pollution while minus sign denotes the opposite.

TABLE 2. Economic impacts and specific policy measures of energy planning at the urban level: Greek context, 1988.

SECTOR \ SCALE	SMALL-SCALE ENERGY ACTIVITIES	MESO-SCALE ENERGY ACTIVITIES	ECONOMIC IMPACT DIRECT URBAN	ECONOMIC IMPACT DIRECT REGIONAL	ECONOMIC IMPACT INDIRECT URBAN	ECONOMIC IMPACT INDIRECT REGIONAL	POLICY MEASURES SMALL-SCALE ACTIVITIES	POLICY MEASURES MESO-SCALE ACTIVITIES
1 RESIDENTIAL	SOLAR HEATERS		+		+	+	-TAX ALLOWANCE INCENTIVES	
	BUILDING INSULATION		+				-BUILDING INSULATION LAW	
	BOILER IMPROVEMENT				+		-EMISSION CONTROL DECREE	
	ELECTRIC HEATING						-TARIFF POLICY	
		DISTRICT HEATING	+		+			-TARIFF POLICY
		NATURAL GAS	+					-BUILDING CONSTRUCTION CODE
2 COMMERCE	BUILDING INSULATION		+				-BUILDING INSULATION LAW	
	BOILER IMPROVEMENT				+		-EMISSION CONTROL DECREE	
	ELECTRIC HEATING						-TARIFF POLICY	
		DISTRICT HEATING	+		+			-TARIFF POLICY
3 TOURISM	SOLAR HEATERS		+		+	+	-TAX ALLOWANCE INCENTIVES	
	BUILDING INSULATION		+				-BUILDING INSULATION LAW	
	ELECTRIC HEATING						-TARIFF POLICY	
	GOOD HOUSEKEEPING		+				-INFORMATION CAMPAIGN	
		DISTRICT HEATING	+		+			-TARIFF POLICY
		NATURAL GAS	+					-BUILDING CONSTRUCTION CODE
4 PUBLIC	SOLAR HEATERS		+		+	+	-TAX ALLOWANCE INCENTIVES	
	BUILDING INSULATION		+				-BUILDING INSULATION LAW	
	BOILER IMPROVEMENT				+		-EMISSION CONTROL DECREE	
	ELECTRIC HEATING						-TARIFF POLICY	
	GOOD HOUSEKEEPING		+				-INFORMATION CAMPAIGN	
		DISTRICT HEATING	+		+			-TARIFF POLICY
		NATURAL GAS	+					-BUILDING CONSTRUCTION CODE
5 INDUSTRY	SOLAR HEATERS		+		+	+	-TAX ALLOWANCE INCENTIVES	
	INSULATION		+		+		-BUILDING INSULATION CODE	
	BOILER IMPROVEMENT		+				-EMISSION CONTROL DECREE	
	ELECTRIC HEATING						-TARIFF POLICY	
	ENERGY SAVING IN THE PROCESS		+				-TRAINING	
	GOOD HOUSEKEEPING		+				-INFORMATION CAMPAIGN	
		NATURAL GAS	+					-TARIFF POLICY
		INDUSTRIAL COGENERATION	+		+	+		
		INDUSTRIAL ZONES/PARKS	+		+	+		-GOOD INFRASTRUCTURE
6 SME's	SOLAR HEATERS		+		+	+	-TAX ALLOWANCE INCENTIVES	
	INSULATION		+				-BUILDING INSULATION CODE	
	BOILER IMPROVEMENT		+		+		-EMISSION CONTROL DECREE	
	ELECTRIC HEATING						-TARIFF POLICY	
	ENERGY SAVING IN THE PROCESS		+				-TRAINING	
		DISTRICT HEATING	+		+			-TARIFF POLICY
		NATURAL GAS	+					-BUILDING CONSTRUCTION CODE
7 TRANSPORTATION	ENERGY SAVING VEHICLES		+		+			
	DIESEL MOTORS				+			
	GAS MOTORS				+			
	ELECTRIC MOTORS				+			
		NEW INFRASTRUCTURE	+		+			
		NEW TRANSPORT MODES			+	+		
8 CONSTRUCTION	ENERGY SAVING IN THE PROCESS		+		+		-INFORMATION CAMPAIGN	
	ELECTRIC MOTORS							
	DIESEL MOTORS							

NOTE : Plus sign denotes positive economic impacts and minus sign negative economic impacts

Figure 1: National grid

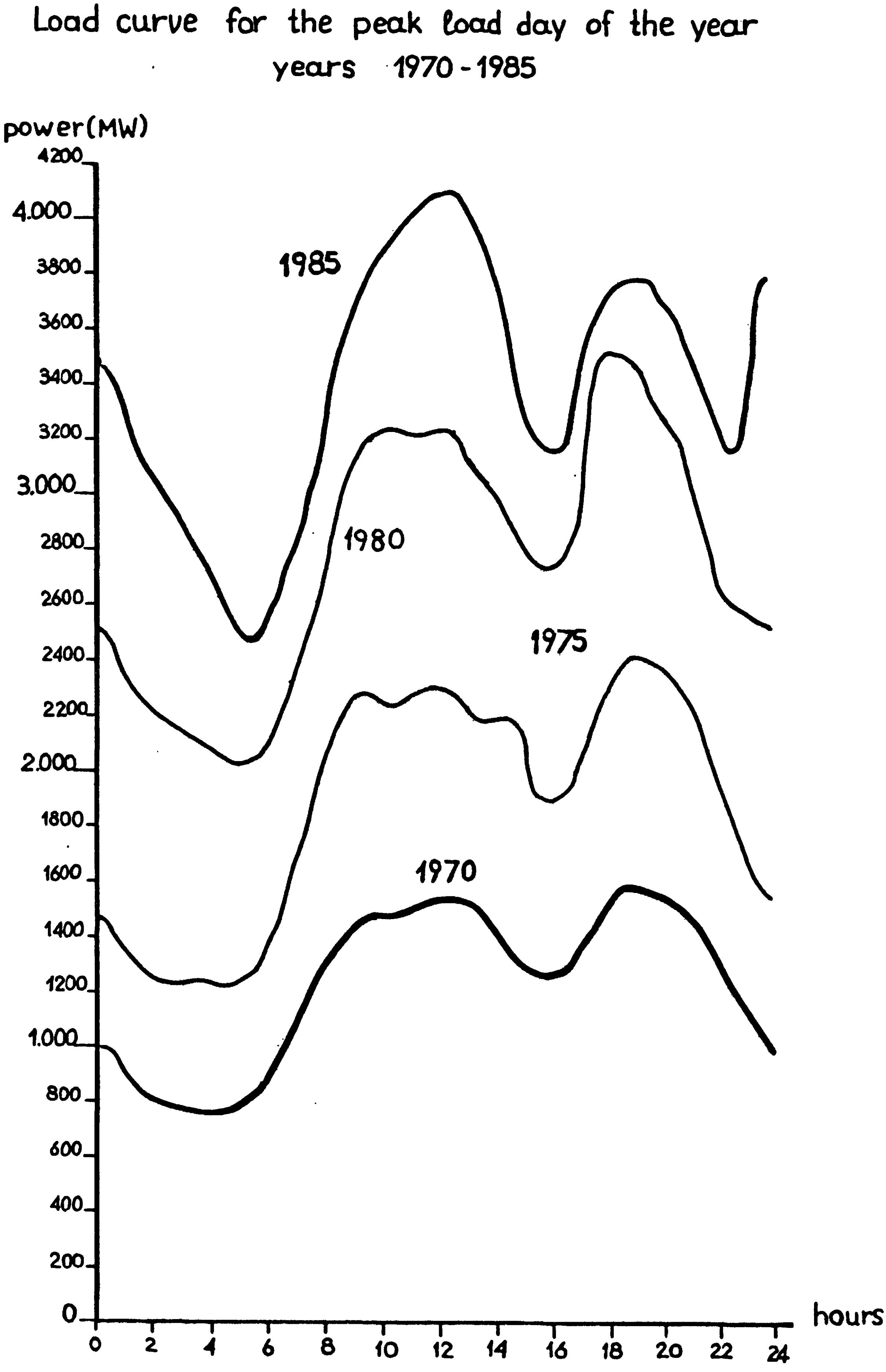
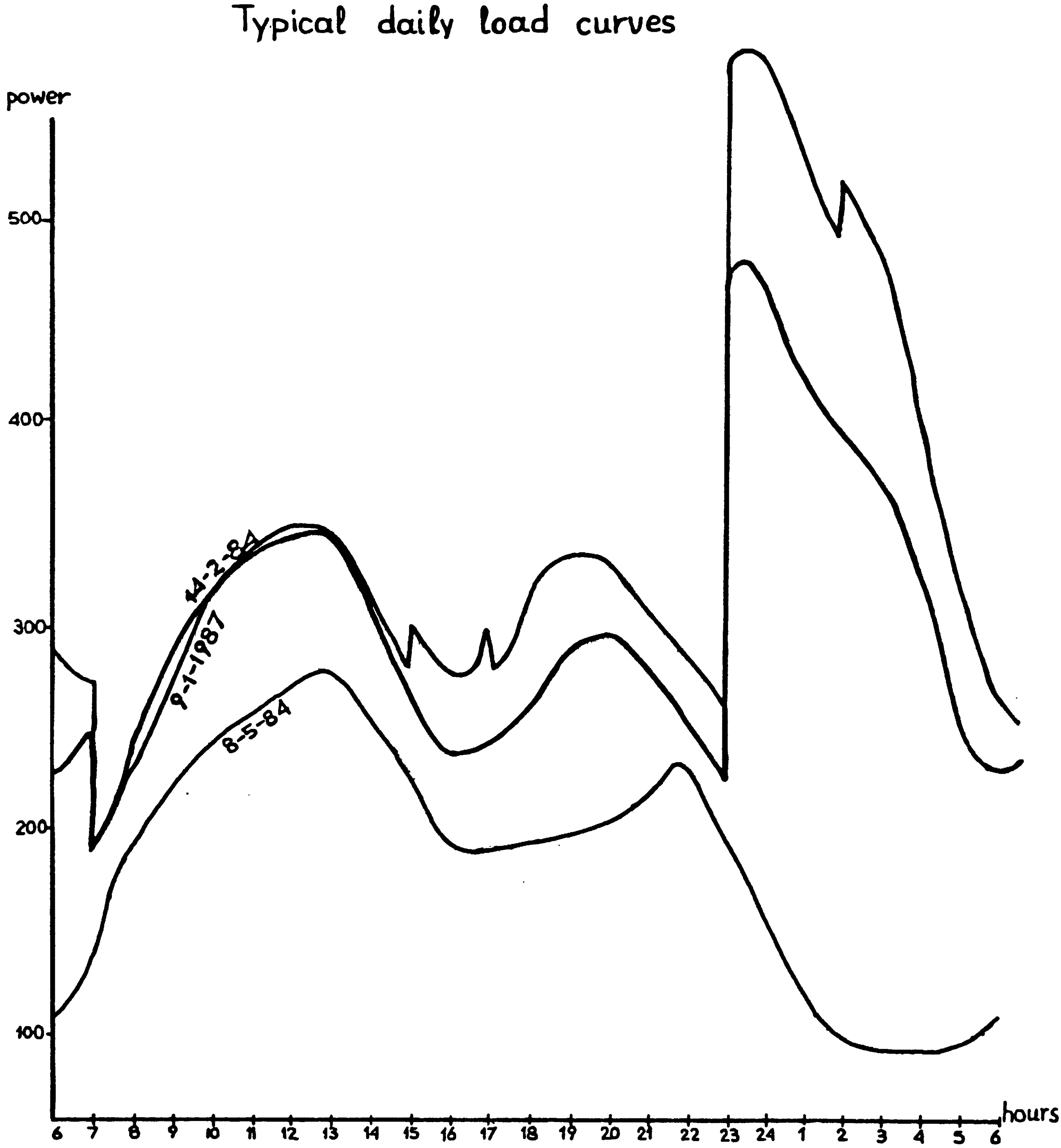


Figure 2: City of Thessaloniki grid



period, that currently midnight electricity demand is to become much higher than the day peak demand hours (Figure 2).

Moreover, the lack of planning at the micro level for Thessaloniki resulted into a heavy electricity demand only at the beginning of the low tariff period and a gradual decline as the heat storage heaters reached their full storage capacity.

In order to meet the all-increasing electricity load during the night, the Public Power corporation decided within the first five years since the implementation of the measure, to strengthen the low tension network of the city. As electric storage heaters kept on being installed in the city, however, the Company had to keep on investing in new low tension substations, medium tension substations and finally high tension substations, in order to meet the progressively higher energy demand of the city.

The case of Thessaloniki is an excelent example illustrating that, unless city specificities are given special consideration, potentially feasible and successful nation- or region-wide energy plans may fail or even result in adverse effects.

2.3 A success story in urban energy planning: the case of the solar settlement in Licovryssi of Athens

Low income housing projects in Greece date from World War II. The state policy on that area was limited to:

- The selection of an available area within an urban centre, close to an industrial or semi-industrial zone.
- The erection of a series of blocks of flats (usually of a standardised construction), and
- The allocation of the appartments to those of the local low income people fulfilling a series of requirements that are occasionally set by the government.

Up to 1979 low income housing construction was a routine subject for planners, since the only parameters that would vary from area to area were size and available funds to be allocated.

In 1979 though - following the second oil price crisis - the energy concern was introduced as a critical factor in low income housing projects.

The first energy concerned housing project of that kind incorporating energy aspects in Greece was designed by a group of Greek and German experts in the city of Athens, in a location called Lycovryssi (Figure 3 and 4).

The innovative aspect of the project aiming at an energy conscious and

FIGURE 3

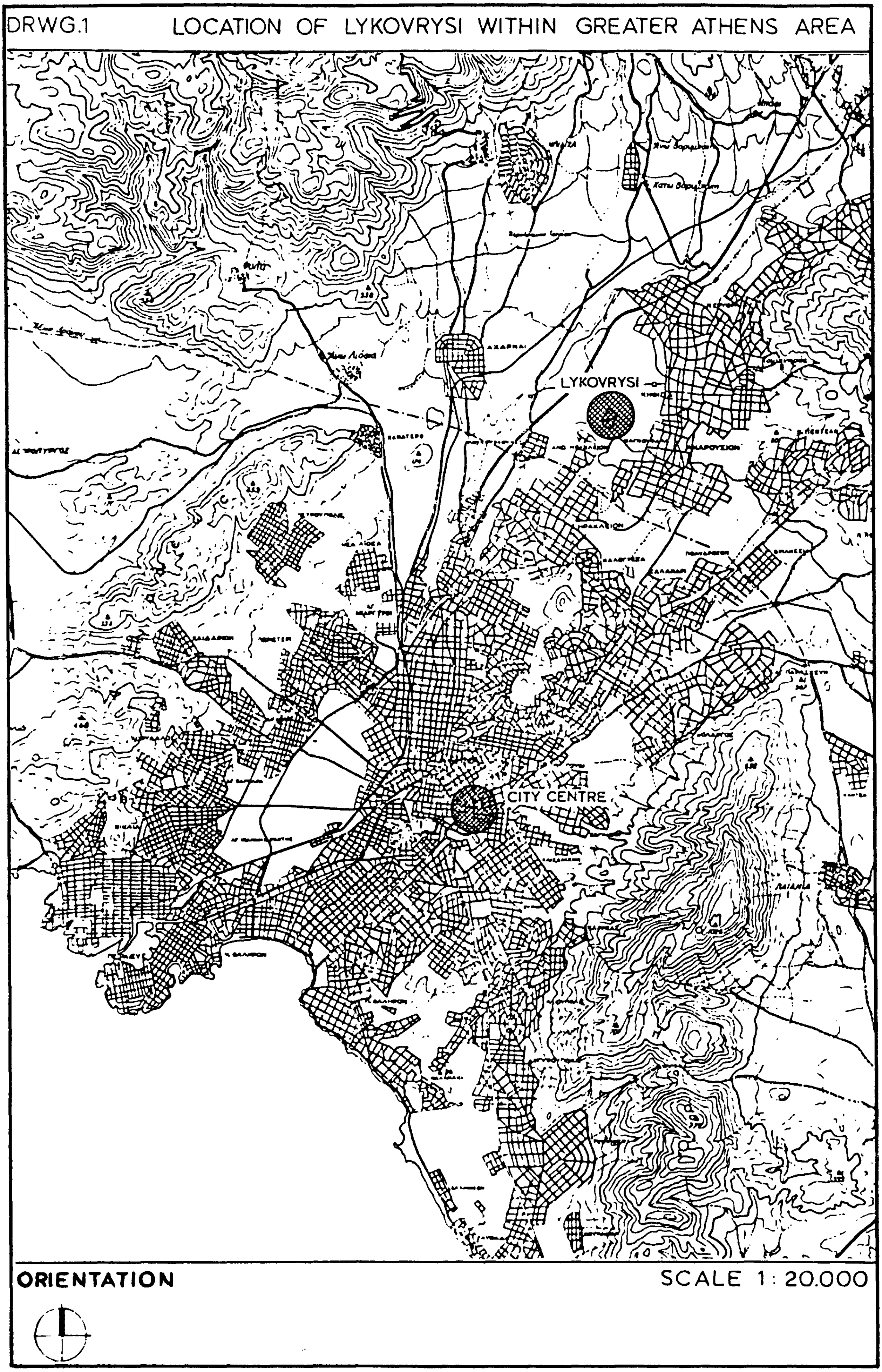
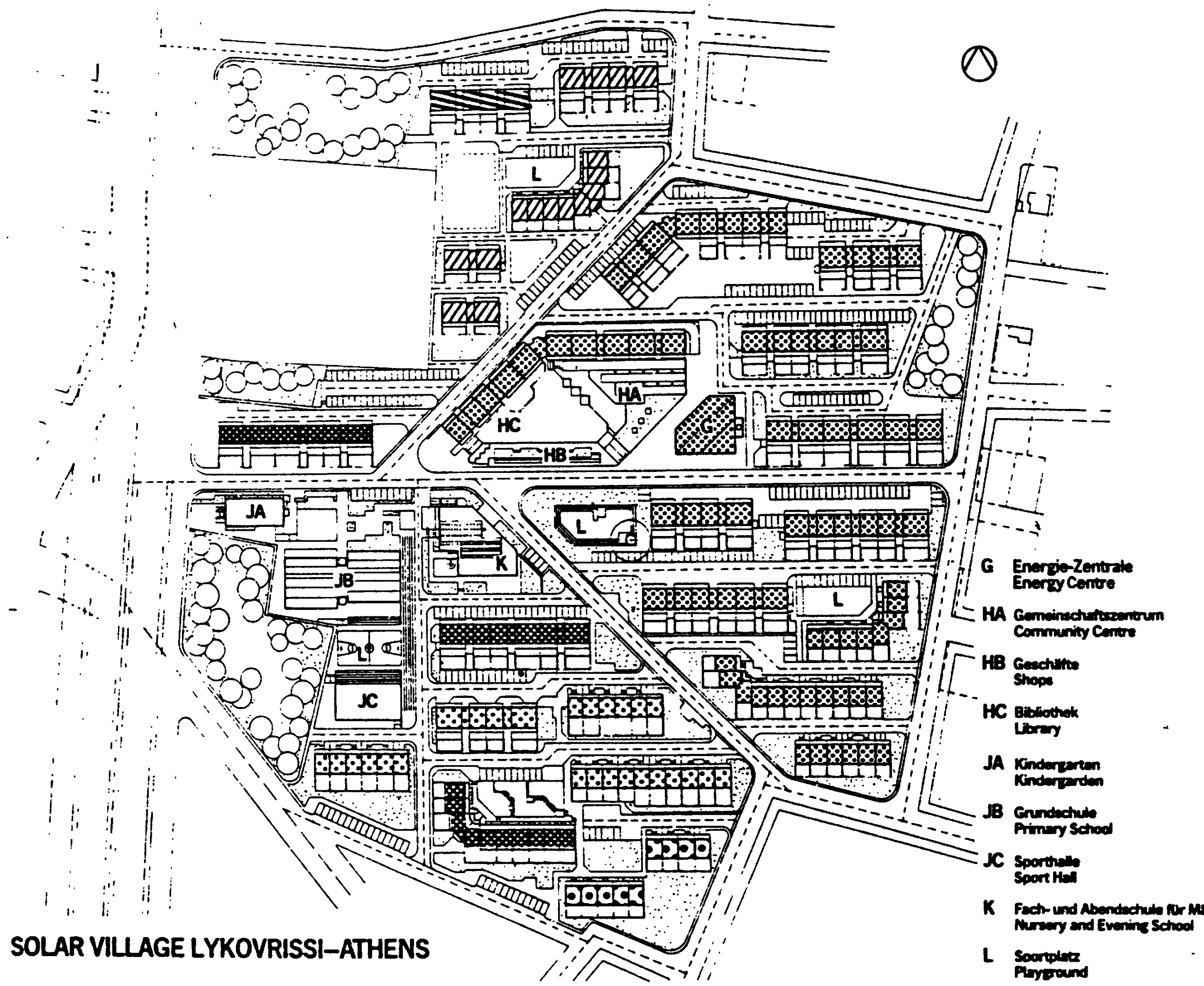

DRWG.1
LOCATION OF LYKOVRYSI WITHIN GREATER ATHENS AREA
LYKOVRYSI
CITY CENTRE
ORIENTATION
SCALE 1: 20.000

FIGURE 4



SOLAR VILLAGE LYKOVRISSI–ATHENS

Region A Zentrale Wärmepumpen mit Luft-/Wasser-Wärmetauscher Abwärme der Dieselmotoren und Wasserkollektoren
Central heat pump and waste heat from dieselengines and water collector

Region B Hochpassive Gebäude (Solararchitektur) und Wasserkollektoren
Highly-passive

Region C Luftkollektoren
Air collector

Region D Absorber – dezentrale elektr. Wärmepumpen (Strom von BHKW in der Zentrale)
Absorber-roof and electr. heat pump

Region E Wasserkollektoren mit Kurzzeitspeicher
Water collector

Region F Wasserkollektoren mit Jahresspeicher
Interseasonal storage

energy efficient community had been the adoption of an Energy System which would also take into account certain social and behavioural aspects of the future inhabitants. The utmost difficulty in the design and implementation of such a project had been the simulation of the likely impact of the technology package to be adopted by the Energy Senarios upon the future population of the settlement.

Energy consciousness in the above context should be transferred from the minds of the planners to the daily lifestyle of the future inhabitants. It was thought that the above effort would never succeed - despite the efficiency of the technical solutions - unless the above endeavour was based on an integrated interdisciplinary approach.

The main objectives on which the plan was based were the following:

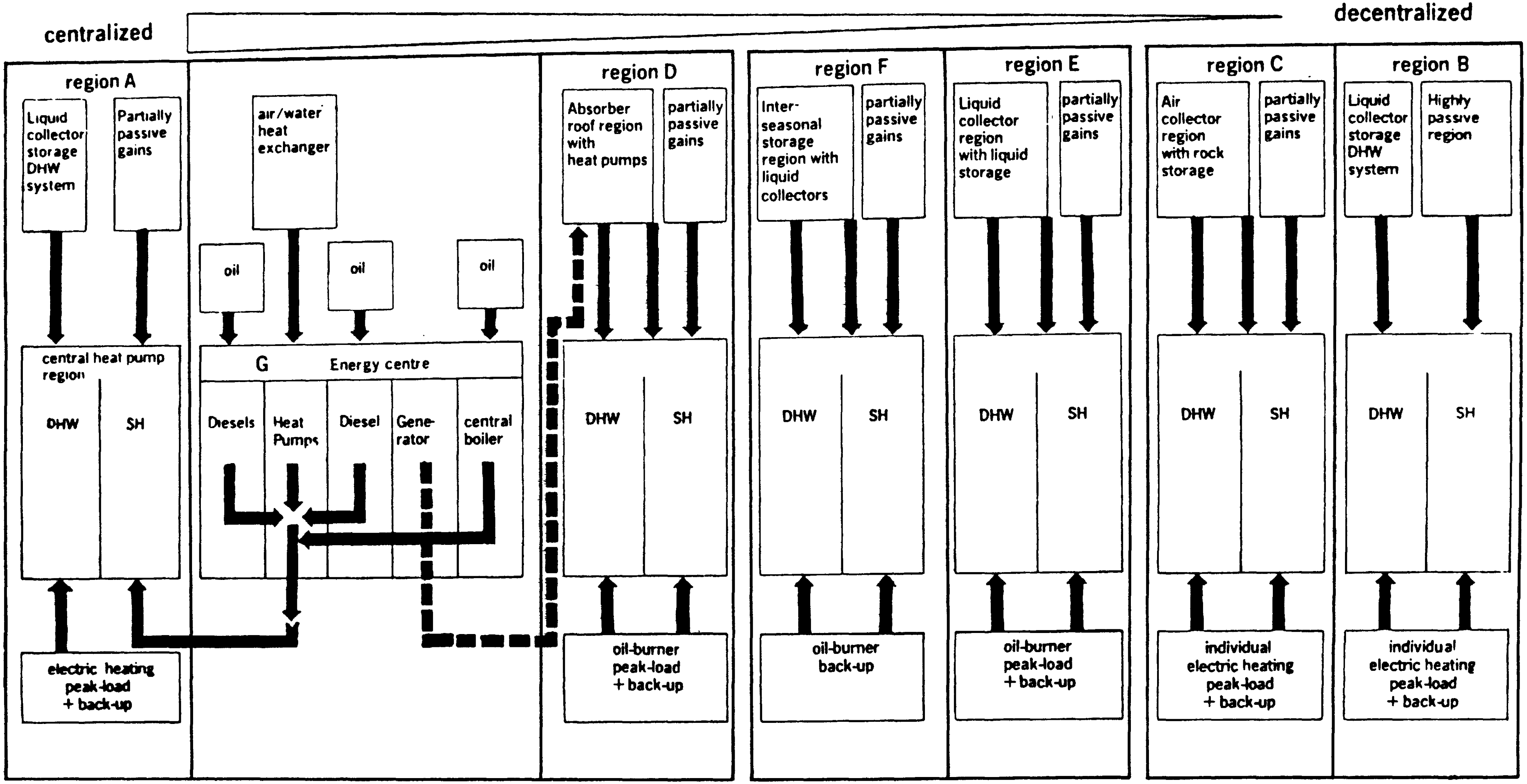
- The proposed scenario should be valid for further applications since it was intended to be also adopted in other low income public housing projects.
- Investment , operation and maintenance costs should be kept at a minimum level in order to be both competitive with market prices in the private sector but also to prove the validity of the new energy systems.
- The utilisation of the technologically advanced energy systems would require high reliability standards but also easy to handle operations from the part of the users, not overlooking the above limitations.
- Environmental consideration.
- Apart from the technical criteria special emphasis was placed upon aesthetic aspects (concensus by the inhabitants), construction standards but also aspects which would raise their living standards.

Perhaps one of the most important issues which planners were faced with was that of the acceptance by the inhabitants to share a common lifestyle including common recreation and utilities but also the advantages offered by energy consciousness itself. Frustration and isolation resulting from modern city life should be avoided at all costs in the solar village, where neighbourhood aspects, common share and community memberhsip had to be promoted instead, in parallel to the proposed energy solutions.

The above criteria were selected in such a way as to promote the idea of energy planning as an integral part of urban design. As Figure 5 shows, energy planning at the micro level allows for the precise specification of energy demand trends as well as the identification of the most appropriate methods for covering that demand.

The solar village project has already been completed, and is currently

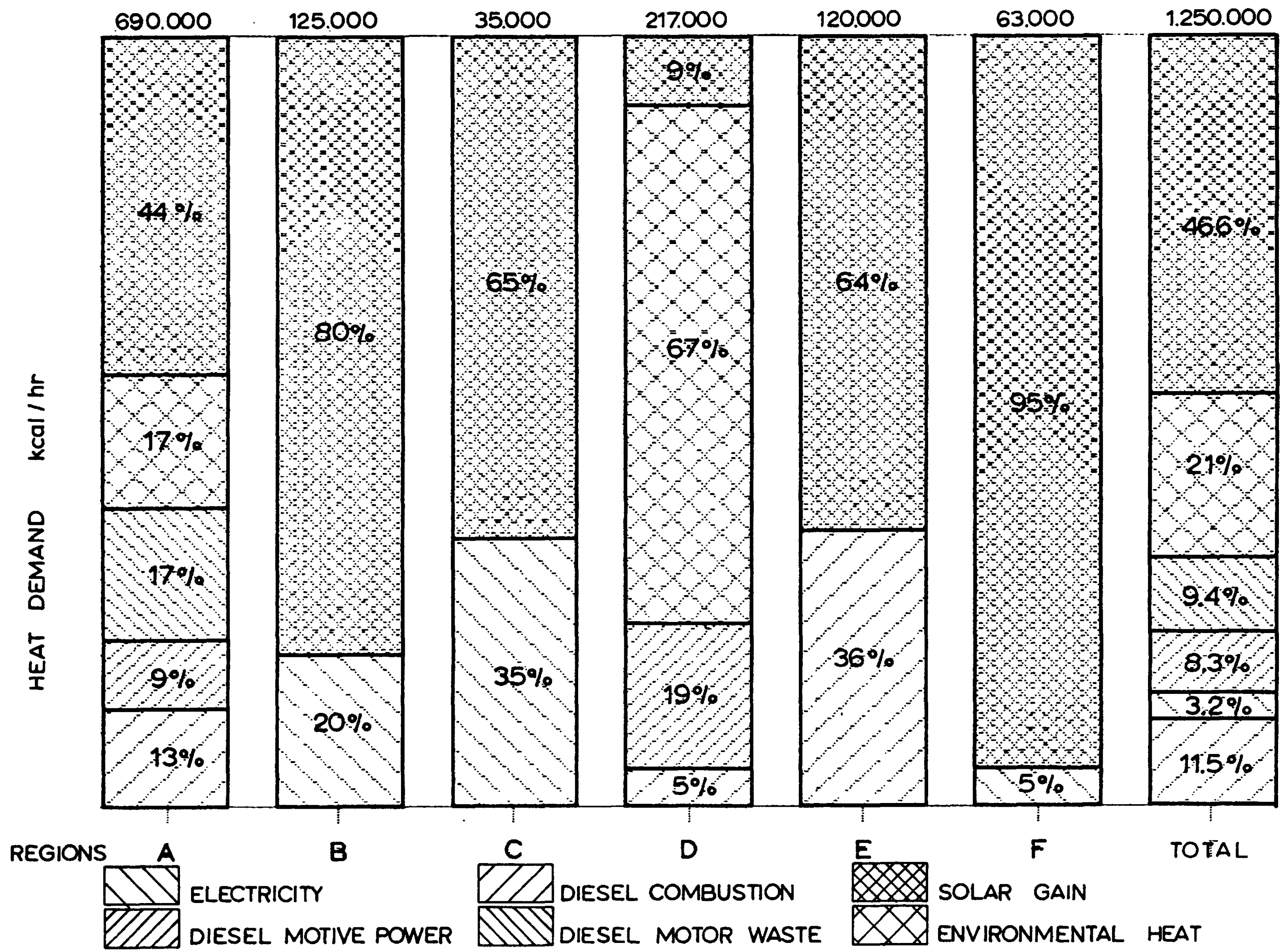
FIGURE 5



SOLAR VILLAGE LYKOVRISSI–ATHENS
block diagram regional breakdown with respect to energy sources

FIGURE 6

SOLAR VILLAGE REGIONS
HEAT ENERGY SATISFACTION
BY ENERGY FORM AND SYSTEM USED



about to be given to its future inhabitants. According to certain estimations, the overall conventional energy saving to be achieved in the total of the 435 flats in the village - with the use of solar systems, passive architecture, district heating and other combined energy systems-mounts up to an approximate average of 70 percent, ranging from 64 percent to 95 percent, depending on the specific techniques used in each of the six different design areas as can be seen in Figure 6.

Public but also private housing projects appear to be a promising sector for energy plans at the urban level. Given the acute problems that most of the urban centers in Europe are facing, an energy conscious policy could prove to be a rather effective tool for upgrading living standards in city level.

3. Conclusions

In the light of the above discussion it becomes of increasing necessity to focus energy planning on a local/urban scale through an integrated approach. This local/urban approach will allow for city-specific conditions to be explored and evaluated against alternative energy sources in order to reach the most efficient energy situation, while the integrated approach incorporating environmental implications will ensue for conflicting goals to be ameliorated with the impact on economic and human resources.

3. EXPERIENCES AND POSSIBILITIES IN LOCAL ENERGY PLANNING AND POLICY IN FLANDERS (BELGIUM)

A. Verbruggen

1. The Crucial Role of Local Energy Planning and Policy

We can consider two classes of arguments as the major ones for focusing research and policy attention on the local energy level. First, energy conservation and local resources (renewables) can only flourish under a strong local energy policy. This has to do with the decentralized nature of energy use and of renewable supplies. This point is not developed here (see the results of the EEC DG XVII Programme on Regional Energy Analysis and Energy Planning). Secondly, local energy authority is necessary when opening the energy markets at the European level. There seems to be some contradiction between the emphasis on the local level from one side and on the European level from the other side. In this chapter, we will try to show why local authority in energy is necessary for a good functioning of the European electricity and natural gas markets.

1.1 Energy markets

Energy as a commodity is traded in various markets. The rather different characteristics (storable vs. non-storable; batch vs. on-line transport; mass supply vs. customer made) of the several energy forms (oil; coal; gas; electricity; heat; saved energy) have given rise to the market variety. A rough alignment of the energy supply modes along an axis of geographically reducing scope, is shown in figure 1.

Dominant market level	↕	Energy supply mode
World		Oil
		Coal
Continental		
		Natural gas
National		
		Electricity
Regional		
Local		Heat distribution
		Renewables
No market		Energy conservation

Figure 1. Variety of energy supplies and of energy markets

Several geographical levels can be distinguished between the world market and the other extreme situation of no market at all (see Figure 1). Supply of oil and coal is traded primarily in a world market. In order to promote competition, artificial barriers to the world market must be lifted. The EEC has already taken many initiatives for a smooth transition from nationally protected oil and coal supplies to free competition.

Natural gas is traded on a continental market with important national accents. Electricity is mainly a national or regional business with supply exchanges and coordination at the European level.

Heat cannot be traded in geographically extended markets because of the high transportation costs (investments in networks, pumping costs, deterioration of the product). Heat markets are basically local developments.

Most of the applications of renewable energy are locally bound. Energy conservation is only available as an option where energy is used. It cannot be exchanged. However, the technologies of renewables and conservation move freely in an open market.

In the progress towards a unified European energy market in the coming years, most attention will be paid to the integration of the natural gas and electricity markets. The latter is of predominant interest, and will here be discussed more in detail.

1.2 The electricity market

Electricity is a flow-type of energy, requiring network links for its transmission. It cannot be stored directly. Storage requires expensive conversions to other forms of energy (chemical, mechanical, potential, ... energy). The two physical characteristics of electricity[1] make a simple trading as a commodity impossible.

In order to create a market, a transmission network has to be established. The extent of any market depends on the extent of the transmission network making exchanges between market parties feasible. With electricity, however, the access to the network is not free. The imposed limitations have two origins. Technically, the transmission network has to be controlled continuously for its equilibria between active and reactive power and between supply and demand. Institutionally, the transmission grids are mostly owned by monopolistic production companies controlling the entry of other producers.

The transmission grid is central in the functioning of the electricity supply industry. Thanks to the grid, one can benefit from economies of scale in generation, diversification, and specialisation of production units (e.g., base- and peak-load), merit-order operation of the system, high reliability at low reserve margins, etc. The interconnected transmission network is the real electricity market, and scholars in the field have focused on the possibilities of opening this market through "common carrier" or "broker" roles for the grid. We will not continue this discussion here but limit ourselves to a few observations.

Given the transmission network being the market place, the production branch can be defined as the supply side and the distribution branch as (part of) the demand side. The three basic types of market structure in electricity supply may be defined as:

- vertical integration;
- open market;
- intermediary solution.

They are shown in Figure 2.

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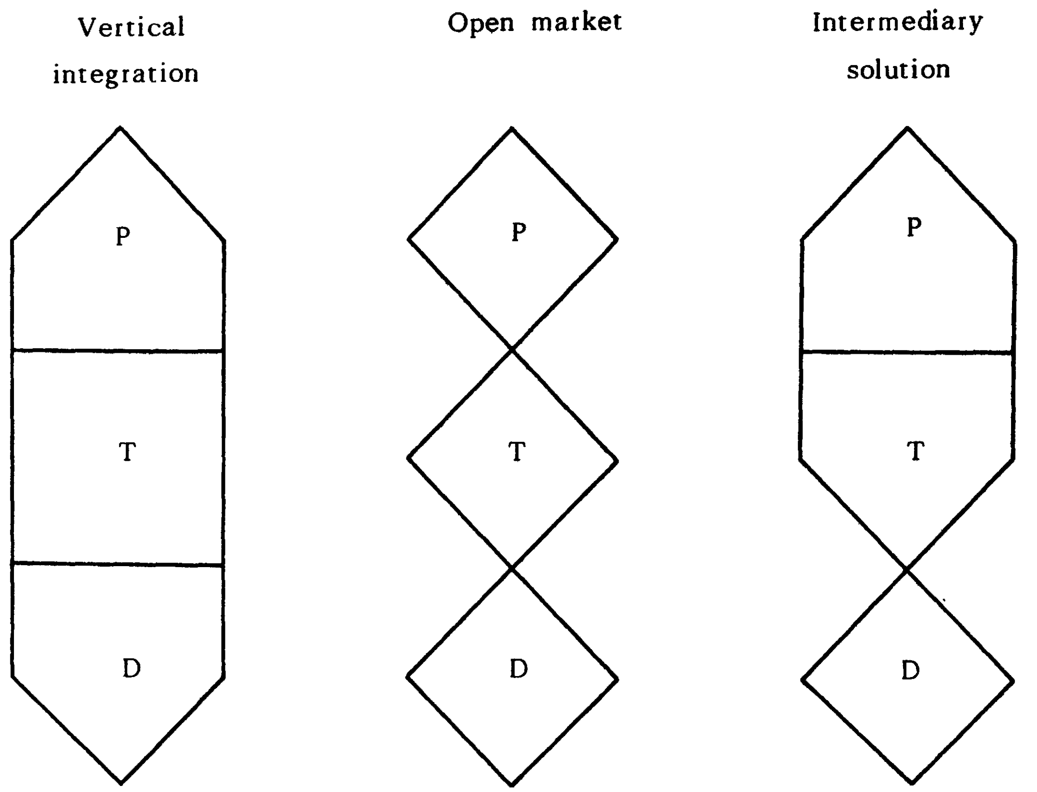
[1] Natural gas and heat have essentially the same characteristics. For both storage is feasible without conversions but also at a cost of capital investments and of energy losses.

Figure 2. Structure of the Electricity Provision



P = production
T = transmission
D = distribution

The vertical integration is well-known. Production, transmission and distribution are all owned and controlled by a single board (e.g., CEGB in UK; E.D.F. in France). Sometimes, the production companies do not own the distribution companies completely, but control their planning and working (e.g., Belgium). In the vertically integrated structures, large-scale generation of power and sales maximisation are emphasized. There is no longer a unified, open electricity market but there are numerous small markets where each customer is linked to the vertical column. Market segmentation is easy now, giving rise to price discrimination, cross-subsidies and monopoly profits. The opposite of the vertical column is the open market represented by the prismatic form in figure 2. The three activities, production, transmission and distribution, are separated. The transmission network plays the role of open market as a "common carrier" or as a "broker" between production (supply) and distribution (demand). Considering the technical difficulties of equilibrating the transmission network, the "broker" type of solution looks more plausible than the "common carrier" option.

Mainly because of the technical tasks of keeping the transmission grid in equilibrium, many observers have the opinion that production and transmission should not be divided in the first round of opening the power market. They prefer the intermediary solution shown in Figure 2. Electricity supply should consist of a supply side (production-transmission) and a demand side (distribution), both regulated in order to avoid abuse of monopoly power.

In this structure, the market mechanism should function to its fullest. Therefore, one should strive for a unified market by allowing all producers access to the transmission networks in the various regions or countries. Competition should be enhanced by increasing the number of (potential) producers and (potential) buyers. Competition crossing the national frontiers requires transparency in market parties, in prices and in cost structures. This means that competition in an integrated European electricity market is only feasible when the distribution activities in all member states are organised independently from the production/transmission activities. Transparency without this independency between structures is nearly impossible to attain.

Local authorities will fullfil a crucial role in setting up and organising independent distribution companies. The technical know-how and financial flows of the distribution activities will figure as the backbone of local energy planning and policy. In this way, there is a natural common interest between the goal of an integrated European electricity market and the goals of sustaining local energy planning and policy efforts.

