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Assessment of the THERMIE programme

ASSESSMENT REPORT FOR THE THERMIE PROGRAMME

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Summary and general conclusions

1. The purpose of the present report is to present an assessment of the THERMIE programme (1990-94). It follows the intermediate report from the Commission on the application of the THERMIE Regulation (COM (93) 642 final) of 9 December 1993. It is based on the assessment of the THERMIE projects (March 1995) and the assessment of the impact of the associated measures (June 1995) carried out by two different panels of independent experts.
2. The THERMIE programme set out to promote a market for efficient energy technologies. To do this, it was endowed with various instruments:
 - support for innovative, dissemination and targeted projects;
 - associated measures aimed at disseminating the results and promoting the technology of the successful projects.

It also laid particular stress on the environmental aspects, on the participation of SMEs and on cohesion between countries of the European Commission whilst also confirming the security of supply and energy efficiency objectives.

In a period of low energy prices, decision-makers are hesitant to invest in innovative technologies. The purpose of the THERMIE programme was therefore to help these novel technologies on to the market. To this end, the THERMIE programme's demonstrational and promotional character was strengthened.

3. A complete assessment of the direct and especially the indirect results of the THERMIE programme is not possible at this time. The projects which received financial backing in 1994 are only just beginning.

However, significant conclusions may be drawn from the assessment of the THERMIE projects which show "definite" results (157 projects out of 726 projects backed) and a sizable proportion of the associated measures.

4. The direct results of the THERMIE programme may be regarded as satisfactory:

Technical success of the projects:

Project assessment has shown that 56% of the projects ended in complete success. Added to this are 23% of projects in which partial technical success was achieved. Moreover, 57% of the projects examined have led to lasting technological improvements.

Commercial success of the projects

An acceptable payback time (varying depending on the programme areas and the application sectors) was achieved in 41% of the projects. Other criteria for commercial success (the presence of promotional activities, compliance with legal obligations) also yield satisfactory results overall.

Replication of the projects:

The new emphasis of the THERMIE programme is on the replication of "successful" THERMIE projects. Overall, the rate of replication of these projects is currently 30%. However, the potential rate of replication is, according to the assessors, close to 80%.

The direct impact of the associated measures:

In 62% of cases the specific activities aroused significant interest on the part of the potential decision-makers and in 38% of cases resulted in a concrete decision.

5. The overall impact of the programme on Community policies was also examined:

The impact as regards energy supply and demand is potentially sizable. The experts estimate that in the sector of the rational use of energy (RUE), between 10 and 20% of final energy demand could still be saved. Some of these savings could be achieved through dissemination of efficient technologies. In the sector of renewable energy sources (RES), the biomass and waste-related projects may make a definite short-term contribution if they are replicated in sufficient number. Similarly, the most efficient technologies in the area of solid fuels and hydrocarbons positively influence both internal supply and energy demand.

The environmental impact of the RUE and RES areas is very significant if a replication rate close to the potential rate is achieved. Efficient technologies in these areas play a definite role in reducing the emissions of CO₂ and other harmful gases as well as in reducing other forms of air, water or soil pollution.

Innovative solid fuels technologies contribute significantly towards reducing emissions of SO_x, NO_x, and CO₂, and their role is appreciably greater than in the previous programmes.

The impact on economic development and on international cooperation is particularly significant, especially if we consider:

- the direct investments of the Community in advanced and efficient technologies having an impact on industrial competitiveness;
- the promotion and dissemination of technologies and information about these technologies throughout the Community, including the less-favoured regions, directly affecting economic and social cohesion;
- the setting-up of an industrial network for international cooperation between large companies and especially SMEs which, by virtue of the THERMIE programme, have had access to advanced technologies;
- the strengthening of cooperation with third countries specifically through associated measures and more particularly with the Eastern European countries, whose energy potential is a matter of prime concern in tomorrow's European energy scenario.

The higher the actual rate of replication, illustrated above, becomes, the more concrete will be the overall impact of the THERMIE programme. With this in mind, the THERMIE programme has set aside 125 MECU (22% of the budget allocated for projects) for dissemination projects aimed at replicating efficient technologies, with a few technical, economic or geographical variants.

The associated measures are also part of this scheme for supporting replication.

6. Coordination with the other activities of the Community in the energy field is also paramount.

Close collaboration has been established between the THERMIE programme and the other four Community energy programmes (SAVE, ALTENER, SYNERGY and regional energy programming) as regards the definition of priorities, exchange of information relating to assessments of proposals and the results obtained, and future developments.

Close contacts have also been established with the JOULE programme and the results dissemination activities.

The JOULE/THERMIE joint programme adopted under the fourth framework programme ensures better continuity of Community action in the Research, Development and Demonstration sector.

The Commission has also undertaken a general assessment of the programmes, in which the synergies and coordination between these programmes will be analysed in depth as will their overall contributions to the relevant Community policies.

Moreover, a PECO (Central and Eastern European countries) working group, whose meetings are attended by officials with responsibility for the JOULE/THERMIE, SYNERGY, PHARE and TACIS programmes, has been set up. It regularly deals with important topics relating to the management of the relevant programmes.

7. Increasingly close coordination with similar activities of the Member States, especially through the THERMIE Committee at which the representatives of the Member States participate fully in the implementation and future direction of the JOULE/THERMIE programme, is also an important means of promoting efficient energy technologies.
8. The THERMIE programme has proved to be a suitable instrument for helping efficient technologies on to the market. To do this, it is important to maintain and, if possible, improve integration between research projects, innovative THERMIE projects, dissemination projects relating to demonstrations under other conditions, targeted projects relating to specific and significant problems, and associated measures and their monitoring. These activities should ideally form one continuous whole enabling the Community to have a complete range of support options from basic research (JOULE) to the entry of efficient technologies into the market (THERMIE and dissemination activities).

1. The THERMIE programme and its implementation

1.1. Principal objectives

The Community's initiatives regarding technological development in the energy field developed out of the energy crisis of 1973. The regulations adopted since that date were intended to respond to the characteristics and changes in the energy market:

- The energy crises of 1973 and 1979 led to two abrupt increases in the price of energy and prompted concern that these increases might be repeated *ad infinitum*. The drop in the price of oil in 1986 altered the equation.
- The awareness of the dependency of the European Union within a strategic area such as energy and the necessity to improve the security of supply.
- The growing importance of the environmental impact of human activities, and of energy-related activities in particular.
- The problem of emissions of CO₂ into the atmosphere (as well as other emissions) contributing to the greenhouse effect has turned out to be particularly important in the energy field.

Annex 1 provides a general overview of the successive regulations since 1974, together with the areas covered.

Council Regulation (EEC) No. 2008/90 of 29 June 1990, concerning the promotion of energy technologies in Europe (THERMIE programme), is aimed mainly at the following objectives:

- maintaining efforts aimed at diversifying the Community's energy supplies and improving energy efficiency;
- the search for balanced solutions in regard to energy and the environment, by resorting to the best economically justified existing technologies;
- making use of the endogenous energy potential of the regions, especially those which are less favoured, so as also to contribute to strengthening the economic and social cohesion of the Community.