1.3 The economic rationale

In the preceding section we stated that local energy initiative is a vital link in the mechanism of an integrated European market. Yet it has to be shown whether the proposed market structure is economically feasible, i.e., whether it will result in a better performance to supply electricity to the customers than for example the vertically integrated structure is achieving.

A better performance of a more competitive, unified European market depends on the advantages of the free market in general, and on an analysis of the cost structure of the electricity supply in particular.

From an economic point of view, economies of scale, density and scope are the basis for a rational organisation of activities. Figure 3 shows which economies are generally acknowledged to belong to the power production and to the power distribution activities.

Figure 3. Economies in power production and distribution and the resulting organisation structure

Activity	Economies of			Suggest the following organisation for the electricity provision
	scale	density	scope	
Production	yes	-	*	- regional, national or international - single product - private
Distribution	-	yes	yes	- local - multiproduct (horizontal integration) - public

* CHP (Combined Heat & Power) is the noteworthy exception.

In the electricity production, large-scale companies (at least 4000 MW capacity) are required to benefit from the economies of scale. Except for the cogeneration of heat and electricity, there are no economies of scope, nor of density. Single product, large-scale private companies are the most suitable organisations to guarantee technological progress and the least cost generation in a competitive market.

In distribution, it is not shown that the extension of the activities outside the boundaries of a naturally given service area (e.g., an urban agglomeration, a provincial city, ...) offers any economic benefits. Economies of density are the obvious basis of the natural monopoly situation. Economies of scope (besides electricity also covering natural gas, district heating, domestic refuse, street maintenance, etc.) are certainly present from the point of view to equilibrate the low-temperature heat market and to lower particular exploitation costs. It requires an efficient organisation to take full advantage of the scope position. As the optimal structure for distribution, locally bound, multiproduct, publicly owned or controlled companies are suggested.

The economic rationale behind the optimal organisation of electricity supply, supports the idea of local energy planning and policy initiatives.

2. Experiences in local Energy Planning in Flanders (Belgium)

2.1 SESO research in local energy planning up to 1987

In 1982, the Belgian Prime Minister's Science Policy Office funded a four year's study at SESO about Local Energy Planning. As in other countries, the idea of integrated local planning was the natural offspring from studies about district heating development in urban areas. SESO has been involved in such studies for the cities of Ghent and Louvain in Flanders (Belgium). Two major shortcomings of its district heating studies urged SESO to broaden its scope to an integrated approach. First, in estimating demand for heating, the conservation potential was underestimated. Second, the competition of district heating with existing or potential supply options was modelled inaccurately.

It was, and still is, our opinion that the conservation potential (demand reduction) should be investigated in a decentralised way, especially when opportunities for influencing it are considered. Also modelling the competition between energy networks asks for a detailed and local basis. In addition, it is at the particular consumption centers (households, factories, services) this demand for energy is met. Therefore, Local Energy

Planning is in the midst of any energy policy wanting to install market equilibria at low levels of energy consumption. The latter objective is set forward by most regional, national and supra-national energy authorities of the world.

In 1985, related research funds were supplied by the European Economic Community, D.G. XVII, in its programme on Regional Energy Analysis and Energy Planning. "The focal point of this work is clearly a determination of demand (where possible in the form of useful energy) and the opportunities for influencing it (through energy conservation and restructuring) and meeting it by means of energy indigenous to the region" (von Scholz, 1986). The EEC-task broadened the SESO-research to a regional scope because one of the main goals of the EEC was to obtain consistent energy balances for the Region of Flanders.

The SESO-research on regional energy balances and local energy planning slowed down in 1987. The ambitious working programme was replaced by more specific studies (on power expansion planning, solar energy, cogeneration, electricity tariffs, electricity distribution, etc.).

Through our contacts with energy companies, local representatives and national and regional governmental officials and politicians, we stay informed about the development of energy policy, in particular regarding local energy planning.

2.2 Experiences gathered by SESO

Because there is no clear-cut, standard methodology available to carry out local energy planning studies, one generally calls on a demonstration case study to generate methods and to test their applicability.

In selecting a reference community, the important impact of some features on the final success of the local planning study has to be considered. At least the following three aspects should be taken into account:

1. A community with some local energy experience should have priority. The existence of prior projects that can be expanded or remodelled are a guarantee of (at least some) success.
2. Public participation has to be active as a proof of an open-minded and positive attitude towards integrated planning. When the willingness to succeed is supplemented by the availability of skilled (and eventually experienced) staff at the planning departments of the local government, the necessary basis for a local energy plan is present.

3. To take off with local energy planning in a community, the availability of funds from outside the community plays a major role. At the local level, demands for money are too competitive to allow for planning projects with uncertain results that are difficult to quantify and to explain to the constituency.

Considering the above list of prerequisites, few (if any) Belgian communities offer bright opportunities as demonstration cases. One of the major lessons of our research effort points to the necessity of preparing the ground for local energy planning. Our effort should be devoted more at creating firm foundations for, and positive attitudes towards, local energy planning than at attempting full-scale planning studies. A well-organized marketing programme should promote the idea of local energy planning at the national, regional and local levels.

At the national (supra-national) level, a long-term commitment is necessary to overcome problems of initial funding and starting failures. More important than financial support is the creation of an institutional and regulatory environment allowing for the birth and growth of local energy experiments. In this field a long way has to be gone in Belgium.

At the local level, public authorities should be convinced that local energy planning belongs to their duties when taking care of the general welfare of the population. Two marketing approaches for this idea are recommended. One is to carry out small-size, representative and highly successful demonstration projects, and to advertise the results directly to the municipal boards. Along with this far-headed but narrow approach, a broad approach should call on each community individually. This can consist of a "personalized" report (drafted automatically from a software and database library), describing the energy situation in the community, including some general forecasts, and foreshadowing the possible direct and indirect benefits to the local community brought forth by a successful local energy plan. This type of report is not sufficient to base local energy planning upon but should open the minds of local authorities for local energy planning.

In the first phase of the research on local and regional energy planning, SESO had not the means, nor the insights, to organise and carry out the above working programme. There was some awareness that demonstration case studies were necessary, but this was more approached as the anvil for forging and calibrating a general methodology of overall use (it was found that this goal was ambitious and out of reach).

SESO did not succeed in developing a methodology of general use and in carrying a demonstration study through its implementation. Nevertheless, we could develop scientific instruments for analysing parts of the local energy plan (e.g., heat demand of residential buildings, heat distribution network planning, etc.). SESO was also asked as advisory expert group in crucial debates on the organisation of power distribution in particular communities (city of Ghent, community of Zelzate, communities in the Province of Brabant). Some major lessons we retained from this work are repeated here without proof.

In the debates about the selected organisational form of energy distribution in a community, no attention is devoted to energy policy issues. The idea of local energy planning is totally absent.

Safeguarding the interests of the population (energy consumers) against monopoly power was the basis for assigning the monopoly right to public representatives (the community boards). The communities do excercise their power very indirectly by the selection of a particular organisational form for the next 20 or 30 years. The predominant criterion for the selection is the amount of profits extracted from the distribution activities that flow towards the municipal board. These profits may be considered as energy excise tax income, avoiding the imposition of other community taxes[2].

When the primary goal is profit maximisation, one is a long way from welfare maximisation, and from energy conservation options, possibly lowering the earnings.

Excesses in monopoly power abuses by distribution companies are restrained by a system of national uniform tariffs (since 1975). Therefore, profit maximisation results from sales maximisation on the one hand, and from cost minimisation on the other hand. While the latter goal is beneficial to the community, the former is opposing the idea of local energy planning (with energy conservation and optimum market sharing between supply models, as its main instruments).

There is a tendency to organise larger distribution companies with tens of communities as members linked to one of the private companies. An important incentive for this concentration is the tariff structure for power purchased at the transmission network by the distribution utilities. The

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[2] The private gas & power companies involved in distribution point out these profit transfers are their tax payments on realized company profits. Because of their involvement in distribution (public, tax-exempted institutions) the utilities do pay only little direct taxes on their noticeable profits.

enlargement of the distribution companies offers only few economies of scale and obstructs all freedom of action or influence by individual communities. Community-based local energy planning becomes fiction.

Local energy policy is modelled and managed by the large-scale energy production/transmission companies aiming at sales maximisation. Utility-sponsored energy conservation programmes are motivated by the desire for increased consumer satisfaction and by opportunities to prevent loss of attractive customers. This has to do with long-term versus short-term sales and profit maximisation.

The basis for local energy planning in the communities in Belgium has eroded significantly. In most communities there is no staff and no expertise available in energy matters. Thinking, planning, financing, managing energy has been left over to well-organized and influential private energy companies. The objectives of these companies are not coinciding with (mostly hostile to) the goals of local energy planning (least-cost long-term energy provision by demand reduction and by equilibrated energy supplies, making maximum use of local resources). Given the institutional structure of wide-spread and long-lasting distribution organisations, there is little hope for a fast change of this situation in the near future. Before local energy plans can be seeded and will flourish one has to break the ground, by creating community-based centers of expertise and of assets. Built-in incentives towards more energy sales (increasing the cash flow for communities and community boards) have to be bended towards more energy conservation.

2.3 Conclusions from previous SESO-work on local energy planning in Flanders

Our findings are very much in agreement with the results published by other scholars in the field and discussed at the forum of the EEC-meetings on the issue in Berlin, Luxemburg and Marseille. They also turn around three major requirements for successful local energy initiatives, i.e.

- local leadership;
- scientific management and support;
- national/international backing.

Some major findings are recapitulated briefly from our final report to the EEC DG XVII (Verbruggen, 1987):

1. Local energy planning is crucial, maybe necessary, for the realisation of energy conservation policies. Demand should be addressed directly on site, in its specific occurences.

2. Local energy planning is a very complex process, involving many interests. Difficult trade-offs have to be made. Local leadership is essential for successful planning and implementation.

3. As yet, there is no firm ground in Belgium to built local energy planning upon, because:
   (i) there is no clear national direction towards local planning;
   (ii) the local energy supply structures are grown wrong in branch-specific and sales maximisation organisations;
   (iii) in most communities, the commitment to the idea of local energy responsibility is too weak to give birth to strong local leadership in the field;
   (iv) fully experienced and versatile study groups for providing high-quality advice on the subject are scarsely at hand.

4. Considering how progress can be made, one should spend most effort on creating firm foundations for, and positive attitudes towards, local energy planning. This may involve:
   (i) no full-scale planning studies in particular communities should be addressed;
   (ii) small-size, representative and highly-successful demonstration projects are to be searched;
   (iii) for each community separately an individual energy report can be drawn. This general report, making use of easily available data and knowledge can awake the interest for the communities' energy problems;
   (iv) know-how centers on local energy planning should be cultivated.

5. Local planning will stay very difficult in Belgium when no rethinking of the energy situation and policy has taken place. Two major shifts are necessary:
   (i) a refocusing of the national energy policy on energy conservation and indigenous energy supplies (renewables, recoveries, refuse). Refocusing means the redirection of important management and financial resources.
   (ii) a far-reaching restructuring of local energy supply from branch-specific, sales-maximizing organisations towards multi-scope, energy servicing utilities.

3. Possibilities of Local Energy Planning in Flanders (Belgium)

3.1 Feasibility of experiment in Flanders

Since about one year, there is growing an opening towards the idea of local energy planning in Flanders. This is due to several factors, e.g.:

- the spill-over of experiments set-up in neighbouring countries;
- the voluntary energy policy carried out by Wallonia (and supported by the EEC-DG XVII);
- the reluctance to go ahead with the expansion of nuclear power generation;
- the continuous attention for the idea of local energy initiatives by SESO and other institutions (backed for this work primarily by EEC- and IEA-participations).

With the new government installed since May 1988, a new energy policy may be feasible. The authority over energy conservation and end-use is now assigned to the regional Ministries. By occasion, the Flemish Minister responsible for the economic affairs and energy is convinced of the necessity of an alternative energy policy in order to avoid further nuclear expansion. This opens a real opportunity for starting an experiment in local energy planning and policy in Flanders.

At the local level, there are still but a few communities with interest in a community-based energy policy. Most of these communities are of smaller scale (10 to 50,000 inhabitants), served by energy distribution utilities having a public statute. We now have contacts with most of these communities. In the larger cities in Flanders, the possibility of local energy planning in the near future is rather weak. Therefore, starting an experiment in a major city in Belgium is not a good choice. We propose two criteria of choice for the experimental community:

(1) Local authority must be firm. There should be a proven interest for energy measures during the last years. Leadership in the community should have proven its capabilities in other fields (e.g. communal planning).

(2) The community can function as an exemplary case for the majority of other communities. There should be no special physical nor institutional circumstances making the community exceptional in comparison with other communities. We would therefore prefer a community served by an energy distribution utility, controled by the private energy companies.

There are only a few communities in Flanders that meet the two criteria. Fortunately, there are some, and from our contacts we learned they would participate with enthusiasm in an experiment of local energy planning and policy in Flanders, when this is backed by regional and/or EEC-authorities.

3.2 Lay-out of an experiment in local energy planning

This lay-out is a first proposal. We found inspiration in the reports prepared for the EEC DG XVII's Programme on Regional Energy Analysis and Energy Planning. From the reports we selected the issues that are most promising at present in the Flemish situation.

Our lay-out is composed of three branches:

- sectors of action;
- results to be measured and evaluated;
- policy instruments.

(a) Sectors of action

At the community level, the sectors of action of prior interest are:

1. Buildings
   - residential buildings
   - commercial buildings
     - owned by the community
     - other commercial buildings
   - industrial buildings

   The energy flows to be studied are mainly heating (eventually also cooling) and lighting, providing most opportunity for conservation.
2. Industrial energy use

   Process heat and motor drive are the major end-used to be studied
3. Waste
   - domestic and comparable refuse (solid; sewage)
   - industrial waste
   - agricultural waste products
4. Public services
   - street lighting
   - public transportation if any
   - traffic planning and organisation

Less attention is devoted to private transportation because the related policy instruments fall generally outside the scope of local authorities (e.g. new energy-saving vehicles; new infrastructures; new transport modes) (cf. Nijkamp and Perrels, 1989).

(b) Results to be measured and evaluated

We think we should try to measure as accurately as possible:

1. The total cost/benefits of energy-saving initiatives beared by the various microeconomic entities (households; industries; community board;...).
2. The environmental impact of the different scenarios and policies. The impact on the community and outside the community should be considered.
3. The financial balance of the community accounts.
4. The economic costs/benefits to the community as a whole (e.g. additional employment; more spending inside the community and less purchasing outside;...).

(c) Policy instruments

We think of applying the following instruments in the various sectors of action.

Sectors	Instruments
Buildings	
- residential	- information and stimulation, via - local television (community based) - audits
- commercial:	
community owned	- centrally controled network for energy monitoring - investments (insulation; regulation; equipment)
other	- audits
- industrial buildings	- audits
Industrial energy use	- audits - cogeneration - investments in efficient equipment - energy exchange programs between industries
Waste	- selective collection of domestic refuse - heatpumps on sewage water when centrally collected - biomass applications
Public services	- efficient street lighting

- new models of public transportation (car-pooling; children and elderly people taxicabs and bus transport,...)
- load management of all public energy uses.

The above lay-out is no more than a first working proposal. We believe it to be feasible in the communities with which we have been in contact about energy projects.

3.3 SESO support for local energy planning

During previous research contracts SESO has built up a know-how in analysing particular energy problems. With respect to local energy planning the following experience may prove useful:

- heat demand assessment (total consumption of buildings; time patterns);
- planning of investments in heat distribution networks;
- evaluation of cogeneration projects;
- electricity tariffs (especially with respect to cogenerators);
- domestic waste incineration;
- energy use in industry;
- investment appraisal;
- understanding of community politics and of barriers to local energy planning.

In addition, SESO has now built up a wideranging network of contacts, including several Ministries (Economic Affairs, Energy, Environment, Science Policy), research institutions (e.g. building research centers), administrations (e.g. environmental protection agencies), industries and their federations, community boards.

Still lacking is a sufficient background for carrying out multicriteria analyses and for studying local energy plans by an integrated global approach. We are convinced that a cooperative working programme at the EEC-level will be very beneficial to the progress of local energy planning in Flanders.

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4. USE OF URBAN WASTE AS A SOURCE OF ENERGY

A. Buekens

1. Scope

The subject of heat or power recovery from solid waste incineration involves matters of local, regional or national policy which are well in scope of this seminar.

Heat recovery from incineration was first practised more than a century ago and since then has met with various appraisals, depending on the availability and cost of ordinary fuels, qualified labour and adapted technology.

Particularly in times of high fuel costs it is desirable to recover and utilize energy from waste combustion where it is practicable to do so. The economics are very much dependent on particular local circumstances, such as unit cost of heat, fuel or power and the availability and conditions of access to the users of these commodities.

2. Uses for Incinerator Heat

2.1 Survey

During combusting the heating value of refuse is almost entirely liberated (96-99%), the available heat is distributed as follows:

-	sensible heat of the flue gases	typically	80%
-	combustibles in the flue gases (CO, soot)	"	< 1%
-	sensible heat of the hot clinker	"	5-10%
-	combustibles in the clinker	"	5-10%
-	heat losses of the furnace	"	5-10%
			100%

Hence, the bulk of the available heat is under the form of the sensible heat of hot flue gases, which can either be used directly, e.g. for drying sewage sludge or wet refuse, or indirectly. In the latter case heat is first transferred to a much cleaner medium, such as steam, hot water, thermal oil, or air, which is either used in a thermodynamic, cyclic process, or in an open, one-way usage.

2.2 Direct uses

Direct drying of sewage sludge requires a suitable contactor, such as a rotary kiln, multiple hearth or fluidized bed drier, or a flail or ball mill drier. High grade uses of the hot flue gases are precluded by the presence of dust and corrosive compounds in the flue gases and by the variable availability of sensible heat.

The flue gases are charged with smelly compounds, while drying and heating the sludge in a direct contactor. Hence they have either to be maintained above 700° C or to be recirculated into the furnace for deodorization. In the first case only a small fraction of the available heat can be used, whereas the recirculation of moist gases lowers the operating temperature of the furnace, which is not always acceptable.

2.3 Indirect uses

In most cases incinerator heat is used indirectly, generally under the form of steam or of pressurized hot water. The latter is extensively used in district heating and for heating public or private centers, such as administrative buildings, schools, hospitals, commercial centers, swimming pools, army barracks or slaughterhouses. Potential industrial users are breweries, dairies, paper mills, or any other large and continuous consumer of low grade heat. Ideally the refuse incinerator delivers the base load, the peak load being covered by a conventional stand-by boiler.

Steam is generated in a waste-heat boiler, used to cool the flue gases, or in a partially or fully integrated boiler which cools the combustion chamber as well.

Part of the steam is required for in-plant uses, such as space heating, operating the soot blowers, or deaerating the boiler feed water. Steam can also be used for the direct driving of rotary equipment, such as fans, pumps, or hammermills. This option is not popular, because the presence of insulated steam lines and traps, with its concomitant leaks and safety problems, is too cumbersome and complicated.

The remaining steam can be used for power generation, district heating and cooling systems, indirect drying of sewage sludge, or water desalination.

The rate of steam production depends on the rate of refuse firing and on the calorific value of the refuse. Since the total output of steam is somewhat unpredictable, it is very convenient when all generated energy can be delivered to a large sink, such as a district heating system or, after conversion to power, the electric grid.

2.4 Power generation

Electricity production for export is feasible, provided the national or local generating authority is willing to take over the supplemental supply under guaranteed sales terms, sufficient to justify the very high additional investment costs involved in providing generating plant at the incinerator site.

For thermodynamic reasons it is attractive to generate high or medium pressure steam, when the power output has to be maximised. This option leads, however, to increased operating problems, such as extensive boiler corrosion and fouling and to a decreased availability of the boiler and hence of the entire plant, especially when the superheat temperature is high.

In Europe and the U.S.A. pressures up to 80-110 bar have been used, but a pressure in the range of 30-45 bar is considered to be a favourable compromise between high power output and low plant availability. In Japan more conservative pressures of 15=25 bar are usual.

Figure 1 allows to estimate how many kWh can be generated per tonne of steam generated, as a function of its pressure, superheat temperature, and pressure of condensation or counterpressure.

<u>Example</u>: A boiler yields steam at a pressure of 40 bar and a superheat temperature of t° C.

The energy content (kWh/tonnes) of the steam can be read as follows:

Ts	260	300	350	400	450	°C
energy content	83	116	153	188	221	kWh./tonne steam

The energy content rapidly rises with superheat temperature. Depending on the efficiency of the condensation turbine about 80% of this energy content can be converted to power. When the condensate is cooled to 50, rather than 20° C, about 14 kWh/tonne are los (lower left corner). For a counterpressure turbine acting against a pressure of 5 bar about 60 kWh/tonne should be deducted (left corner).

It follows that under typical W. European conditions a power output of about 200 kWh/tonne of refuse is possible, of which 40-80 kWh/tonne of refuse are required for local consumption. Under Japanese operating conditions it is difficult to generate the local power requirements entirely.

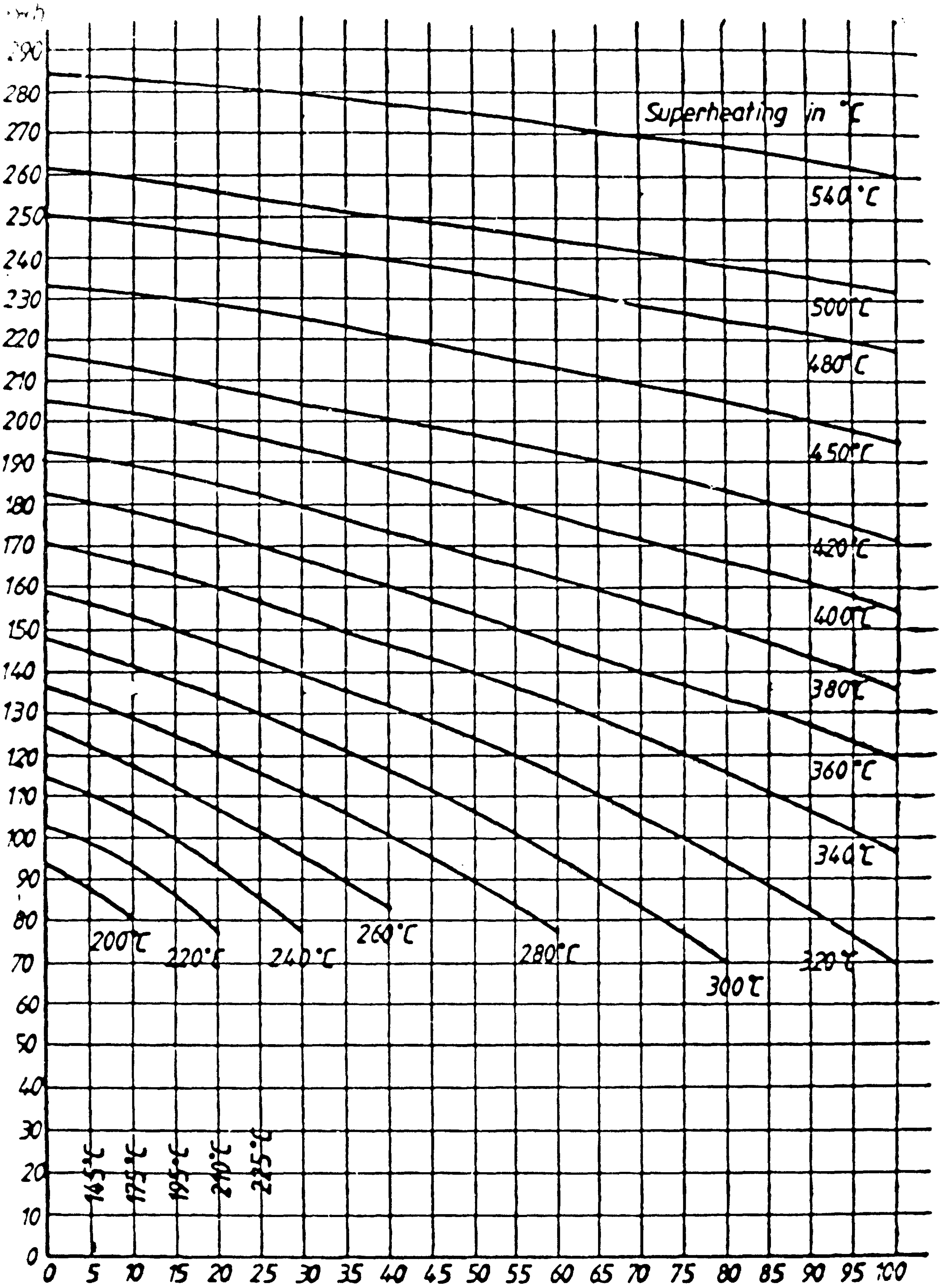


Figure 1. :Energy content of 1 ton superheated steam in kWh by condensing to 20°C

A municipal incinerator can be operated as an independent power plant or it can be integrated within a larger power generating complex. The latter possibility gives a marked cost advantage, since the feedwater treatment and the turboelectric part are already available. The boiler feedwater is supplied by the conventional power plant, and steam is returned. Unfortunately, the incinerator boiler often must raise steam at an elevated temperature and pressure, matching these of the main power plant. This has led to severe corrosion problems, especially in the superheater. As an alternative, steam may be raised at the pressure of the first step of expansion of the turbine, used for power generation.

2.5 Preheating of combustion air

In the sixties it was a current practice to preheat a part of the combustion air by means of convective heat exchange surfaces, arranged in the rear part of the boiler plant. These preheaters were gradually abandoned because there was no longer a need for preheating the air and because of problems due to extensive corrosion and fouling. Nowadays preference would be given to the indirect preheating of air by means of steam, in case a need for hot air arises. Another option is to recirculate part of the cleaned flue gases to dry the refuse.

It is also possible to cool the flue gases by means of circulating thermal oil. This option is unusual, probably because of the absence of large-scale usages for thermal oil. In the Antwerp/Wilrijk combined refuse/sewage sludge incinerator plant, designed by Seghers Engineering, circulation of hot thermal oil was used for heating a multiple stage sludge drying plant.

3. Limitations of Heat Recovery from Incinerators

The primary purpose of a municipal incinerator is refuse disposal. Storage of refuse is possible only for 2-3 days, inasmuch as adequate pit volume is available. Basically, the refuse is incinerated at a constant rate, near design capacity, the purpose of the storage pit being to bridge the gaps between collection cycle and stoking rate.

It follows the heat output is determined by the available and variable quantities and properties of the refused fired. In conventional boiler plants the heat output can be regulated by varying the firing rate. Moreover, the inventory of fuel allows for 1-3 months of operation, in case of coal or fuel-oil firing.

The availability of a single incinerator furnace with heat recovery conservatively can be estimated at 80% for a well maintained plant. When a plant is composed of several furnaces, the probability of having at least part of the plant available is higher, but so are the investment and maintenance costs.

Since incinerator availability cannot be fully guaranteed, complete standby capacity under the form of a conventional fuel-fired unit has to be provided. Moreover, cooling capacity has to be available to dissipate all heat generated, since incineration is continued also at times where heat demand is non-existent or slack. This inflates investment cost and is often symptomatic of inefficient use of incinerator heat.

Integration of the incinerator into a power plant, a large district heating or water desalination system, or another large heat sink, allows the inevitable variations and fluctuations in incinerator heat output to go by unnoticed. The incinerator is used to deliver part of the base-load, the rest of the demand being delivered by a conventional unit with a suitable turn-down ratio.

4. District Heating and Cooling

District heating is in widespread use in the Scandinavian countries. In Sweden on 22 incinerators 1 generated power, 1 steam, 11 hot water for heating, 9 have no heat recovery.

The heat demand of a district heating and (more seldom) cooling system is closely related to the annual and daily cycle of ambient temperature and to the occupation and activity of the premises to be heated or cooled.

Figure 2 gives an example of such a yearly distribution curve. In W. Europe there is a short winter peak and a low, relatively flat demand during summertime.

Heat demand is slack during the night and on week-ends and high in the early morning, when the temperature of buildings is being raised.

In Toronto (Canada) the lowest load in summertime presents 6% of the winter maximum, with an average demand of 30-40% of the total capacity. A refuse incinerator capable of supplying 10% of the winter maximum is in a position to sell 92% of the heat generated, the balance requiring dissipation.

In Ottawa (Canada) district cooling is supplied to government buildings, using a chilled water distribution system, with turbine driven chillers. The lowest demand amounts to 50% of the winter peak load, to be compared with only 6% in Toronto.

Because of this combination of heating and cooling the incinerator can provide a much higher proportion of the required load, without recurring to heat dissipation.

District heating was opted for in Bremen (1969) because power generation yielded an inadequate return to cover the supplemental investment cost, required for steam generation.

Also the availability of the boilers was expected to decrease, due to the higher operating temperatures required for efficient power generation. In Bremen only a minor amount of steam is generated; the steam serves to cover the consumption of soot blowers and to generate a fraction of the local power consumption. The turboaggregate is coupled to the feedwater pumps and to asynchronic generators.

The heat is delivered to an existing and a planned dwelling area (420 GJ/h) and to a new university campus. This campus in summertime has notable heat requirements to operate absorption cooling and air conditioning plants (630 GJ/h). The latter require fixed conditions for the feed of hot water; in the residential area, on the other hand, the conditions of heating are adapted to the prevailing heat requirements (Figure 2).

The curve of utilization shows 3 areas:

(a) heat requirements for space heating and sanitary hot water
(b) heat requirements for absorption cooling
(c) balance, to be dissipated

The conditions for economic exploitation of a district heating system have been reviewed by Kreiter, who cites a few prerequisites for success:

- waste incineration should be the preferred method of waste disposal;
- a district heating system should be pre-existent (or at least at a planning stage);
- it should be feasible to connect the incinerator to the system;
- one should realise a good operating factor throughout the year.

Under the conditions of the (Dutch) case-study it was proposed to generate steam at 350° C and 35 bar.

This steam is expanded (see Figure 3) in:

- <u>a backpressure turbine</u>, when the heat requirements are high (in wintertime);
- a <u>condensation turbine</u> with extraction of the variable steam requirements when the heat requirements are slack.

Figure 2.Heat requirements by time of the year

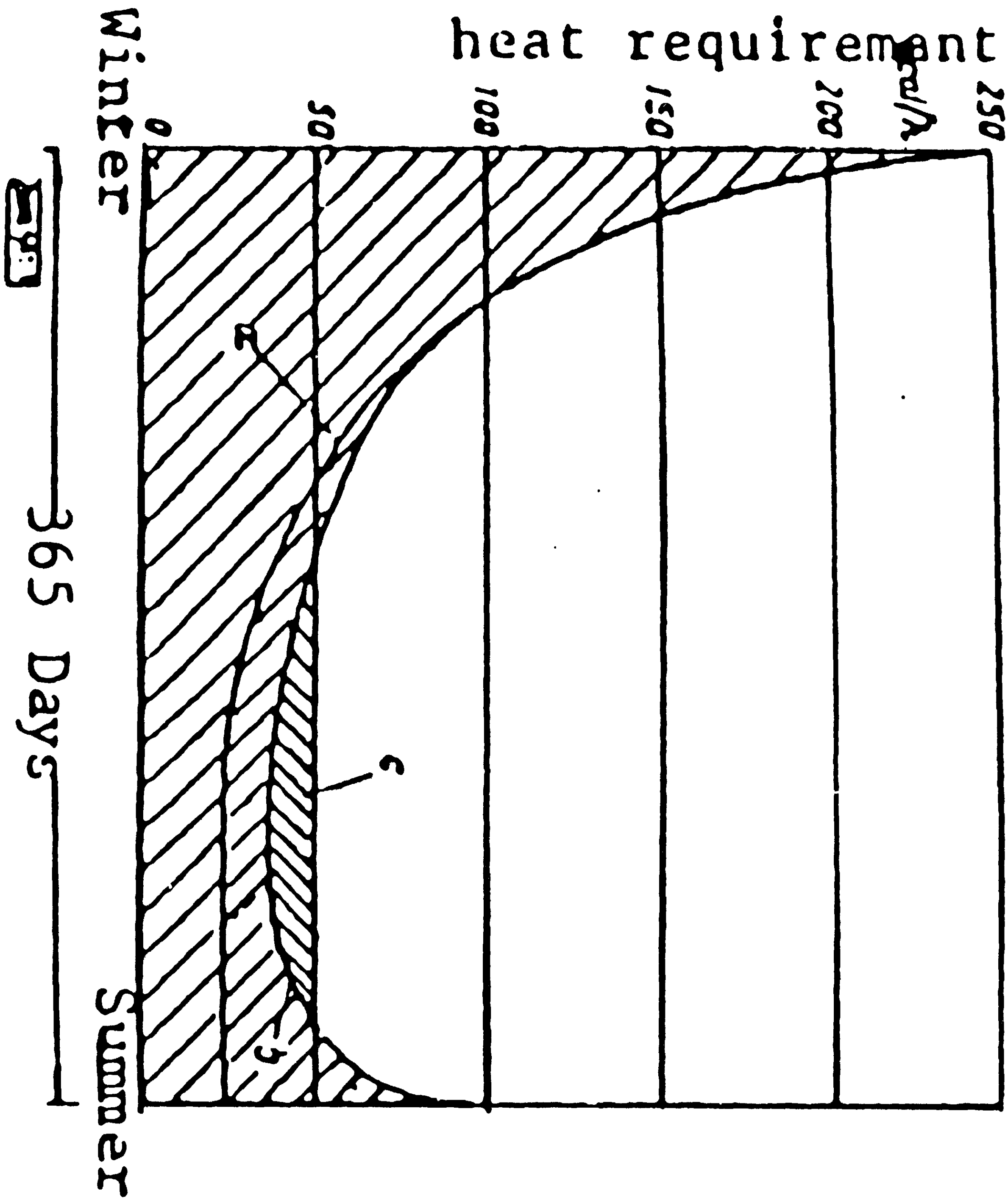
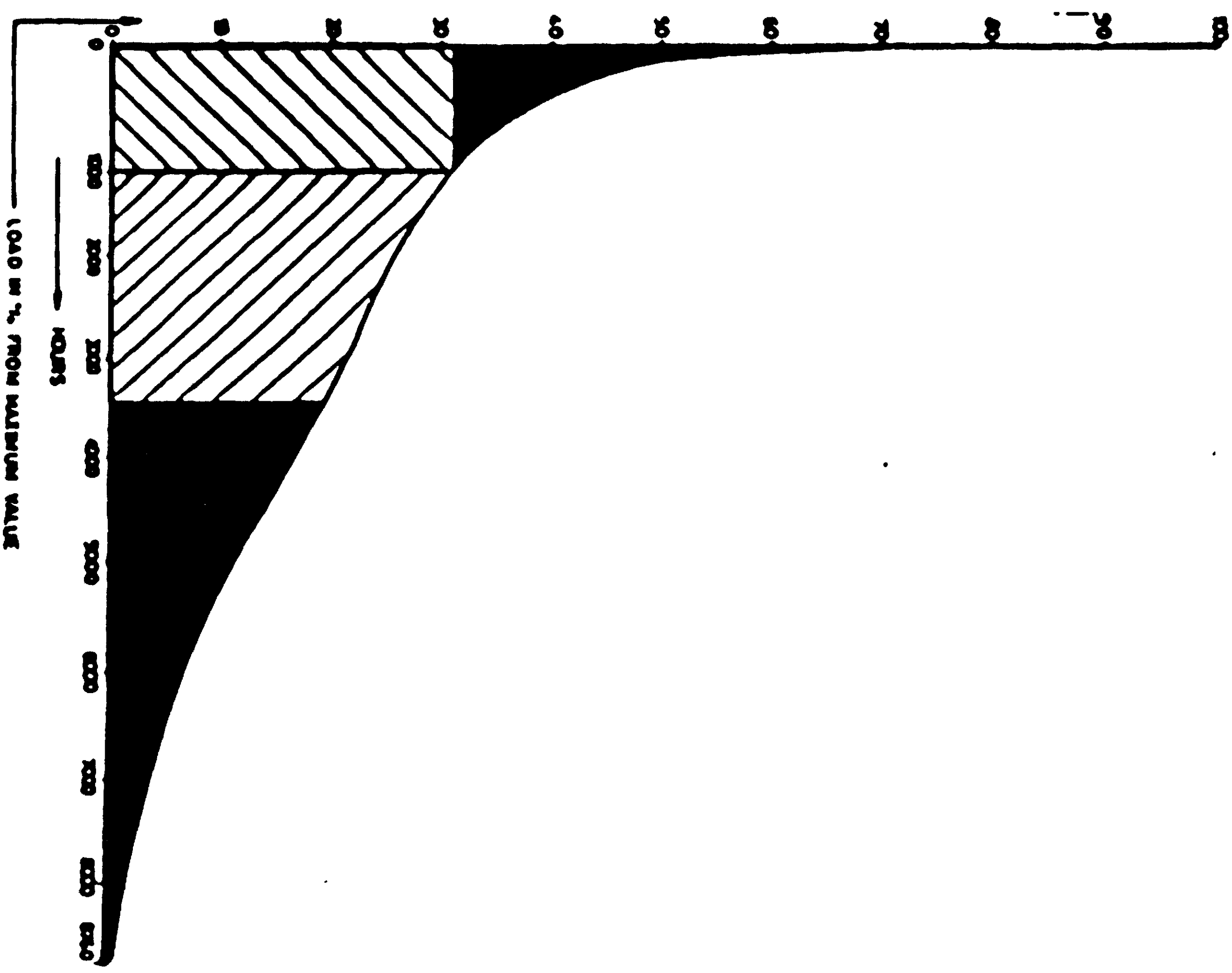


Figure 3. Results of incinerator system



In the other seasons the amount of extracted steam is readily adaptable to a variable demand.

In this case power can be considered to be a by-product of heat delivery. Similar views were at the basis of the Paris plants of Ivry and Issy-les-Moulineaux, which are justly famous as early applications of the coupling of heat and power.

In case of much larger district heating grid is considered it is opted for two counterpressure turbines. This situation is to be assimilated to a base load heat district plant.

Waste heat utilization has been used extensively in the Scandinavian countries, as follows from figures 4 and 5.

Figure 6 shows an integrated system, used in the municipal incinerator plant of Bern, featuring a battery of 5 cascade convertors. About 85% of the recirculated cooled pressurized water is reheated in direct contact with condensing high pressure steam. The balance of 15% is reheated by means of the pressurized water boiler 13.

5. Conclusions

In an incinerator plant waste is burned at more or less a constant rate, generally near to the design capacity. The heat output cannot be controlled or varied to meet fluctuating demand, since it is determined by the immediate properties of the waste being fired; in a conventional boiler plant, on the contrary, the output is regulated by varying the firing rate.

This circumstance puts a serious limitation to the potential uses of incinerator heat and makes it a focal point in urban planning.