To do this, the THERMIE programme adopts two approaches which are complementary with respect to the previous energy programmes and research programmes:

- continuity of the actions undertaken in the framework of the demonstration projects and industrial pilot projects in the energy field Regulation 3640/85) and of the programme supporting technological development in the hydrocarbon sector (Regulation 3639/85)
- promotion of innovative energy-related technologies with a view to their wider use, either under different economic or geographical conditions, or with technical variants.

Through this programme, the Community decided to back projects and associated measures in order to promote a market for efficient energy technologies. By comparison with the earlier demonstration programmes, the THERMIE programme devotes a sizable proportion of its activities to the disseminating of novel technologies. It is further downstream than the research programmes, and, through this new approach, it is also

somewhat downstream of the previous energy programmes.

1.2. Types of projects and areas of application

There are three types of project which can benefit from financial backing:

- innovative projects, for which the research/development phase is in essence complete, but for which the technical and economic viability of the new technologies needs to be proved;
- dissemination projects, for which the technology has already been the subject of a first demonstration but whose penetration into the market is promoted under different economic or geographical conditions;
- targeted projects for which an essential need exists or a significant technological advance can be made through strengthened cooperation.

The areas of application of the THERMIE programme are as follows:

- the rational use of energy;
- renewable energy sources;
- solid fuels;
- hydrocarbons.

1.3. Associated measures

Associated measures are also undertaken to promote the application of energy technologies and their penetration into the market.

These measures include:

- analysis of the characteristics and assessment of the potential of the market;
- project monitoring and assessment;
- the dissemination of information and the promotion of technologies and project results through various instruments;
- recourse to public or private, national/regional or local institutions;
- industrial cooperation with third countries.

1.4. Implementation of projects

1.4.1. Financial commitments

The financial commitments under the THERMIE Regulation relate to:

- the financial contribution to the projects;
- the associated measures;
- the administration of the programme.

Table 1.4.1. shows the indicative shareout of the commitments made between these categories of THERMIE.

Table 1.4.1.: THERMIE - Indicative breakdown of commitments made

(in MECU)

	1990	1991	1992	1993	1994	Total	%
1. Support to projects	44.9	115.5	127.6	138.0	148.1	574.1	81.2
2. Associated measures		20.7	26.3	31.6	27.8	106.4	15.0
3a. Operational expenditure on studies, experts, meetings, etc..	0,1	4,6	3,3	4,8	4,6	17,4	2,5
3b. Expenditure on support and assistance	0.1	9.2	6.9	4.3	6.1	26.6	3.8
Total	45.0	145.4 ¹	160.8 ²	173.9	182.0	707.1	100.0

The table in Annex 2 illustrates the number of projects and the financial backing per area.

a) The rational use of energy (RUE)

An examination of the shareout of the budget provision for the projects shows that the area of the rational use of energy represents around 172 MECU of financial contributions, namely 30% of the earmarked funds (574 MECU) and 259 projects, namely 35% of the total number of projects picked (726 projects).

This area is subdivided into 4 sectors:

- the building sector for which 71 projects were financed for a sum total of 31 MECU
- the industry sector with 144 projects receiving a total of 84.7 MECU
- the energy industry sector with 11 projects receiving a total of 9.8 MECU, and
- the transport sector for which 33 projects were supported for a sum total of 46.3 MECU.

The area of RUE covers a vast range of technologies with a very high innovation potential. It is also characterized by the presence, among the contractors, of a higher number of users than producers/suppliers. A sizable proportion of these contractors are SMEs.

¹ including 10,1 Mecu for the new German Länder.

² excluding POSEIMA (5 Mecu).

In the industrial sector the majority of the contractors are private companies, and numerous public enterprises are involved in the projects which come under the building and transport sectors.

b) Renewable energy sources (RES)

The projects in the area of renewable energy sources (RES) received an overall financial backing of 159.5 MECU (around 28% of the sum total of funds) shared out among 272 projects (37.5% of the projects picked).

This area is subdivided into 5 sectors:

- the solar sector with 107 projects selected for a total financing of 34.6 MECU
- the biomass sector with 50 projects backed for a sum total of 62.4 MECU.

The relatively small number of biomass projects backed as against the sizable sum total of the backing results from the selection in 1994 of 3 targeted biomass gasification projects (see also Annex 12) for a sum total of 21 MECU. These 3 biomass targeted projects constitute the first and only targeted projects of the THERMIE programme within the RES area.

- the geothermal sector with 26 projects for a total of 15.2 MECU
- the hydroelectric sector with 37 projects for a sum total of 13 MECU
- the wind-power sector in which 52 projects were financed with a total provision of 34.2 MECU.

Many of the contractors encountered in this area are public enterprises or SMEs, notably equipment manufacturers with fewer than 100 staff.

c) Hydrocarbons

The area of hydrocarbons received overall financial backing of 122 MECU (21% of the total budget) for 167 projects (23% of the total).

This is a particularly strategic area which has been the subject of Community programmes since 1973. Under the THERMIE programme, this area is subdivided into four principal sectors: exploration, production, transport and storage.

The contractors encountered in this area are either large oil companies or small engineering concerns.

d) Solid fuels

The solid fuels area was granted a financial backing of 121 MECU (21% of the budget used to finance the projects) for 28 projects (4% of the projects picked).

This is an area in which the projects are of considerably greater size than average (average financial backing per project of around 4.3 MECU as against a general average contribution of around 800 000 ECU).

The projects in this area are split into four sectors: combustion, conversion, waste and integrated gasification with a combined gas/steam cycle.

The contractors encountered in this area are principally energy-producing concerns.

1.4.2. Types of projects financed

Table 1.4.2. illustrates the shareout by area and by type of project.

The innovative projects represent almost 70% of the projects picked and almost 59% of the total budget.

The dissemination projects constitute 27% of the projects and 21% of the budget.

The targeted projects form 3% of the projects but, in view of their "aggregating" nature and their areas of preference (solid fuels, biomass and RUE), represent 20% of the total budget.

Table 1.4.2. Implementation of THERMIE by sector and by type of project

(in MECU)

1990 1994	Innovative projects		Dissemination projects		Targeted projects		Total number of projects	Total support to the projects
	Number	Sums allocated	Number	Sums allocated	Number	Sums allocated		
RUE	161	87	84	48	14	37	259	172
RES	159	69	110	69	3	21	272	159
SOLID FUELS	20	62	2	3	6	56	28	121
HYDROCARBONS	159	117	8	5	0	0	167	122
TOTAL	499	335	204	125	23	114	726	574

1.4.3. Technical objectives and examples of projects

Annex 12 sets out succinctly the technical objectives sought through the backing of the projects in each area and each sector.

Annex 13 describes a few examples of projects financed under the programme, together with the expected technical results.

1.5 Implementation of associated measures

Execution of the associated measures was entrusted in essence to organizations - called OPETs ("Organizations for the Promotion of Energy Technologies") - which exist within the Member States and are responsible for promoting the energy technologies of the national programmes or have the capacity to promote the technologies coming within the areas of application of THERMIE. This is a major tool for promoting novel energy technologies. This structure, unique among the Community instruments, enables information to be disseminated across the European Community and beyond, and to ensure coordination of the promotional measures carried out at Community, national and regional levels within the European Community.