Figure 4 : Waste Heat Utilization for District Heating Plants in Denmark(1979)

Figure 5 : Combined Heat and Power in Denmark (1979)

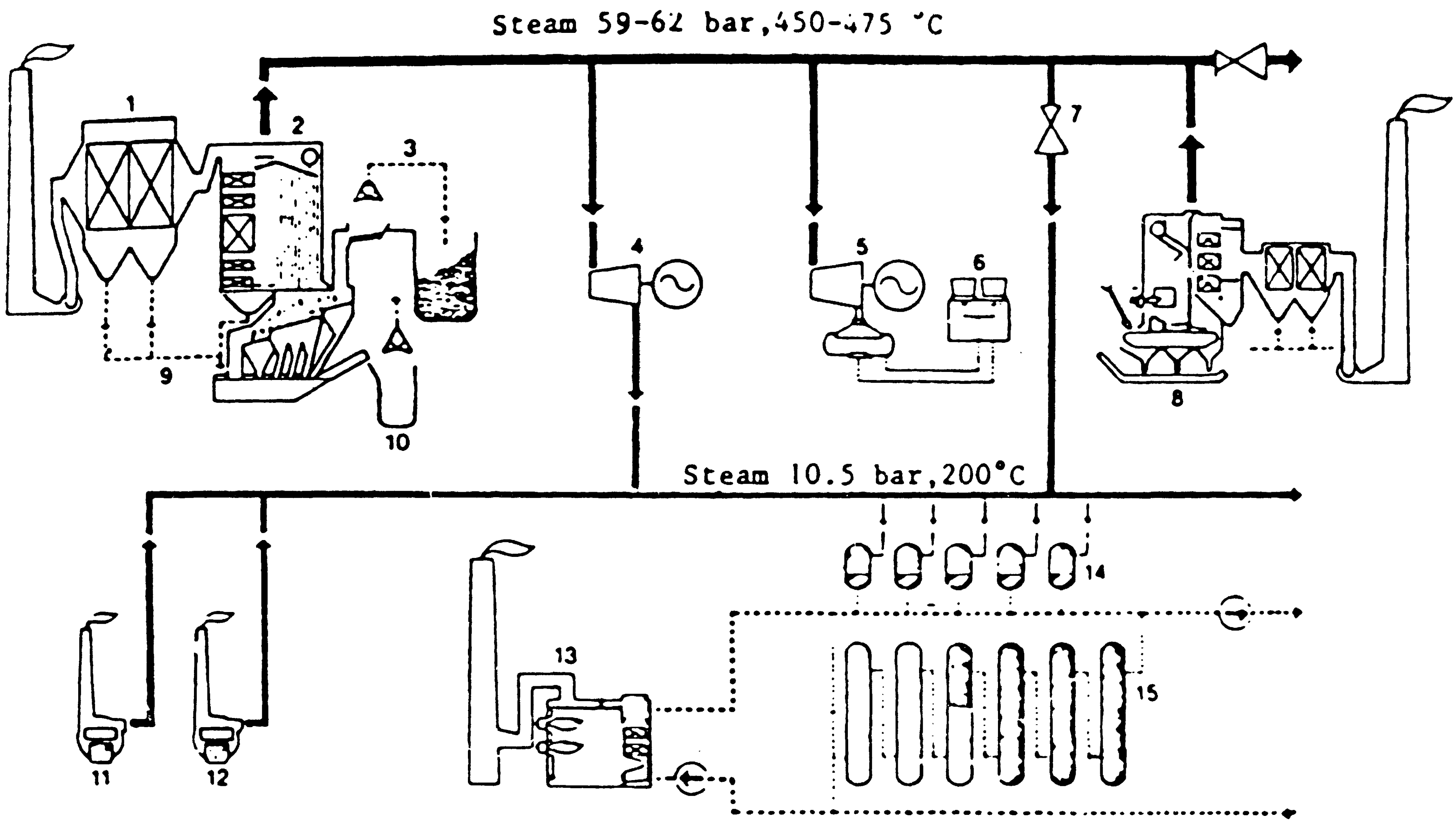

Steam 59-62 bar, 450-475 °C
Steam 10.5 bar, 200°C
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15

Figure 6

5. ECOLOGICAL ENERGY PLANNING

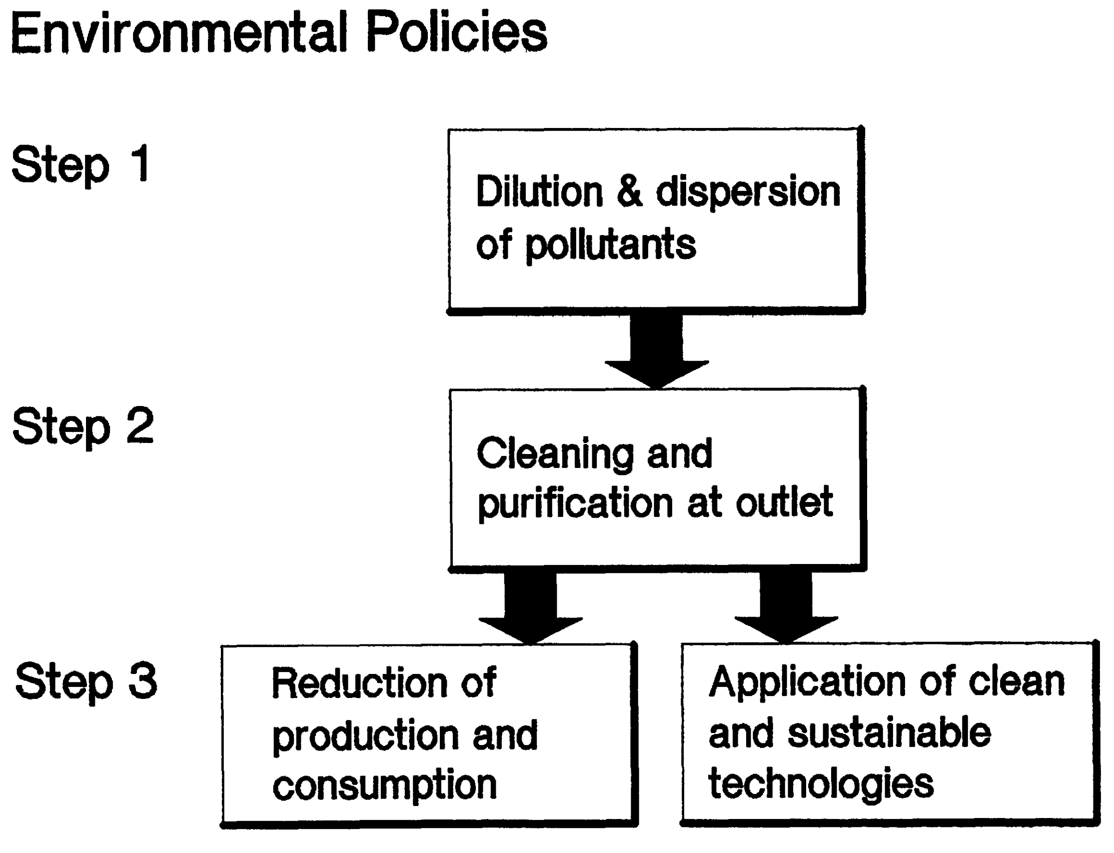
E. Bernsen

1. Introduction

A number of studies on environmental impacts of production and use of energy have been and are being performed. However, consideration of environmental effects has not yet become a practical and standard approach in the energy planning process. Environmental aspects should (and could) be integrated in all energy planning phases from the definition of energy policies to the approval of implementation programmes.

Future energy supply systems can no longer be evaluated with regard to technical and economical aspects only. Environmental consequences at local, regional and global level and within short and long term time perspective have to be analysed and the results included in the decision basis.

The development of environmental policies can be described in various steps illustrated in the flow chart below:



Step 1 was characterized by a preference towards the construction of tall chimneys as regards air pollution, and the analogue construction of long sea outfall pipes, when considering water pollution. Gradually, a transition into Step 2 occurred as the consequences in terms of, for instance acid rain, was observed.

Step 2 comprises a policy where cleaning and purification at the source is aimed at. Within the area of air-pollution filters, cyclones, catalysts, etc. are introduced in response to steadily narrowing limits for the emission of polluting elements. The waste products from the cleaning equipment will, however, again pose an environmental problem as ashes and other wastes have a high concentration of pollutants. The water analogue is the waste water treatment plants and the sludge.

Realizing that basically we are moving around with matters with higher and higher concentrations of pollutants, other approaches and policies should be pursued.

Step 3 where the environmental problems are largely reduced or prevented from occurring, would be the ideal target for the planner. But how do we reach this stage? Which methods/models can be used to analyse the relationships and consequences and how can we present the results to the decision makers in a meaningful way?

2. Integration of Environmental Impacts in Energy Planning

As mentioned environmental aspects should be integrated in all energy planning phases from the definition of energy policies to the approval of implementation programmes. Improvement of environment thus should be an objective to the decision makers of equal value than e.g. safety of suply, economy, etc.

During the registration phase in the energy planning process all aspects concerning environmental conditions can be registered as these aspects are closely connected to:

- the registration of existing and potential energy resources;
- registration of energy demands and consumption;
- registration of existing energy supply technology and supply systems.

The energy balance sheet for the present situation is, when multiplied with experience emission factors, at the same time at total overview of the present emission originating from energy sources.

The theoretical emission registration thus elaborated could be combined with a rough emission analysis based upon existing pollution measurements and biological monitation.

In analysis of alternative supply schemes, a rough dispersion calculation for major polluting plants together with the overall emission registration based on standard values and full consumption estimates gives information to the decision makers at a level equal to other analysed parameters.

The main problems arise as a consequence of the lacking understanding of the quantities and effects of the environmental aspects.

It is easier to compare and understand the costs of two alternative supply schemes than the long term effect on forests in other countries. However, this problem must be solved through a better illustration of the interactions and mechanisms during the presentation of the energy plans giving the decisionmakers a better basis for their decisions.

A pilot project on integrated planning for energy and environment was launched on the island of Bornholm in the summer 1988. The project comprises the following main activities:

a. Elaboration of an environmental status for Bornholm.
b. A survey of the contribution from the energy system to the total pollution on Bornholm.
c. Analyses of the impact on environment caused by different energy sources.
d. Analyses of integrated energy/environment scenarios for Bornholm.
e. Development of an action programme for realization of the recommendations.

One of the major objectives of this project is to develop planning tools, which later on can be used generally by municipalities countries and by the central authorities.

6. HEAT PLANNING IN ODENSE

N.A. Gadegaard

In the early seventies the Danish Parliament passed several planning acts. The common factor was the wish of linking together state, regional and local, physical planning.

Regional and local planning was emphasized in this legislation. Decentralizing of the political responsability was underlined.

After having discovered natural gas in the North Sea and in retrospect of two energy-crises in the seventies an act on heatplanning was passed in 1979.

To-day Denmark has a unique position in planning for heating. We have gained much experience and it is worth while to mention some of them in a publication on energy planning in Odense (300 km^2 of which 1/3 is urban area) with its 170.000 inhabitants.

In 1953 a new combined heat and power plant, Fynsværket, was built in Odense. The power plant should provide the region, Funen, with electricity. The district heating in Odense, established in 1929, now got into an expansive phase due to the fact that the new 90 MW power plant was built to produce 96.000 Gcal hot water in a co-production. Today the capacity is about 600 MW.

<u>Fynsvaerket</u>

Capacity	
1953	90 MW
1961	166 MW
1968	371 MW
1974	666 MW
1991	760 MW

In 1979 the City Council decided to supply up to 90% of the households, with district heating based upon combined heat and power from Fynsværket.

The municipal plan and the plan according to the new heating act created several problems. The local politicians saw advantages for their population in using the combined heat and power within the municipality. The planning aimed at the advantages for the social economy.

The community was divided into approx. 25 heating districts and social economy should be the basis whether a district should be natural gas-heated or supplied with district heating. In fact the municipality had success with such calculations adding the economics for several districts.

My conclusion is that energy planning must not be confined to urban planning. Using the advantages of the combined production at the powerplant must be regional to achieve the optimal economics to the society.

I shall now introduce the results of the Odense planning in figures. They are interesting because they show that the citizens of Odense have saved energy at the same rate as in other areas in Denmark in spite of the fact that district heating is 2 to 3 times cheaper than other household heating. Odense is famous in Denmark for having the lowest prices for heating purposes.

Within the last ten years the heat production for Odense has grown from 1,6 mio. Gcal to 2,2 mio. Gcal. Fynsværket produces 90% of the total consumed heat in Odense. 96% of the households in Odense are now connected to the district heating system.

Heat Production

Mio. GCal

1977	1983	1987
1,6	1,8	2,2

In the same period the amount of heated room has increased from 22 mio. cubicmetres to 35 mio. cubicmetres.

Consumption

m^3 Heated room

1977	1983	1987
22 mio.	30 mio.	35 mio.

m^3 Water sold

1977	1983	1987
30 mio.	28 mio.	36 mio.

That shows with an increase in the production with 37%, we now heat 60% more room.

1977-1987

Heat production: +37%

m^3 Heated room : +60%

The energy saving in the households shows a consumption in 1977 at 1,4 m^3 hot water pr. m^3 room each year falling - in 1987 to 1,0 m^3 hot water. The total consumption for an average household was 504 m^3 hot water pr. year in 1977 and 360 m^3 in 1987.

Energy saving

(average customer)

m^3 water/m^3 room:

1977	1983	1987
1,4	1,2	1,0

Consumption/year:

1977	1983	1987
504 m^3	432 m^3	360 m^3

The number of consumers (households, institutions, etc.) within the 1400 km double mainpipes has grown from approx. 28.000 to approx. 45.000.

Estates connected

1977: 28,100

1987: 45,700 (79,000 households)

96% of households

And in the same period Fynsværket has started delivering to 4 other municipalities with 40,000 inhabitants and flower- and greenhouses with an area under glass at 1,2 mio. m^2.

In a general energy plan from 1986 renewable energy sources have been introduced.

In a village Davinde in the southern part of Odense a biogasplant now delivers the necessary heat for 95 houses and shortly another plan, built by 38 farmers in Fangel, will provide the main district heating system with heat enough for 4-500 households.

Hot water generated from a woodmill is already connected to the transmission lines, and projects with heat from an ironwork and a larger brewery are under consideration. At the sewage plants biogas from the sludge generates electricity for more than self sufficiency.

Renewable energy sources will in my opinion not be introduced if a local consumers' benefit is not obvious.

As for electricity we plan for savings in the future.

We have introduced a time differing rate for electricity with advantages for industrial production outside the most hectic periods of consumption. The connected monitoring discloses often major possibilities for energy saving.

Heating and electricity savings in public buildings have been considerable. To our opinion public authorities must take the lead in connecting to collective systems and energy savings. In the last 10 years the consumption of heat have gone down by 40% and electricity with 23%.

Energy Consumption in Public Institutions

1977-1987

Electricity: ÷ 23%

Heat : ÷ 40%

Combined heat and power production at Fynsværket is profitable for Odense because:

1. The combined production means better fuel economics (from 40% exploitation of the energy in the fuel at an ordinary power plant to nearly 80% at a combined heat and power plant).
2. More room heated for less money when connected to the district heating system.
3. A better environment.

The environmental improvement can be confirmed by the following comparison:

Air pollution when not producing electricity and heat as a combined production (Odense consumption 1985):

8,400 tons SO_2

2,840 tons NOx

935.000 tons CO_2

Combined power and heat production:

2,000 tons SO_2

1,500 tons NOx

320.000 tons CO_2

It is clear that the environment of Odense benefits of the combined heat and power production. The public health and the lack of corrosion of assets is difficult to calculate, but I have the opinion that the saved money must be considerable.

Our air contral measuring stations tell us that Odense has an air quality second to few bigger cities. The contents of SO2 are less than 10% of the guidelines for acceptable immission, and the major part of the pollution can be traced to Poland and the German Democratic Republic.

The energy saving aspect is obvious in our latest plan for recycling of waste.

Formerly, we deposited approx. 365.000 tons of domestic and industrial waste. The priority given to our new plan is:

1. Recycling of paper, glass and plastics.
2. Composting of organic matters.
3. Incineration.
4. Landfilling.

The refuse is divided into the proper fractions due to the priority at the source, that is in the household and at the factory, etc.

The oil savings can be calculated as:

Recycling of paper 2,300 tons oil per year.

Recycling of glass 350 tons oil per year.

From incinerating of refuse at plants in the region outside the central combined heat and power covered district heating areas you may gain further oil savings at approx. 20,000 tons oil per year, increasing when composting is less than planned.

In my experience, physical planning, e.g. town planning, road planning, industrial planning etc., must be considering the consequences for a better energy economy and environment. Denmark has saved much energy since the first energy crisis in 1973, but we can still do better when planning in the interests of the regions and the entire society.

7. CITY OF AMSTERDAM: ENERGY MANAGEMENT FOR THE FUTURE

G.J. Zijlstra

1. Preface

This presentation gives a short review of energy management in Amsterdam in the late seventies and eighties and of the recent resurgence of interest in the subject, under the pressure of environmental strains. Special attention is given to the position of the municipal electricity and gas company.

2. Instruments for Energy Management

In a larger Dutch city such as Amsterdam the local government has many instruments to influence the present and future energy consumption. The instruments are partly derived from the position of the city in physical planning and housing, partly derived from its competences as the owner of municipal services or companies. In sum the instruments are:

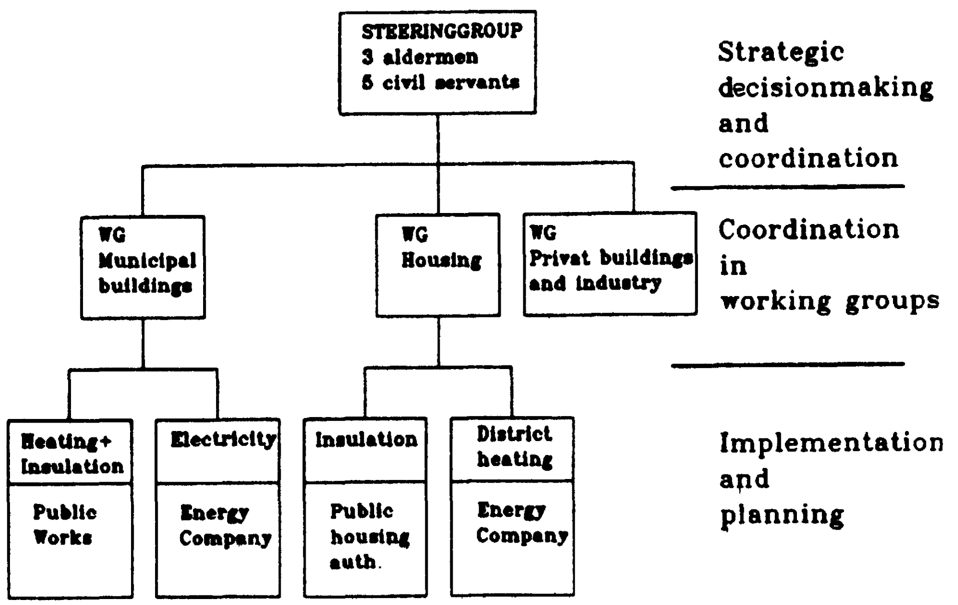
1. regulation of energy quality for municipal buildings;
2. direct and indirect regulation of the energy quality of existing and new housing;
3. determining the energy quality of physical planning;
4. the policy of the municipal energy company;
5. the policy of the municipal transport company;
6. the policy of the municipal sanitary department;
7. the policy of the public works department.

The history of energy management in Amsterdam suggests that the instruments are not used for purposes of energy saving or environmental protection unless there is a specific organisational structrue to promote these interests and the central government supports the policy with incentives such as grants.

3. Energy Management 1977-1987

In 1977 an organizational structure was set up to coordinate the efforts to promote energy savings (Figure 1).

Figure 1. The organizational structure for energy saving in Amsterdam



Strategic decision making and coordination was done in a steering group of three aldermen and three senior civil servants. Under the steering group "working groups" coordinated the policy for specific subject areas as municipal buildings, housing and private buildings and industry. Municipal departments and municipal companies were charged with special implementation tasks.

The organizational set up had a positive effect on the conservation activities, though very soon the steering group did not function effectively due to lack of time and the reduced interests with the members of the steering group. The working groups were the most effective and especially in those areas were implementation could be done by municipal departments or companies. In the municipal buildings and the housing sector more than 30 percent energy savings could be realized. In both cases optimal use was made of existing national grants and regulations.

District heating failed, mainly because the original set up of the district heating planning was of a too large scale. The energy company and the public housing department conflicted in their approach of the matter and neither the steering group nor the city government were able to solve the dispute. The plan was abolished.

Lack of competences or instruments towards the private sector was the obvious cause of very few results in that sector. In short: successes were obtained in those sectors in which municipal instruments and national funds were combined with effective municipal organization and knowledge.

After 1985 interest in energy savings decreased, largely because of lower energy prices, a reduction of grants and because of a municipal reorganisation. A major part of the 1977 organisational structure of energy saving dissolved slowly, though it was never officially abolished.

4. Recent Trends

Although the need for energy savings was less urgent as a result of the lower energy prices, knowledge of energy saving methods is abundant and many organisations have internalised energy saving policies. The housing department pays special attention to the energy quality of new housing and the energy company is developing new instruments to promote energy saving. In fact, the municipal energy company has become one of the main promotors of energy conservation.

There are two reasons for this more central position. In the first place the recognition within the city government that the energy company should play a more central role. A special department within the energy company, charged with the promotion of energy saving, was established. But perhaps even more important is the recent national reorganisation of the electricity and gas supply.

In this reorganisation several objects were obtained

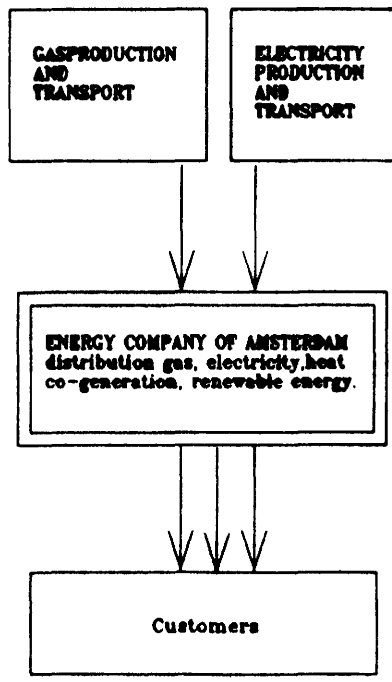
1. separation of large scale production and distribution;
2. integration of gas and electricity distribution (already realized 40 years ago in Amsterdam);
3. competition in the electricity sector:
   - large customers may buy electricity from another distribution company or may even import electricity. They also may produce their own electricity;
   - distribution companies may buy electricity from another production company and have to buy electricity from private producers (combined heatpower) for reasonable prices;

- distribution companies may produce electricity with combined heat-power plants, refuse incineration plants, and renewable energy;

4. customer orientation of distribution companies, with a special task in promoting energy efficiency.

The position of the municipal energy company is shown in Figure 2.

Figure 2: Organization of the gas and electricity sector



Natural gas is bought from the NV Gasunie, the national gas transport company and distributed to the customers. Electricity is bought from the NV UNA, the regional electricity producer, and distributed. The growing activities in co-generation result in the production of electricity and heat.

The (re)new(ed) activities of the energy company are:

- installation and operation of combined heat/power (CHP). It is estimated that 25 percent of the electricity consumed in Amsterdam can be supplied by CHP;
- installation and operation of renewable energy projects, such as wind turbines (for which there are only limited applications in an urban region), solar boilers, solar cells;
- renewed evaluation of district heating by using disposed heat of a large coal fired plant which will be installed in the industrial west part of the city;

- energy management as a service to customers. This means not only advice to customers, but also active promotion methods. One example of these activities is the promotion of energy efficient lamps. For this action a 30 percent price reduction during the action time was negotiated with the manufacturing companies (Philips/Osram). Every customer is informed personally by the energy company about the action and has the opportunity to buy to a maximum of four lamps on a pay-off basis. The price of the lamps is paid in 10 monthly parts via the energy bill;
- a more inventive role of the energy company in municipal physical planning.

Some of these activities are only in the first stage of development but the results are encouraging.

Energy saving has obtained renewed interest. Not because of higher energy prices but because of the urgent situation of the environment. Energy saving is becoming an integrated part of environmental policy. This means that the energy saving policies have to be coordinated with environmental policies. The city of Amsterdam is engaged in setting up such a coordinated policy. The city has many potential instruments that may influence the environmental conditions. In short:

1. The energy company as an instrument in:
   - combined heat/power;
   - district heating;
   - renewable energy: wind, solar;
   - stimulating energy efficiency.
2. Physical planning as an instrument in:
   - optimising the effective use of sun for the heating of houses;
   - evaluating and stimulating the use of district heating, combined heat/power and renewable energy resources;
   - stimulating an energy efficient transport infrastructure;
   - setting standards for the energy quality of new buildings.
3. Housing authority in cooperation with the land authority:
   - regulating the energy efficiency of new buildings and housing;
   - regulating the use of materials that are not harmful for the environment.
4. Transport company:
   - low emission and energy efficient vehicles;
   - optimizing public transport as a public service.
5. Sanitary department:

- separated collection of refuse;
- refuse incineration combined with electricity production (a 67 MW refuse incineration plant is planned for 1992).

6. Public works:
   - special sewery systems.
7. Regulating authority in the emissions of pollutants and noise:
   - the municipal authorities have a certain degree of freedom to demand more restricted standards for emissions.

The new extension of the city which will be built in the early nineties - Amsterdam Nieuw Oost - will probably be the showpiece of environmental municipal policy.

8. DECENTRALISATION ET MAITRISE DE L'ENERGIE DANS LA REGION NORD-PAS DE CALAIS

Ch. Bataille

Décentralisation et maîtrise de l'énergie vont de pair et chacun comprendra ici le rapprochement qui s'opère naturellement quand on parle à la fois de régionalisation et de la demande d'un consommateur.

Mon exposé sera structuré de la manière suivante: dans un premier temps, je vous décrirai brièvement, afin que nous nous comprenions mieux, le contexte des politiques nationales et régionales en ce domaine; ensuite, je vous relaterai, à titre d'exemple, la démarche que j'ai entreprise dans ma Région en direction des collectivités locales, depuis l'information jusqu'à l'aide aux travaux d'économie d'énergie; enfin, j'essaierai d'apporter une réponse aux diverses interrogations que posait le programme préalable.

1. Politiques Energetiques Nationales et Regionales

Au niveau national, le plan d'indépendance énergétique mis en place en 1981 s'appuyait sur deux axes majeurs:

- réduction et maîtrise des consommations par d'importants efforts et travaux d'économies d'énergie;
- substitution des énergies importées, notamment du pétrole par les énergies nationales, charbon et surtout électricité, d'origine nucléaire.

Les évolutions des divers paramètres liés à la détermination de la facture nationale des importations ont conduit à une diminution sensible de cette dernière, qui s'établit à 82 milliards de Francs en 1987, contre 180 milliards en 1985. Toutefois, la facture des consommateurs finaux, compte tenu des transformations et des différentes taxations, reste élevée. Elle s'élève à 470 milliards de Francs en 1987, soit 11% du Produit Intérieur Brut.

La politique énergétique française, très soutenue de 81 à 86 sur les deux axes que je décrivais plus haut, a connu depuis un relâchement motivé par la baisse spectaculaire des prix du pétrole, conduisant en 1987 à la baisse des crédits et des effectifs du seul outil national au service de la demande: L'AGENCE FRANCAISE POUR LA MAITRISE DE L'ENERGIE. Je le déplore vivement pour ma part car cette vision à court terme peut coûter très cher en cas de retournement de la situation. Elle conduit d'ailleurs aujourd'hui les producteurs d'énergie à une promotion de leurs énergies respectives, toutes, bien entendu, plus économes ou plus pratiques les unes que les autres, sans véritable possibilité pour la consommateur de discerner dans ces offres laquelle lui apportera le meilleur service au moindre coût.

Je ne doute pas que l'actuel gouvernement modifie dans un proche avenir cette politique et en renforce les moyens.

Sur le plan régional, dans les régions les plus consommatrices, parmi lesquelles le Nord-Pas de Calais qui, avec 15 millions de Tonnes Equivalent Pétrole, représente 10% de la consommation française, se sont mises en place, à l'initiative des Conseils Régionaux, des agences régionales de l'énergie qui assurent cette fonction d'assistance et de conseil au consommateur, ainsi que des Fonds Régionaux pour la Maîtrise de l'Energie qui assurent le financement des politiques régionales.

Dans le Nord-Pas de Calais, le Fonds Régional pour la Maîtrise de l'Energie représente environ 24 millions de Francs par an et soutient les études et travaux d'économie d'énergie et de développement des énergies renouvelables dans tous les secteurs de consommations. Plus de 80% de ses interventions concernent les collectivités locales, soit près de 20 millions de Francs par an.

2. Politique Energetique Regionale en Direction des Communes Urbaines et Rurales

Je pense tout d'abord que vous reviendrez dans vos travaux sur la définition de l'entité urbaine ou communal puisque sur les 38.000 communes d'Europe, 36.000 sont françaises!

Notre politique régionale s'exerce différemment selon la taille de la commune.

Pour les communes importantes, de plus de 10.000 habitants, notre assistance et nos subventions portent sur:

* la mise en place de réseaux de chaleur, tels que ceux de Dunkerque ou Lille, qui assurent le chauffage de quelque 15.000 logements chacun;
* la formation d'homme énergie dans les communes;
* l'aide aux études de diagnostic thermique;
* l'aide aux travaux d'économie d'énergie.

Pour les communes rurales, notre travail et nos aides sont beaucoup plus élaborées puisque ces dernières ne disposent pas des moyens techniques et financiers pour aborder rationnellement cette préoccupation.

Voici donc l'esposé de cette politique en direction des petites communes:

2.1 Quelques grandeurs caracteristiques de la région

Avant de vous exposer cette démarche, quelques caractéristiques de notre région:

- une position stratégique au coeur de l'Europe;
- 4 millions d'habitants;
- 1550 communes;
- 7,3% des français;
- une consommation équivalant à environ 15 millions de tonnes de pétrole.

2.2 Energie et décentralisation

Quelles sont les responsabilités du Conseil Régional vis-à-vis de cette population? Depuis 1981 se met en application la décentralisation. Comme le dit fort justement le Président de la République M. François MITTERAND: "La France a eu besoin d'un pouvoir centralisé pour se faire, elle a besoin d'un pouvoir décentralisé pour ne pas se défaire". Ainsi ont été principalement dévolues aux Régions les compétences de planification et d'aménagement du territoire, de développement économique, de formation et d'enseignement. Point d'énergie dans tout cela et pourtant, de l'énergie partout!

Comme l'air, comme l'eau, l'énergie relève de l'intendance, mais rien ne se construit sans elle et on n'y prête réellement attention, comme aux déchets, que quand elle pose problème, à la production en cas d'accident dans une centrale, ou à la consommation quand le prix du pétrole augmente.

Les économies qu'on peut en attendre sont toutefois importantes; c'est la raison pour laquelle, à divers titres, la Conseil Régional a le souci de l'utilisation rationnelle de l'énergie dans les logements, dans les entreprises, dans l'agriculture et, bien entendu, dans les collectivités locales.

2.3 Exposé de la démarche

De la même manière que le diagnostic thermique est considéré comme un outil de classement des investissements destinés à économiser l'énergie, en les ordonnant par rentabilité décroissante, le Conseil Régional a mis sur pied une méthode qui peut être considérée comme un diagnostic, non plus thermique, mais énergétique, beaucoup plus global, cherchant un effet de levier maximum afin de déclencher le réflexe de gestion ou d'investissement économe en énergie, et comportant 4 phases principales.

- L'information.
- La gestion.
- La formation.
- Le choix des investissements.

Ces 4 phases sont indissociables. Tout investissement non suivi, non compris sera mal utilisé. Il faut donc un responsable "Energie" chez le consommateur. L'investissement est une décision, que l'élu communal ne prendra que s'il y est sensibilisé, d'ou l'information; la comptabilité de l'énergie devrait être un préalable aux investissements; quant à la négociation des contrats d'énergie-chauffage ou électricité, son temps de retour est souvent quasi instantané.

2.4 **Informer**

Considérant que Lille, capitale de notre région, n'était pas l'aboutissement d'un processus de décentralisation, mes services ont organisé durant deux ans 11 réunions dan des secteurs géographiques regroupant 60 à 80 communes.

Le scénario de ces réunions est construit pour répondre aux préoccupations des élus locaux: après un mot d'accueil du maire de la commune qui héberge la réunion, un Conseiller Régional présente la politique régionale concernée et situe les différents partenaires administratifs: Agence Française pour la Maîtrise de l'Energie, Ministère de l'Equipement, et bien sûr les Services du Conseil Régional.

Très rapidement ensuite, sont présentés plusieurs exemples concrets de réalisations soit de travaux soit d'études, dont l'objet est d'inciter les gestionnaires, que sont de plus en plus les élus locaux, à privilégier les investissements et la gestion de maîtrise de l'énergie dans leur patrimoine. En effet, les investissements, notamment, constituent les seuls investissements productifs de la commune, par opposition aux autres, que relèvent du pur service public, effectués à fonds perdu. A titre d'exemple, il est conseillé à l'élu de ne pas hésiter entre la régulation du chauffage dans l'école et les travaux dans la piscine. Ce sont les économies engendrées par les premiers qui financeront les remboursements d'emprunts des seconds.

Cette information est ensuite relayée par d'autres vecteurs:

*Une revue trimestrielle, tirée à 10.000 exemplaires, qui relate les opérations financées par le Fonds Régional pour la Maîtrise de l'Energie et relaye auprès des consommateurs régionaux l'avis des experts nationaux et mondiaux sur la conjoncture, les prix et leurs évolutions, etc....

*Un véhicule, l'ENERBOUTIQUE, assez semblable à celui qui aujourd'hui vous est présenté dans une flaquette à l'entrée du forum, et qui, sur demande des collectivités locales, vient dispenser conseils et brochures sur l'énergie dans l'habitat particulier.

De plus, si, suite à une réunion d'information des élus locaux, un regroupement de communes en Syndicat Mixte ou Association souhaite promouvoir ce message auprès de sa population, le Conseil Régional, avec le concours de l'Agence Française pour la Maîtrise de l'Energie, peut assurer le financement à 50% du fonctionnement d'un "Plan Energétique Local" dont le rôle sera l'animation et la permanence de cette prise en compte de l'énergie dans les budgets de la commune certes, mais aussi des habitants, des agriculteurs et des industries locales. Un agent peut alors être formé par le Conseil Régional à l'animation de tels programmes.

Huit de ces plans énergétiques locaux sont actuellement en foncionnement. Le contrat alors passé entre les collectivités ainsi réunies et le Conseil Régional leur fait bénéficier en priorité des services tels que l'Enerboutique ou le Bus Energie.

2.5 Gérer

Seconde phase du dispositif: l'aide à la gestion. Après avoir été informés de la particularité de la maîtrise de l'énergie en terme d'investissement, le Conseil Régional apporte, par le biais de son Agence Régionale de l'Energie, NORCALENERGIE, une assistance à la gestion comprenant trois volets:

1. <u>Aide à la mise en place d'une comptabilité énergétique spécifique</u>: Il n'est pas rare en effet que d'une année sur l'autre une augmentation de 15% de la consommation d'énergie en unités physiques se traduise par une augmentation de 100% sur le plan financier. C'était le cas entre 1981 et 1984. Certes la baisse actuelle du prix de certaines énergies invalide ce raisonnement, mais d'une part, ce n'est que provisoire, (les prix peuvent remonter, et il faut pouvoir le mettre en évidence) et d'autre part ce n'est que partiel, car les factures sont souvent régies par des contrats qui eux ne sont pas, loin s'en faut, liés directement au prix du brut du pétrole.
2. <u>L'analyse des contrats d'énergie</u>: Une installation de chauffage est une machine thermodynamique complexe dont le fonctionnement dans des conditions optimales nécessite une gamme étendue de connaissances qui couvrent les domaines de la chimie, de la physique, de l'hydraulique et de l'électricité.

Bien souvent la fourniture de l'énergie est régie par un contrat, de chauffage ou d'électricité, passé avec une Société d'exploitation de chauffage ou un producteur d'énergie.

Il comprend généralement en (France) plusieurs paramètres: le coût du combustible, le coût de la surveillance et de réglage, la provision pour le gros entretien et celle de financement pour renouvellement du matériel. La valeur de chacun de ces paramètres est le fruit d'un calcul et non d'une évaluation. La clarté de ce calcul caractérisera la transparence du contrat.

2.6 **Former**

Il existe de nombreux prestataires de services, ingénieurs conseils, bureaux d'études que peuvent assister la commune dans le cadre de la mise en place d'une programme d'économie d'énergie. Toutefois, sans nier l'intérêt du recours à ces formes d'assistance pour des missions très précises, il est désormais prouvé que les meilleurs résultats sont obtenus par l'insertion, au sein de l'équipe municipale, d'un "énergéticien communal". Les différentes missions de ce technicien sont la gestion (suivi des factures, des consommations), le contrôle technique (contrôle des chaufferies, contrôle du respect des températures, réglages, adaptation des programmes et régulation, travaux) la formation des utilisateurs et des responsables d'entretien dans tous les secteurs consommateurs: chauffage des bâtiments éclairage public, parc automobile.

Pour une ville de plus de 10.000 habitants, ou pour un regroupement de communes totalisant ce nombre, l'"énergéticien communal" génère plus d'économies financières pour la collectivité que ce qu'il coûte en charges, et ceci sur plusieurs années. Ces postes doivent par ailleurs être pérennisés. En effet, il est prouvé que quand ils existent, leur suppression entraîne un brusque accroissement de ce budget quelques années après leur création.

Le Conseil Régional a créé une formation spécifique à cette fonction. En effet, si les thermiciens existent, si les employés municipaux existent, il n'existe pas de formation qui permet immédiatement à un technicien de traduire par des actes ses idées d'amélioration.

Un programme de 900 heures, sur 6 mois, a donc été bâti par les Services du conseil Régional, comprenant:

- une partie "thermique";
- une partie "connaissance du fonctionnement administratif d'une commune".

Nous avons à ce sujet fait un pari audacieux: après avoir recruté 14 demandeurs d'emploi de niveau "Technicien", nous avons lancé la formation et, durant les six mois de sa durée, les Services du Conseil Régional ont recherché parmi les 80 communes de plus de 10.000 habitants celles qui pourraient les accueillir sur les seul pari de la rentabilité de leur poste par les économies induites.

12 d'entre eux ont un emploi aujourd'hui, un est ingénieur conseil, le dernier a repris des études plus poussées.

La première promotion est donc une réussite. Nous avons déjà plusieurs demandes de communes pour une seconde formation et sommes prêts a accueillir des stagiaires d'autres régions françaises, voire d'autres pays.

2.7 **Le choix des investissements**

lère Phase Le diagnostic thermique

Toujours dans la même logique, après avoir informé, ou sensibilisé, ce qui parfois suffit pour déclencher un comportement ou un investissement économes, après avoir mis en oeuvre un processus de gestion et de formation, le Conseil Régional va aider la commune à identifier dans un premier temps les investissements aptes à réduire la consommation d'énergie ou à consommer une énergie plus adaptée et moins onéreuse, et dans un second temps à les classer par ordre décroissant de rentabilité.

Le Conseil Régional, avec le concours de l'AMFE, a pour les communes, fait l'acquisition d'un "BUS ENERGIE", véhicule équipé d'un plan de travail et d'un micro-ordinateur avec imprimante. L'exploitation de ce véhicule est assurée par l'Agence Régionale de l'Energie du Conseil Régional. Il a pour mission d'effectuer ces diagnostics, en priorité dans les petites communes. Les communes importantes (plus de 3.000 habitants) font en effet l'objet d'un démarchage des bureaux d'étude privés et il n'est pas, ni dans l'objet ni dans l'intention de l'Agence Régionale de réaliser des prestations d'études sur un marché privé. Seules donc les petites communes sont visitées.

A ce jour l'Agence a réalisé le diagnostic de 800 bâtiments dans 200 communes.

On remarque par ailleurs sur la carte suivante l'impact des réunions d'informations sur les diagnostics réalisés.

Le Bus Energie porte également les autres messages de l'assistance aux communes et pratique désormais, à l'aide de logiciels adaptés, l'optimisation des tarifs d'électricité tout en véhiculant, au sens propre du terme, des divers services du Conseil Régional.

2ème phase L'aide aux travaux

Enfin, parce que parfois les communes, et notamment les plus démunies d'entre elles, ne disposent pas toujours de ressources suffisantes pour réaliser les travaux déconomie d'énergie, le Conseil Régional et l'Agence Française pour la Maîtrise de l'Energie, les aident financièrement à hauteur de 30 à 40% du montant des travaux;

40% pour les communes de petite taille et de potentiel fiscal, par habitant, faible;

30% pour les autres dans la limite des crédits disponibles.

88 Millions de francs francçais ont ainsi été, depuis 1983, consacrés par l'AMFE et la Région, aux études et investissements d'utilisation rationnelle de l'énergie.

La plus grande satisfaction de cet exposé est sans doute le fait de constater que ce long processus, qui n'a pu être révélé dans ses résultats sur des cartes qu'après 5 années de tavail, a conduit à une véritable politique régionale où tous les secteurs géographiques de la région ont pu bénéficier des aides et services.

2.8 **Les outils du Conseil Régional Nord-Pas-de-Calais**

Pour réaliser ce travail, il était nécessaire de disposer à la fois:

*D'une structure d'assistance technique. Le Conseil Régional a donc créé l'Agence Régionale de l'Energie en 1980 pour la mise en oeuvre de ce type d'actions. Cette Agence, que je préside, anime donc les Plans Energétiques Locaux, gère le BUS ENERGIE, aide les gros consommateurs dans la négociation de leur contrats, conçoit la revue Energie Nord-Pas-de-Calais, et par ailleurs gère une bourse régionale de mise en relation de producteurs et d'utilisateurs potentiels de déchets.

*De crédits: ainsi a été créé le Fonds Régional pour la Maîtrise de l'Energie doté de 24 MF français/an et le Programme Régional pour la Maîtrise des Déchets pour les déchets, doté de 3 MF français/an.

En conclusion de cette partie de mon exposé, je voudrais attirer votre attention sur deux points:

- La construction de cette politique, depuis la sensibilisation, peu chère, jusqu'a l'investissement, aboutissement ultime d'un processus qui, comme vous le constatez, a porté ses fruits.
- L'originalité des investissements de maîtrise de l'énergie, seuls investissements productifs accessibles aux communes, générateurs de travaux dans l'économie locale.