1.5.1. Financial commitments

A sum total of 106.4 MECU was set aside for the associated measures in the THERMIE programme, namely 15% of the budget provision.

The shareout of this sum total by programme area is illustrated in Table 1.5.1. below:

Table 1.5.1. Shareout of the budget provision for the associated measures by programme area.

Sector	Sum Total MECU	%
RUE	48.9	46
RES	23	21.6
Hydrocarbons	17.5	16.4
Solid fuels	17	16
TOTAL	106.4	100

1.5.2. Types of associated measures

The associated measures are subdivided into two categories: general tasks and specific tasks.

a) General tasks

These are tasks imposed by the very nature of the THERMIE activity in regard to promotion. The existence of the network of OPETs, the necessities of coordination, the extending of the activities to the Energy Centres in the Countries of Central and Eastern Europe and the monitoring and assessment of projects entail horizontal tasks in order to disseminate information, coordinate activities, ensure homogeneity and fully exploit the opportunities offered by the network of OPETs.

These cross-sector tasks provide the support required by the specific tasks. A sum total of 60 MECU was set aside for this type of activity. The table in Annex 3 gives details of the general tasks carried out.

The monitoring and assessment of projects constitutes a significant general task.

Continuous awareness of the state of projects enables the Commission to define the most suitable actions during the life of the projects or after they have been completed and to ensure proper financial management of the sums allocated to the programme.

Other general tasks include:

- the preparation and production of documentation, videos and other promotional material of a general nature;
- the analysis of the characteristics and the assessment of the potential of the market (including management of the "market groups") in respect of the application of energy technologies and their penetration into the market;
- the optimization of data banks;
- the organization of and participation in seminars, conferences and technical and environmental fairs, of a general and/or cross-sector nature.

The OPET network, made up of private or public national, regional or local institutions, has been the main route for the application of the associated actions. It operates at several levels:

- In the Member States, the participants in the network carry out the various activities alone or in cooperation.
- The collaboration of several OPETs in carrying out an action of European dimension is overseen by one of them from its headquarters in the Member States.
- All of the actions are ultimately coordinated by the OPETs which have set up a coordination and support office in the departments of the Commission at Brussels (OPET-CS).
- Lastly, in third countries, as the OPETs do not have a permanent structure, the Commission has facilitated the opening of Energy Centres. These centres have the goal of helping to promote energy technologies within the relevant markets and of putting into practice the industrial cooperation actions provided for in the regulation.

At the end of 1994, the OPET network comprised 49 bodies present in all the Community countries. Besides the OPETs, 15 Energy Centres are financed in the countries of Central and Eastern Europe and the CIS. Annex 4 gives the list of OPETs and Energy Centres.

b) Specific tasks

These tasks are geared towards promotional actions in well-defined areas. A sum total of 46.4 MECU was set aside to finance 1185 actions covering the 4 areas of the programme. The importance of this cooperation with third countries has caused the programme to be particularly active in these countries; 414 specific actions were financed there, to which we must add 74 "mixed" actions (Community/third countries).

The 1185 specific actions financed can be divided up according to the data in Table 1.5.2. The actions in the area of the rational use of energy are most numerous with 779 actions whereas the area of renewable energies occupies second place with 204 actions. Finally, the 2 sectors relating to fossil-fuel energy sources were characterized by lesser involvement. This can be explained by the nature of these industrial sectors in which the capacity for dissemination of those involved is greater and where the actions are aimed at a limited number of decision-makers in the market.

Table 1.5.2. THERMIE-ASSOCIATED MEASURES
Specific actions - Division by area

SECTOR	Number of measures	%	Sums granted (Mécus)	%
RUE	779	65.8	29,126	62.9
RES	204	17.2	9,611	20.7
Hydrocarbons	97	8.2	3,136	6.7
Solid fuels	74	6.2	3,464	7.4
Mixed	31	2.6	1,053	2.3
TOTAL	1,185	100	46,390	100

The dissemination of information regarding the promotion of the energy technologies and of the results of projects has taken up a large proportion of the Community action relating to the specific actions. The facilities employed cover the entire gamut of existing possibilities, from diverse publications ("flag brochures" and "maxi-brochures") to the organizing of technical conferences and seminars. The table in Annex 5 details the specific actions by category. The division of these actions in terms of the area of involvement covered by THERMIE shows that a large proportion of the actions related to the rational use of energy, with the emphasis on market studies, workshops and publications, as shown by the table in Annex 6.

Market studies represent, with 255 actions, a specific type of activity which is very important with regard to the analysis of the characteristics and potential of the markets concerned. Per area, 174 studies had the objective of identifying opportunities for technologies for reducing energy consumption (RUE), 60 studies were concerned with alternative energy sources, 14 dealt with the potential of hydrocarbon technologies and 6 related to the market for solid fuels.

1.5.3. Technical objectives and examples of associated measures

Annex 12 sets out succinctly the technical objectives sought through the associated measures.

Annex 13 describes a few specific actions undertaken.

2. The results of the THERMIE programme

2.1. Projects

Since the THERMIE programme covers the period 1990-94, it is not possible to undertake a complete analysis of the results relating to all the projects supported. This is explained by the relatively long lifetime of the projects, including contractual obligations, scaling-up and the measurement and assessment period.

The present analysis is based on the THERMIE projects which have produced definite results, namely 157 projects out of a total of 726 projects supported. These are projects which are either finished or unfinished and for which the assessors were able to issue an appraisal.

2.1.1. The direct objectives of the projects

The direct objectives of the projects can be analysed according to three criteria:

- technical success
- commercial success
- replication rate

2.1.1.1. Technical success

The technical performance of the THERMIE projects can be regarded as satisfactory, since 56% of the projects ended in "complete technical success" in relation to the technical objectives envisaged.

Table 2.1.1.1. illustrates the division by area of the technically successful projects:

Table 2.1.1.1. Technical success of the THERMIE projects

	Complete technical success	Partial success
THERMIE programme	56%	23%
Rational use of energy	60%	26%
Renewable energy sources	41%	—22%
Hydrocarbons	71%	16%
Solid fuels	67%	17%

This table therefore illustrates the fact that 79% of the projects gave rise to significant technical results.

Moreover, according to the assessors, 57% of the projects afforded a lasting technological improvement.

The technical performance of the projects varied from one area to another:

- The rate of complete success of the projects relating to the Rational Use of Energy (RUE) is 60% with a majority of projects leading to technological improvements.
- The "Industry" sector represents the highest degree of technical success. It is also interesting to note that, on average, the SMEs obtained technical results which are at least as good as the large concerns.
- The area of Renewable Energy Sources (RES) achieved the worst result from the technical point of view (41%) and only one third of the projects ended in a technological innovation.
- The area of Hydrocarbons is the sector with the highest rate of complete technical success (71%) and almost 2/3 of the projects led to lasting technological improvements.

The best results are found in the highly specialized sectors such as exploration and offshore systems.

- The projects in the Solid Fuels area show a healthy rate of success (67%), thus constituting an improvement in relation to the previous programmes where this percentage was generally lower (48% for the period 1979-84). Moreover, the very expensive projects in this area often produced particularly significant technological improvements.

2.1.1.2. Commercial success

Commercial success is rather difficult to measure at this stage.

Within the framework of the assessment, three main criteria were taken into consideration in its definition.

- An acceptable payback time

This concept depends on the area, sector or industry to which the project applies.

According to the assessors, in the case of industry, a payback time is considered to be acceptable at around 23 years in the area of the rational use of energy and 58 years in the area of renewable energy sources. Out of the 157 THERMIE projects examined, 41% had an acceptable payback time. Considering that the replication of THERMIE projects gives rise to far fewer risks and uncertainties, this percentage should be higher for this type of project.

- Other reasons for commercial success

A project may be of commercial interest, even if the payback time exceeds the periods indicated above.

For example, it may be of interest from the point of view of safety, impact on the environment or compliance with legal provisions. In the case of THERMIE, 33% of the projects were regarded as of interest according to this criterion, and so their replication should be encouraged.

- The presence of promotional activities

In 52% of the projects, diverse promotional actions were undertaken by the contractors. This latter element does not come directly under the financial aspect but the replication of the successful projects often stems from it.

Of the various areas covered by the programme, the Rational Use of Energy (RUE) projects showed the best payback time: 50% of the projects.

This criterion is by far the most important element; the "other elements for success" were encountered in only 18% of the projects.

The best results are found in industry, building and transport, but they are not as good for the energy industry.

The collaboration between users and suppliers seems to be an important element for success.

The projects coming under Renewable Energy Sources (RES) showed performance which was not as good in regard to acceptable payback time: 25%, but showed a high percentage of success for other reasons: 41%. This payback period and the percentage of success show that the RES sector is taking off in economic terms.

Naturally, differences may be found depending on the sector: wind-based energy, biomass and certain solar applications have good market prospects in relation to the current price of energy. In respect of geothermal and hydroelectric energy, the technologies are more mature and it is more difficult to commercialize technical improvements.

In the area of Hydrocarbons, it was hard to unearth reliable data regarding payback times, since the purpose of the projects financed in this area was to promote or develop innovative concepts which can only be commercially profitable in the event of high oil prices. Moreover, many of the projects cover specific phases of technological development. In addition, the introduction of an innovative technology ensuring better exploitation of a deposit and hence better use of resources is in itself a total success.

In the area of Solid Fuels, it has not been possible to date to draw conclusions in regard to commercial success in view of the limited number of projects with definite results. At all events, the complexity of these technologies makes it difficult to come to a conclusion in terms of payback period (return on investment). However, security of supply

in future in itself represents a fundamental element of success.

2.1.1.3. Replication

The THERMIE Regulation laid the stress on replication of the demonstrated technologies.

As in the case of the previous criteria, a project is replicated according to procedures which vary depending on the area concerned.

This criterion relates to the projects which enjoyed complete or partial success (to a sufficient degree). 115 THERMIE projects (out of the 157 with a definite result) were taken into consideration.

Four types of replication were highlighted by the assessors: (the percentages cannot be accumulated)

- inside the concern (contractor) : 18% of projects
- inside the country in which the project took place : 17% of projects
- inside the European Union : 20% of projects
- outside the European union : 10% of projects

Overall, and lumping together all the types of replication, the replication rate is of the order of 30%. This means that to date, 30% of the projects taken into consideration have been replicated at least once.

However, it is estimated that the "successful" projects have a replication potential of the order of 80%.

The difference between the potential rate and the actual rate is due to various factors:

- a high percentage of the contractors are solely users. They naturally have little interest in replicating their projects or even in disseminating the results.

This situation is encountered particularly in the RUE area in the industrial sector.

- the unfavourable market conditions due to the low price of energy (all sectors).
- novel technologies (essentially RES) are not always accepted by the market, conventional technologies appearing to be more reliable.
- the effects of promotional campaigns are not visible over such a short period.

2.1.2. Overall impact on Community policies

Apart from the direct results of the THERMIE projects, the latter also have an overall impact on various Community policies;

- energy supply and demand
- the environment
- economic development
- international cooperation

2.1.2.1. Impact on energy supply and demand

The impact was analysed for the various programme areas.

It should be emphasized here that, this being an overall impact, it is difficult to provide specific data. However, extremely useful indications can be deduced:

- Within the RUE area, the impact on energy supply and demand depends, more than with the other areas, on project replication, since the projects themselves have little impact on the demand.

However, the potential for energy savings is far from negligible; the assessors estimated this potential for savings at 120 MTOE/y.

Better penetration of the market by efficient technologies would therefore enable very concrete results to be achieved in this area.

- In the area of RES, assessment of the impact in terms of energy supply and demand varies very greatly across sectors.

The photovoltaic projects produce little energy, whereas by contrast the projects involving energy from biomass and waste have a more significant energy impact. Moreover, the ability to replicate the projects (and hence, like the RUE projects, their actual impact) is likewise highly variable: for example, the hydroelectric, geothermal or wind-based projects depend on the availability of a site allowing exploitation under acceptable economic conditions.

According to the assessors, the RES projects may potentially lead to a production of 2.8 MTOE/y of energy, half of it coming from the biomass and waste projects.

- In the area of Hydrocarbons (oil and gas), the Community's position as a producer was strengthened notably thanks to the efforts made through the Community energy programmes.

The Community's annual production of hydrocarbons has increased from 130 MTOE in the 1970s to 250/300 MTOE in recent years, it having been virtually nil in 1973.

The hydrocarbon projects of the THERMIE programme also played a

part in reducing demand: according to the assessors, 56% of the "successful" THERMIE projects led to a sizable reduction in oil imports and 11% to sizable reductions in imports of other energy sources (usually gas).

- In the area of Solid Fuels, the impact in terms of energy supply and demand is weaker.

The rate of replication of the projects in this sector is low. However, the potential for replication is, according to the assessors, very great and may therefore lead in due course to a significant impact.

The production of energy from solid fuels can be increased, based on the results acquired. However, two elements need to be taken into account in this area: the construction of new power stations and the solving of environmental problems (emissions into the atmosphere).

More specifically, the impact on supply and demand by area and by type of impact can also be illustrated by Table 2.1.2.1. below:

Type of impact	RUE	RES	Hydrocarbons	Solid fuels
Increase in available fossil-based energy sources			*****	*****
Promotion of international energy relations		***	****	**
Promotion of European energy cooperation	**	**	***	**
Development of industrial cooperation with third countries	****	**		****
Strengthening of the energy industry	***	*	***	***
Efficiency of energy production	****	**	***	***
Development of local energy sources		*****	*	**
Reduction of the demand for energy	*****	***	**	
Novel forms of energy services	***	***	*	
Scoring system: From 1 to 5, (5 indicating the greatest impact)				

2.1.2.2. Impact on the environment

The environmental impact of the THERMIE programme and of the previous energy programmes was positive.

In the RUE area, the impact stems in large part from the reduction in energy production (and hence from the reduction in emissions). The use of more efficient techniques may also lead to reductions in waste, or in raw materials used (including water).