Le secteur de consommation qui constituent les communes ne représente toutefois qu'une étape vers l'habitat, qui constitue environ 20% de la consommation régionale.

Le Conseil Régional va donc développer dès 1989 une démarche similaire en direction des citoyens. Ces derniers étant bien nombreux (4 millions, je vous le rappelle) il était nécessaire de trouver des relais. Les communes avec lesquelles nous avons travaillé en constituent d'excellents. Nous allons donc avec elles porter la démarche auprès de leurs concitoyens, avec la même méthodologie, disposant d'un atout supplémentaire, la valeur d'exemple de la commune:

- information;
- gestion, analyse des tarifs;
- diagnostics;
- aide aux investissements dans le cadre d'amélioration de l'habitat.

3. Conclusion

Je ne sais si la Commission (C.E.E.) s'interroge sur son meilleur niveau de partenariat: Région ou ville. Par contre, je sais que tout est ici affaire à la fois de définition et de compétence.

En France, l'échelon régional permet ce partenariat (22 Régions). Chacune d'elle est ainsi conçue qu'on puisse, à l'instar du Département à sa criation, traiter d'un problème en une journée en se rendant sur le site, dans la ville ou dans l'entreprise, remplaçant pour la circonstance le cheval d'antan par les multiples chevaux de nos véhicules... Etre ainsi à l'écoute de la demande est chose possible.

D'autre part, un certain nombre de fonctions et de moyens peuvent être mutualisés et mis à disposition des communes (exemple du Bus Energie).

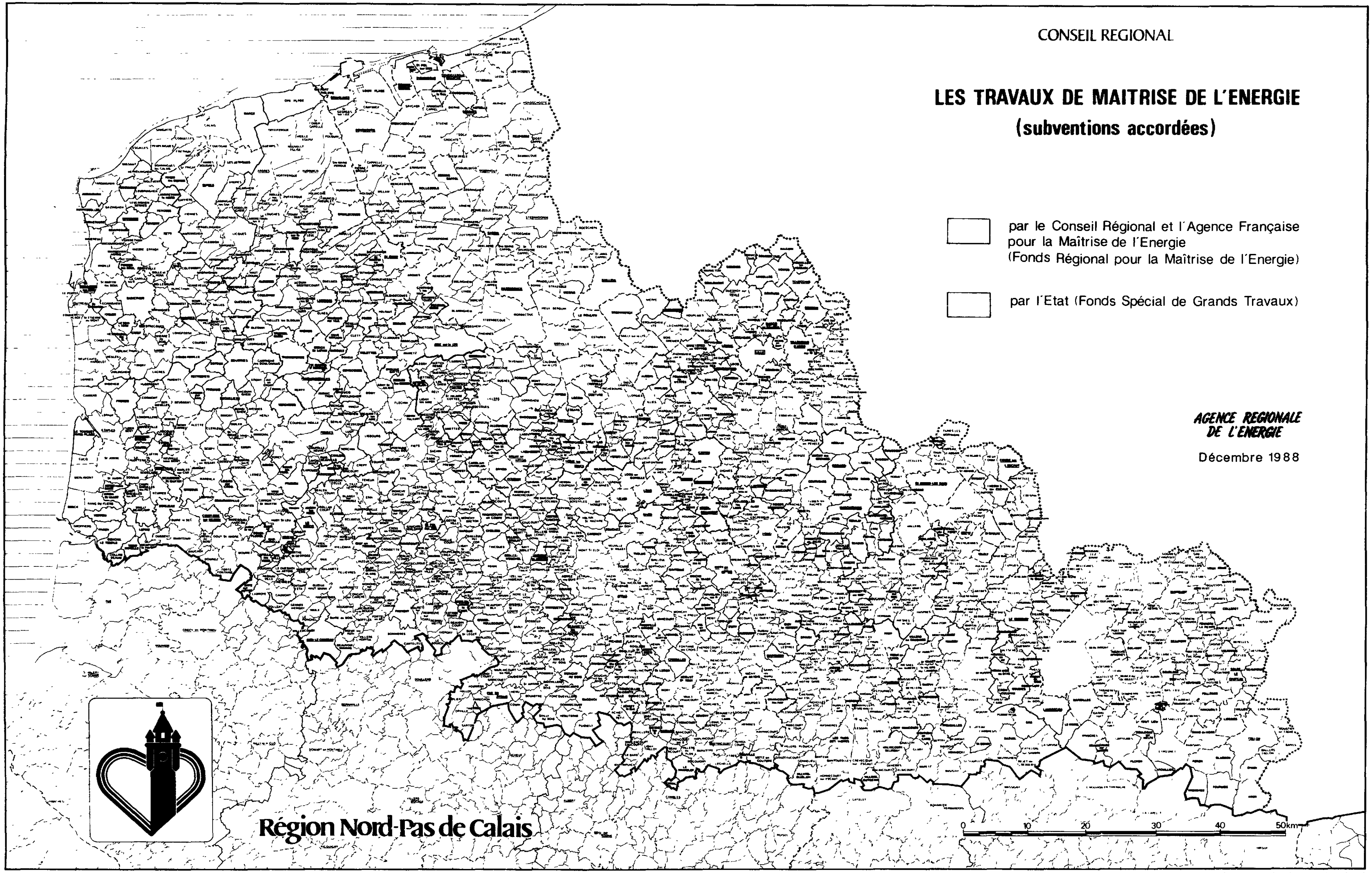
Enfin, la Région française a de larges compétences en vertu de la loi de décentralisation. Sa seule limitation est financière. Pour ce qui concerne la maîtrise de l'énergie, le niveau de partenariat et les moyens financiers sont tout à fait adaptés à l'échelon régional. Le partenariat est d'ailleurs multiple. Il existe en France aujourd'hui avec les Fonds Régionaux pour la Maîtrise de l'Energie qui comporte pour demi des credits de l'Etat. Il peut l'être demain avec la C.E.E. ou d'autres pays voisins.

Je n'exclus pas dans mon propos le travail au niveau urbain, bien entendu; vour l'avergu.

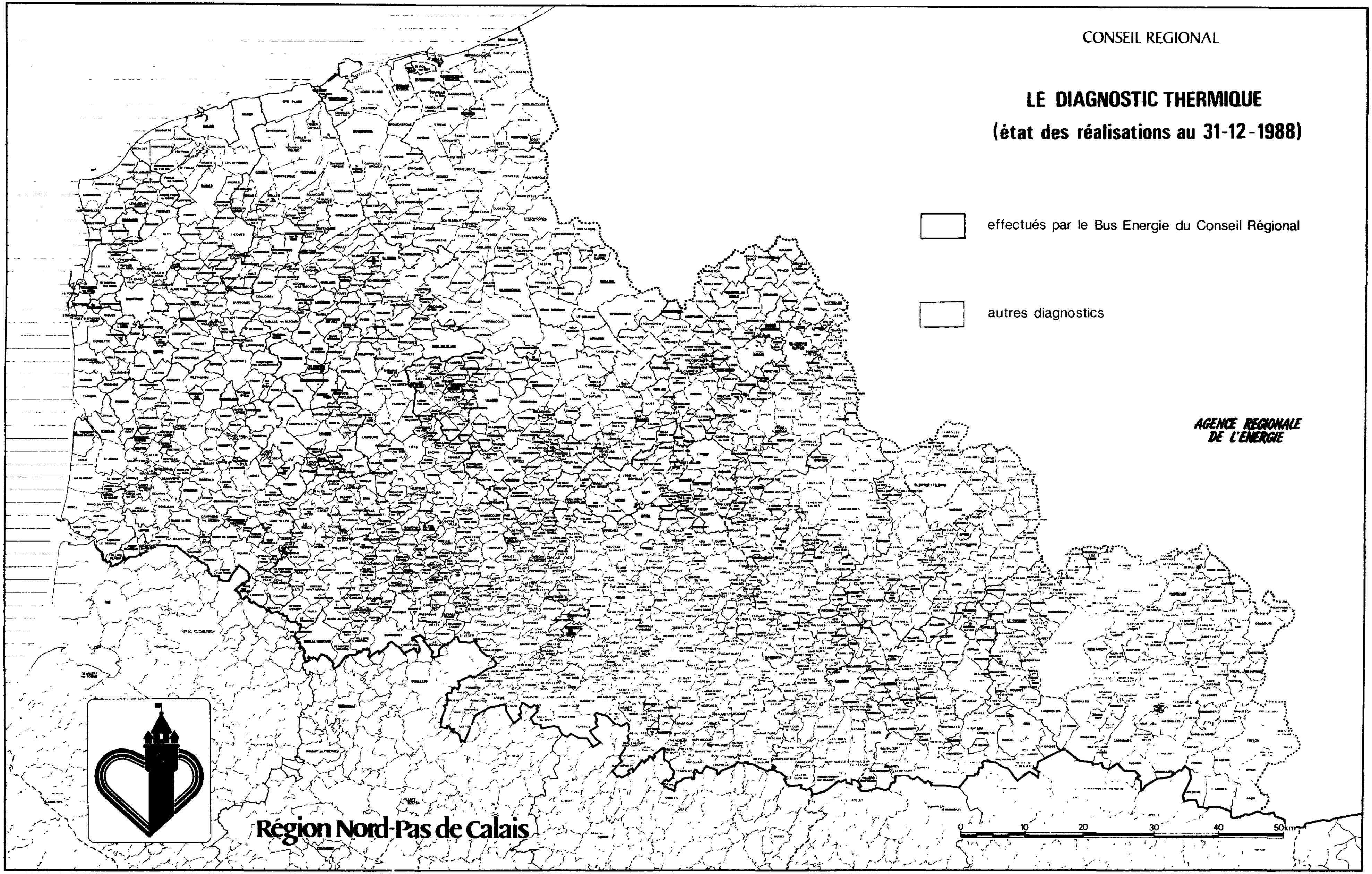
Dans le secteur rural, nous travaillons avec des ensembles de communes regroupées en Plans Energétiques Locaux.

En site urbain, nous menons des opérations assez intensives telles que les Villes-pilotes, avec l'A.F.M.E., où durant un an, les habitants se voient offrir le diagnostic thermique de leur maison après qu'une thermographie aérienne ait été réalisée. Nous travaillons également sur les schémas directeurs d'urbanisme afin que la préoccupation énergétique soit prise en compte, notamment dans les transports et l'habitat.

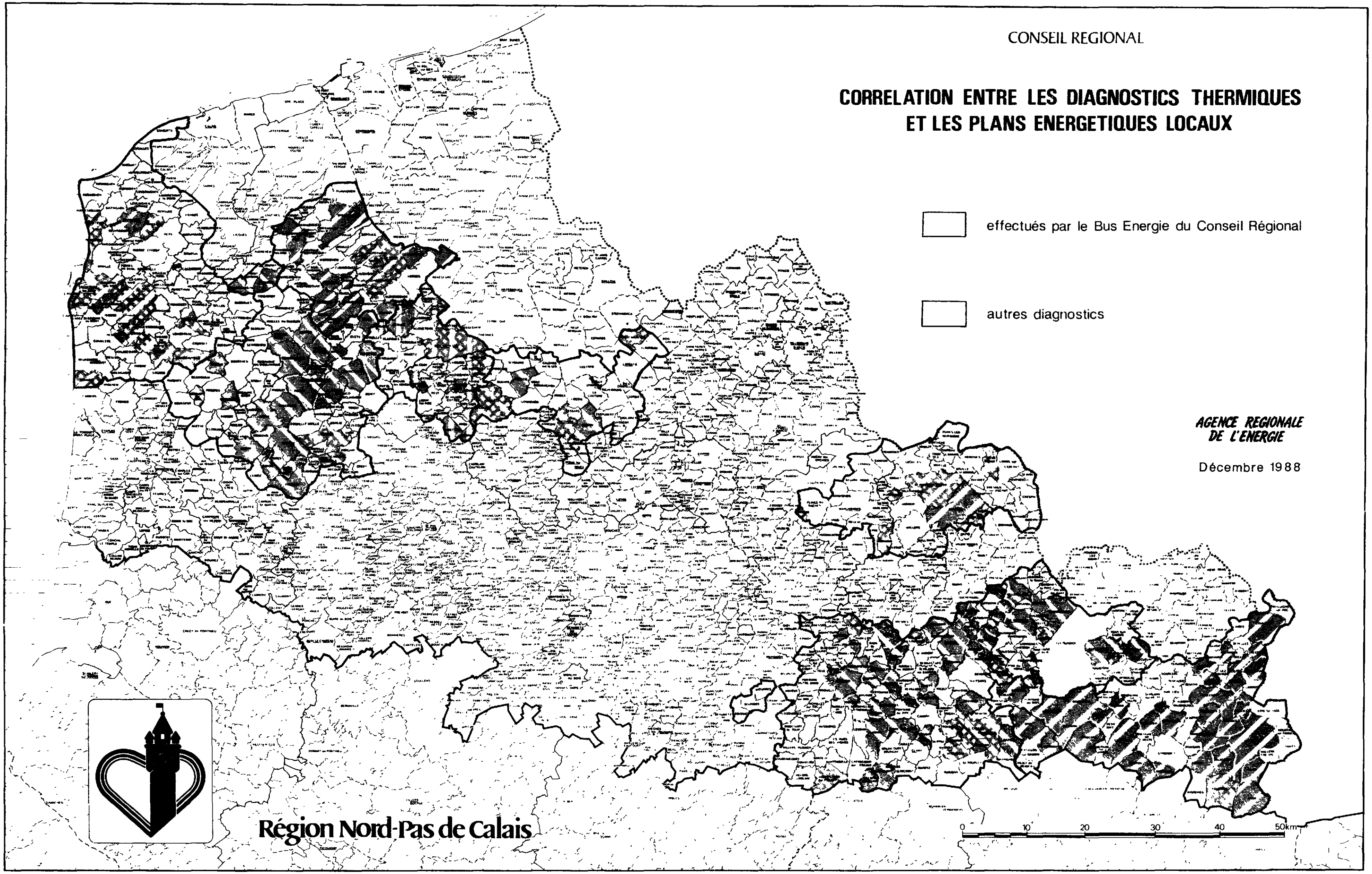
Mais je crois, en France en tout cas, que le travail sur une commune est surtout important dans la mise en place d'une strategie urbaine, et des outils et moyens correspondants financiers et humains. Ensuite, il faut aider une autre ville ou commune. C'est ce à quoi nous nous employons de façon permanente au niveau régional, mettant à la disposition de chaque commune: technicité, compétence et moyens financiers.



Atelier de Dessin et de Cartographie du Conseil Regional



Atelier de Dessin et de Cartographie du Conseil Regional


CONSEIL REGIONAL
CORRELATION ENTRE LES DIAGNOSTICS THERMIQUES
ET LES PLANS ENERGETIQUES LOCAUX
effectués par le Bus Energie du Conseil Régional
autres diagnostics
AGENCE REGIONALE
DE L'ENERGIE
Décembre 1988
Région Nord-Pas de Calais
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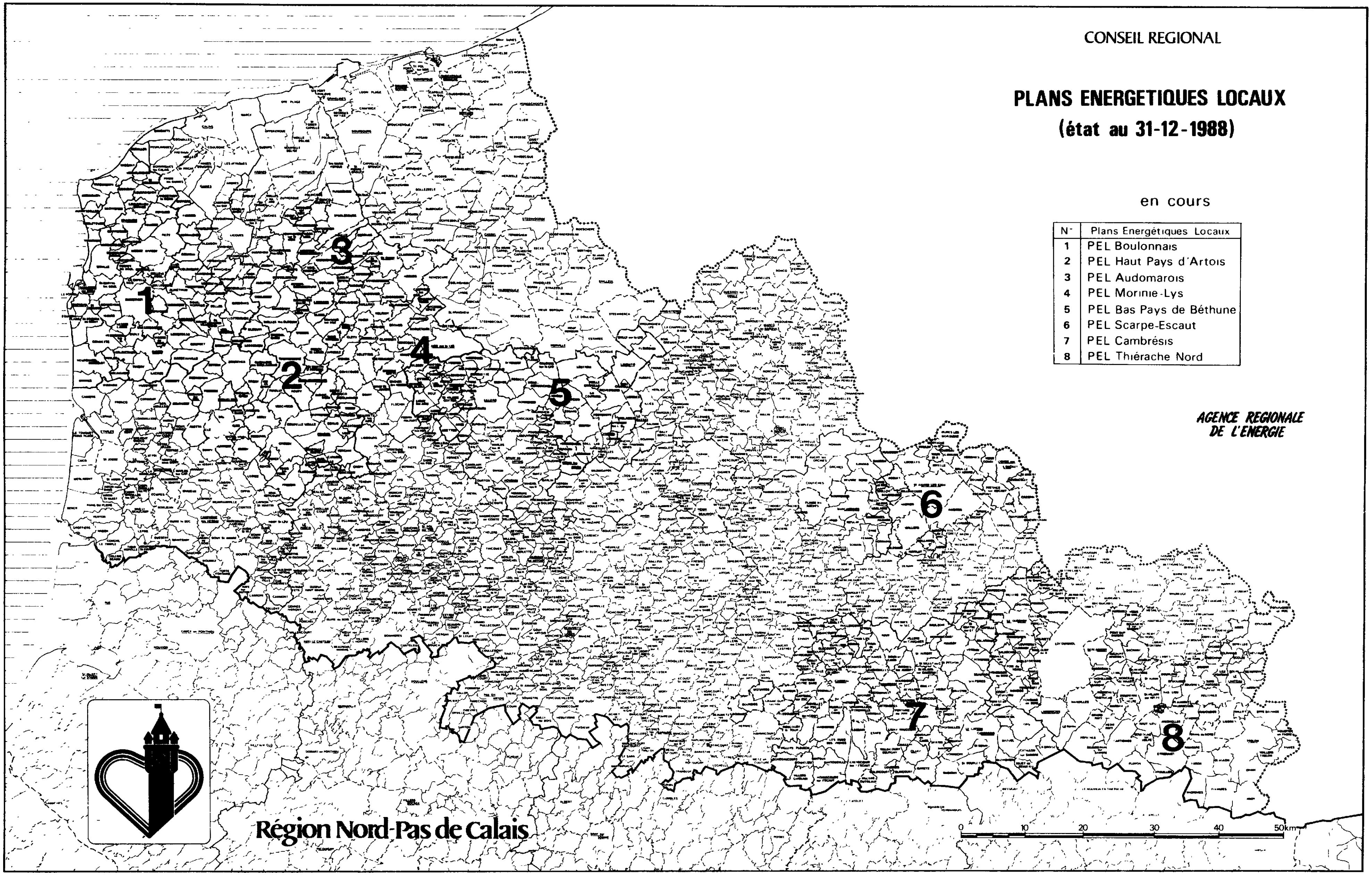
Atelier de Dessin et de Cartographie du Conseil Regional



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9. LE CONCEPT DE PLANIFICATION ENERGETIQUE LOCALE A LA LUMIERE DE L'EXPERIENCE DES VILLES FRANCAISES

J.P. Bonaiti

1. Energie et Decentralisation dans le Contexte Français

L'extrême centralisation du système énergétique français

- les entreprises nationales: EDF, GDF, CDF;
- un opérateur de "maîtrise de l'énergie": l'AFME.

De la logique de l'offre aux surcapacités et à la concurrence exacerbée

- corporatisme et évolution du leadership;
- concurrence dans les usages thermiques.

Mouvement historique de "désaisissement" des collectivités locales

- les droits historiques des régions et communes ne sont plus appliqués;
- échec de la tentative de décentralisation institutionelle proposée par le gouvernement en 1981.

Revendication de responsabilité énergétique des collectivités locales

- une évolution des idées en faveur de la décentralisation;
- une prise de conscience consécutive aux chocs pétroliers;
- conflits avec les entreprises énergétiques nationales;
- les points d'appui régionaux pour les initiatives locales;
- une expérience acquise de la gestion de l'énergie et de la distribution de l'énergie dans quelques villes pour des raisons historiques.

2. La Prise en Charge de l'Energie par les Collectivites Locales Depuis 1973

Origine des principales sollicitations

- élévations des charges de chauffage (patrimoine municipal, habitat);
- mouvement écologiste (avant 1981);
- dynamisation conjointe des politiques de gestion locale (urbanisme transport, déchets, gestion habitat social, restauration immobilière, emploi, etc...);
- incohérence des stratégies des entreprises énergétiques (développement des réseaux, implantation ou fermeture de grands équipements énergétiques);

- difficulté de contrôle des entreprises énergétiques municipales (corporatisme, désaccords avec les concessionnaires privés).

Les acteurs locaux

- faible intérêt des associations d'habitants et des syndicats d'entrepreneurs pour l'énergie;
- quelques réseaux "actifs" ici ou là (entrepreneurs, chercheurs, élus et techniciens municipaux etc...).

Les rapports triangulaires etat/entreprises énergétiques/collectivités locales

- alliances, conflits, coopérations.

Nature, niveaux et formes de l'engagement des collectivites locales

- motivations: gestion économe, résolution de conflits, anticipations, image politique;
- freins et obstacles: risques techniques ou financiers, concurrence des autres preoccupations, opposition des entreprises énergétiques et de l'Etat aux responsabilités communales;
- les quatre niveaux d'engagement possibles:

  1. gestion du patrimoine municipal;
  2. orientation des services et entreprises paramunicipaux (transports en commun, habitat social, etc...) et planification urbaine (P.O.S. etc...);
  3. contrôle et gestion des entreprises énergétiques locales (régies gaz-électricité, réseaux de chaleur);
  4. "intervention" hors champs de compétition habituels
     - coordination du développement des réseaux de distribution énergétique;
     - négociation avec entreprises énergétique à propos des grands équipements de production ou transport d'énergie
     - soutien au développement des énergies locales et à la maîtrise de l'énergie dans le secteur privé.

3. Les Differents Contenus du Concept de Planification Energetique Locale

- La planification energetique urbaine: insertion de l'énergie dans les documents d'urbanisme (Reims etc...).
- Les bilans énergétiques locaux et etudes de potentiels
  . les bilans (Grenoble, 1978);
  . les plans départementaux.

- Les programmes locaux de maîtrise de l'énergie: de nombreuses villes moyennes (Mâcon, Roanne, Epernay, Vitré, Luçon, etc...).
- Les plan communaux: programmes d'intervention dans le patrimoine communal et projets des entreprises énergétiques locales (Rennes, Lille, Valence etc...).
- Les plans locaux: dynamiques de concertation multi-partenaires (techniques, administratifs, associatifs, politiques) visant à définir des objectifs et stratégies de prise en charge de l'énergie à tous les niveaux: (patrimoines municipal et para-municipal, entreprises énergétiques locales, réseaux énergétiques (Grenoble, 1981-83, La Bruguiere, La Roche s/Yon).

4. Bilan et Enseignements

- L'énergie composante des politiques locales et non pas enjeu sectoriel.
- Le temps et la gestion de l'énergie: l'apprentissage de la "culture" énergétique, les dynamiques conjointes ou séquentielles.
- Les poids des opérateurs nationaux et l'assignation d'un rôle de "relais" aux collectivités locales.
- Diversité des capacités de prise en charge de l'énergie selon les villes et les régions.
- Les facteurs de reussite de la planification locale
  - les compétences des "outils" locaux (agences d'urbanisme, services des villes, compagnies de chauffage urbain etc.);
  - la coordination des élus municipaux, services techniques et acteurs locaux;
  - l'engagement et la continuité du pouvoir politique municipal.

5. Conclusion: Quelle Strategie pour les Villes Françaises?

- L'énergie n'est pas un enjeu en tant que tel mais une composante d'autres enjeux.
- Très grande variabilité des situations et capacités d'initiative: pas de modèle transposable.
- Quels alliés: régions, AFME, Caisse des Dépôts, Administrations nationales?
- Le concept de planification énergétique paraît aujourd'hui moins adapté que celui de Programme d'actions ou Actions programmees.

10. L'ENERGIE ET LA VILLE, L'APPROCHE FRANCAISE

O. Bouissou

1. Introduction

En France, la politique de Maîtrise de l'Energie est, traditionnellement, mise en oeuvre à deux niveaux:

- au niveau national: une structure forte, l'AFME, pour s'occuper de l'utilisation rationnelle de l'énergie, des énergies renouvelables: 400 personnes; budget annuel d'intervention d'environ 420 MF: action de R D&D et de diffusion;
- au niveau régional: actions conjointes des régions et des délégations régionales de l'AFME.

La ville est le point de rencontre de tous les problèmes: circulation, éclairage, gestion d'un patrimoine propre, gestion d'un patrimoine collectif (équipements sportifs, sanitaires, habitat social, pollution, etc.).

Il faut essayer de faire de la ville le point de rencontre des solutions.

Les villes consomment
exercent des cométences et gèrent des services
produisent et distribuent de l'énergie
conseillent et aident les citoyens

2. Les Villes, Consommatrices d'Energie

Enquête sur 54 villes: les municipalités ont dépensé en moyenne de 73 à 270 F/hab. (180 F en moyenne) pour:

- chauffer les bâtiments (44%)
- éclairer les bâtiments (28%)
- éclairer les rues (20%)
- faire rouler les véhicules (8%)

L'objectif est donc de réduire la facture en gérant au mieux l'existant et, si nécessaire, en le modifiant.

Des résultats importants peuvent être obtenus: exemples de Rennes, Besançon, Sartrouville.

A. Bien gérer l'existant

a) Un préalable: Etablir un bilan financier annuel. C'est possible grâce au plan comptable obligatoire qui facilite les comparaisons. Cela permet d'évaluer l'enjeu de la Maîtrise de l'Energie et d'éviter les erreurs.

b) 1ère étape: mise en place d'un responsable Energie pour:

- le suivi des consommations
- le suivi technique
- la formation et l'information des consommateurs.

Ce responsable doit être formé --> Centre national de la fonction publique territoriale.

Jusqu'à 50.000 habitants, un responsable Energie peut suffire.

c) 2ème étape: mise en place d'outils de gestion:

- tableaux de bord
- relevés hebdomadaires.

--> nécessité fréquente d'un soutien technique extérieur

d) 3ème étape: rechercher les meilleurs tarifs:

- informatique --> logiciels spécifiques
- tarifs à renégocier après le diagnostic énergétique.

B. Améliorer l'existant

a) un préalable: le diagnostic

C'est l'analyse systématique de toutes les sources d'économie d'énergie avec description de la situation, analyse, proposition d'actions et de travaux.

On peut faire un pré-diagnostic en comparant les ratios habituellement constatés dans d'autres villes.

b) Optimisation du choix des travaux: Ce choix peut être fait par:

- ordre de rentabilité décroissante;
- ordre de coûts croissants.

On peut aussi établir une méthodologie par type d'équipement. Par exemple:

- Ecoles et bureaux: usage intermittent, d'où l'intérêt de la programmation, de la régulation et d'un changement de tarification. En revanche, l'isolation et les transformations d'installation sont moins prioritaires. Chaque équipement a ainsi des caractéristiques et donc des solutions qui lui sont propres: équipement sportif, piscine, logement, établissement de santé, éclairage public, véhicule, etc...

c) <u>Le financement</u>

Le financement peut être assuré:

- sur le budget de fonctionnement pour les travaux à temps de retour inférieurs à un an (modification tarifaire, amélioration d'exploitation, programmation et régulation simples);
- sur le budget d'intervention pour les autres: régulation et programmation complexes, isolation, récupération de chaleur, changement de matériel.

Le financement peut être assuré par: subventions, emprunts, auto-financement.

Deux types de financement spécifiques: le credit-bail (SOFERGIES), le financement par tiers. Ces deux modes de financement sont bien adaptés aux travaux d'économie d'énergie qui se caractérisent par le fait qu'il faut dépenser plus aujourd'hui pour dépenser moins demain.

d. <u>Construire des bâtiment de qualité</u>

- en tenant compte du climat et de la localisation;
- en respectant les règlementations thermiques;
- en étudiant le choix de l'énergie.

3. Les Villes Exercent des Compétences et Gèrent des Services

A. La circulation

En France 45% du carburant sont consommés pour des déplacements urbains. --> régulation du trafic, promotion des transports en commun (métro, bus, transports à la demande), un urbanisme adapté au déplacement des piétons et des deux-roues.

- Transports en commun: Pour les 100 plus grandes villes françaises-hors Paris - le nombre de voyages/hab/an est passé de 58 en 1973 à 93 en 1985--> progrès. Certaines municipalités atteignent le chiffre de 200 voyages/hab/an.

B. L'urbanisme

- Comment construire une ville économe?

--> exemple des villes nouvelles

- Maîtrise de l'énergie, protection de l'environnement et qualité de la vie vont en général de pair.

4. Les Villes comme Productrices et Distributrices d'Energie

En France, il s'agit surtout d'énergies "locales", puisque les régies de gaz et d'électricité représentent < 3%:

A. Réseaux de chaleur

En France, 322 réseaux de chaleur > 3,5 MW --> 2,7 Mtep, soit 7% de l'énergie consacrée au chauffage. Ils permettent d'utiliser des sources d'énergie très diverses (charbon, ordures, géothermie, bois, ...).
Contraintes économiques: investissements lourds et baisse du prix du fioul.
Contraintes techniques: zones denses des agglomérations.

Il faut assurer la coordination des différents acteurs économiques locaux: --> loi sur la chaleur (juillet 1980).

B. Elimination des déchets

Trois procédés:

- incinération: 65 municipalités traitent les déchets du quart de la population française;
- méthanisation (procédé Valorga à Amiens);
- fabrication de combustibles solides.

Là aussi, intérêt de la comparaison des procédés: rôle de l'Institut International de Gestion et de Génie de l'Environnement.

C. Epuration des eaux usées

- les possiblités du biogaz.

D. Les ressources minihydrauliques

Un guide d'études et un catalogue d'entreprises spécialisées ont été spécialement préparés par l'AFME pour répondre aux besoins d'information des collectivités locales.

E. L'énergie solaire

- l'eau chaude solaire: surtout pour les piscines mais aussi pour hôpitaux, camping, etc.
- l'électricité photovoltaïque: signalisation, éclairage, télécommunication, etc.

5. Les Villes Conseillent et Aident les Citoyens

A. Information des habitants

Brochures, renseignements téléphoniques, articles de presse, relais permanents d'information.

B. Rénovation thermique des logements

Expérience des "villes pilotes" dans une quarantaine de municipalités.

6. Conclusion

La planification énergétique et la Maîtrise de l'Energie dans une ville permettent:

- des économies directes sur le budget de la cité;
- des économies indirectes sur les coûts d'entretien et de renouvellement des matériels et des bâtiments;
- une amélioration de la productivité des services: grâce à une amélioration de la circulation, notamment;
- une solution à des problèmes cruciaux: pollution atmosphérique, élimination des déchets, déplacements urbains et donc à une amélioration de la qualité de la vie;
- une stimulation de l'activité économique locale.

Pour un responsable municipal, c'est une occasion unique de jouer sur autant de tableaux.

Les conditions de la réussite sont:

- la convergence d'une volonté politique au niveau local et de la mise au point d'une capacité technique;
- un développement des comparaisons nationales et internationales pour mieux informer les responsables sur les expériences réussies afin de les motiver et de les stimuler.

Dans cette perspective, la CEE peut jouer un rôle important.

11. PLAN ENERGETIQUE A LA VILLE DE RENNES

F. Berthet

1. Maîtrise de l'énergie par les Collectivités Locales

La plus grande partie de l'énergie consommée dans nos pays industrialisés est consommée dans la ville: 65% de l'énergie utilisée pour l'industrie, 75% de l'énergie utilisée pour les secteurs résidentiels et tertiaires et 50% de l'énergie totale consacrée aux transports l'est dans les agglomérations.

C'est ainsi que plus de 70% de l'énergie totale de la France est consommée dans la Ville.

Les villes interviennent dans la maîtrise de l'énergie du territoire communal à divers titres:

- utilisateur, la Ville consomme de l'énergie comme gestionnaire du patrimoine communal (bâtiments, voirie, jardins, réseaux...) et de services rendus à la population (transports, ordures ménagères, eau, assainissement...);
- fourniture d'énergie par l'intermédiaire le plus souvent de résaux de chaleur (307 réseaux représentent 15 800 MW installés et concernent 3 millions d'habitants) ou plus rarement pour l'électricité et le gaz;
- aménageur, par le choix qu'elle opère, elle joue un rôle sur les consommations pour les déplacements et le secteur domestique;
- enfin la Ville peut jouer un rôle de sensibilisation et d'incitateur de comportements, en montrant l'exemple d'une bonne gestion de l'énergie pour ses propres besoins, en réalisant des réalisations exemplaires, en sensibilisant la population et en rapprochant les organismes intéressés par l'énergie pour des actions concertées.

2. Elaboration d'un plan "L'Energie dans la Ville"

Ces diverses interventions ont conduit la Ville de Rennes à une réflexion sur l'action et le rôle des responsables municipaux à travers leurs diverses compétences; décideurs, concepteurs et gestionnaires à la vie de la cité.

C'est ainsi que Monsieur le Maire de la Ville de Rennes, alors Ministre délégué auprès du Ministre de l'Energie, chargé de l'Energie, a confié en 1981 à Monsieur le Directeur Général des Services Techniques de la Ville de Rennes la mission d'organiser et piloter des groupes de travail Energie couvrant des différents domaines municipaux comprenant des ingénieurs municipaux et des représentants d'organismes publics, parapublics et privés.

Onze groups ont ainsi été constitués et ont travaillé pendant 8 mois:

- urbanisme et aménagement;
- assainissement et eau;
- chauffage urbain - ordures ménagères;
- abattoirs et entrepôts frigorifiques;
- serres;
- parcs et ateliers;
- transports;
- architecture et bâtiment;
- energie dans le district (communes périphériques);
- sensibilisation des écoles;
- habitat neuf et ancien - permis de construire.

La Ville de Rennes, pour sa part, était déjà sensibilisée à la Maîtrise de l'Energie, depuis plusieurs années elle avait entrepris des actions dans ce sens (Isolation des bâtiments, régulation, programmation et rénovation de chaufferies, remplacement des lampes fluorescentes par des lampes à Vapeur de Sodium Haute Pression, utilisation du gaz méthane à la station d'epuration des eaux usées, récupération de chaleur à l'usine d'incinération des ordures ménagères, utilisation de l'énergie solaire).

Depuis plusieurs années, les services techniques de la Ville de Rennes établissaient déjà un rapport d'exercise sur l'énergie dont les propositions ont pu être reprises lors de la mise en place des groupes de travail Energie le 21 September 1981.

Chaque groupe a eu pour tâche d'analyser la situation de la Ville de Rennes sur le plan énergétique, ainsi que les problèmes techniques, financiers et juridiques posés, puis de définir les objectifs, de délimiter le champ d'etudes afin de présenter à la municipalité un plan pluriannuel d'actions.

Le projet final ainsi mis au point en Juin 1982 a permis de négocier des contrats avec l'Etat.

Outre l'elaboration du projet de contrat, le fonctionnement de ces groupes de travail a été l'occasion d'échanges très positifs avec l'ensembre des partenaires associés et dans l'ensemble l'expérience a permis de créer des liens nouveaux ou de renforcer des relations entre techniciens d'organismes différents.

3. Conclusions

La mise en oeuvre du plan pluriannuel depuis 1982 permet de tirer des conclusions.

Tout d'abord, la mise au point d'un projet global de plan énergétique communal est une tâche complexe comme tous les exercises de programmation et en particulier dans le domaine de l'énergie où les responsabilités su superposent entre la commune, les services publics nationaux et les sociétés nationalisées.

La complexité d'approche provient également du fait que les problèmes d'énergie se rencontrent dans toutes les activités municipales et l'élaboration d'un plan pluriannuel énergétique doit être conduite avec le souci de prendre en compte les éléments de planification connus ou envisagés dans les autres secteurs.

Pour le moins, le plan énergétique ne doit pas contrarier les politiques municipales arrêtées par ailleurs en matière d'urbanisme, de transports, d'équipements, d'infrastructures.

En tant qu'utilisateur, la Ville maîtrise bien les actions en matière énergétique, négocie efficacement les contrats d'aides avec l'Etat, poursuit annuellement la réalisation de travaux d'économies d'énergie.

L'établissement de bilans annuels et de tableaux de bord permettent de mesurer et suivre les résultats obtenus.

Pour la fourniture d'énergie, la situation est bien plus complexe. Si pour le chauffage urbain, la Ville peut maîtriser la production et la deistribution, soit par une régie municipale, soit par l'intermédiaire d'une société exploitante, il n'en va plus de même pour l'électricité et le gaz.

En effet, la planification de la distribution de ces deux energies échappe en grande partie à la Ville du fait de l'existence de sociétés nationalisées qui appliquent en premier lieu les politiques de l'Etat.

Le rôle du pouvoir concédant des villes, pourtant affirmé par la loi de nationalisation de 1946 sur le gaz et l'électricité et soutenu par les récentes lois sur la décentralisation au profit des communes, est pratiquement ignoré. C'est ainsi qu'aucune convention de concession pour la distribution de l'électricité n'a été signée en France.

Cette situation se répercute sur le rôle d'aménageur de la Ville où la prise en compte du choix de desserte en énergie résulte de négociations laborieuses notamment sur l'aspect économique. En effet, l'impact des coûts d'énergie pour les habitants et des coûts de fonctionnement ultérieurs pour la commune sont mal pris en compte et difficilement maitrisés.

L'absence de bilans et de tableaux de bord au niveau du territoire communal souligne déjà la difficile maîtrise de la Ville au niveau de la fourniture d'énergie.

En ce qui concerne le rôle de sensibilisation et d'incitation de comportements de la Ville, celui-ci ne relève pas d'une compétence propre en matière énergétique, mais s'inscrit comme un prolongement ou l'intégration à d'autres actions de type économique ou de logements par exemple.

La planification de ces actions dépend donc d'une bonne coordination avec les différents partenaires publics, parapublics ou privés.

Du fait de sa qualité de gestionnaire de la cité, la Ville a cependant un rôle important de soutien, coordonateur et de fédérateur d'initiatives. C'est ainsi qu'un salon sur les économies d'énergies dans l'habitat est organisé et que des programmes de diagnostics thermiques auprès des particuliers sont élaborés avec les partenaires locaux (Agence Française pour la Maîtrise de l'Energie, Agence Nationale pour l'Amélioration de l'Habitat, Direction Départementale de l'Equipement, Association pour la Protection, l'Amélioration, la Conservation, la Transformation de l'Habitat et la Restauration Immobilière).

Depuis 1985, les coûts de l'énergie ont baissé de manière importante: 48% pour le fuel, 35% pour le gaz, 30% pour le chauffage urbain. Ces baisses ont un impact important sur les budgets énergie, laissant le champ libre à un relachement des comportements et un désintérêt croissant pour la maîtrise de l'énergie.

La question est posée, faut-il poursuivre l'élaboration ou la mise à jour de plans énergétiques communaux?

A cela, il apparaît pour la Ville de Rennes que le coût total des dépenses d'énergie reste malgré tout élevé, 29 000 000 F en 1987, sans économies d'énergie ce coût serait supérieur de près de 15 000 000 F, cette masse financière est donc disponible pour d'autres dépenses.

Des matériels nouveaux plus économes apparaissent sur le marché, il faut donc continuer à les tester et étendre leur emploi le cas échéant, dont l'impact dépasse les simples économies d'énergie.

Par exemple, l'emploi de diodes électroluminescentes pour la signalisation permet non seulement des économies d'énergie mais également de maintenance.

Dans cette conjoncture énergétique facile, le rôle d'exemple de la Collectivité est d'autant plus important.

Enfin, l'énergie coûte cher à la France, deux fois plus que la santé, quatre fois plus que l'enseignement, cinq fois plus que la défense, donc établir un plan de maîtrise énergétique communal cela vaut la peine.

Cette réponse étant donnée, il convient de s'interroger sur les éléments à prendre en compte dans le futur, notamment face au marché unique européen de l'énergie.

Une étude prospective "L'énergie et la Ville au seuil de XXI siècle" réalisée pour l'Association des Ingénieurs des Villes de France, Groupe de Travail Energie fournit les éléments de prospective suivants:

- Au niveau des jprogrammes traditionnels de gestion rationnelle de l'énergie visant les secteurs actuels d'intervention de la Ville, notamment son propre patrimoine, la programmation restera de la compétence de la Ville et sera poursuivie. Des arguments moteurs devront certainement être adaptés à la conjoncture.
- Au niveau moins traditionnel pour la Ville en France, de valorisation des ressources énergétiques locales et des productions locales d'énergie, d'une maîtrise accrue de la distribution, permettant par exemple la production et la vente combinée l'électricité et chaleur, ainsi qu'au niveau d'une maîtrise accrue d'arbitrage entre des choix d'énergie, et de conseil auprès des consommateurs locaux, la programmation peut évoluer:

  . vers une plus grande compétence comme opérateur énergétique notamment si l'Europe énergétique progresse vite et fortement et si EDF se trouve face à un marché énergétique européen très ouvert;

  . vers la perpétuation de la quasi absence de la Ville comme opérateur énergétique si l'Europe énergétique progresse peu et lentement et si EDF, se trouvant alors face à peu de débouclés à l'exportation, continue à jouer un rôle "étouffoir" vis-à-vis des énergies concurrentes.

La développement d'une planification énergétique urbaine dépendra donc de la réalisation de l'une ou l'autre de ces hypothèses.

12. CONCEPTS OF LOCAL ENERGY PROVISION IN THE FEDERAL REPUBLIC OF GERMANY

W. Gottschalk

1. Nature of the Concept of Local Energy Supply

As a start, I will give a definition of the concept of local energy supply (ÖVK). In Germany public utilities understand that as follows:

- systematic planning and realisation of integrated line-bound supply of energy (gas, electricity, district heat);
- within a certain local unit (region, commune, district);
- targeted to the local situation and local goals of development;
- by taking into account the aims of the government regarding energy policy and environment (federation and region);
- the need to use energy efficiently and economically;
- by taking into account the customer concerned (inhabitants, trade and industry).

The targets of local energy provisions are firstly to reduce the heating of single units on a carbon and fuel oil basis which in most cases is a burden to the environment, and secondly to cover as much as possible of the needed energy supply by line-bound energy such as gas, electricity and district heating.

A concept of local energy provision should contain the needed strategies, which have to be extrapolated and transformed into practical operations.

Emphasis is laid on the connection between the concept of local energy provision and local planning of economic development. This means integrated and systematic planning of all conditions of living necessary for the inhabitants' welfare: that is structure of settlement, development, infrasturcture, structure of economics, structure of provision, of social formations, etc.

Therefore, we define the concept of local energy provision as long-term planning by experts within the scope of the local planning of the economic development.

The <u>political responsibility</u> for this is charged to the elected representatives of the ordinary inhabitants (municipal council).

The <u>professional responsibility</u> for local concepts of energy supply is bound to the public utilities' boards (municipal provision).

A concept of local energy supply mostly consists of

- a frame concept and
- several area concepts derived from the frame.

The <u>frame</u> concept is prepared for the total region under consideration of the inquiry (for instance municipal district). The statistical figures for the needed status are only classified roughly.

<u>Area</u> concepts only refer to the chosen part of a district (quarters, settlements, industrial areas), or objects (hospitals, university districts, administration areas). The basis of the figures has to be more detailed. The treatment of area-concepts is mainly handled in the frame of the time-table for the realisation of the concept for energy supply.

Concepts for local energy supply have to take into account energy and environmental political aspects, as well as those of economy and local politics. In addition, they have to meet all the requirements of industrial management: the proposed solutions have to be examined in respect of efficiency.

Local concepts of energy supply have to take into account the economic system of the Federal Republic of Germany. It is a social market economy which entails a competitive profit system. Because of the free enterprise system, energy supply concepts are handled by using marketing instruments and in competition with other energy suppliers.

In each case a concept of energy supply is neither the instrument of a planned economy for introducing certain kinds of energy by force (for example district heating), nor an instrument to induce political motivated changes in the structure of the energy supply industry of the Federal Republic of Germany.

2. Reasons for the Development of Concepts of Provision and their Actual Status

In the Federal Republic new concepts for energy supply according to the definition indicated were started during the sixties. The development was statutory and supported by the government during the seventies as a result of the fuel-oil price crisis and the growing concern about protection of the environment.

Many governmental programmes supplied local areas with the necessary means from the public budget in order to introduce useful investigations (for example, how to save heating energy, extension of carbon heating factories and district-heating).

In 1980 the Federal Republic decided on a research program entitled "Local and Regional Energy Supply Concepts". The target was to support local governments and enterprises in energy supply. So-called parameter surveys, plan surveys and model surveys were carried out by scientists, research institutes and energy supply enterprises.

The government's request to initiate energy supply concepts was taken very seriously by local governments and local enterprises. In 1986 the PROGNOS AG institute (Basel, Switzerland) noted that there are as many as 190 local and regional energy supply concepts in the Federal Republic.

All towns of more than 200,000 inhabitants have already developed and energy supply concept, except for one town. In smaller towns the situation is less favourable.

Three kinds of supply concepts can be differentiated:

- planning-oriented concepts;
- enterprise-oriented concepts;
- coordination-oriented concepts.

The emphasis of the concept is to be found in the area of the enterprise and coordination orientated ones.

Of the total amount of the known concepts

24% is in the stage of preparation;
7% in the stage of analysis;
16% in the stage of finding the concept;
13% in the stage of decision;
40% in the stage of realisation.

The initiative for setting up a concept came

in 54% of all cases from an enterprise for energy supply;
in 36% of all cases from the local administration;
in 10% of all cases from the government (Federation).

An interesting point is to see which kinds of energy are preferred within the existing supply concepts:

- 26% district-heating (pipelines);
- 54% natural gas;
- 10% electric power;
- 3% carbon;
- 7% regenerative energy.

3. The Sequence of Operations in Setting up Supply Concepts

Usually the sequence of operations in setting up local supply concepts is divided in the following stages:

- phase of preparing plans;
- phase of analysis;
- working out the concept including an efficiency calculation of profitability;
- phase of realisation.

Within the phase of preparation plans the organisation and method to construct the concept is determined, that is

- setting up a project organisation;
- determining all persons involved;
- timing;
- coordination of the sequence of operations;
- size of operation;
- character of operation (planning orientation, enterprise orientation, customer orientation).

Within the phase of analysis the information which is necessary for the heating atlas is collected and put together (structure of settlement, building, structure of energy demand, structure of energy supply, situation of the environment).

This phase requires a lot of time and money. It is often very difficult to provide the necessary figures. The use of computers is essential.

Within the phase working out the concept an opinion on the results of the analysis is formed. From these concrete local targets are set which become a basis for developing alternative solutions for the presented energy supply scenarios.

The scenarios are compared, an efficiency calculation is made and further valuation criteria are checked as well, for example

- efficiency and reasonableness for provision;
- degree of nergy saving;
- substitution of fuel oil;
- security of supply;
- tolerance for the environment;
- tolerance for social patterns and acceptance by the customer;
- accordance with region-specific aims of the community.

After all these steps a decision will be made of one of the proposed alternatives. Within the following phase of realization the decision will be accepted or not by the committee of the municipal provision enterprise and within the political town council.

Within the phase of realization it has to be made sure that the concept can be realized. Contracts have to be ratified, governmental authorisations have to be received. Financial resources have to be found, customers have to be advised and motivated, etc. Technical and economical questions have to be solved. The planning of the line-bound energy has to be designed in detail.

Advice for customers and marketing is essential. Models for reducing the energy supply in public buildings have to be worked out. Parallel with these steps a well-targetet public information campaign has to be started. Finally, the extrapolation of the energy supply concepts has to be planned. All these operations have to be organized by the community enterprise (sequence of operations, establishing of manpower, etc.).

Within the limited space available, it was not possible to give more details on the points which are being discussed in politics and in economics, for example, the political contents of supply concepts; problems with the realisation of concepts, and the already visible development in this subject.

13. URBAN ENERGY PLANNING IN HAMBURG

N. Stein

In this contribution, I would like to present two projects under consideration in ZEWU. ZEWU is the abbreviation of Zentrum für Energie-, Wasser- und Umwelttechnik. This might be translated as Center of Energy, Water and Environmental Technology.

ZEWU is one department of the Chamber of Craft of the city of Hamburg (figure 1). This chamber is quite different from the Chamber of Commerce, where all trading and industrial companies are organised. The members of our chamber are mostly small enterprises of craftsmen. In Hamburg there are about 13,000 of such enterprises with more than 100.000 employees.

Considering its membership, the Chamber of Craft is highly interested in the decentralisation of energy supply.

Now I will discuss the two projects. The first project is aimed to promote heat energy conservation. This has to be done by technical and organisational efforts. In this country the lodging-law is one of the major obstacles for lowering energy consumption in our cities. In a flat block the proprietor has to provide the heating equipment as part of the house. As it will be in his interest to keep his own costs low, he will invest as little money as possible in the heating installation. However, he can distribute all heating costs to the lodgers. The lodger himself may influence his own costs by his heating behaviour, but he does not have any influence on the installation of the heating equipment.

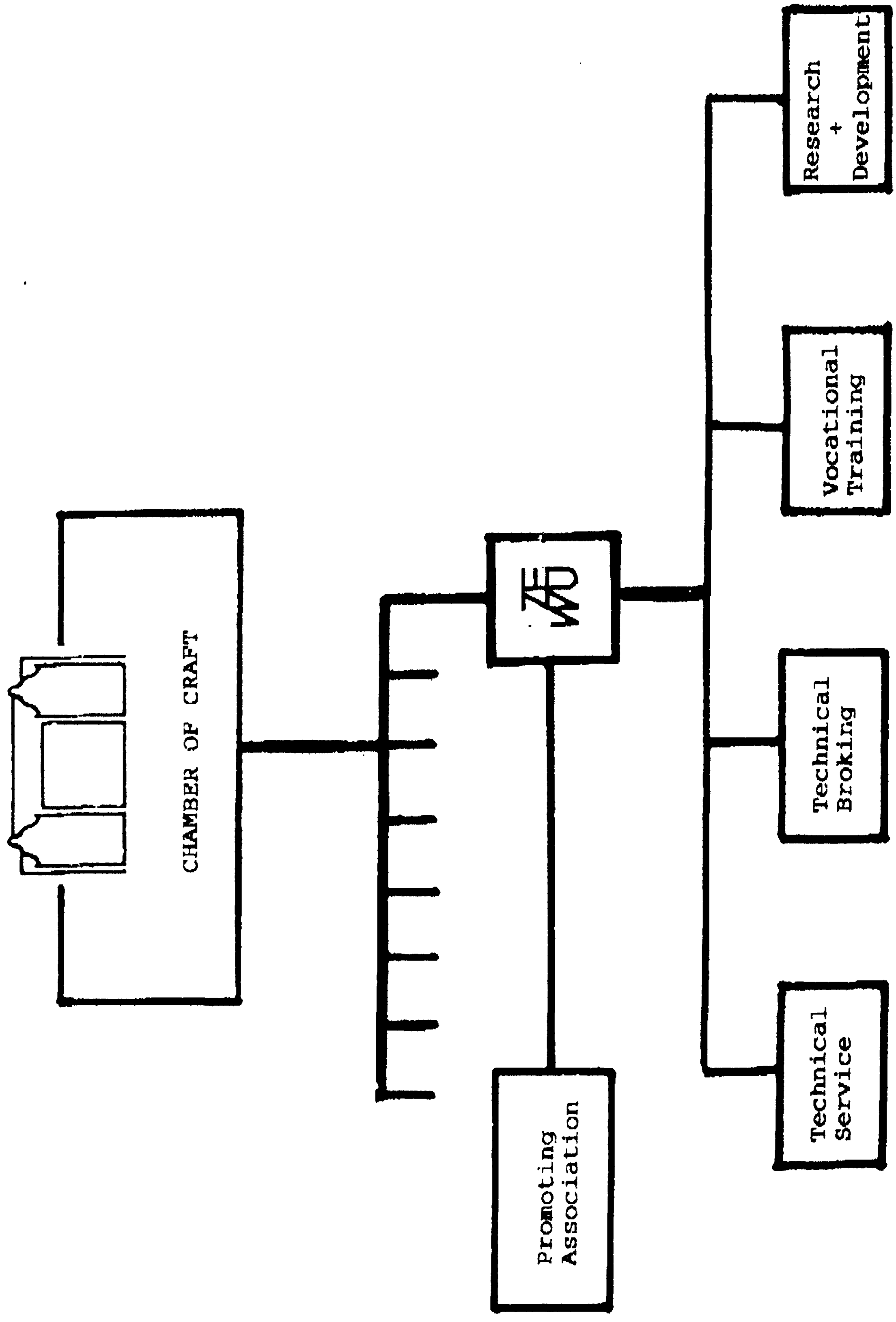
In our project we will try to combine these two interest: the economic interest and the interest of energy conservation.

If the heating equipment in lodging houses has to be replaced, the craftsmen will no longer offer the proprietor a new equipment at a maximum low-cost basis, but a complete service package. The product "room heat" can be produced by means of exact planning and engineering, which is individually tuned upon the special needs of the user, by providing optimal heating and controlling technology (figure 2), by executing the installation in a high quality, and last but not least by an on-line surveying. The product has to be offered to the proprietor and he pays for it.

This implies a considerably financial advantage for the prorpietor. He

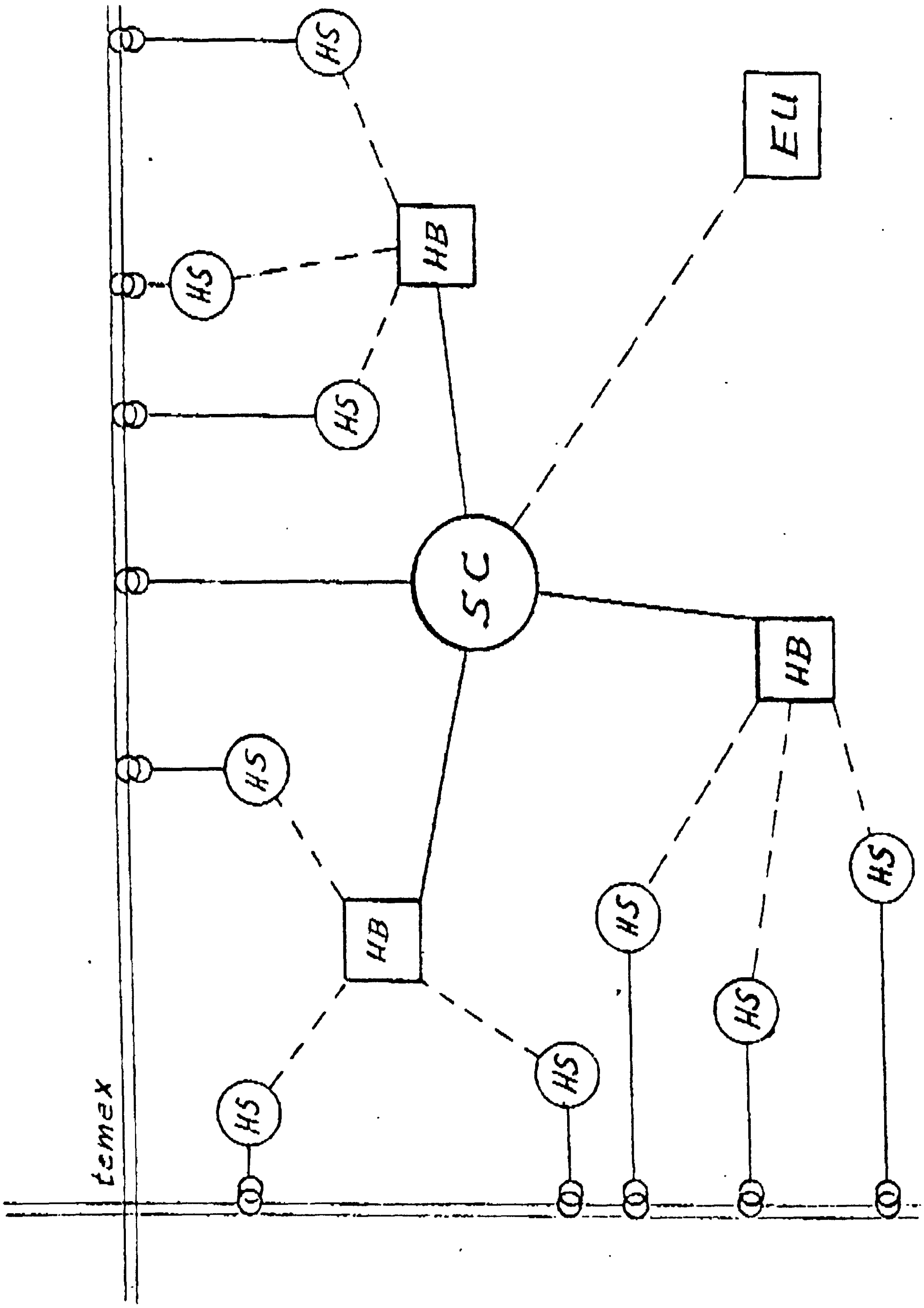
Figure 1

Zentrum für Energie-, Wasser- und Umwelttechnik der Handwerkskammer Hamburg



Zentrum für Energie-, Wasser- und Umwelttechnik der Handwerkskammer Hamburg

Figure 2



ZEWU – Buxtehuder Str. 76, 2100 Hamburg 90, Tel. (040) 7 66 00 9-0, Telefax 76 60 09 25

only has to invest some money into building connected parts, for example a new fire resistant door or the upgrading of the chimney.

The prices of the new service "room heat" should be the same as the lodger paid in the past. (We learned from experience that they can even be a little lower than in the actual distribution method).

The "Third of the party", the craft contractor, who had to install the heating equipment at his own costs, will be refunded for the difference between the former and the actual energy consumption. For him it will be very motivating

1. to apply an optimal, most energy conserving heating station;
2. to run it with the highest possible efficiency.

With this proposed method the economic interests will lead directly to ecological improvements.

In spite of our badly shaped labour market an additionally positive effect will be reached. I will give you some figures.
Only in the city of Hamburg there are about 30,000 flat blocks, which are equiped with old, inefficient heating installations. With an investment of 20,000 to 30,000 German Marks for each building, 600 to 900 million German Marks can be activated in the next few years.

One part of this project, the planning and engineering, has already been promoted by our Federal Ministry of Research and Development, in cooperation with a Hamburgian craft company and a Technical Institute of the Federal Craft Organisation. The other part, the surveying, and perhaps the accounting services should now be developed as well.

With the actual gas and oil prices, the proposed method of heat supply may not be economical in all cases, but as our experience with eight installations shows, it is always near the break-even point. Now we should start with a serious project to evaluate this model in order to be ready in a few years when energy prices will be increasing.

Another project might be of special interest for big cities in Southern Europe, for example Athens or Madrid.

The idea was that big electric utilities should no longer generate electric power for house heating. Especially night-storage-heating should be omitted.

If there is an over-capacity of power which cannot be reduced rapidly in the next few years, we thought it would be better, from an ecological point of view, to use the surplus electric energy for urban traffic.

Every day there are about 200,000 people shuttling from the surroundings of Hamburg into the city and back. In addition, there are about half a million people doing the same from the Hamburgian suburbs. Their vehicles could be powered by electricity, charging the batteries during the night and replenishing them while the people are at work.

The overall efficiency of a combustion engine powered car might be maximal 10 percent in urban traffic; modern electric powered ones may reach the 3 to 6 fold value considering the possibility of battery replenishment by recuperation of the breaking energy.

Another idea that has come up: The charging or at least the replenishment of the car batteries could be performed in daytime by photo voltaic generation. The solar panels might be placed on the roof of parking houses or at parking areas. This could especially be interesting for cities in southern countries.

I have to acknowledge that we are just doing the first steps into this project. But for example the Volkswagen- and the AEG-Photo voltaic systems Company at Wedel near Hamburg, has already shown its interest.

14. GENERAL EXPERIENCES WITH INTEGRATED URBAN ENERGY PLANNING

N. Bensch

1. Data on Mannheim

First of all, I will provide some important facts characterising the situation of our city.

Mannheim is situated on the so-called Rhine band, a central European regional planning axis ranging from Rotterdam via Frankfurt and Basle to Italy. With a number of approx. 300,000 inhabitants Mannheim is both the economic and cultrual centre of the Rhine-Neckar-area which has a policentral structure, formed by the cities of Heidelberg, Ludwigshafen, Spires, Schwetzingen and Worms. In this conurbation live 1.75 million people. Given these facts, this area is the sixth largest economic area in the Federal Republic.

The surface of the city area is approx. 145 km^2 and 47% of it is built area. In 1987 there were approx. 140,000 residential units in Mannheim which were occupied, on the statistical average, by only 2.16 persons.

Let me outline the following features of the economic structure of our city. Of the approx. 171,000 employees subject to obligatory insurance 41% has been employed in the processing industry, 6% in the building industry, 19% in trade and commerce, and 32% in other services. So the most important industry in Mannheim is the processing industry. The low structural share within the services sector has primarily contributed to the fact that in Mannheim an unfavourable employment development has occurred. In 1987 the unemployment ratio was approx. 9%. Mannheim's industrial structure is mainly marked by the capital goods sector. Solely this sector is binding even 70% of the persons employed in industry, with a considerable distance in terms of significance vis-à-vis next industries, like the plastics and producer goods industry. In this sector the share of employees is approx. 18%. The consumption goods and food processing industry only play a minor part. Symptomatical for the Mannheim situation is also the fact that 75% of all persons employed in industry is working in companies with more than 500 employees.

A main element of energy supply in Mannheim is the Mannheim Huge Power Station with a capacity of 1,860 MW. Furthermore, Mannheim is connected to the mineral oil pipeline of Marseille and to the European natural gas network. The energy conversion processes determine the emission situation in our city.

Three quarters of the emissions are released by the industrial sector, of which approx. 74% of all inorganic gases, such as sulphur dioxide, carbon monoxide and nitrogen monoxides are yielded by high sources. The bulk of local emissions is thus transported beyond the boundaries of the city and therefore do not directly act upon Mannheim. Nevertheless, the air nuisance is not inconsiderable. Mainly the NO_2 immissions, released by motor vehicles, constitute a local problem. But also due to the local specific climatic conditions, frequent atmospheric inversions, a concentration of air pollutants takes place which again and again produce a haze dome over the city.

2. Integrated Planning

First step

In the mid seventies the city of Mannheim has established the integrated planning by the creation of a working team for environmental protection. This working team includes, beside the Office of Urbiculture where I am working - my centre of gravity thus not being energy planning but town planning - the urban energy supply company of the City of Mannheim, the Public Cleansing Office, the Lower Authority of Nature Conservation and the Lower Water Protection Authority, etc. This body usually meets once a month in order to coordinate the impendent technical planning and technical problems. Within this scope the urban energy supply company of the City of Mannheim has developed on its own account the conception for energy supply. It is based on the following principles:

- For reasons of energy saving and environmental protection the guided energy supply has to be systematically developed.
- By means of comprehensive investigations (heat density; structure of heat density; existing line system, etc.) all parts of the Mannheim urban area were examined to the effects whether natural gas, district heating or current (also for heating purposes) would be the appropriate long-term source of energy. Based on this investigation, areas with provision of either natural gas or district heating or current have been determined.
- A long-term objective is the double supply, either by current and natural gas or current and district heating.

- New construction areas are, as a general principle, developed only with current and natural gas or current and district heating.
- In order to realise the conception as smoothly as possible, consumers are given intense counsel, and financial assistance is made available for adjusting the buildings to the optimum offer of energy.
- The determination of the areas with provision of either natural gas or district heating follows solely from technical and economic criteria.
- Through the integrated planning aspired to by means of the working team for environmental protection, an early coordination of the development planning authority of the City, the individual planning of the building enterprises and the reflections of the urban energy supply company could be achieved. On the part of the development planning authority, for example, the legal instrument of the burning prohibition has been instituted, interdicting burning of solid and liquid burnables for heating purposes in new construction areas. By this way the use of anti-pollution energy (district heating, natural gas) shall be enhanced in order to discharge the air in Mannheim from pollutants.

Moreover, the City of Mannheim has developed a demonstration project in order to favourably influence the individual plannings of private builders within the meaning of the concept. So, for instance, in all public buildings all possibilities of energy saving are consequently pointed out and converted by concrete measures by means of consumption coverage and corresponding evaluation. The thus achieved energy saving has been exemplary, and the experiences of this project are being relayed by seminars and instruction courses for influencing the consumers' behaviour. Our principal aim is to achieve insulation against loss of heat within the buildings and to accelerate the installation of automatic control systems. The energy supply company also offers advice on energy saving possibilities, even after the connection to the natural gas or district heating network in order to be able to connect more customers to the same network as a result of the reduction of the individual consumption of the consumers.

Success of the Energy Supply Concept:

Within the selected areas with provision of district heating approx. 85% of the buildings are connected to the distribution network. About 95% of all buildings with a connected wattage of more than 250 KW (major projects) are supplied with district heating. The fact that primarily also major projects are supplied with district heating leads to the result that in

Mannheim already 50% of the low-temperature heating requirement are furnished with district heating, whereas the share of the housing supply amounts to 34%.

Today, the guided energy suppliers cover nearly three quarters of the heat requirement of the Mannheim accommodations. This output should particularly be emphasized as in this respect Mannheim plays a leading part among the German and European metropolitans.

Expecting a share of approx 90% in the year 200, the development and concentration of guided housing heat supply in Mannheim will then largely be completed.

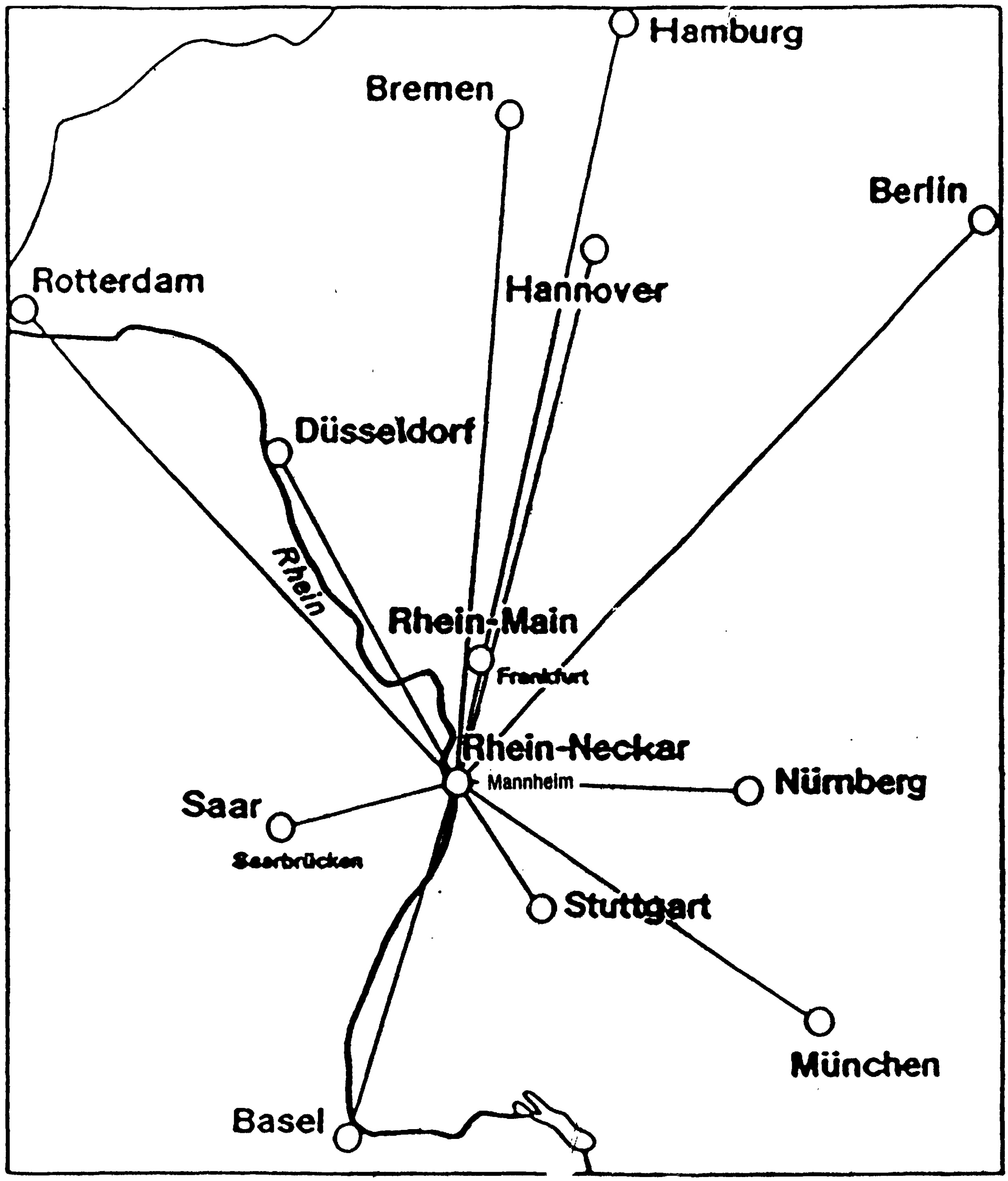
The environmental impact for SO_2 is today 0.033 mg/m^3 in Mannheim. That is about a third of the sum of the year 1979. This is an important success for the environmental protection.

Second step

In the future it will be even more important than so far to consequently exhaust the saving potential in buildings. By the year 2000 the effects of the introduced technical planning "Energy Supply Concept" will on the whole be achieved. Therefore, it is now necessary to further develop and improve the integrative concept started by the working team Environmental Protection. Network thinking will be necessary. The so far unconnected data stock of the individual technical plannings have to be associated. Models that permit simulation will have to be constructed. Only by these means it will be possible in the future to evaluate the effects of measures with regard to their dimension and to recognize consequent results. By means of the model-like connection of nuisance paths of the environmental pollutants, the City of Mannheim sees a way for better coordination of measures which influence the environmental situation of our city. Taking all this into consideration, the energy consumption of motor vehicles will focus our attention.

By such a developed integrative concept of energy and environmental planning we wish to further stabilise our proved and reasonably-priced energy supply. Furthermore, however, an effect for economic development will be achieved by creating attractive location conditions by reasonably-priced supply offers in our industrial areas. Moreover, such a demonstration system will indicate how environmental load can be further reduced and where the priorities should be placed.

Geographical location of Mannheim



Mannheim

300,000 inhabitants

140,000 flats ⌀ persons / flat : 2,16

Energy consumption of private households for room-heating
- Natural gas 34.1%
- District heating 34.1%
- Others (coal, oil, electricity) 31.8%

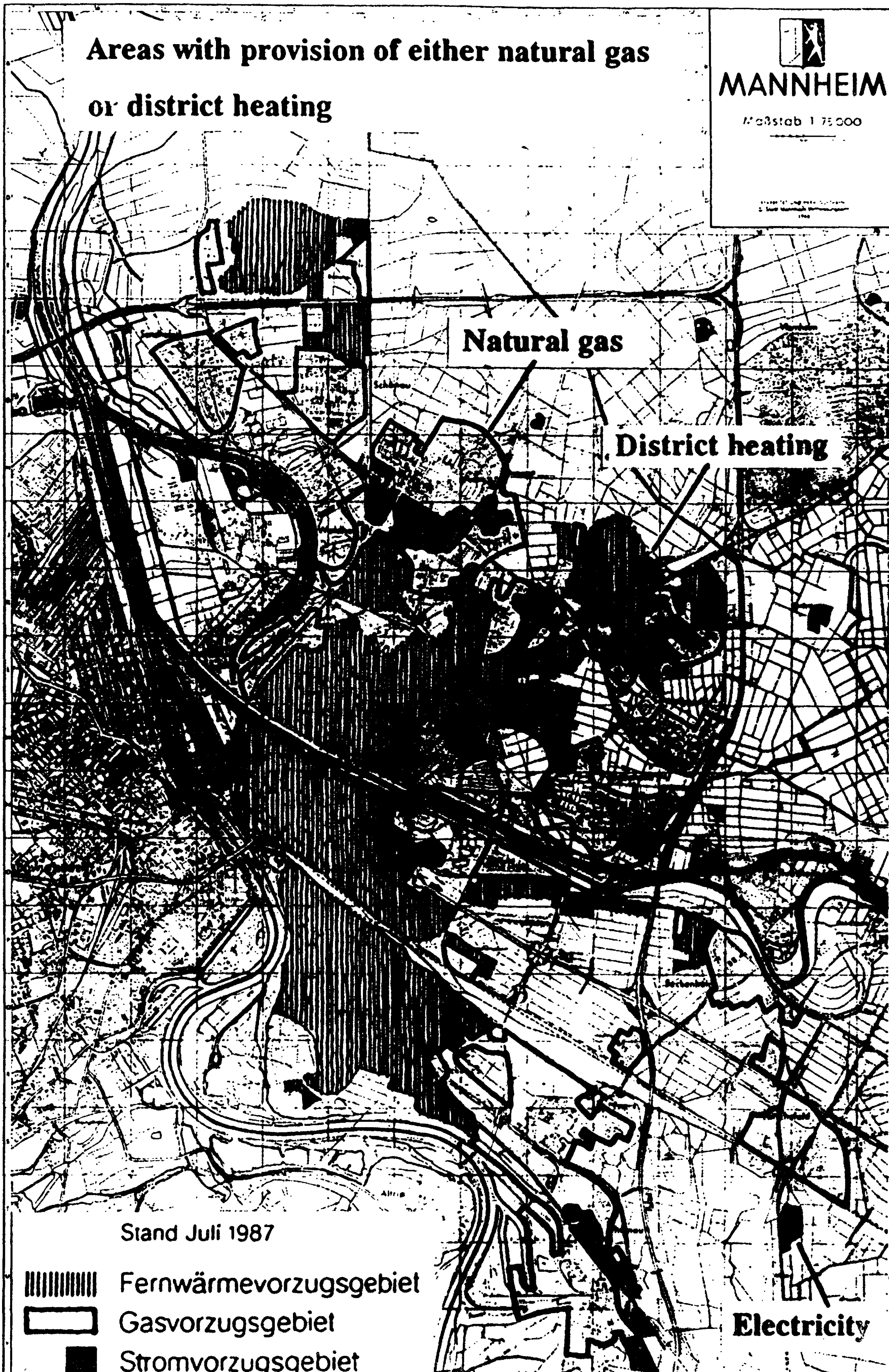
Environmental impact SO_2: 33 ug/m^3 average per year 1987-88

102 ug/m^3 average per year 1979

Industry: refinery, harbour, pharmaceutical, paper
fabrikation of buses
and fabrikation of motors
(Daimler - Benz)

171 000 employees

- 41 % processing indrustry
- 6 % building industry
- 19 % trade and commerce
- 32 % other services
  - 70 % capital goods sector
  - 18 % plastics and producer's goods


Areas with provision of either natural gas or district heating
MANNHEIM
Natural gas
District heating
Electricity
Stand Juli 1987
Fernwärmevorzugsgebiet
Gasvorzugsgebiet
Stromvorzugsgebiet

Position of the town planning authorities

a. The town planning authorities do not wish the inhabitants to be pressurised into having no choice as regards type of energy carrier, but favour a more competitive situation between the energy carriers

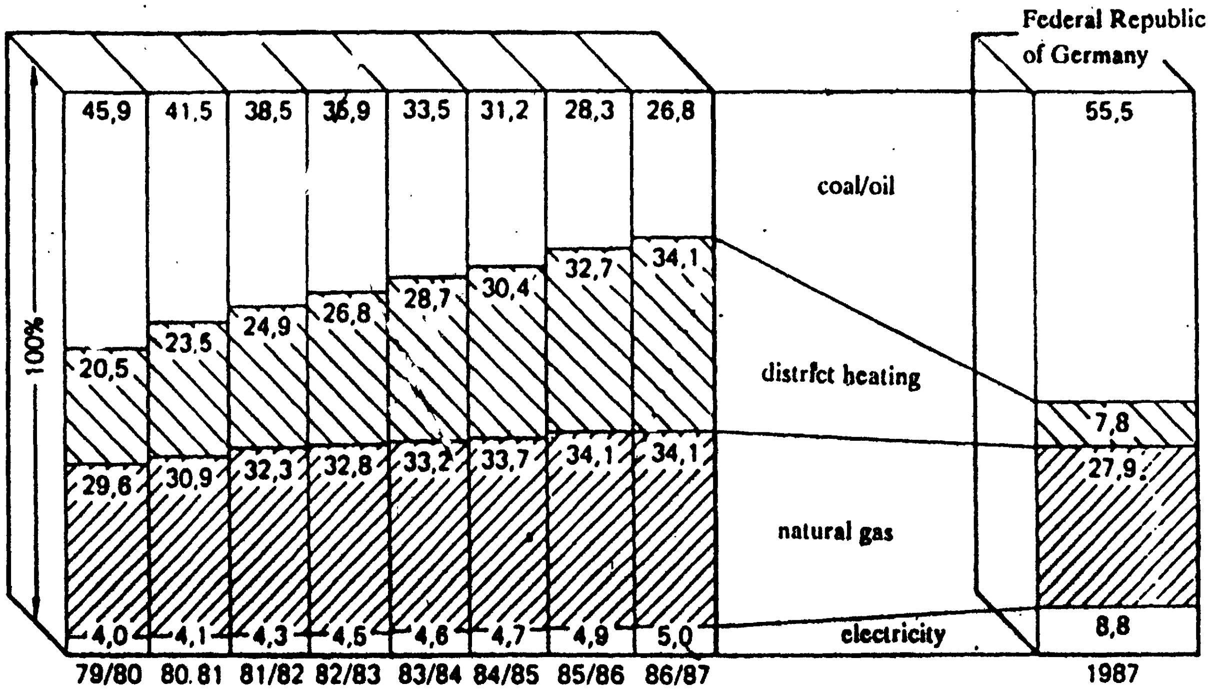
b. District heating must be produced in a cogenerating process, i.e. not in heating stations

c. People on a low income in particular, don't wish to be pressurised into paying large amounts they can't really afford for heating

d. Consideration of environmental improvement aspects

e. Energy conservation i.e. no further use of electricty for room-heating

Development of the proportions of energy carriers in the households for room-heating



Current gaps

No connections / interrelations between all data on energy, city planning and environmental pollution

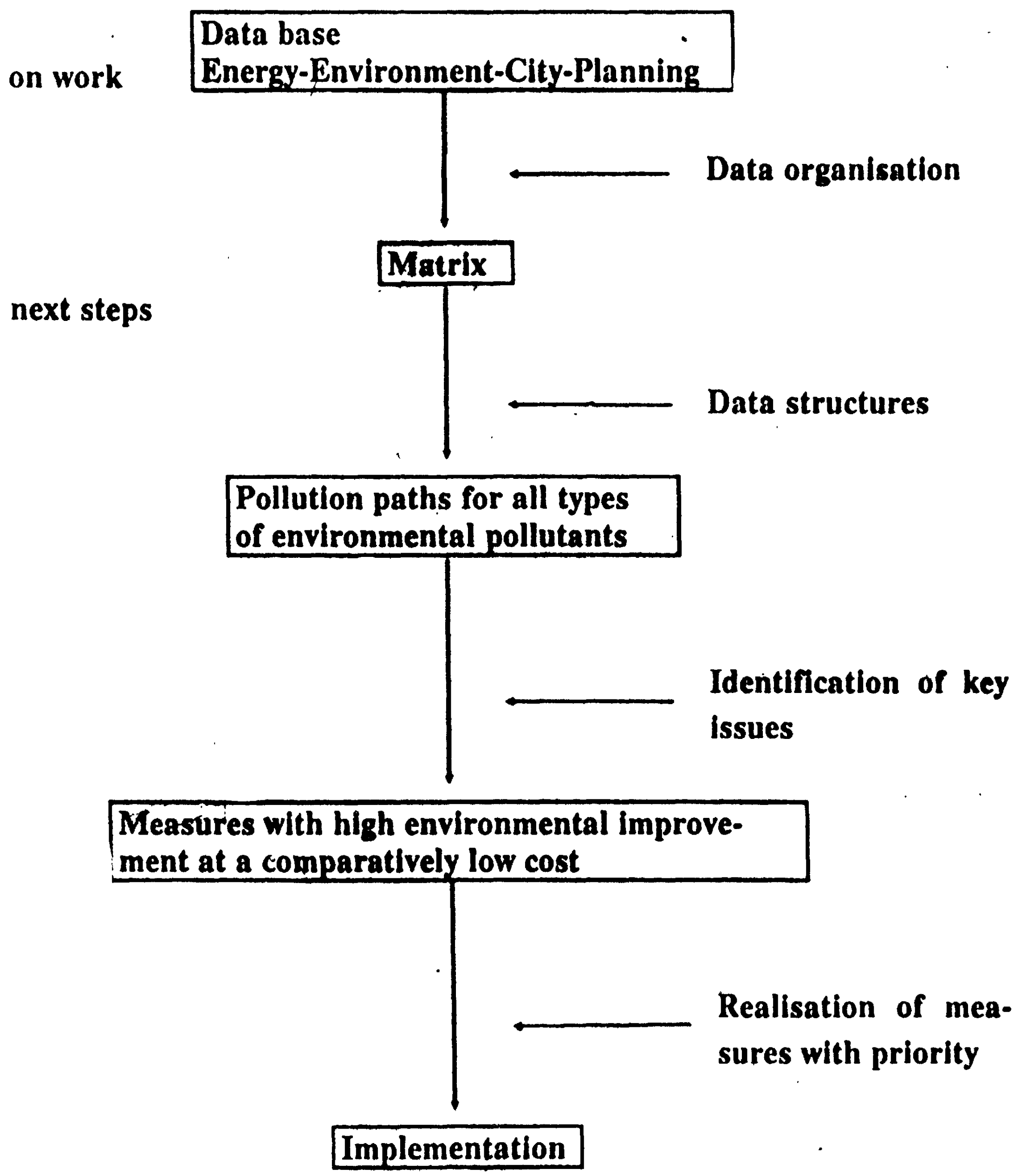
- sources of emissions (industry, transport...)