According to the assessors, lumping all the programmes together, 61% of the successful projects led to a reduction in pollutant emissions into the air, 29% to a reduction in pollutant emissions into water and 18% to a reduction in pollutant or waste emissions into or onto the surrounding land.

Note that in the area of transport, reducing pollutant emission into the air was and is a prime concern, especially in regard to reducing urban pollution by vehicles.

In the RES area, taken as a whole, the technologies employed had a very positive impact on the environment: long-lasting resource, little or no contribution to the greenhouse effect. However, a few technologies may have negative implications, such as for example the incineration of waste (although the emissions standards are becoming increasingly stringent) or poor integration of a small hydroelectric power station into its environment. Special monitoring of the subsectors in question is essential.

In the area of Hydrocarbons, the THERMIE programme laid particular stress on the environment; 47% of the "successful" projects had a positive impact in regard to protection of the environment as against an average of 17% for the hydrocarbon projects under the previous regulations.

The current projects have the objective of "zero pollution", especially in regard to marine technologies.

In the area of Solid Fuels, from now on, decision-makers are aware that a project is acceptable only if it is efficient, and also "clean". It emerges from the assessment that the technologies of the THERMIE projects (and hence the most recent projects within this sector) meet these objectives.

2.1.2.3. Impact on economic development

The impact of the THERMIE programme on economic development can only be measured indirectly via qualitative indicators.

Table 2.1.2.3. below illustrates the type of impacts encountered. Just as for the earlier cases, these vary across areas.

Type of impact	RUE	RES	Hydrocarbons	Solid fuels
Increased efficiency of production	***	*	***	***
Indirect investments	**	**	***	***
Development of industrial branches		***	*****	**
Creation of employment	***	****	*	*
Promotion of SMEs	****	*****	***	*
Production of energy in outlying areas		*****		
Scoring system: From 1 to 5 (5 indicating the greatest impact)				

- In the RUE area, the technologies are essentially capital-intensive, leading to a rise in investment and an increase in productivity.

SMEs are particularly numerous in the field of the production and installation of energy-related equipment.

- In the area of RES, there is also a very sizable presence of SMEs. The latter have put the THERMIE programme to good use in order to expand their collaboration beyond their respective countries.

The projects in the RES area also had considerable importance in the provision of energy in peripheral areas, especially through solar projects or wind-power projects. The technologies in this sector have more generally highlighted the use of local energy resources.

- In the area of Hydrocarbons, the role of the Community programmes was of paramount importance: a complex network of large companies and specialist SMEs was set up. Certain countries witnessed the creation of oil companies where, before these programmes were launched, there were none (e.g. Ireland). This area is characterized by the strengthening (or the creation) of an industrial structure and increased European cooperation, especially through particularly efficient collaboration between multinationals and specialist SMEs.

- In the area of Solid Fuels, the technologies are very capital-intensive and highly automated, thereby strengthening European industrial competitiveness.

The table in Annex 7 sets out the number of THERMIE projects in which SMEs feature.

The table in Annex 8 illustrates the outlay of the programme in regard to economic and social cohesion through the support of projects originating in the so-called "cohesion" Community countries. The Community earmarked more than 25% of the THERMIE budget for projects originating in these countries. This outlay was considerable in the area of solid fuels (almost 60%) in which Spain was given particular consideration.

2.1.2.4. Impact on cooperation between Member States

The THERMIE programme laid particular stress on projects with partners from different countries, as compared to the previous energy programmes.

The table in Annex 9 illustrates the importance which international cooperation played in the programme.

The multinational projects represent 35% of the total number of projects and 49% of the total budget.

In the four areas, international collaboration networks were set up.

In the area of Solid Fuels, there is beneficial international collaboration between large companies, especially within the framework of targeted projects. International collaboration exists in 53% of the projects, covering 54.5% of the budget allocated to this area.

In the areas of RUE (39% of the projects, 52% of the budget) and RES (33% of the projects, 54% of the budget), international cooperation was reinforced through the particularly sizable participation of SMEs.

The area of hydrocarbons (27.5% of the projects and 32% of the budget) shows a lesser degree of international collaboration, although of very good quality.

2.2. Associated measures

It is quite difficult to assess the results of actions coming under the associated measures.

The general actions including the activities of the OPET network are, as already indicated, support activities. By their very nature, the impact of these measures is not really measurable. Nevertheless, as regards these OPET activities, the assessors have stressed the need for better coordination and greater transparency for this type of action.

As regards to the specific actions, it has been possible to carry out an evaluation of

their impact. The purpose of these actions is to influence the decision-makers in their decision to invest in a technology which is efficient according to the criteria of the THERMIE programme.

The assessors carried out an opinion survey among the relevant actors (OPETs and beneficiaries of/participants in the actions).

2.2.1. The direct objectives of the associated measures

In order to assess the direct impact of the actions undertaken, the assessors measured their effect among the relevant decision-makers with the AIDA method (Attention, Interest, Decision, Action). This method makes it possible to assess the attitude of the beneficiary of the action and the direct impact on his behaviour.

According to the assessors, the direct impact of the specific actions is conclusive: The attitude of the relevant actors to the specific actions assessed was respectively:

Neutral	:	18%	
Attention	:	20%	
Interest	:	24%	}
Decision	:	25%	}significant impact
Action	:	13%	}

(survey based on 46% of the budget set aside for specific actions).

We can consider there to be a significant impact from interest onwards, that is to say in 62% of the actions. Moreover, for 38% of the actions there is decision on the part of the user following an associated measure.

The results by programme area are as follows:

Sector	Neutral (1)	Attention (2)	Interest (3)	Decision (4)	Action (5)	Significant impact (3)+(4)+(5)	Investor decision (4)+(5)
RUE	16	20	23	26	15	64	41
RES	18	20	23	28	11	62	39
HC	25	27	32	14	2	48	16
SF	19	20	26	28	7	61	35

This analysis demonstrates that the associated measures have a relatively homogeneous impact in 3 of the 4 areas of the programme. In the hydrocarbon sector, the specific actions have less influence. This state of affairs is due to the highly specialist nature of the actors (large oil companies, very specialist SMEs) who are hardly likely to be influenced from outside.

2.2.2. Overall impact on Community policies

The overall impact of the associated measures is difficult to assess. However, the assessors have attempted to draw up a global picture, through interviews with the relevant actors.

- Through their informational actions, in the general sense of the term, the associated measures make it possible to accelerate the penetration of the innovative technologies into the relevant markets.

According to the reckoning of the assessors, well-managed information dissemination actions can accelerate this penetration by 2 or 3 years depending on the technology and the sector concerned.

- The associated measures have firmly strengthened the multinational networks set in place by the partnerships of the THERMIE projects. In particular, they have enabled actors from regions or outlying countries to gain access to quality information which they would otherwise have been able to obtain only with difficulty, and also play a role in terms of economic cohesion and Community cooperation which may be described as not insignificant.
- The contribution of the associated measures to extra-Community cooperation was substantial.

Through the Energy Centres, they enabled Community decision-makers to obtain a foothold in the countries of Central and Eastern Europe and of the CIS in order to promote efficient technologies by means of the various instruments made available through the Community.