- environmental pollutants (SO_2, NO_x,...)

- transmission and impacts

- lack of current measures

Necessary work



The urban energy supply company's energy plan

a. Increase the sale of district heating, natural gas and electricity

b. Define areas where either natural gas or district heating should be provided

c. Insulation and energy conservation to add more households to the district heating system

15. ECONOMIE ET ENERGIE EN LOMBARDIE

P. Berra

L'étude sur la Lombardie qui a demandé deux ans de travail et que nous avons terminé l'été dernier, a pour but d'analyser les tendances actuelles du système socio-économique et énergétique en vue de définir l'évolution de la demande d'énergie en Lombardie jusqu'en 1985.

La choix de cette région découle de deux raisons.

La première, à caractère général, dépend du fait que la Lombardie est la Région italienne la plus adaptée à une étude sur l'évolution de la demande d'énergie se basant, dans l'analyse prévisionelle, sur l'évaluation de la structure des différents secteurs de production, des modalités et des avantages de l'installation d'entreprises industrielles et du tertiaire avancé, des modifications qui s'ensuivent dans les centres habités et dans les systèmes de transport.

En effet, en Lombardie, on peut remarquer dans le système productif un processus fort dynamique qui évolue sous les formes caractéristiques de la société post-industrielle et, à la fois, il y a une presence remarquable de branches traditionnelles.

La deuxième raison, à caractère méthodologique, concerne l'analyse d'un système énergétique (demande et offre d'énergie) dans une zone caractérisée par une importante transformation socio-économique et technologique.

La case de la "Regione Lombardia" nous a semblé bien répondre à ce genre d'analyse, étant donné qu'il s'agissait de "mesurer" les effets provoqués par les grandes transformations sociales, économiques et territoriales qui se sont produites au cours des ces vingts dernières années, sur la demande énergétique, en visant, notemment, les rapports existant entre la réalité socio-économique et la consommation énergétique.

Thème central de l'étude et aussi fil conducteur de toute la recherche à été la liaison étroite entre l'économie et l'énergie.

Sous le profil énergétique la région Lombardie a toujours constitué un système économique caractérisé, vis-à-vis du système national, par une intensité énergétique moins élevée et une plus grande consommation d'énergie par habitant (Figures 1 et 2).

La paradoxe apparent s'explique du fait que, dans la région,

Figure 1

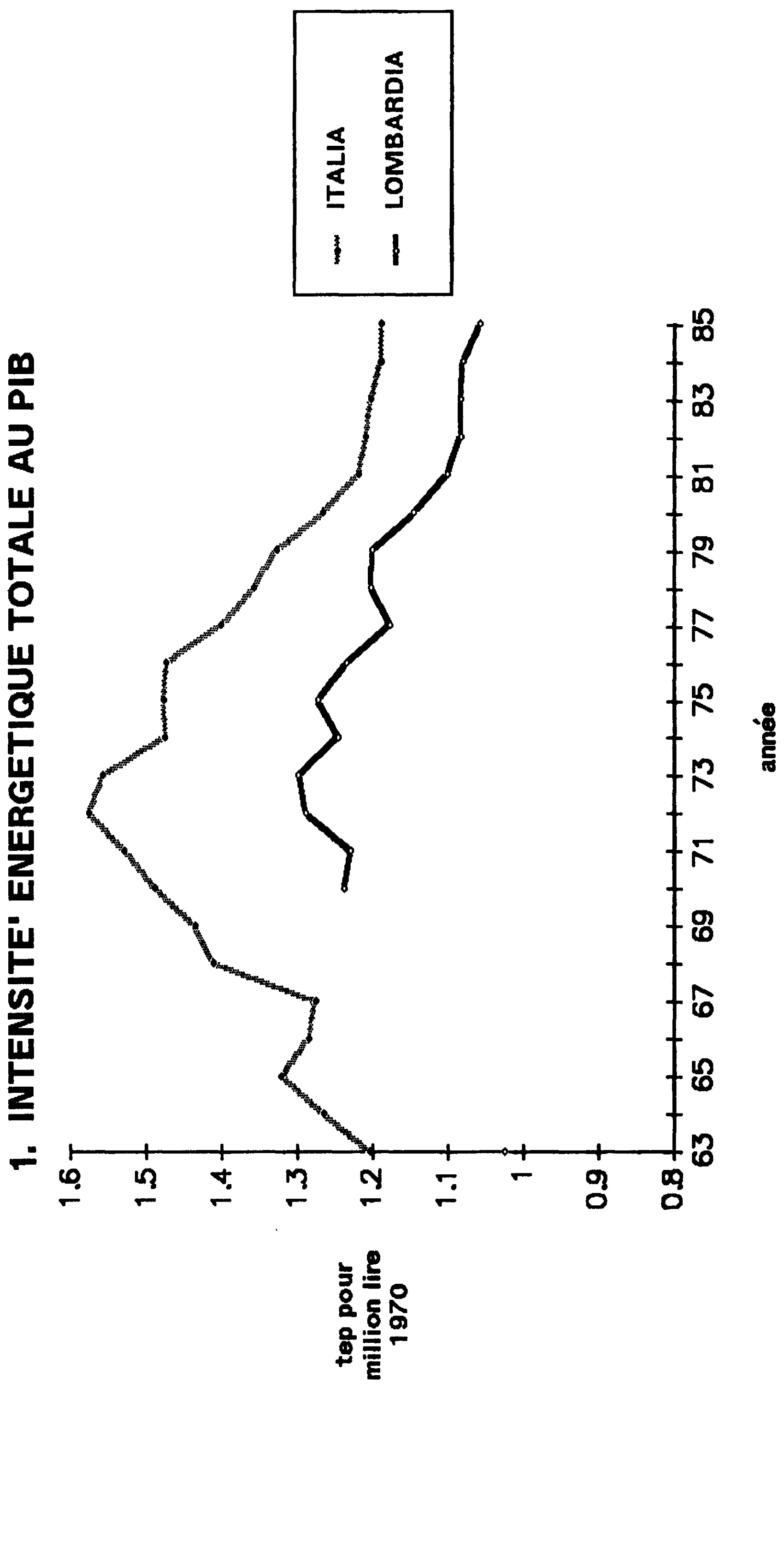
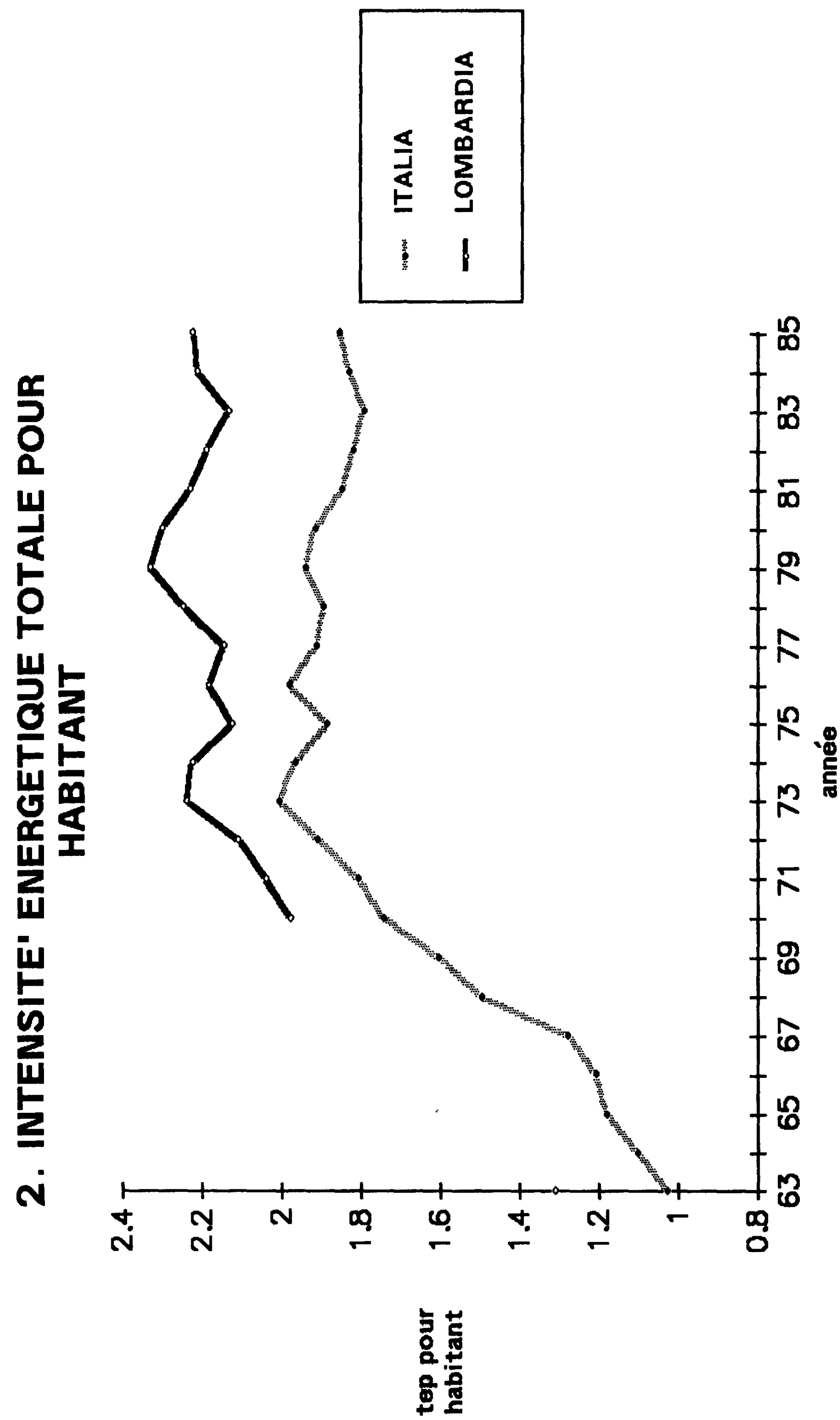

1. INTENSITE' ENERGETIQUE TOTALE AU PIB
ITALIA
LOMBARDIA
tep pour million lire 1970
1.6
1.5
1.4
1.3
1.2
1.1
1
0.9
0.8
63
65
67
69
71
73
75
77
79
81
83
85
année

Figure 2


2. INTENSITE' ENERGETIQUE TOTALE POUR HABITANT
ITALIA
LOMBARDIA
tep pour habitant
2.4
2.2
2
1.8
1.6
1.4
1.2
1
0.8
63
65
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69
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75
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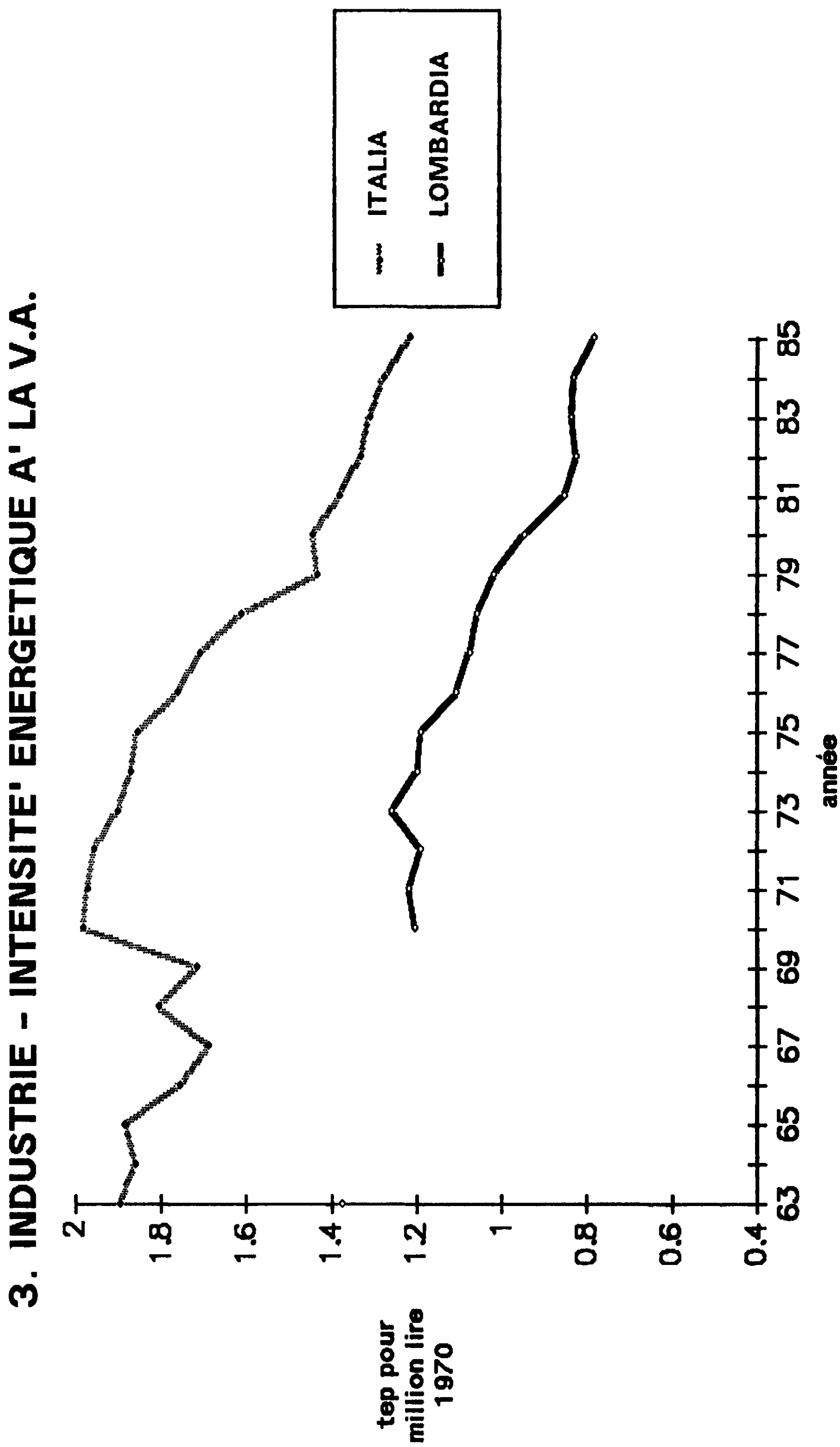
81
83
85
année

Figure 3


3. INDUSTRIE - INTENSITE' ENERGETIQUE A' LA V.A.
ITALIA
LOMBARDIA
tep pour million lire 1970
2
1.8
1.6
1.4
1.2
1
0.8
0.6
0.4
63
65
67
69
71
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année

l'industrie energy-intensive a une incidence sur l'économie régionale bien plus petite que celle qu'elle a sur le plan national (Figure 3).

En outre, l'haut niveau du revenu pro-capite et les conditions de vie typiques d'une société à bien-être élevé comportent des consommations d'énergie pour usages domestiques beaucoup plus élevées que celles à niveau national.

Pour arriver à la construction des deux scenarios possibles de l'évolution de la demande d'énergie en Lombardie jusque'en 1995, qui a représenté la phase finale de la recherche, ont été réalisées les analyses suivantes:

1. La première analyse a concerné le développement de l'économie lombarde. L'on a ciblé les "megatrends" (PIB, valeurs ajoutées des différentes secteurs, import-export, investissements, ampleurs démographiques, emploi, établissements industriels, consommations des familles) sur la base desquels a été tiré un tableau synthétique du possible développement futur de l'économie lombarde, en soulignant quatre classes d'activités:
   a. les activités à croissance accélerée (transports, communications, services aux entreprises, industries pour la production de machines de bureaux et d'instruments de production et de moyens de transport aériens);
   b. les activités dans lesquelles la région se spéfialise (crédit, activités de recherche et d'enseignement, autres services);
   c. les activités sujettes à décentralisation de production (industries de construction de matériel électrique, industries laitères, industries des boissons, industries métallurgiques, industries du caoutchouc et matières plastiques, industries textiles et confection);
   d. les activités sujettes à de remarquables processus de restructuration (industrie de base energy intensive comme l'industrie chimique et papetière, activités de l'industrie alimentaire).

2. La deuxième analyse a regardé le secteur industriel. Les déterminants économiques, technologiques et énergétiques des secteurs industriels à intensité énergétique élevée ou faible ont été cernées; notamment, en calculant que la consommation des secteurs energy intensive représente plus que la moitié des consommation totales en énergie de l'industrie lombarde, l'on a analysé d'une façon approfondie l'industrie

sidérurgique, chimique, papetière, du ciment, et pour chacune d'elles a été dressé un rapport sur la situation économique et de production, sans oublier les problèmes de restructuration, de décentralisation et de transformation et de leurs effets sur les consommations énergétiques; ces analyses industrielles ont été effectuées au moyen d'enquêtes visant les entreprises principales en Lombardie et au moyen d'entretiens avec les organisations industrielles et les experts du secteurs.

3. La troisième analyse a regardé le <u>secteur des habitations et du tertiaire</u>. Les éléments caractéristiques de l'évolution du système résidentiel et du tertiaire ont été localisés; du point de vue des consommations énergétiques l'on a examiné séparément les consommations pour le chauffage (qui utilise pour la plupart les dérivés du pétrole et le gaz naturel) et les consommations électriques.

4. La quatrième analyse à été faite sur le <u>secteur des transports</u>. L'analyse a été réalisée en examinant le transport des personnes (notamment le trafic routier qui est tout à fait prédominant) et des merchandises (avec la prédominance du camionnage); il s'agit d'un secteur où les exigences de bien-être et de confort tendent à augmenter le nombre des voitures, ainsi que leur performances, tandis que l'expansion de l'économie régionale tend, dans l'ensemble, à augmenter la demande du transport des marchandises.

5. La cinquième analyse concerne <u>l'industrie énergétique</u>. Une enquête a été faite sur la structure de l'offre d'énergie et sur les perspectives de développement en Lombardie, articulée sur quatre vecteurs énergétiques principaux, à savoir: pétrole et dérivés, gaz naturel, charbon, énergie électrique. Notamment en ce qui concerne le secteur pétrolier, on a conclu une enquête directe sur les raffineries lombardes, ayant le but de vérifier les caractéristiques techniques et économiques du cycle du raffinage du pétrole, tandis que pour les autres sources énergétiques on a utilisé les informations et la documentation rassemblée même au cours d'entretiens avec des fonctionnaires d'Organismes Energétiques nationaux et locaux.

6. La sixième analyse a regardé <u>le secteur des sources renouvables et de l'utilisation rationnelle de l'énergie</u>. L'on a examiné les expériences

locales et de secteur les plus significatives, effectueés dans ce domaine; un examen soigneux a été réalisé sur les sujets principaux (opérateurs publics notamment) qui agissent à niveau régional.

7. Enfin, la septième analyse a eu pur but la construction des Bilans Energétiques Régionaux. La série annuelle des bilans énergétiques régionaux concernant la période 1978-1985 a été rédigée. En utilisant des travaux précedents effectués par notre Institut universitair et qui fournissaient des données énergétiques à partir de l'année 1963, il a été possible de tracer les caractéristiques principales de la structure du système énergétique lombard dans une longue période (1963-1985), aussi bien du point de vue remplacement des sources utilisés que rapport entre énergie et économie (consommation pro capite, intensité énergétiques, etc.).

Pour exposer l'évolution de la demande énergétique jusqu'en 1995 l'on a construit deux scénarios qui prennent en compte les résultats atteints grâce aux analyses que nous venons de rappeler (Figures 4 et 5).

Les deux scénarios représentent deux formes de croissance qui dépendent du choix des opérateurs publiques et privés à niveau régional, outre, évidemment, que des décisions nationales et internationales.

L'orientation des opérateurs et leur capacité de faire front aux défits du futur ont donc une importance décisive aux fins d'établir les lignes prévalentes d'évolution: celles d'une croissance suffisamment soutenue, favorisée par de nouvelles fonctions de leadership sur le plan national; ou bien, une évolution lente et assez limitée en ce qui concerne les changements, visant essentiellement à mettre à profit les spécialisations encore considérables dont la Lombardie dispose.

Le premier scénario, du type "de conservation", est caractérisé par:

- l'aspect presque stationnaire des consommations énergétiques. En effet, le taux moyen annuel d'augmentation des consommations totales prévue atteint environ +0,4% comparé à une croissance dans la période 1970-1985 de 1,2%, comme moyenne annuelle;
- l'augmentation croissante des consommations du secteur des transports (+1,3% moyenne annuelle), bien qu'elle soit inférieure par rapport au passé, à cause de la lente croissance du revenu et d'un mouvement démographique negatif;

Figure 4

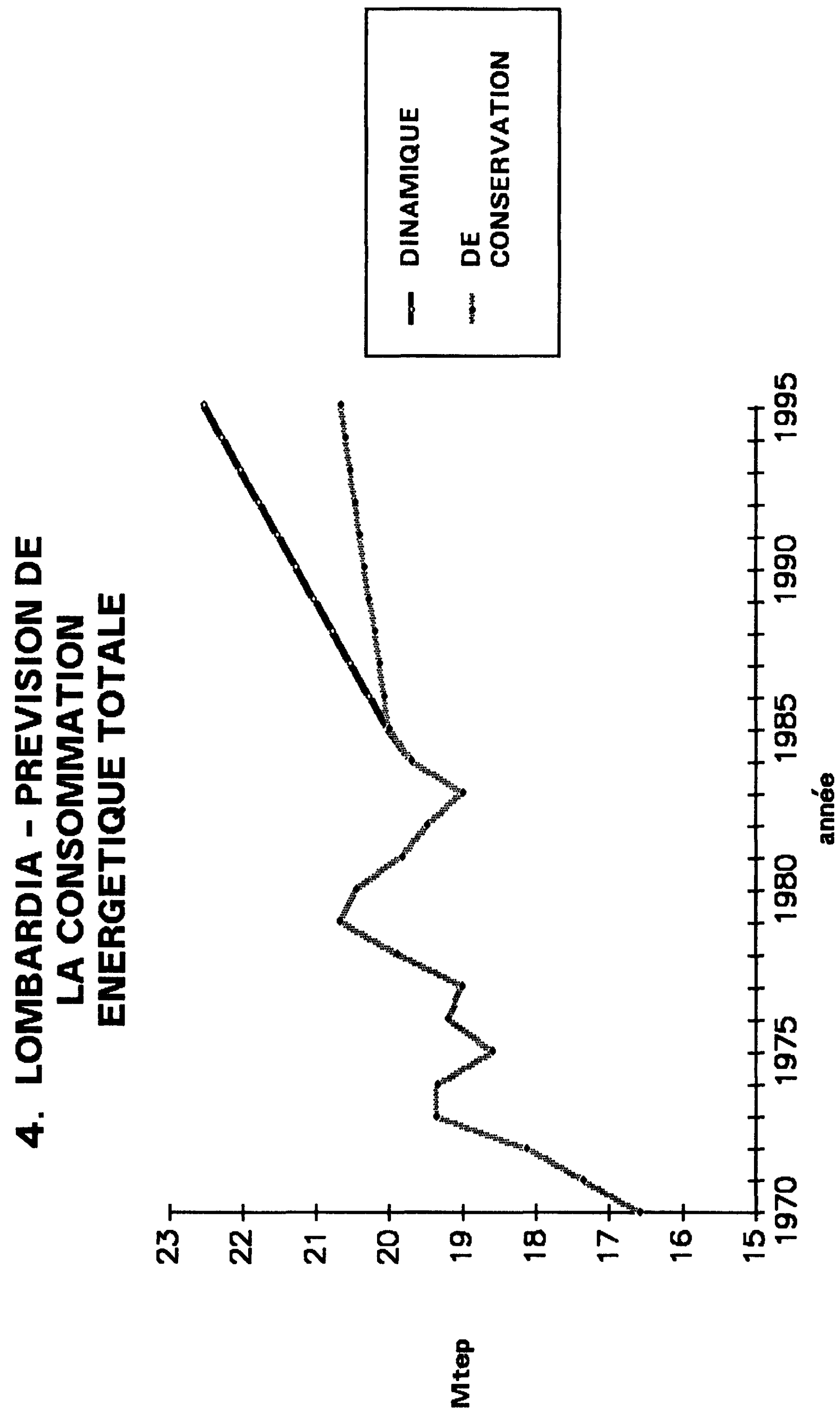
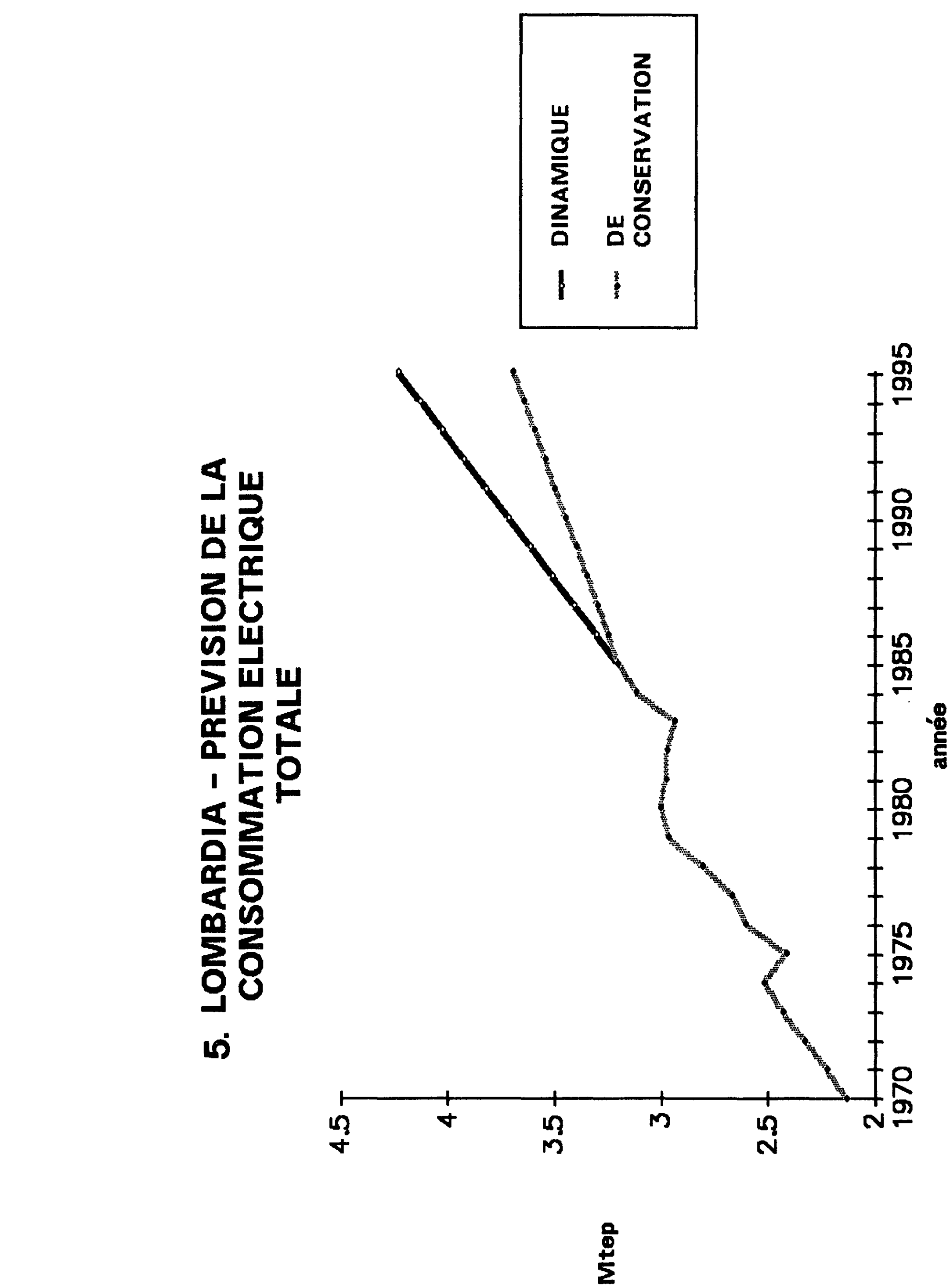

4. LOMBARDIA - PREVISION DE LA CONSOMMATION ENERGETIQUE TOTALE
DINAMIQUE
DE CONSERVATION
Mtep
23
22
21
20
19
18
17
16
15
1970
1975
1980
1985
1990
1995
année

Figure 5


5. LOMBARDIA - PREVISION DE LA CONSOMMATION ELECTRIQUE TOTALE
Mtep
4.5
4
3.5
3
2.5
2
1970
1975
1980
1985
1990
1995
année
DINAMIQUE
DE CONSERVATION

- une représentation de l'industrie lombarde qui ne subira aucune modification de grande importance et une diffusion limitée du tertiaire. Ce qui, en termes de percentage sur le totale des consommations énergétiques, signifie que les transports gagnent 2 points, le tertiaire un seul point alors que deviennent moins marquants l'industrie et surtout les utilisations ménagéres. Dans ce scénario, la région lombarde se caractérise par une structure de consommation semblable à la situation actuelle: une faible tendance vers de nouveaux investissements et, par conséquence, une introduction introduction plus lente d'innovations technologiques pouvant économiser de l'énergie.

Le <u>second scénario</u>, de type "dynamique", est caractérisé par:

- un taux annuel moyen d'augmentation des consommations totales qui s'élève à environ 1,3% et qui dépasse donc de très peu le taux enregistré dans la période 1970-1985 (1,2%);
- la prévision d'un "trend" de croissance qui ne diffère pas sensiblement de la tendance passée, si considérée dans son ensemble, mais qui s'avère le résultat de grands changements dans les modes de développement des secteurs principaux;
- un secteur industriel dont le mouvement a caractérisé, par le passé, l'évolution des consommations énergétiques totales qui tend à réduire son influence soit en raison de la baisse de sa cotation sur le total, soit parce que les nouveaux investissements se concentrent dans les secteurs à faible consommation d'énergie et aussi parce que l'on accentue la caractérisation <u>energy saving</u> des investissements;
- une croissance prévue qui s'explique même si à des taux inférieurs par rapport aux précedents (2,1% contre le précedent 3,6 m.a.) et du secteur de tertiaire;
- des cotations relatives aux différentes secteurs qui se modifient rapidement: les secteurs domestiques et industriels perdent deux points en pour cent à l'avantage du tertiaire et des transports.

C'est nécessaire enfin de souligner qu'on est passé d'une concentration rélative des consommations en peu de secteurs industriels (energy intensive), celle que l'on avait au commencement des années '60, à une co-détermination des consommations énergétiques de la part d'une pluralité d'usages et d'activités.

La plus petite dépendence énergétique de certaines importantes activités donnera lieu à plus grande stabilité de la courbe des consommations d'énergie.

Enfin, une question sur les possibles utilisations de cette étude: nous pensons que cet étude pourra être utilisée soit pour proposer au niveau comunitaire un cas significatif de l'analyse des tendences futures de la demande d'énergie dans une région très industrialisée (disons sous l'aspect méthodologique), soit pour mettre en condition le pouvoir publique au niveau régional de prendre responsablement quelques décisions programmatiques dans le domaine énergétique (disons sous l'aspect opérationnel).

En effet, en Italie les compétences de la Région en matière d'énergie concernent principalement la planification économique, dont celle énergétique est une part significative, le développement des sources énergétiques locales, les économies d'énergie et l'utilisation rationnelle de l'énergie dans les différents secteurs, la localisation et construction des centrales électriques, la tutèle de l'environnement.

Ce sont des compétences très importantes et nous pensons que l'étude presentée puisse être un instrument utile de connaissance approfondie pour le pouvoir publique et pour ses décisions programmatiques et opérationnelles.

16. COMMENTS AND NOTES WITH A VIEW TO POSSIBLE ENERGY PLANNING: THE SPANISH SITUATION

A. Ceña

1. Introduction

The experience accumulated in the different energy planning actions which have been carried out, shows that its contribution often goes beyond the energy component. This is a result of the influence which energy bears on all the economic and social aspects and the fact that the benefits of energy utilization are often not the result of this planning, which is as uncertain as the theories on which it was based but on the collection, systemisation and comparison of the data used and on the knowledge of how the different energy fuels are produced, transformed, transported and consumed.

This is even more important when the geographical field to be analysed is narrowed down and it is especially relevant to the present situation of energy prices where aspects such as technological modernisation, industrial competition, quality of life, market penetration strategies or the environment issue are becoming more priorities than the energy ones. Therefore those are the elements which must sustain any efficient energy utilisation policy if more or less immediate results are to be obtained, as well as the elements which must be contemplated in the energy planning studies.

2. Regional Energy Planning in Spain

In administrative terms Spain is divided into 17 autonomous communities or regions with different levels of competence and administrative articulation.

In 1975 energy planning began on a state level, following the precedent of the 1972 electricity plan. Since then four plans have been published to meet the need to adapt forecasts, which, for example, had overestimated the presence of nuclear energy and natural gas in the domestic energy supply. The current PEN-83 National Energy Plan, which is more realistic than its predecessors and has better results, is now under revision and it is expected that the new version will be ready for the next year.

As regards the autonomous regions, at the end of the seventies Catalonia and the Basque Country began analysis studies of their energy consumption which subsequently gave way to energy planning action, particularly in the Basque case. Moreover, the Canaries carried out their energy plan known as PECAN, approved in 1985, but the greater part of it has not been taken up by the new regional government after the elections of 1986.

These three regions, together with the Valencia region, have received funds from the commission to develop their energy planning studies or analyses of demand.

Other regions such as Andalusia, Castilla y León, Galicia y Navarra have carried out or begun action in this field involving different aims and scope.

A highly significant aspect of these activities are the different methodologies which are used, resulting in incoherent findings in neighbouring regions.

On the other hand, the IDAE carries out the regional energy balances and in fact the ones for 1984 and 1985 are complete. These are designed with two fundamental aims in view: to assess the energy demand on a regional level which will enable to draw up a promotional strategy on the efficient use of energy, backed by the economic and administrative vertebration of each region and in addition allow the work carried out by the regional governements to be harmonized. At the same time these balances are designed to offer a working document with a single methodology in which the supply and demand (as a result of the audits carried out by the IDAE) are cross indexed. Care is taken because the sum of the balances by the regional governments ought to give the total corresponding to the state, the only situation in which the incoming and outgoing energy flows are clear. It should be stated that as regards this second aim, the results have in fact been the opposite of those expected. This is the result of the fact that the IDAE has drawn up balances, which has provoked the regional governments to start working on the matter and in doing so the uniformity of methodology and criteria which were sought after, have become lost.

As a final conclusion to the section on regional energy planning and balances, it must be stated that in many cases a clear objective of the studies was missing. It was not made clear who should be the final recipient of the results and in many cases the full potential content of the gathered data was not put to use. Although it is obvious that there have been advantages to carrying out these activities, it can be said that on average the cost:benefit ratio has been poor and that certain synergies and working methods could have been used to advantage which more than one autonomous region could have updated.

3. Urban-Level Energy Planning

The comments made in earlier sections in connection with the need to uniformise methodologies, define clear end objectives and to the effect that energy planning is not generally an instrument in itself but just a means by which certain sectoral policies can be better integrated are elements which must be taken into account when discussing urban energy planning.

In connection with the urban environment and Spain in particular, it can be assumed that for an average year 44% of the total primary energy consumption in the country is related to urban consumption. This includes 14% consumption by the industry linked to the sector, 24% city consumption, related to activities inside the buildings, and 6% for urban surface and underground transport. All this is orientative information and shows the importance of the habitat in energy consumption as a whole in Spain.

Another feature to be borne in mind is that it is in this city consumption where individuals can act most directly, since the possibilities of acting in a particular process in industrial consumption are limited.

Furthermore, there is a clear relationship between energy consumption and environment, especially in the large urban centres where the upset caused the environment is felt more acutely at a local level.

Thus the three elements most making up this energy-environment binomial are:

- heating of houses (to a lesser extent domestic hot water and for cooking purposes, depending on the regions concerned and their climate);
- urban surface and underground transport;
- solid urban waste.

There are in Spain many examples where energy has another important component such as water pumping or desalinization, (in Las Palmas, Canary Islands, for example, 70% of the consumed water is desalinated) and there are some clear action possibilities here.

Urban or municipal planning clearly has its limitations. This must be borne in mind when defining the aims involved which are obviously linked to the configuration of the environment. A succint list of some of these limitations could be as follows:

- Generally speaking, time has perfectly defined and limited the urban environment. Therefore, action possibilities are limited and will involve the rehabilitation of buildings, changes in the fuel which is used, regulation of transport and evaluation of urban waste.
- Excessive dispersion of the decision-making centres or difficulties over coming to common criteria in the face of the excessive horizontal division of blocks (the majority of the city-dwelling Spaniards live in apartments).
- Heterogeneity and multitude of intervening factors.
- Multitude of actions requiring a long maturity period.

In order to integrate this dispersion as far as possible, the criterion to be applied to planning should always be based on improving the quality of life of the city dwellers, which will obviously entail a clear environmental component (noise, pollution, suitable atmosphere, etc.) and in the last instance an energy component. However, the level of equipment installed in houses in Spain is low and the energy consumption could increase when the standard of living rises. It would be unforgivable if this increase in energy consumption is not accompanied by a clear criterion of efficient use of fuels.

Another point which should not be overlooked is that a city is by no means an isolated area but an area which creates a flow of people and goods with an obvious effect on the surroundings. This effect is even larger if the city also has an industrial development area on a provincial or local level. This should be taken into account when planning the remodelling or repair of road networks which in this case imply high costs for the citizens in terms of money and energy.

As a conclusion to this section about urban planning, it should be emphasized how important it is to keep the existing equipment and installations properly maintained in order to decrease energy consumption and that it is necessary to integrate energy into other urban planning activities.

4. IDAE Activities at Municipal Level

Although there is not much data on energy planning, the IDAE has been carrying out different programmes on a municipal level which have coincided with the energy supply.

Some of these activities can be listed schematically as follows:

- Council Advisory Service for townships of under 50,000 inhabitants (SAM): here the object is to decrease the energy consumption in the municipal offices and extend their exemplarifying nature to the rest of the problem.
- Energy Optimization Programme for townships of over 50,000 inhabitants (POE M-50).
- Solid Urban Waste energy utilization programme: this covers five major cities.
- Small hydroplant exploitation programme, linked to the Community's VALOREN Programme.

Activities have also begun in collaboration with the OMIC municipal consumer information organization programmes, but the scope is only small for the moment.

17. PERSPECTIVES OF URBAN ENERGY PLANNING IN THE UNITED KINGDOM

A. Parker

1. Background

Energy planning is historically not an important role for local government or local institutions in the U.K. The policy for energy supply has been determined by Central Government and publicly owned monopolies in coal, gas and electricity, with relatively little involvement of locally based organisations. Indeed, only about one third of local authorities currently address energy planning as such in their policy statements.

Local authorities have been very active in energy efficiency however, an area where significant improvement in domestic comfort and local authority expenditure can result.

Examples of local initiatives include:

- Neighbourhood Energy Action (- Cardiff)
- Monitoring of Local Authority Buildings
- Energy Advice Centres (- Newcastle)
- I.R. Aerial Surveys
- Energy Surveys of Local Authority Buildings
- Energy Efficient Design (- Milton Keynes, Basildon)

2. CHP and Local Energy Planning

The history of development of municipal CHP/DH is perhaps the best example of the experience of local energy planning. These projects require the highest degree of commitment, analysis and institutional support of all energy related projects, and UK experience over the past 10 years is of particular relevance.

An initial national report in 1979 recommended that lead cities should be identified and that local organisations should be responsible for developing individual city CHP/DH Schemes. In 1982 further reports were issued, which covered nine cities, all of which were found to be technically feasible candidates for CHP. Six years later, and although several of the projects are still under serious consideration, notably Leicester and Newcastle, no concrete progress has been made. The privatisation of gas and electricity industries in the late eighties may, however, radically alter the viability of CHP Schemes. The 12 regional electricity distribution companies in England and Wales will have an interest in securing cost effective local supply, and already local initiatives in power generation are being very actively investigated across the country.

3. Constraints to Energy Planning

One of the major constraints to future local action identified in the North West regional study in the UK was the lack of regional bodies with the responsibility or interest in energy work, other than the major gas and electricity utilities. In the Cornwall energy study, the natural focus for continuing activities exists in the County Council. In the North East, the Northern Regional Councils Association is the co-ordinating body for all local authorities in the region, and would be an appropriate focus for energy planning.

Clearly, at the urban level, properly constituted authorities do exist in the U.K. with clearly defined boundaries, budget allocations and responsibility to provide good services and environment in the cities. The problem therefore is to identify suitable projects which will fit well with the authorities overall objectives, of being efficient providers of local services. In Newcastle and Leicester, we are already beginning to see the collaboration between private and public organisations on major energy projects.

4. Possible Future Activities in Urban Energy Planning

The majority of existing energy activities in the UK have of course occurred in urban areas. Perhaps in future, consideration of the town or city as an energy cost centre may be appropriate, rather than treating the city as a conglomeration of domestic, commercial and industrial activities.

Ideas for assisting urban energy planning might include:

- Review of early 1980's city CHP appraisals following privatisation of electricity.
- Assessment and possible mapping of heat loads.
- Assessment and mapping of energy related emissions.
- Provision of Energy Efficiency Information Centres.
- Review of planning constraints for renewables.
- Assessment of impact of transport energy use.

- Extension of CEM services.
- Waste as fuel feasibility - Hospitals, Municipal, Industry.

Much of the initial work involved in these activities has formed part of the three regional energy studies in the UK. In the North East of England for example, the following areas have been identified for further action by working groups.

- CHP development.
- Planning constraints for renewables.
- Waste as fuel.
- Domestic and Local Authority Building insulation.
- Provision of targeted energy efficiency information.

A possible approach to improved energy planning in UK cities would be to harness the enthusiasm created by the regional studies for such specific initiatives.

If local energy planning is to develop in the U.K., it should be based upon existing successful activities and show benefits to communities at a time of significant changes in the energy supply industries.

18. REGIONAL ENERGY PLANNING IN THE UNITED KINGDOM: EXPERIENCE AND LESSONS

I. Brown

1. Introduction

Any discussion of regional energy planning in the UK must start with a discussion of the place of energy planning at the national level in the UK. At present there is no formal energy plan for the United Kingdom. The last energy plan was published in 1967 and the last proposed plan was published in 1978 under the last Labour administration. The attitude of the present government to energy planning could be described as sceptical.

As was highlighted at a recent public inquiry into the construction of a new 1000 MW nuclear reactor in Somerset in the UK, the Department of Energy does not produce forecasts of electricity consumption for the UK, but rather the Government relies upon the forecasts of the electricity supply industry. It should also be noted that the privatisation of the gas industry, and the forthcoming privatisation and dismemberment of the presently state-owned electricity industry will, at least in theory, reduce still further the State's involvement in energy decision making. The stated purpose of the electricity privatisation is to allow the free market to operate and to reduce, with important provisos relating to nuclear power, government involvement in investment decision making.

Thus energy planning, and any resultant energy policy do not formally exist in the UK, unless to have no policy can itself be described as an energy policy. This does not mean that all energy decisions made by the UK government since 1979 have been made on an ad hoc basis, though certainly the accusation of inconsistency can be levelled at the government, in the absence of any formal energy plan.

2. Regional Energy Planning Initiatives

Directorate-General XVII-Energy of the European Commission has taken the lead in initiating a number of regional energy planning efforts in the UK. To date studies have been completed in the North West region; are near to completion in the North East and Cornwall; will soon begin in Scotland; and may soon be commissioned for the West Midlands. Since the study undertaken in the North West region is the only study completed and published to date I will concentrate my remarks on that study, and will both summarize the findings of that study, and draw conclusions concerning the application of regional energy planning in the UK.

3. Energy Study of the North West Region of the UK

Principal Findings

The energy study of the North West region of the UK was commissioned from the March Consulting Group in 1985 and completed in December 1987. The North West region has a final consumption of 15.8 m TOE, which amounts to 12.5% of UK final demand.

The consultants produced forecasts of energy demand in the region by the year 2000 against three scenarios. Taking the middle scenario (medium fuel price and economic growth) demand would grow by 24% if present levels of energy efficiency remain. If, however, the rate of implementation of energy efficiency measures and some alternative energies are increased demand growth could be only 3%.

In the industrial and commercial sectors 15% of present consumption could be saved with existing techniques and technology with paybacks of two years or less, equivalent to 1.1 m TOE.

In the domestic sector, the energy saving potential was estimated as 408,000 TOE from existing techniques. Interestingly the consultants concluded that the savings from new technologies was substantially less than those that could be achieved from existing technologies. They assessed the potential improvement in energy efficiency which new technologies could bring as accounting for a reduction in demand of 350,000 TOE by the year 2000.

Recommendations

Analysis of the recommendations, and the progress with the implementation of these recommendations in the year since this report was completed allows lessons to be drawn on the relevance of regional energy planning in the UK.

However, the most telling aspect of the recommendations is to whom they are addressed: to quote from the study (Ref. 1) "In absence of any regional authority, many of our recommendations are directed at the (national) Energy Efficiency Office."

Although a number of regional initiatives are recommended the bulk of the recommendations concern national initiatives. The regional initiatives recommended include:

- 'Energy Action' exercises to be carried out in a number of cities.
- Undertake a full evaluation of several cogeneration and waste burning schemes.
- Establish a consortium of energy suppliers, financial institutions and local authorities in order to carry out home energy audits.
- The establishment of a coordinating regional energy forum.

At the national level recommended actions included:

- Encouragement of the growth of third party financing.
- Setting up of a loan scheme to companies that have undertaken an energy audit.
- Research and Development in a number of areas, including steam metering and electric motor controllers.
- The modification and expansion of the existing grant-aided energy survey scheme for commercial and industrial sectors. (Note: this scheme has since been abolished).

In addition recommendations were made for Local Authorities and for Energy Suppliers. Progress in implementing these recommendations has been difficult to discern, and the reason for this lack of progress highlights the deficiency of regional energy planning in the UK: there is no regional authority to act as the agent to implement change.

4. Conclusions

In the UK, as the North West Regional study has shown, power is highly centralised, with the national government and the national fuel suppliers being the principal agents capable of implementing change. Even at the national level responsibility for energy policy is both diffused and confused. Although the Department of Energy retains overall responsibility for energy matters other Departments retain an important role, for example the Department of the Environment has responsibility for Housing, and for Buildings, including the setting of Building Regulations. It has not always been clear that the objectives of both Departments have been in concert.

At the local level, in the absence of any regional government, the competence of local government in the UK to undertake energy planning, or more importantly to act upon the results of such planning, is severely limited. Local governments have only limited ability to influence energy supply patterns, chiefly in the promotion of Combined Heat and Power schemes. The difficulty of regional energy planning in the UK is the problem of implementation. When this mismatch between planning level, i.e. regional or national is added to the previously stated belief in the efficacy of the free market of the present UK government the difficulties are unsurprising.

This is not to argue that regional energy planning in the UK is inappropriate. Rather energy planning must be undertaken with an awareness of administrative structures if actions are to result. The study undertaken by March consultants was an excellent exposition of the potential of energy efficiency to reduce the growth in demand in the North West region in the UK, and a number of practical and specific recommendations were given as to how demand patterns could be changed. However, the lack of any regional power structure has frustrated any implementation of the recommendations. This is a lesson for regional energy planning in the European Community.

19. NOTE ON THE SITUATION IN DUBLIN, IRELAND

T. Macmanus

Summary

While there has been no co-ordinated effort to develop an urban energy utilisation plan for the city of Dublin, a number of measures have been taken in recent years by public utilities, public transport companies and local authorities which have contributed significantly to improvements in both the efficiency of fuel utilisation in the city and air quality. This is not to say that Dublin no longer has its environmental problems; air quality can deteriorate markedly under certain climatic conditions. Efforts to mitigate this particular problem were begun recently.

The City of Dublin

The city of Dublin celebrated its millennium in 1988. While the remains of the original Viking settlement are limited largely to jewellery and other domestic relics exhibited in local museums, the city still boasts many interesting and ancient buildings, some dating back to the Middle Ages. The city has been spared many of the excesses of modern urban planning. City centre traffic congests streets laid out two centuries ago. Few buildings exceed five storeys high. People live mostly in two storey dwellings. The city enjoys an enviable acreage of public parks, gardens, recreational areas, and green space. For a European city its population density is quite low. At the last census in 1986 its 250 sq. km was home to 921,000 citizens.

The Measures which have Improved Energy Efficiency and the Environment

The main developments which have led to an improvement in the efficient use of energy and to improvements in environmental quality have been

- the introduction of natural gas to Dublin;
- the electrification of the Dublin suburban rail network;
- the implementation of measures recommended by the Dublin Transportation Task Force.

More recently smokeless zones have been created in parts of the city in response to a number of smoke pollution incidents.

The Introduction of Natural Gas

Natural gas was discovered off the south coast of Ireland in 1973 and a national gas transmission grid constructed over the following years. Gas was brought to Dublin in December 1982 and by 1983 it was being used by the local gas utility and at two local power stations. The introduction of natural gas to Dublin has displaced significant amounts of imported coal and oil, has reduced atmospheric emissions, and has contributed to improved energy efficiency.

Gas sales by the Dublin Gas Co. have increased more than fourfold since 1982. In 1988 gas utility sales of around 87 million therms (9.2 million GJ) displaced an estimated 215,000 tonnes of coal, 65,000 tonnes of gas oil, and 66,000 tonnes of heavy fuel oil. The improved efficiency of gas burning equipment conserved an estimated 2.7 million GJ of fuel. This fuel saving arises in the main from the replacement in the domestic sector of inefficient open coal fires by gas appliances. Currently just over half of Dublin's 265,000 homes are supplied with gas. As the proportion of homes connected to gas increases it is expected that gas sales in Dublin will near 140 million therms (15 million GJ) by the mid 1990's.

The two power stations operated by the Electricity Supply Board (ESB) in Dublin comprise a 510 MW conventional thermal station and a 146 MW combined cycle combustion turbine station. The larger unit can burn heavy fuel oil or gas, while the turbine must use gas, LPG, or a distillate fuel. However since gas became available both stations have operated mostly on natural gas. In a typical year the Dublin power stations consume 215 million therms (22.7 million GJ) of gas and so displace 385,000 tonnes of heavy fuel oil and 137,000 tonnes of gas oil. While there is only a very marginal direct efficiency benefit (power stations operate just as efficiently on oil) there is a significant environmental benefit arising from the reduction in sulphur dioxide emissions.

Electrification of the Urban Rail System

In 1834 the first railway was built in Ireland between Dublin and Dun Laoghaire. Exactly 150 years later, in 1984, work was completed on the electrification of this route and of other sections of the local suburban rail network. Passenger numbers on this network had fallen to 7 million per year by 1981 largely as a result of the poor service provided by outdated diesel trains.

The electrification of the network and the introduction of efficient modern comfortable electrical multiple units soon won back passengers. The system, called DART (Dublin Area Rapid Transit), carried 15.3 million passengers in 1987. Passenger growth rates now exceed 15% per annum.

One of the main impacts of DART, besides the reduction in noise and pollution once caused by the old diesel trains, is that a large number of people now travel to work by rail instead of by car. This makes a welcome contribution to alleviating traffic congestion.

The electrical supply to the system is from the ESB grid, and further energy efficiencies are obtained by a "chopper control" device which cuts down power consumption by the trains once they have reached cruising speed.

Dublin Transportation Task Force

This Task Force was set up in 1980 to examine ways of reducing traffic congestion in Dublin. Over the six years it was in existence it made many recommendations aimed at reducing the number of private motor vehicles and heavy goods vehicles entering the city while improving the average speed of the traffic which continued to use city centre streets. Among several of the recommendations adopted were

- Bus Lanes (Dublin now has 74 such priority routes);
- Urban Traffic Control (computerised linking of 190 sets of traffic signals, automatic reporting of signal faults, and 'green wave' facility for emergency vehicles);
- Closed Circuit Television (a 10 camera scheme monitoring key junctions, with facility to modify the computerised traffic signals);
- Selective Bus Detection (a pilot scheme involving 120 buses permits slow or delayed buses to catch up on the timetable by automatic influencing of traffic signals).

These measures played a major part in reducing the number of private vehicles entering Dublin by 8% from 1982 to 1985. However since 1986 private traffic has been on the increase and by 1987 it had reached 98% of earlier peak levels (27,000 cars per hour). This is not an unusual phenomenon. It has been observed in other cities that as measures are taken to improve public transport and traffic flow, driving becomes easier and motorists are again encouraged to employ their cars for commuting.

Smokeless Zones

In the winter of 1982 and again in November and December 1988 smoke levels in Dublin exceeded the limits recommended by the E.C. and peaked in one instance at 1700 micrograms per cubic metre. A major cause of the problem in Dublin is the large number of homes (approx. 50%) which use bituminous coal in open hearths as their main source of heating.

The present plan is to comply with the E.C. Directive and to adopt measures in those areas of the city which breach the rules (i.e. exceed 250 micrograms per cubic metre) before 1993. In the six areas worst affected smokeless zones will be introduced. A start has been made and by the winter of 1989/1990 around 3000 homes in these areas will be obliged to use smokeless fuels.

In parallel with these official measures residents in other areas of the city have formed voluntary associations to encourage a switch to the more expensive smokeless fuels when a pollution incident is threatened.

20. THE VALORIZATION OF THE ENERGETIC POTENTIAL OF URBAN WASTE: THE SITUATION IN PORTUGAL

H. Baguenier

The use of energetic potential of urban waste is a very recent experience in Portugal and no significant project has yet been undertaken. This situation is mainly due to the following factors:

- the non-resolution, until recently, of the problems caused by the accumulation of urban waste dumpt in more or less controlled dischargings in big and medium sized cities;
- the innovation involved in power production from urban waste, and the subsequent lack of know-how;
- the absence of markets for the power produced from urban waste. Actually, the heat market in Portugal is not comparable to those in northern Europe (e.g, urban heating), and is mainly directed to industrial needs. On the other hand, until very recently, the conditions of electricity purchase by the Company that has electricity production, transport and distribution monopoly was not favorable to independent producers.

During the last three years, however, the conditions needed to better use urban waste power were significantly altered:

- The economic development and the reinforcement of the democratic local power were translated simultaneously by an aspiration for a better life in the cities and for more means available to local powers to better answer to the needs of their constituencies. Thus, in the main cities, the responsibles believe that they will have to solve the issue on urban waste in the following years, and many projects of treatment plants are ready to be launched (Coimbra, Cascais-Oeiras-Sintra, Portimao, Sao Joao da Madeira, etc.). Most of these projects will be supported by FEDER under the Regional Development Programme or under other Community Programmes to start in 1989 (ENVIREG Programme).
- The implementation of an energy policy was more firmly oriented towards the valorization of endogenous potential and rational use of energy. Several incitement programmes were also created. Among these, SIURE (Programa de Incentivos à Utilizaçao Racional de Energia) can be of

great value, and -combined with the VALOREN Programme - allows to finance a number of investments in different forms of power production, including those from urban waste. Also Portuguese Parliament passed a law on Independent Electricity Production establishing very favorable purchasing conditions, and allowing, for instance the practicability of projects of power production in incineration plants. It is also important to verify that the VALOREN Programme will assign at least 6% of the 200 million ECU of investment foreseen to this type of projects.

The new dynamics assigned to the valorization of the different energy potentials at regional and local levels, cannot hide the obstacles the responsibles have to face in the implementation[1] of the above mentioned programmes and actions, among which are:

- the non-acquaintance, at local decision agents level, of the economic potential urban solid waste used to produce energy may represent. Consequently, systematic actions to insure a good divulgation of information are needed;
- the lack of projects of "reference". It would be of great value to promote actions of demonstration (for example, in the framework of demonstration projects from DG XVII of the EEC) in order to convince deciders that the techniques used are warranted;
- the absence of tradition in energy management at municipal levels, is an obstacle not only to decisions but also to actions of follow-up to the projects decided. One solution would be to create training programmes to local agents, linked to appearance of a new function of the "Man Energy" integrated in municipal technical services;
- the financial budget to which municipalities are often tied, especially because of the blind rules on the permitted levels of debts. Appropriate financing tools should be elaborated.

We think that, in spite of the obstacles underlined above - which we believe can be overpassed - and of the relative lack of unexperience of the national industry and the local deciders, the use of urban waste to produce energy will soon be a reality in Portugal. The political will stated by the authorities (and present in the laws) and the aid systems approved is the best proof to that. To this national will we can add community financings

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[1] Remember that Portugal has only 300 Municipalities (Concelhos), each one grouping several Parishes (Preguesios).

and results of experiences acquired in other EEC countries. Condition number one to success seems to be that municipalities have to become aware of the fact they need to obtain tools and means to take in charge the management of their energy.

21. INTEGRATED ENERGY/EMISSIONS CONTROL PLANNING ON A MUNICIPAL LEVEL

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J. Johnsson
T. Larsson
B. Ryden

1. Introduction

From the Viewpoint (Espejo 1987) of the Environment, the energy system contains a number of point sources which emit pollutants that might be harmful for the environment. Control measures are designed to reduce emissions from these identifiable point sources. From the Energy Viewpoint the energy system produces services demanded by the society, but in doing so it also creates byproducts that can pose external risks, i.e., might cause damage outside the energy system. Byproducts can be reduced either by technical "fixes" at individual production plants or by shifting production of services to parts of the energy system with no or little harmful byproducts.

There are considerable advantages in trying to merge the two viewpoints: i.e., co-ordinating the efforts to develop the energy system and to control the emissions from it. The advantages are visible both in control costs and in risk management:

- Control costs. There are several indications that control costs depend strongly both on system boundaries and on the way control options are considered within the system (e.g., Garvey et al., 1982; Ryden and Wene, 1987; Bergman, 1988). Coordinating development and control can reduce the cost for control by up to 60%. "Bubbling", banking, trading of emission rights are examples of compliant schemes which permit different co-ordinating efforts (cf Siebert, 1987).
- Risk management. There are several acid rain precursors that may have to be controlled. The raising concern about the greenhouse effect puts other by-product gases from the energy system in focus. Applying a strict Environment Viewpoint on the control of all relevant byproducts may ignore important synergies or overlook potential areas of conflicts. Some measures for controlling acid rain (e.g., switching

from coal to natural gas or nuclear energy) will also help control the greenhouse effect, while other measures (e.g., installing scrubbers) will reduce acid rain precursors but not greenhouse gases. Both the Environment and the Energy Viewpoints are needed to provide a methodology for obtaining consistency between technical control strategies for acid rain precursors and strategies to manage the risks of a greenhouse effect (Larsson and Wene, 1988).

A methodology for integrated energy/emissions planning has been developed (Ryden and Wene, 1987) and is now being tested in case studies in three Swedish communities; Gothenburg, Uppsala and Varnamo with 400,000, 150,000 and 30,000 inhabitants respectively. The Swedish community is an ideal administrative unit to implement such a planning instrument. The law on municipal energy planning (SOS 1976) makes the local government responsible for energy planning and the last amendment in 1985 mandates the city council to design a complete energy plan for the whole community. In communities with district heating systems, an Environmental Bill passed in Parliament in June 1988 demands stricter emission standards for SO2 and NOx from those local systems.

The Energy Systems Technology Group at Chalmers University of Technology has worked with municipal energy planning since 1980 (Wene and Andersson, 1981; Wene and Ryden, 1987; Wene, 1988) and the integrated energy/emissions planning is an extension of this work. All work is done in close co-operation with the community authorities. The methodology uses a comprehensive model for the technical energy system, MARKAL. MARKAL is a dynamic Linear Programming model developed in a multi-national co-operation within the framework of the International Energy Agency (Abilock et al., 1979; Altdorfer et al., 1979; Fishbone and Abilock, 1981).

The purpose of this contribution is to give a brief description and a rationale for the methodology, and illustrate the use of the methodology by some results from the case studies.

2. Methodology

2.1 The technical energy system

Figure 1 shows a simple picture of the community energy system. The community Technical Energy System (TES) contains all energy technologies in the community and all flows of energy to this technologies from outside the community, between the technologies and from the technologies to the end

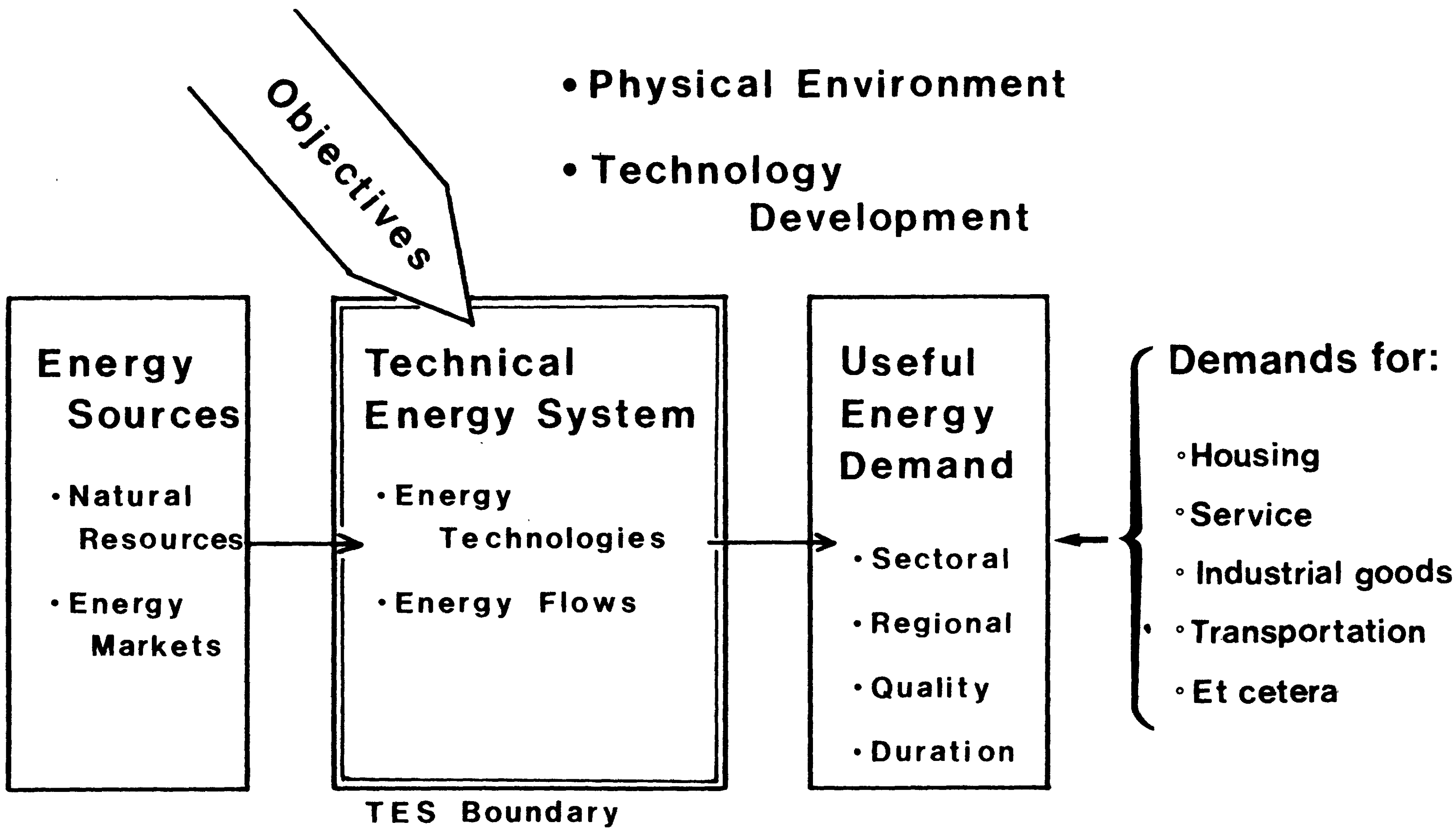


Figure 1: Schematic model of the technical energy system and its environment

users. The TES may thus contain technologies for extraction of energy carriers from e.g. peat moss, for large and small scale energy conversion, and for distribution of energy carriers. Quite specifically, it also contains technology for energy conservation by the end user, e.g., insulation techniques.

The existing community Technical Energy System is described in MARKAL together with all possible alternative energy technologies and energy paths. The model selects the combination of energy technologies and energy flow paths that best satisfies the specified system objective over the planning period (25-30 years). The model also enables to study the balance of supply and energy conservation (Wene, 1980). The system objective is usually expressed as minimum total system cost with a real discount rate of r%, where r in the case studies discussed here is 6%.

Figure 1 indicates four factors in the system environment, that influence the choice of energy technologies and energy flow paths. Consistent assumptions on the development of these factors form a scenario. Scenario parameters are given as external input to the model; they "drive" the model. The factors are:

- Energy sources: the price and availability of energy carriers on international, national and regional energy markets, and the availability and cost of extraction of energy carriers from natural resources within the system boundaries.
- Useful Energy Demand: demand for energy services in different sectors and different geographical regions of the community.
- Technological research and development: technical and economic properties of energy technologies available to the community-TES.
- Physical environment: Consists of two parts:
  * Physical Constraints on the use of technologies, e.g.
  availability of natural heat sinks or heat sources;
  solar radiation etc.
  * Environmental Control. Constraints, costs or benefits
  included to internalize the external damage of the technical energy system. Emissions Control is part of the Environment Control (see 2.2!).

2.2 Coordinating the development of the energy system and the control of emissions

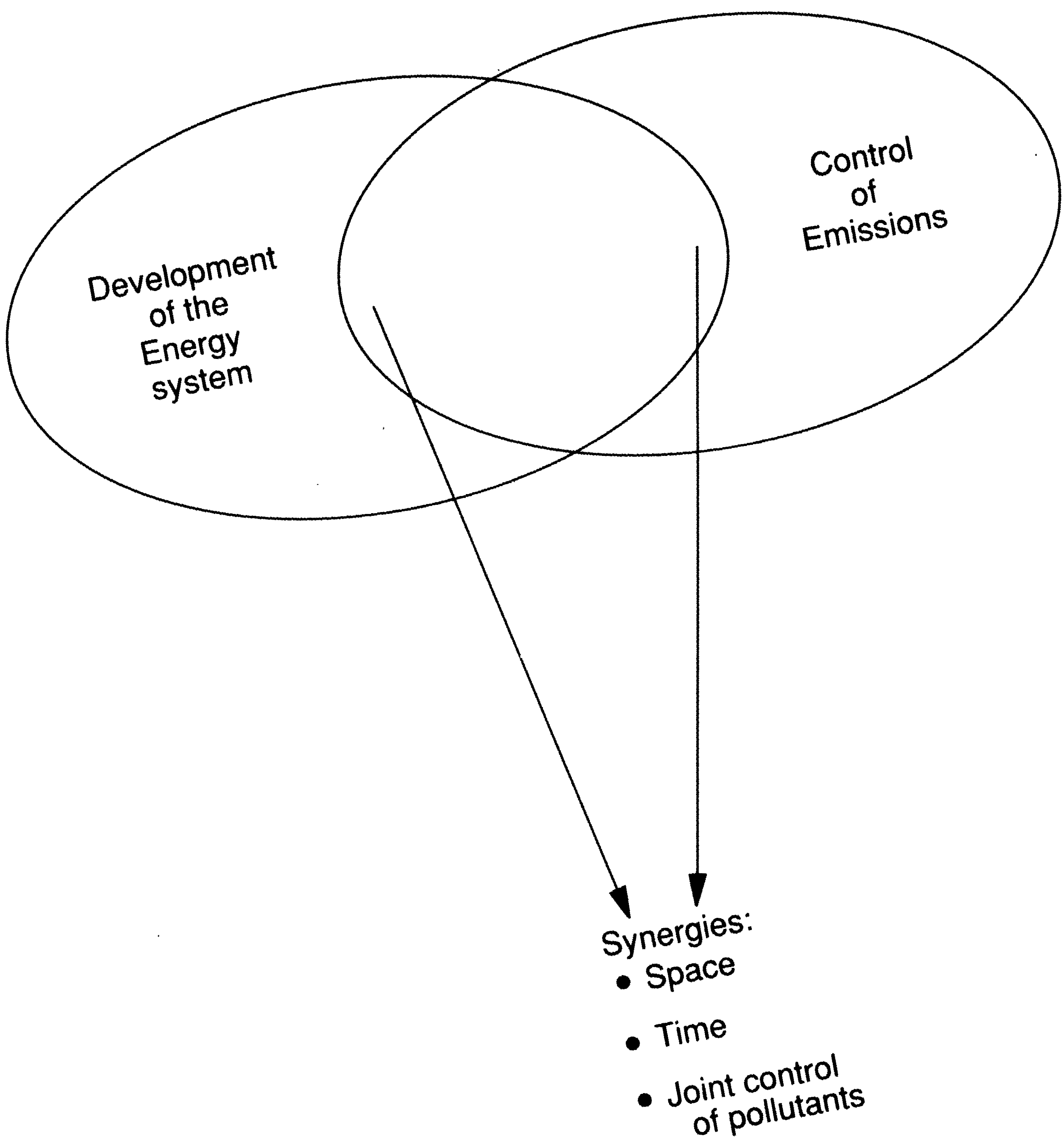
It is important to realize that the model decides on investments in the energy system, the operation of the system and emissions control at the same time; an LP-model considers all possible trade-offs between the system objectives and system constraints. The methodology therefore offers possibilities to explore all options for coordinating the development of the technical energy system with the control of emissions from this system, thus pointing to possibilities for total cost reductions. Repowering with pressurized fluidised bed or integrated coal gasification combined cycle are examples of such options that coordinates efforts for system development and emissions control. A detailed account of how the methodology can be extended to treat the combined problem of developing and controlling is given by Ryden and Wene (1987).

Figure 2 indicates that there are three types of synergies that can be exploited by coordinating development and control:

- Energy flows and technologies (space). Cost-efficient emissions control may involve changing energy flows and conversion technologies in different parts of the energy system, geographically separated from the emissions control point. Changing dispatch patterns is an example within the electric subsystem. Cogeneration is an example where energy flows within two subsystems (e.g., electric and district heating) can be co-ordinated both to increase the energy efficiency and to reduce total emissions. A very interesting set of measures concerns the coupling between the demand and supply sides. Examples of demand measures that will affect total system emissions are: investment in new conversion technologies leading to less demand for electricity and investments in conservation.
- Dynamics (time). Changes in the energy system can be coordinated with more rigorous emissions control. This may involve delaying or advancing the time schedule for investments in control measures or energy technologies in order to achieve better cost-efficiency.
- Joint control of pollutants. There may be considerable cost reductions through joint control of several pollutants (e.g., SO_2 and NO_x) compared to the separate control of each one. Many emerging technologies permit the joint control of several pollutants: fluidised bed combustion, integrated coal gasification combined cycle (IGCC). The cost-efficiency of these technologies is better seen when looking at the combined problem of developing the energy system and controlling the emissions.

The methodology is especially adapted to fit into two risk management frameworks (Lave, 1984):

Figure 2: The combined problem



- Cost-efficiency: Emissions control is expressed as contraints on the total emissions of different pollutants from the whole technical energy system or from parts of it, e.g., the district heating system. The model finds the cost-efficient solution that satisfies these constraints. The new Environment Bill passed through Parliament in June 1988 permits such a "bubble" over the local district heating system.
- Cost-benefit: the external damage of emissions are entered into the model either as marginal costs for continuing the emissions (i.e., an emission fee paid by the system) or as marginal benefits for reducing the emissions. The model will reduce the emissions as long as it decreases the total system costs, i.e., as long as the costs for reduction are less than the emission fee or less than the received benefits.

2.3 The network of organisations

The energy-environment system in a community has many actors. The system is best described as being managed by a network of organisations, or "esoteric boxes" (Beer, 1975). The role of a comprehensive model like MARKAL in the planning process has been discussed by Wene and Ryden (1988).

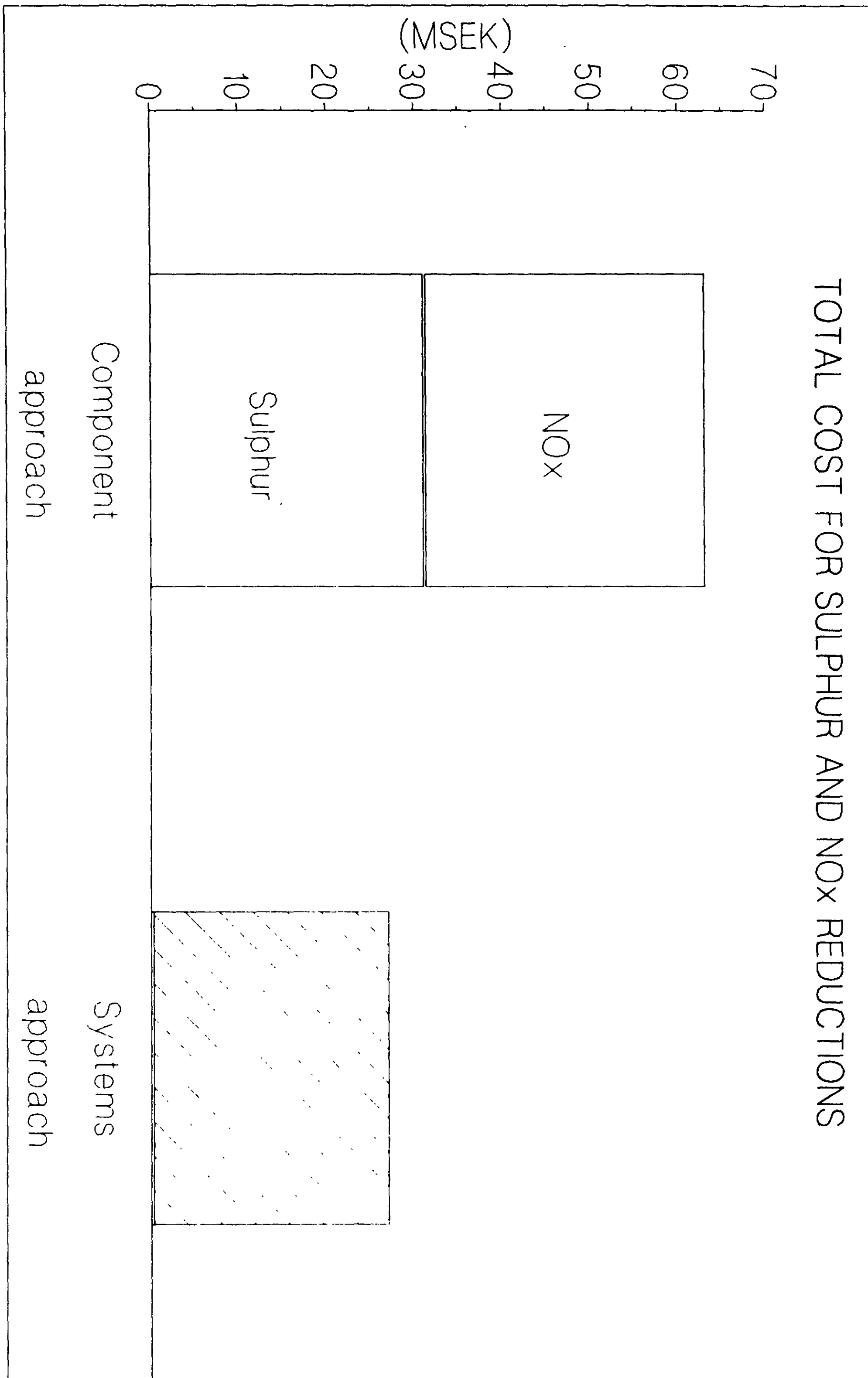
Considerable efforts are made in all the case-studies to involve actors from the important parts of the organisational network in all phases of the work: collection and judgement of data, validation of database, selection of scenarios, evaluation of results. A reference group follows the work and provides a stage for discussions between the different actors. The model results give the "hard facts" input to these discussions and provide consistent answers to the "What if..." questions. Although the methodology is built on an optimising model, the process that it initiates is best described as a <u>learning process</u> (Checkland, 1981).

3. Examples of Results

3.1 Total costs for emissions control

Figure 3 shows the cost differential between a component by component control and control of the stationary part of the technical energy system in one of the case studies (Varnamo, 1988). The reduction achieved is the same in the two cases: 30% reduction of NOx and 60% reduction of sulphur by 1996. The figure illustrates the cost reductions possible if emission constraints are applied to the whole technical energy system, and the system is allowed

Figure 3: Total cost for sulphur and NOx reductions.
Component approach v.s. Systems approach.



to comply using all the different types of coordination described in 2.2. above.

3.2 The four factors decision: local electricity generation, use of natural gas, burning of municipal refuse and emissions

Figure 4 shows the supply of primary energy and electricity "imported" from the national grid to the community of Uppsala 1987-2015 (Johnsson et al., 1988). Uppsala is situated about 60 miles north of Stockholm. With its 150,000 inhabitants it is the fourth largest community in Sweden. Most of the inhabitants live in the city of Uppsala, where 95% of the residential and commercial houses are connected to the district heating grid. The district heating system also delivers steam to the major industry; a pharmaceutical enterprise. The local utility, owned by the municipality, is thus the major buyer of primary energy in the community energy system.

The figure is a result of the MARKAL model. The price of the internationally traded energy carriers (oil, coal, gas) are assumed to increase by 3% per year. The phase out of nuclear power is assumed to cause a doubling of the price of electricity by the year 2010. Peat is a domestic energy carrier produced by a company partially owned by the municipal utility. The price for peat is equal to the variable production cost.

Figure 4 indicates that the utility has to make a major decision in the next few years: to use or not to use natural gas in their production system. If the assumptions about the system environment in the scenario in Figure 4 are correct, the most economical solution is to introduce natrual gas around 1995 and practically all the natural gas should go to the district heating system. However, such a decision will effect most parts of the energy system and not least the cost for emissions control.