They have also enabled the decision-makers in the countries of Central and Eastern Europe and of the CIS to be integrated into the THERMIE information and promotion network, thereby paving the way for the take-up of efficient Community energy technologies.

- The assessors have also drawn up a list of impacts which were ranked in order of importance. These types of impact were divided into 2 categories:

Impacts relating to energy supply and demand (Annex 10) and impacts on economic development, including intra and extra-Community international cooperation (Annex 11).

3. Coordination with Community instruments

The Community has various programmes which have a significant energy component.

3.1. The other Community energy programmes

Four Community energy programmes or actions were developed in parallel with the THERMIE programme:

SAVE: Promotion of the rational use of energy and improvement in energy efficiency.

ALTENER: Development of the use of renewable energies.

SYNERGY: Cooperation with third countries in the definition and implementation of energy policy.

Regional energy programming: promotion of regional and local energy management.

Close collaboration has been established between these programmes and the THERMIE programme so as to avoid any risk of duplication of effort and to extract the maximum advantage from the synergy between these actions.

This collaboration is embodied, in particular, in:

- the defining of the priorities of the various existing programmes;
- the exchanging of information in regard to the assessment of proposals received within the framework of these programmes;
- the exchanging of information in regard to the results of the actions supported;
- the future development of these programmes.

The initiation, in the course of 1995, of a horizontal assessment of the energy programmes (including THERMIE) whose purpose, in particular, is to examine the coordination and synergies between these programmes, is indicative of the concern for optimal collaboration between these initiatives.

3.2. The programmes for exploiting and optimizing the results of Research and Technological Development

The Commission has developed, starting with its 3rd RTD framework programme, a scheme for disseminating technologies which covers the energy sector in part. Joint participation in exhibitions embracing the theme of energy has been exploited. Collaboration is up and running with the centres in regard to the dissemination of Community R&D results under the VALUE programme.

Furthermore, the Euro Info Centres established by the Directorate-General for "Enterprise policy, distributive trades, tourism and cooperatives" (DG XXIII), are effective staging posts and have played a not insignificant role in informing the public about the THERMIE programme, certain bodies in the OPET network also being Euro

Info Centres.

3.3. The Community Research and Technological Development programmes

Among the various programmes in support of R&D, the JOULE programme is developing energy technologies. This programme operates upstream of THERMIE and has the objectives of developing novel energy options which are economically viable and more advantageous in terms of their consequences for the environment and of developing technologies which consume less energy.

A natural tendency in the results of the JOULE projects would be to give rise subsequently to THERMIE projects when demonstration proves to be necessary. In the same way, the results of THERMIE projects may provide inspiration for new JOULE projects.

However, this connection in Community action has a few weaknesses. These may be explained in part by the different nature of the participants in each programme - universities and research institutes in the case of the JOULE programme and companies in the case of THERMIE - as well as by a lack of information about the results and opportunities offered by the two programmes.

The Council Decision of 23 November 1994 adopting a specific programme of research and technological development, including demonstration, in the area of non-nuclear energy (JOULE-THERMIE programme) under the 4th Framework Programme, should improve this state of affairs.

It should be possible to achieve a satisfactory degree of integration through better matching of the areas covered, harmonization at management level of the two components (JOULE and THERMIE), and increased exchange of information about the actions undertaken.

3.4. The Structural Funds

With the reform of the Structural Funds, the Objective 1 regions are in receipt of significant aid in respect of energy-related equipment. The CSFs (Community Support Frameworks) for the Objective 1 regions are extending the efforts made under the Community VALOREN programme (1987-91) insofar as it emphasizes the optimization of the endogenous energy potential.

The VALOREN programme, assigned 400 million ECU, covered Greece, Portugal, certain regions of Spain, the Italian Mezzogiorno, Corsica, and the French Overseas Departments, Ireland and Northern Ireland. Because it covers areas of technology which are similar to those of the demonstration and THERMIE programmes, obvious links have emerged between the two programmes. In each of the geographical sectors covered, there are several directly matching projects, whether it be the replication of a technology supported during the development phase or the extending of a project to a large-scale application phase.

Outside of the VALOREN programme, the INTERREG and REGIS Community initiatives propose, among the eligible measures, the development of renewable energy sources.

3.5. The PHARE and TACIS programmes

The PHARE and TACIS programmes have definite synergies with the THERMIE programme.

Certain Energy Centres established in the countries of Central and Eastern Europe and of the CIS are in receipt of combined support (THERMIE/TACIS or THERMIE/PHARE/SYNERGY), and working relationships, especially via a Task Force, have been set in place between the departments with responsibility for these three Community instruments.

3.5.1. The TACIS programme

The TACIS programme was set up in order to help the newly independent States (Commonwealth of Independent States) to successfully achieve their transition from a planned economy to a democratic market economy.

The priority sectors in this programme are infrastructures (including energy) and the environment, and hence there is the opportunity for fruitful cooperation with the THERMIE programme. Four Energy Centres are financed by the two programmes (Moscow, St. Petersburg, Minsk, Kiev).

For example, the programme supports training activities, pre-investment and assistance studies which may culminate in fruitful collaboration. The complementary nature of the two programmes concerned may also be emphasized, especially in the case of a number of TACIS pilot projects which THERMIE is not in a position to finance but whose results it will be possible to harness.

3.5.2. The PHARE programme

The purpose of the PHARE programme is similar to that of the TACIS programme but is aimed at the countries of Central and Eastern Europe (including the Baltic countries).

Here too, infrastructure (including energy) and the environment are the prime sectors and therefore close collaboration with THERMIE is highly desirable.

Certain forms of joint regional collaboration may be emphasized, especially the contribution of the THERMIE programme to the Budapest Energy Centre set up under the PHARE programme.

The PHARE programme stresses the preparation and carrying out of technical assistance projects in the framework of existing national programmes, culminating in recommendations for reforms involving investments which may sometimes be substantial.

4. Coordination with similar programmes of the Member States

4.1. In order to carry out the THERMIE programme, the Commission is assisted by a Committee made up of representatives of the Member States. The latter are accompanied by experts. Through this Committee, the representatives of the Member States have, in agreement with the Commission:

- modified the sectors covered by the programme and their budget provision;
- established priorities in respect of calls for proposals;
- selected the projects and fixed the rate of financial support.

The THERMIE Committee has therefore played an important role which has enabled it to lay the stress on complementary aspects and to avoid duplicating the work of the existing initiatives within the Member States.

4.2. The project selection process also provides a good opportunity to meet the interested parties from the Member States. Commission officials are assisted in this task by outside experts. The latter are either proposed by the representatives of the Member States (THERMIE Committee), or selected directly by the Commission on the basis of their technical skills. They represent a wide spectrum of organizations with an interest in the programme (industry, technical centres, universities, various consultants) and can inform the Commission directly of progress and gaps in the energy sector at any given time.

4.3. A study has also been undertaken to examine the problem of coordination ("Coordination of THERMIE with other Member State programmes").