- Local production of electricity. Cogeneration in district heating systems is an energy-efficient way of producing electricity and in such a large district heating system as Uppsala it is also a very cost-efficient option if nuclear power has to be phased out. In a combined cycle where peat is used to raise additional steam it is possible to have an electricity to heat ratio close to 1 and to run against the district heat load curve over the whole year while still having an equivalent full load time in gas usage of 6000 hours. Figure 5 shows the result for the electric system. The combined cycle is built in two steps: the first gas turbine will be installed in 1995, the second in 2005, the utility already has a steam turbine with spare capacity. The community changes from being a net importer to a net exporter of

Figure 4: Primary energy and imported electricity to the community of Uppsala. Base scenario

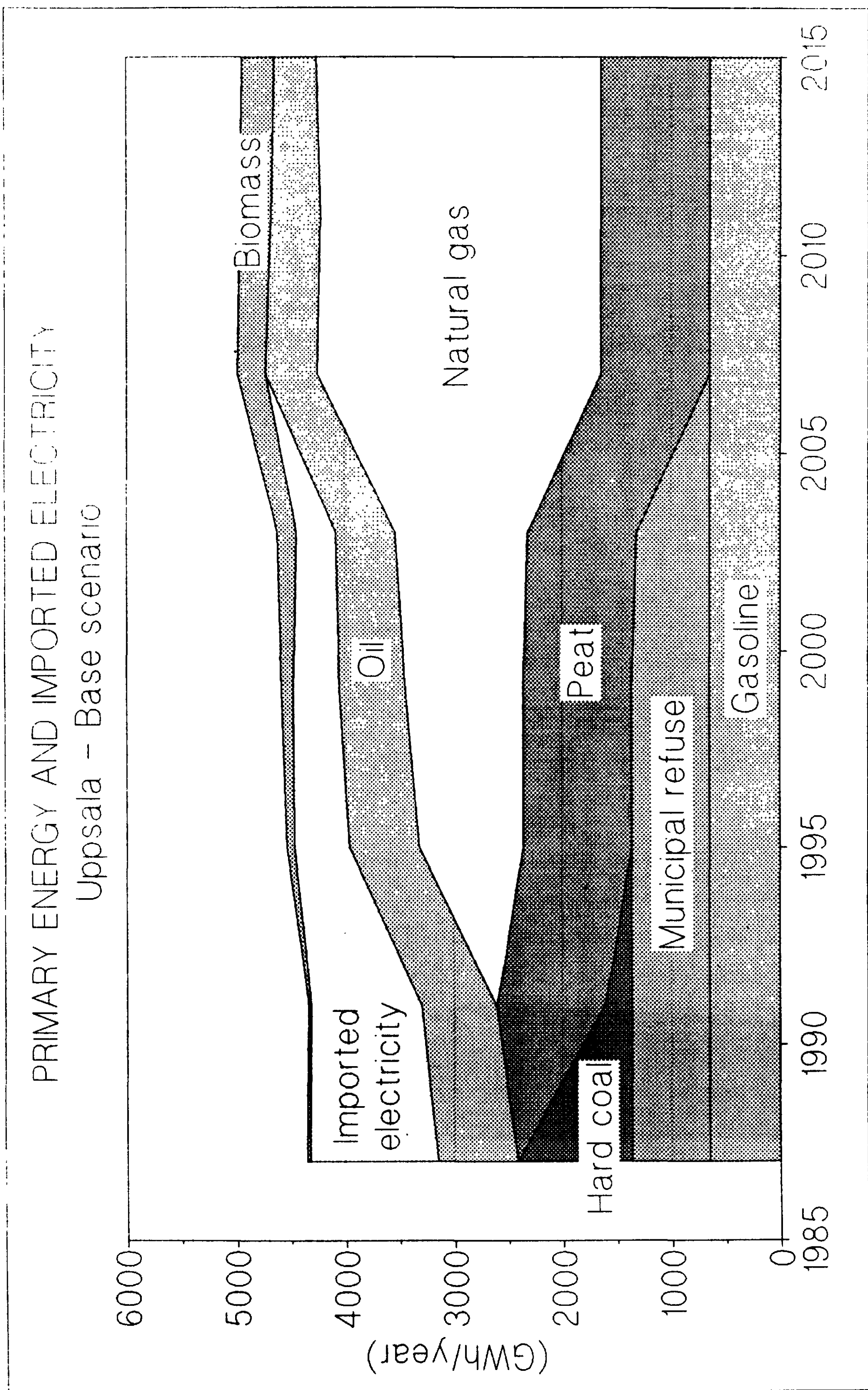
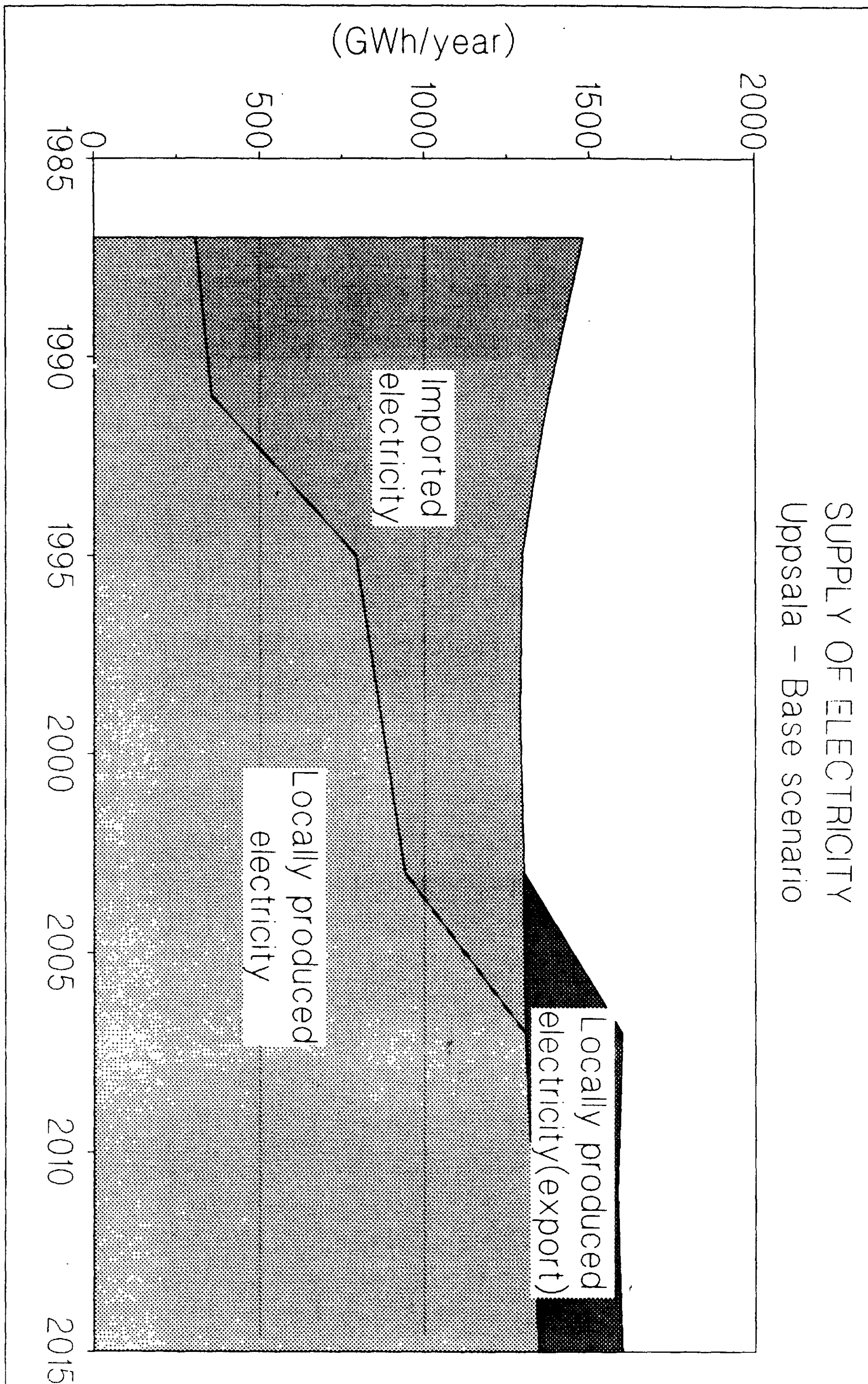


Figure 5: The electric system of the community of Uppsala.
Base scenario.



electricity at the end of the period. These interesting results raise several questions:

- How safe is the supply of natural gas? Gas is an environmentally benevolent energy carrier; how will more stringent emission standards and the raising concern about the "greenhouse effect" affect the relative price?
- No municipal refuse is burnt after 2005. It has been assumed that a major reinvestment has to be made in the refuse burner at this time and the model then finds it more economical to invest in a second gas turbine and produce more electricity. Uppsala burns the municipal refuse from 20 neighouring communities. The present licence to run the refuse burner expires in 1991, the contract with the other communities expires in 1995. The combined cycle an the refuse burner are competing for the heat load in the summer. The result is a complex interplay between investment costs, gas price, alternative costs for refuse handling, and minimum equivalent load times for gas and refuse (the refuse cannot be stored over any longer period of time). What will be done with municipal refuse after 2005? How sensitive is the system to the costs for alternative ways of handling municipal refuse? What are the environmental consequences of these alternative ways compared with burning (which produces NOx as well as chlorine and dioxine)? Should refuse be phased out earlier than in the base case due to other emissions than NOx or sulphur?
- The emissions of sulphur and NOx from the district heating system are restricted in accordance with the environmental bill passed in Parliament in June 1988. A "bubble" is placed over the district heating system and the emissions of sulphur is maximised to 400 tonnes/yr after 1995 while the average specific emissions of NOx is maximised to 80 mg NOx/MJ fuel (input). Figures 6 and 7 show the resulting emissions from the total energy system ("Base case"). The increase in NOx emissions after 2005 is due to the second step of the combined cycle and export of electricity. Note that the net effect for the Swedish energy system will probably be positive because electricity for cogeneration will substitute electricity from condensing plants. What are the consequences on emissions from higher gas prices, earlier phase out of refuse burning? What is the cost of more stringent emission standards? Is it possible to reduce the control costs by widening the bubble to the whole community energy system?

Figure 6: Emissions of sulphur from the community of Uppsala, includiing imported electricity, excluding transport.

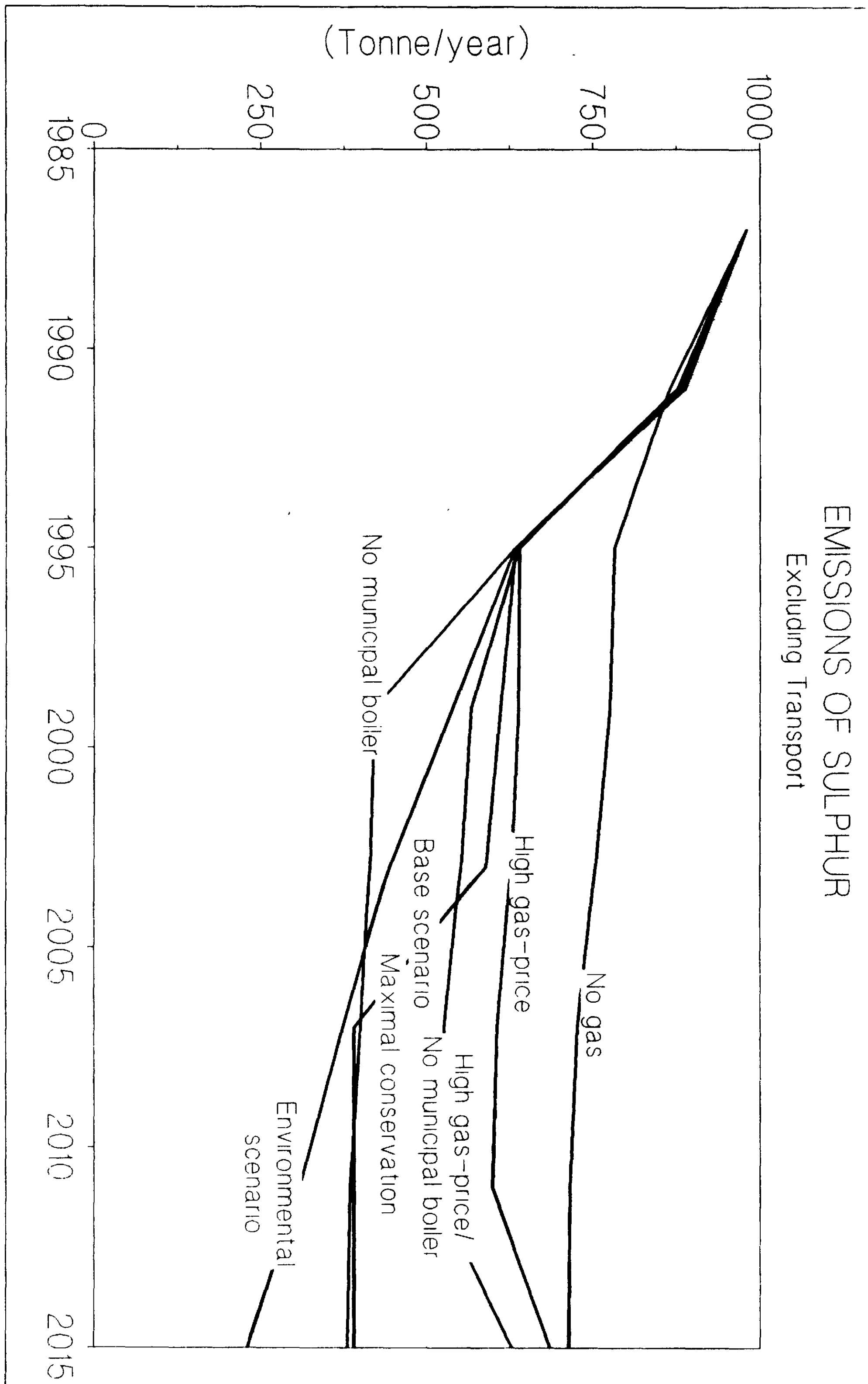
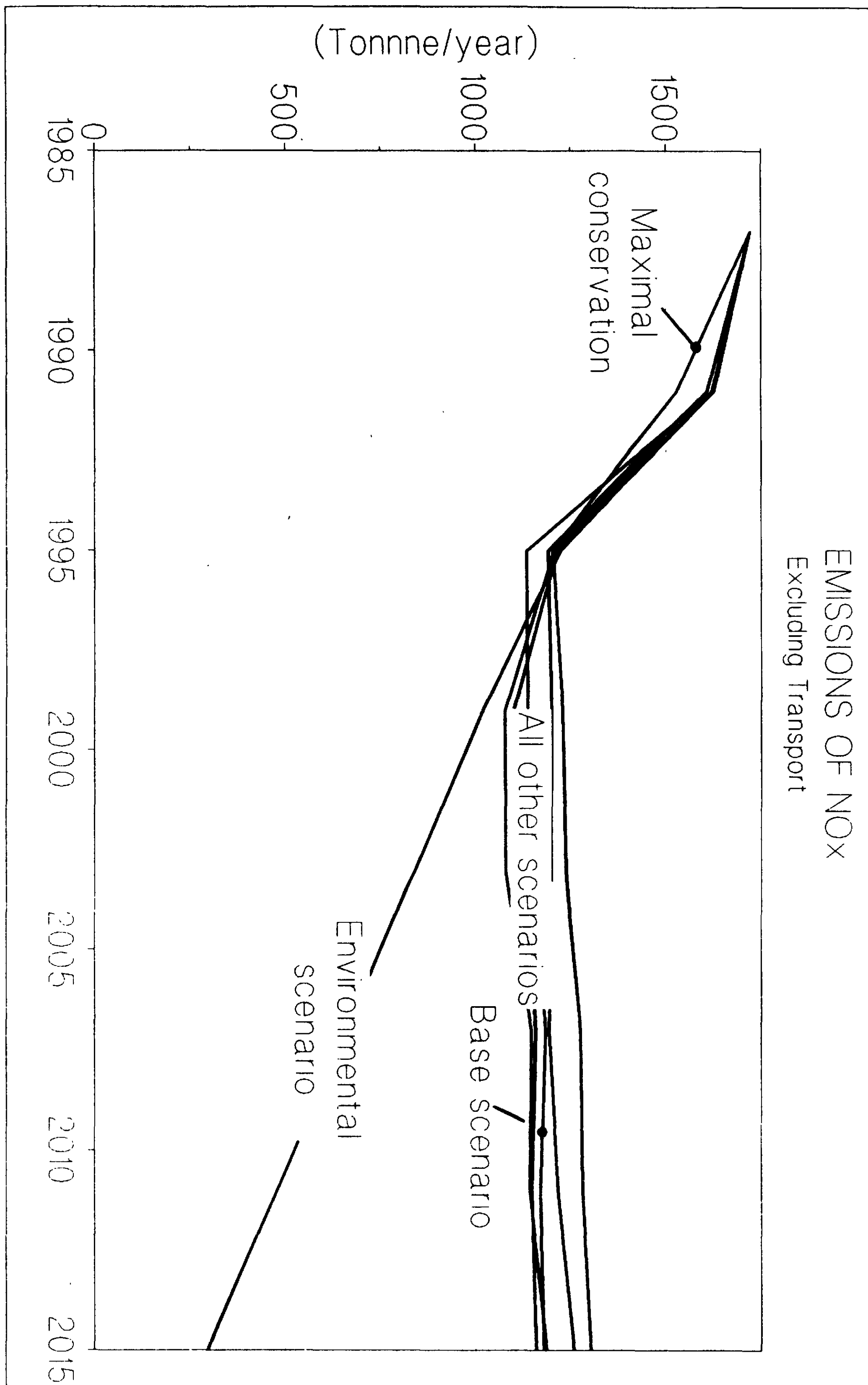


Figure 7: Emissions of NOx from the community of Uppsala, including imported electricity, excluding transport.



The matrix in Figure 8 shows the scenarios that have been investigated so far and Figures 6 and 7 indicate the effects on emissions of sulphur and NOx. "High gas price" refers to a case where the gas price increases by 6%/year, mimicing a scenario where stringent environmental standards implied in most nations drives up the gas price. "Maximal energy conservation" refers to a case where very stringent conservation measures are implemented in the whole building stock.

Figure 9 shows the relation between NOx-emissions and use of natural gas. The figure shows no clear trends which the corresponding figure for sulphur and gas use does. This indicates that the system is constrained by the limit on NOx emissions. Figure 9 should be compared with Figure 10 which shows the system costs of the different scenarios. It is interesting to notice that "Maximal energy conservation" reduces NOx by 100 tonnes at 2010 to the cost of 730 MSEK but putting a bubble over the whole system and forcing a reduction of 800 tonnes relative to the base scenario only increases the total system cost by 440 MSEK. Widening the bubble to the whole system in the base case reduces the total system costs by 145 MSEK.

Figure 11 shows the cost efficiency of gas for electricity production; more than three times as much electricity is produced in the base scenario compared to a case with no gas available but everything else being equal. "Maximal energy conservation" reduces electricity production by about 200 GWh/year while more stringent environmental standards have very little effect.

4. Conclusion

The above mentioned examples show the strong interrelation between energy and environmental issues indicating the need for tools that can handle both. Further work will be made on analysis of marginal costs for different emissions reduction strategies, generalising in a bottom-up approach the experiences gained on the local level to the national level and testing the consistency of schemes for reducing "acid rain" precursors with strategies for handling the risk of a "greenhouse effect". Other important issues concern the use of comprehensive models in the energy-environment planning process and the legal and regulatory framework necessary to coordinate the efforts to develop the energy system and control its emissions.

Figure 8: Scenario-matrix

		ENVIRONMENT FACTORS		
ENERGY FACTORS		Base scenario: Environment	Environment scenario	No municipal refuse boiler
	Base scenario: Energy	X	X	X
	High gas price	X		X
	No gas	X		
	Maximal energy conservation	X		

Figure 9: Use of natural gas and local production of electricity about 2010. All scenarios. The scenario without municipal refuse boiler coincide with the Base scenario.

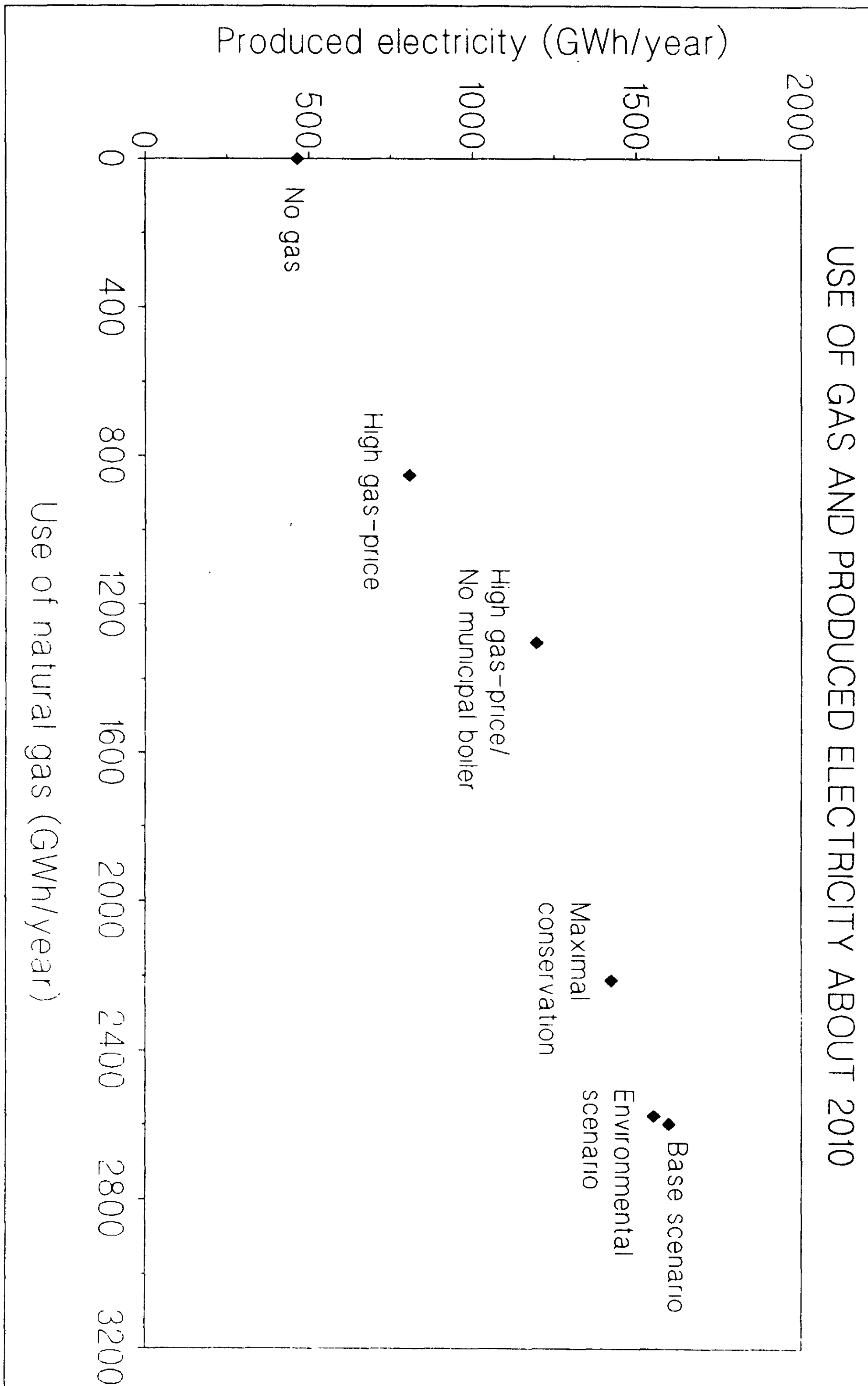


Figure 10: Total system cost. Net present value, real discount rate of 6%.

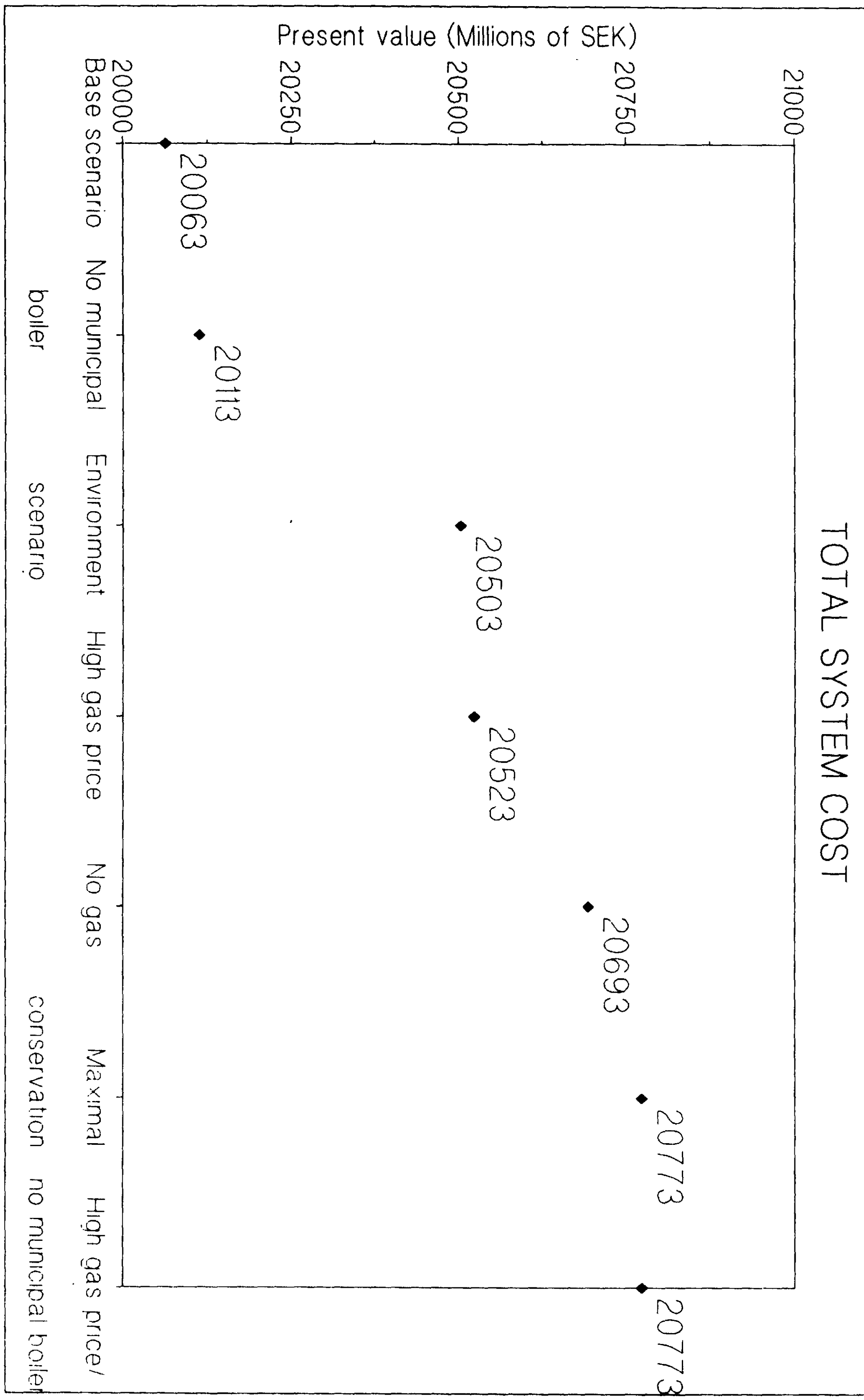
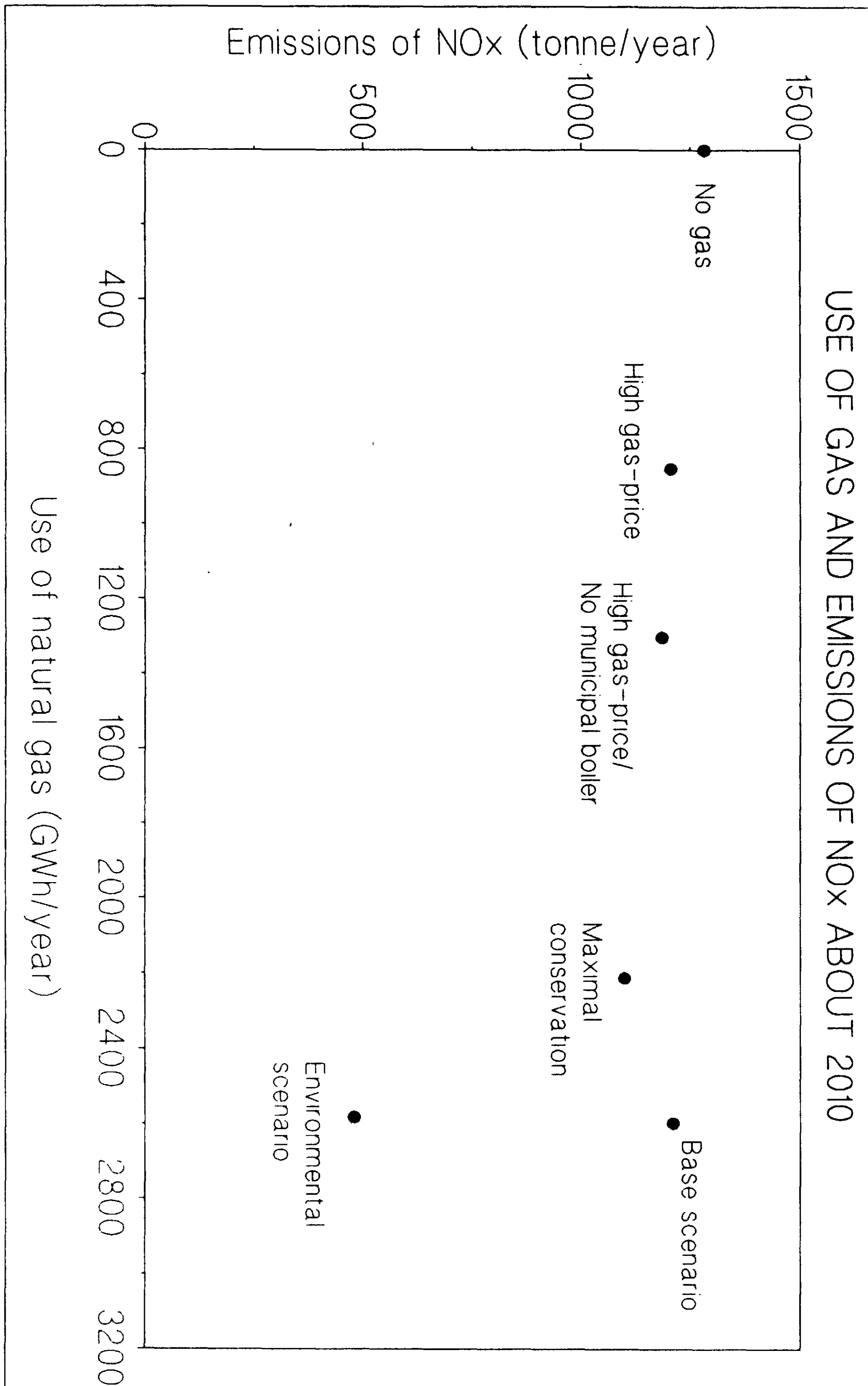


Figure 11: Use of natural gas and emissions of NOx about 2010. All scenarios. The scenario without municipal refuse boiler coincide with the Base scenario.



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22. URBAN ENERGY PLANNING: A NEW DIMENSION

K. Juul

P. Nijkamp

In this concluding chapter various arguments in favour of urban energy planning will be brought together. A plea will be made for a systematic European effort to stimulate efficient and effective energy policies through the medium of decentralized, local initiatives. The arguments and considerations will be presented in a concise way in the form of a 'shopping list'[1].

1. Energy Policy Objectives and Urban Energy Planning

In the past years, the European Community has formulated various general objectives in regard to energy policy, which should lead to the following results:

- increase of energy efficiency;
- reduction of environmental pollution caused by energy use;
- reduction of energy costs for the business sector;
- improvement of spending capacity of households through a reduction of energy costs in the residential sector (with a simultaneous improvement of living conditions);
- reduction of dependence on foreign (or extra-regional) energy sources;
- enhancement of regional growth through effective energy planning.

The achievement of these results needs a wide variety of different policy measures, most of them being a responsibility of national, regional or local governments. Urban energy is one of such policy initiatives. It aims at contributing to the fulfilment of the above mentioned general results, although from a decentralized angle the focus is much more on the

[1] The authors wish to thank M. Broege, Ph. Devuyst, M. Giaoutzi, A. Perrels and P. Vitorio for their suggestions regarding the contents of this chapter.

potential of urban areas to support these objectives. There is evidently a wide variety of urban energy problems and related urban energy and environmental policies. Some of them have failed, but several of them have been relatively successful (as was clearly shown in the present volume). Apparently there is a need for a further exchange of good experiences in the area of urban energy planning.

2. A Multi-client Orientation

Cities are the workfloors of planning in many respects, such as transportation, environmental quality management, physical planning, energy provision, social planning and so forth.

Decentralized policy initiatives at the urban level which at the same time covers a considerable share of the population of a nation may increase the efficiency of planning. Urban energy planning may be a good case in this context. It should be realized, however, that in general urban energy policies are multi-faceted and linked to various sectors in the city (e.g., physical planning, transportation, housing, land use, environment etc.). Thus they may in various cases also embody conflicts between diverging interests (as was clearly shown in various case studies in this book). However, they have a higher chance of being broadly accepted by all parties involved if they are directed towards generating benefits for (almost) all sectors, agencies or institutions within the urban territory (e.g., consumers, industry, electricity companies etc.). Thus a 'multi-client' orientation of urban energy plans is an important way of enhancing its successfulness. Such a multi-client orientation presupposes an integration- or at least coherent treatment - of different sector plans in a city (e.g., housing planning, dwelling insulation, district heating, waste management, industrial co- generation, heat recovery at an incineration factory etc.).

3. Institutional Barriers

Various case studies point at the limited degree of flexibility in urban energy planning caused by rigid institutional barriers or administrative competences reflecting a self-interest of some established interest groups. It should be added, however, that the reluctance to accept decentralized energy options at a local scale is often strongly depending on lack of convincing arguments. Urban energy planning may broadly be regarded as an appropriate policy option, when it is clearly demonstrated that it is technically feasible and economically meaningful.

Rational arguments - taking into consideration the market situation and the technology potential - may act as convincing vehicles for removing institutional obstacles for urban energy planning. Arguments to be used in this context are amongst others:

- financial revenues for all parties;
- favourable environmental effects;
- more competitiveness in view of the open European market;
- contribution to deregulation (including public-private partnership);
- flexibility in terms of production and distribution of energy in case of small-scale options;
- better matching of long-term and short-term energy planning.

In any case, a planning system of incentives based on efficient cooperation is always to be preferred to alienating monopolisation leading to institutional competence disputes.

4. Marketing

Urban energy planning objectives are to be accompanied by well thought out marketing strategies and investment plans of local utilities. For instance, resort might be taken to a blend of physical urban planning and energy planning, in which local space heating supply systems may favour urban quality of life as a major goal of urban sustainability policy. Similarly, the substitution of conventional oil- or coal-based space heating for more environment-friendly alternatives (e.g., natural gas, cogenerated district heating) may reduce the ambient concentration of pollutants and-through a reduction of social costs of energy provision - increase the overall energy efficiency. Various examples from European countries have shown that this is a meaningful strategy. The promotion of more sustainable energy policies at the urban level should of course point out the benefits of more efficient urban energy plans, but should also emphasize the feasibility of implementing such urban energy systems in practice. Only in this case, a willingness may emerge as to the acceptance of new institutional configurations, in which energy utility companies may act as energy service companies. Clearly, cities may - temporarily - support the development of such energy service companies by providing financial assistance during an initial phase (and - whenever possible - by using their influence on the marketing and investment strategies of publicly owned energy utility companies). A critical judgement of existing experiences and a transfer of information on successful cases in a European context would then be desirable.

5. Information Transfer

There is a variety of different cities; there is at the same time also a great diversity in urban energy policies, based e.g. on solar heating, peak load management, geothermal sources, combined heat-power systems, etc. A system of disseminating appropriate information and know-how on such initiatives would be extremely helpful for increasing energy efficiency in various cities in the European Community, especially when it were combined with complementary indicators such as ecological quality, emission of pollutants (SO_2, NO_x, CO, CO_2 etc). Systematic urban energy impact analysis and well structured decision support methods may be extremely useful here, especially since a quick transfer of suitable knowledge may contribute to preventive environmental policies. Various experiences described in the present volume point out the potential of such new endeavours, especially if they are combined with decentralized information provision or information centres. Besides, exchange of expert knowledge and training of experts may also be an important vehicle in this framework. A broader policy programme focusing on a wide range of services rendered to local energy initiatives may then be desirable, for instance, information provision, problem diagnosis, assistance and consultation programmes, demonstration projects of local energy projects, etc. It goes without saying that all such new endeavours would have to be based on proper urban energy information and monitoring systems (using inter alia remote controls, remote alarms and remote measurements) that also incorporate relevant sectoral, spatial and environmental information.

6. Towards a European Urban Energy Programme?

The experiences reported on in the present volume show the potential benefits of appropriate urban energy plans. Instead of straightforward capacity expansion (with all environmental externalities involved) alternative options do exist through a clever management and re-arrangement of existing possibilities. However, information on good case studies is rare. What is essentially needed as a first start, is a cross-European programme on urban energy planning that serves to disseminate information on successful and innovative urban energy policies. Thus 'success stories' of urban energy policy which can act as learning mechanisms and catalysts for other cities are of paramount importance, in particular because at present the exchange of know-how between cities is undoubtedly unsatisfactory. Consequently, information on interesting and feasible examples of urban energy policy which may provide new insights for other cities in Europe would have to be collected on a systematic basis. Such a well focussed cross- European urban energy initiative might provide a stimulating role as a catalyst for new ways of energy planning in Europe.

PROGRAMME

ENERGY PLANNING

ENVIRONMENTAL MANAGEMENT

REGIONS AND CITIES

19 - 21 December 1988, Rome

19 December 1988

NEW ISSUES IN REGIONAL ENERGY PLANNING
AND ENVIRONMENTAL MANAGEMENT-
EXPERIENCES FROM DEVELOPED AND
DEVELOPING REGIONS

20-21 December 1988

URBAN ENERGY PLANNING

Place of Venue : Diplomatic Institute - Via di Villa Madama 250 - Roma

19 December 1988, Rome

NEW ISSUES IN REGIONAL ENERGY PLANNING AND ENVIRONMENTAL MANAGEMENT

EXPERIENCES FROM DEVELOPED AND DEVELOPING REGIONS

*** 09.30 - 10.00 Opening**

Words of Welcome — M. Ramasso Valacca, President SIES; O.A. Barra, LIFE(I)

Opening address

Recent Developments in the Community's Energy Programmes — C. Jones, Deputy Director-General (EC, DG XVII)

Chairmain : P. Nijkamp (NL) **Rapporteur** : Ph. Devuyst (B)

*** 10.00 - 11.30 Regional Energy Planning : New Directions**

New Perspectives in Energy Planning at Local and Regional Levels — A. Ceña Lazaro (SP)

British Experiences in Urban and Regional Energy Policy — I. Brown (GB)

Use of Urban Waste as a Source of Energy — A. Buekens (B)

Links between Energy Planning and Environmental Management — M. Wolf (EC,DG XI)

*** 11.30 - 12.00 Coffee Break**

*** 12.00 - 12.30 Discussion**

*** 12.30 - 14.30 Lunch**

*** 14.30 - 16.00 Energy Planning and Environmental Management Problems and Possibilities in Restructuring Areas**

Chairman : R. Funck (D) **Rapporteur** : M. Giaoutzi (HE)

BNL and ENEA For South Italy : Support For Regional Energy — W. Mebane (ENEA, I)

Ecological Energy Planning — E. Bernsen (DK)

New Developments in Urban Energy Planning in German Cities — W.G. Gottschalk (D)

Environmental Policy from the Viewpoint of ENEL — J. Cartas (ENEL, I)

*** 16.00 - 16.30 Coffee Break**

*** 16.30 - 17.30 Discussion**

*** 17.30 - 17.45 Summary Report** — M. Caillouet (EC, DG XVII)

*** 17.45 Closing**

URBAN ENERGY PLANNING

Tuesday 20 December 1988

*** 9.30 - 10.00 Opening**

Chairman : T. MacManus (IRL) — **Rapporteur** : M. Broege (F/D)

Words of Welcome — M. Ramasso Valacca, President SIES

Opening Address C. Jones — Deputy Director-General (EC, DG XVII)

Relevance of Urban Energy Planning — K. Juul (EC, DG XVII)

*** 10.00 - 11.15 General Experience in Integrated Urban Energy Planning**

Urban Energy Planning in the City of Mannheim	K. Bensch (D)
An Overview of Urban Energy Planning Experience in Greece	L. Damianidis/M. Giaoutzi (HE)
Urban Energy Planning in Amsterdam	G.J. Zijlstra (NL)
Experiences with Urban Energy Planning in French Cities	J.P. Bonaiti (F)
The Italian Experience in Lombardy	P. Berra (I)

*** 11.15 - 11.45 Coffee Break**

*** 11.45 - 12.30 Discussion**

*** 12.30 - 14.30 Lunch**

*** 14.30 - 16.15 Urban Energy Planning in Various Countries Case Studies**

Chairman : M. Klinger (D) — **Rapporteur** : P. Vitorio (I)

Recent Experiences in Energy and Waste Management in Portugal	M. Baguenier (P)
Integrated Planning of Energy and Waste Disposal in Rennes	P. Berchet (F)
New Organisation of Heating Supply in Urban Lodging Houses	N. Stein (D)
French Experiences in Urban Energy Policies	C. Bataille(F)
Urban Energy Planning Experience in Italy	S. Lanzuolo (ENI) (I)
Heat Planning in the Municipality of Odense	N.A. Gadegaard (DK)

*** 16.15 - 16.45 Coffee Break**

*** 16.45 - 17.45 Discussion**

*** 17.45 Gasoline Policy and Pollution in Italy** — M. Colitti (ENI, I)

Wednesday 21 December 1988

*** 9.30 - 11.15 Analytical Issues and Problems in Local Energy Planning**

Chairman : M. Giaoutzi (HE) **Rapporteur** : A. Perrels (NL)

Integrated Energy Emission Control at the Municipal Level in Sweden	C.O. Wene (S)
French Perspectives for Integrated Urban Energy Planning	O. Bouissou (F)
British Perspectives for Integrated Urban Energy Planning	A. Parker (GB)
Resource Allocation to Local Communities in the Framework of Integrated Planning	A. Ricci (I)
Experiences and Possibilities in Local Energy Planning and Policy in Flanders	A. Verbruggen (B)
Environment and Energy in Italy	A.G. Ceccarelli Secretary State of the Environment
Laws local energy Planning in Developing Countries	C. Boffa, SIES
Laws and Instruments of Italian Energy Policies	A. Pela, Ministry of Industry

*** 11.15 - 11.45 Coffee Break**

*** 11.45 - 12.30 Discussion**

*** 12.30 - 14.00 Lunch**

*** 14.00 - 14.45 Round Table Session**

Chairman : C. Jones, Deputy Director-General (EC, DG XVII)

*** 14.45 - 15.00 Closing Remarks** P. Nijkamp (NL)
K. Juul (EC, DG XVII)

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