The conclusions of this study have highlighted the following points:

- a number of Member States have no programme of support for energy technologies;
- in the RUE and RES areas, where the Member States are more active, the type of project supported by THERMIE is not generally covered by any national programme;
- the stress laid by the THERMIE programme on projects with several partners from various Member States, and on the so-called cohesion countries, differentiates it from the national initiatives;
- associated measures geared to third countries and especially towards the countries of Central and Eastern Europe and the CIS are not generally to be found in the national programmes and therefore represent a significant complementary factor.

5. Conclusions

5.1. The general conclusion to be drawn from the implementation of the THERMIE programme and the two assessments carried out by independent experts is that the new emphasis of the programme on helping efficient technologies on to the market has produced, at this stage, results which may be described as good, both as regards direct results (technical and commercial success, rate of replication) and global impact on the Community policies.

5.2. The THERMIE programme has proved to be a suitable instrument for exploiting the energy efficiency potential and for helping the new technologies to penetrate the market.

It has played a significant role in regard to the competitiveness of enterprises by proposing efficient technologies which improve their industrial competitiveness. The great majority of these efficient technologies were also shown to have a positive impact on the environment. The programme has played a not insignificant role in regard to support to SMEs (61% of the projects involve SMEs) and economic and social cohesion (21.5% of the projects were allotted to the so-called cohesion countries). Furthermore, it built a network of international cooperation (35% of the projects have contractors from different Member States), strengthened by the associated measures.

5.3. The overall impact of the programme is linked with the rate of replication of efficient technologies. This rate, which is currently around 30%, can be considerably improved. The THERMIE programme has implemented two instruments to achieve this:

- dissemination projects
- associated measures.

It is too early to say whether, in the way in which they have been used, these two new instruments will or will not allow the situation to be substantially improved. Very probably the answer is yes. However, if that is not the case, a redirection of these instruments should be envisaged.

5.4. The adoption of a JOULE-THERMIE joint programme under the 4th Framework Programme is an important step towards consolidating the efforts undertaken by THERMIE.

However, the furtherance of the instruments which are indispensable to strengthening the impact of this type of programme on the energy policy objectives and the objectives of other Community policies (environment, economic development including industrial competitiveness, international cooperation), namely the projects and other dissemination activities, must be ensured. Under these conditions, the Community will be able to maintain and even strengthen a complete and suitable range of support options from basic research to the entry of efficient technologies into the market and to fully exploit the potential of this Community instrument.

- 5.5. The furtherance of efforts towards third countries and especially towards the countries of Central and Eastern Europe and the CIS, through the associated measures, in coordination with other relevant Community instruments, is also of major importance in view of the potential of these markets both from the viewpoint of the supply of energy and the demand for efficient technologies.

Regulations aimed at technological development and demonstration in the energy sector (DG XVII)

Regulations	Periods	Hydrocarbons	Solid fuels	Alternative sources	Rational use	
3056/73	1973-85	X				
1302/78	1978-82		X	X		
1303/78	1978-82				X	
1971/83	1983-84		X			
1972/83	1983-84			X	X	
3639/85	1985-89	X				
3640/85	1985-89		X	X	X	
2008/90	1990-94	X	X	X	X	
Council Dec. 23.11.94	1995-98	X	X	X	X	+ R D

Sectors concerned by the energy regulations and programmes

	Hydrocarbons	Solid Fuels Gasification Liquefaction	Alternative Energy Sources	Energy Saving and Substitution of Hydrocarbons
1974	Technological Development			
1975				
1976				
1977				
1978		Demonstration	Exploitation	Demonstration
1979				
1980				
1981				
1982				
1983		Pilot Industrial & Demonstration	Demonstration	
1984				
1985	Support	Pilot Industrial and Demonstration		
1986				
1987				
1988				
1989				
1990	THERMIE			
1991				
1992				
1993				
1994				
1995				
1996				
1997	JOULE- THERMIE			R&D
1998				
1999				

**IMPLEMENTATION OF THERMIE
NUMBER OF PROJECTS AND FINANCIAL SUPPORT**

(in MECU)

SECTOR	1990		1991		1992		1993		1994		TOTAL	
	No. of projects	Financial support										
RUE	39	18.713	65	34.809	52	31.527	42	43.311	61	43.420	259	171.780
Building	11	2.761	19	4.417	14	5.404	9	8.545	18	9.852	71	30.979
Industry	26	14.971	31	19.135	26	16.015	27	15.855	34	18.728	144	84.704
Energy industry	-	-	5	3.269	3	3.954	3	2.615	-	-	11	9.838
Transport	2	0.981	10	7.988	9	6.154	3	16.296	9	14.840	33	46.259
RES	27	6.613	51	35.718	67	35.115	52	35.218	75	46.752	272	159.416
Solar	19	3.622	13	7.155	24	7.232	24	8.539	27	8.019	107	34.567
Biomass	5	2.362	12	9.392	14	11.228	14	16.887	5	22.555	50	62.424
Geo-thermal	-	-	7	6.080	5	2.267	-	-	14	6.797	26	15.144
Hydro-electric	-	-	10	4.087	9	3.751	-	-	18	5.240	37	13.078
Wind	3	0.629	9	9.004	15	10.637	14	9.792	11	4.141	52	34.203
SOLID FUELS	3	9.591	6	22.115	4	33.195	10	33.026	5	23.060	28	120.987
HYDRO-CARBONS	16	9.973	30	22.888	31	27.700	35	26.447	55	34.910	167	121.918
TOTAL	85	44.890	152	115.530	154	127.537	139	138.002	196	148.142	726	574.101

RUE = Rational Use of Energy
RES = Renewable Energy Sources

THERMIE - ASSOCIATED MEASURES
General actions

Type	Amounts granted (MECU)	%
Market and technology assessment	0.906	1.51
Data gathering and processing; databases	2.040	3.40
Programme evaluation	3.024	5.04
Documentation (brochures, videos, etc.) and translation	2.592	4.32
Dissemination of documentation and information	2.178	3.63
Organization of and/or participation in promotional activities	6.972	11.62
Reinforcement of promotion organizations	1.524	2.54
Technical advice (project monitoring and evaluation)	4.998	8.33
Support for the development of strategies for the promotion and coordination of activities (Member States - regions)	4.194	6.99
Industrial cooperation in third countries in the above areas	12.264	20.44
General coordination of OPET activities	3.444	5.74
OPET - CS (Coordination Centre, Brussels)	15.864	26.44
TOTAL	60.000	100.00

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**"ORGANIZATIONS FOR THE PROMOTION OF ENERGY
TECHNOLOGIES"
(O P E T)**

ADEME, F - Paris	ICIE, I - Rome
ASTER SRL, I - Bologna	IDAE, E - Madrid
BCEOM, F - Guyancourt	IMPIVA, E - Valencia
BRESCU, UK - Watford	INET/ITE, P - Lisbon
CCE, P - Amadora	INNOTECH, D - Berlin
CEEETA - PARTEX Cps, P - Lisbon	Institut Wallon-Energium 2000, B - Namur
CESEN S.p.A., I - Genoa	IRO, NL - Zoetermeer
CORA c/o SEA, D - Saarbrücken	KEMA Nederland B.V., NL - Arnhem
COWIconsult, DK - Lyngby	LDK, GR - Athens
CRES, GR - Pikermi	LUXCONTROL, L - Esch-sur-Alzette
EAB, D - Berlin	MARCH Consulting Group, UK - Manchester
ECD, DK - Copenhagen	NIFES, UK - Glasgow
ECOTEC, UK - Birmingham	Novem, NL - Sittard
ENEA, I-S. Maria di Galeria Rome	OCICARBON, E - Madrid
ETM Consortium, B - Brussels	PSTI, UK - Aberdeen
ETSU, UK - Harwell	RARE c/o RHONALPENERGIE, F - Lyons
EUROPLAN, F - Antibes	SODEAN, E - Seville
EVE, E - Bilbao	SOGES S.p.A., I - Turin
FAST, I - Milan	SYNERGIA, GR - Athens
KFA/FIZ, D - Karlsruhe/Jülich	TÜV RHEINLAND, D - Cologne
FORBAIRT, IR - Dublin	UCD, IR - Dublin
Friedmann & Johnson-Consultants, D - Berlin	VLAAMSE THERMIE COÖRDINATIE, B - Mol
GEP, F - Paris la Défense	Zre, D - Regensburg
GOPA - Consultants, D - Bad Homburg	
ICAEN, E - Barcelona	
ICEU, D - Leipzig	

<p style="text-align: center;">European Community Energy Centres in Central and Eastern Europe</p>

Regional Energy Centres

Bratislava Energy Centre, Slovakia
Budapest Energy Centre, Hungary
Kiev Energy Centre, Ukraine
Minsk Energy Centre, Belarus
Moscow Energy Centre, Russia
Prague Energy Centre, Czech Republic
Riga Energy Centre, Latvia
St. Petersburg Energy Centre, Russia
Sofia Energy Centre, Bulgaria
Tallinn Energy Centre, Estonia
Vilnius Energy Centre, Lithuania
Warsaw Energy Centre, Poland

Sectoral Energy Centres

Elblag Energy Centre, Poland
Katowice Energy Centre, Poland
Tyumen Energy Centre, Russia

THERMIE - ASSOCIATED MEASURES - Specific Actions

Division by type of action

TYPE	Number of actions	%	Sum total granted (in Mécus)	%
Audit	37	3.1	1, 044	2.2
Business Mission	30	2.6	11, 893	4.1
Conferences	24	2.0	0,752	1.6
Exhibitions	85	7.2	2, 672	5.8
Publications/Maxi-brochures	236	19.9	7, 973	17.2
Seminars	143	12.1	8, 250	17.8
Studies	255	21.5	10, 351	22.3
Training courses	56	4.7	1, 808	3.9
Targeted campaigns	4	0.4	0,339	0.7
Video	23	1.9	1, 312	2.8
Visits	11	0.9	0,325	0.7
Workshop	267	22.5	9, 303	20.1
Others	14	1.2	0,368	0.8
TOTAL	1 185	100	46, 390	100

THERMIE - ASSOCIATED MEASURES

Specific Actions

Division by type and by sector and sums granted (1000 écus)

Number	RUE		RES		Hydrocarbons		Solid fuels		Mixed		TOTAL	
	Number	Sum	Number	Sum	Number	Sum	Number	Sum	Number	Sum	Number	Sum
Audit	35	949	1	65	-	-	-	-	1	30	37	1044
Business Mission	13	529	8	475	-	-	9	889	-	-	30	1893
Conferences	9	222	8	323	2	78	4	107	1	22	24	752
Exhibitions	32	761	2	20	29	1223	3	147	19	521	55	2672
Publications/ Maxi-brochures	156	5215	47	1938	11	197	20	589	2	34	236	7973
Seminars	99	5023	29	2102	2	139	10	672	3	314	143	8250
Studies	174	6877	60	2613	14	512	6	279	1	70	255	10351
Training courses	51	1702	1	42	1	9	3	55	-	-	56	1808
Targeted campaigns	2	258	2	81	-	-	-	-	-	-	4	339
Videos	13	791	8	450	1	35	1	36	-	-	23	1312
Visits	1	7	2	49	3	98	5	171	-	-	11	325
Workshops	181	6454	35	1423	34	845	13	519	4	62	267	9303
Others	13	338	1	30	-	-	-	-	-	-	14	368
TOTAL	779	29126	204	9611	97	3136	74	3464	31	1053	1185	46390

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Projects involving SMEs (contractors)

Sector	Number of projects	%	Sums granted (in MECU)	%
RUE	160	22.0	94	16.4
RES	185	25.5	85	14.8
Solid fuels	4	0.5	28	4.9
Hydrocarbons	95	13.1	53	9.2
SME Projects TOTAL	444	61.1	260	45.3
THERMIE TOTAL	726	100	574	100

RUE : Rational Use of Energy

RES : Renewable Energy Sources

**IMPLEMENTATION OF THERMIE
COHESION COUNTRIES**

(in MECU)

	RUE (1)		RES (2)		SOLID FUELS		HYDROCARBON S		TOTAL		COUNTRIES/EUR 12	
	Number of projects	Financial support										
SPAIN	33	20.497	28	15.808	9	71.522	2	0.444	72	108.271	9.9%	18.9%
GREECE	12	4.929	10	3.229	1	0.982	4	1.253	27	10.393	3.7%	1.8%
IRELAND	25	11.196	9	3.448	-	-	1	0.477	35	15.121	4.8%	2.6%
PORTUGAL	11	7.411	10	5.333	-	-	1	0.140	22	12.884	3.1%	2.2%
COHESION COUNTRIES	81	44.033	57	27.818	10	72.504	8	2.314	156	148.659	21.5%	25.5%
EUR 12	259	171.780	272	159.416	28	120.987	167	121.918	726	574.101		
COHESION COUNTRIES/ EUR 12	31.3%	25.6%	20.9%	17.4%	35.7%	59.9%	4.8%	1.9%	21.5%	25.5%		

(1) RUE : Rational Use of Energy

(2) RES : Renewable Energy Sources

**Projects involving the collaboration of contractors
from different Member States**

Sector	Number of projects	%	Sums granted (in MECU)	%
RUE	102	14.0	89	15.5
RES	90	12.2	86	15.0
Solid fuels	15	2.1	66	11.5
Hydrocarbons	46	6.3	39	6.8
International Projects	253	34.8	280	48.8
TOTAL				
THERMIE TOTAL	726	100	574	100

RUE : Rational Use of Energy

RES : Renewable Energy Sources

Ranking of the impacts of the associated measures on energy supply and demand

Type of impact	Ranking by importance of impact
- Reducing energy demand	1
- Strengthening the energy technology industry	2
- Support for the cooperation of Member States	3
- Promoting local, regional and national programmes	4
- Improving diversification	5
- Support for international industrial cooperation	6
- Increasing supply	7
- Strengthening the EU's supply base	8
- Developing local sources of supply	9
- Improving the security of supply	10

Ranking of the impacts of the associated measures in regard to economic development and international cooperation

Type of Impact	Ranking	Magnitude of the impact		
		High	Medium	Low
Awareness of the importance of European cooperation	1	X		
Cooperation with the EU	2	X		
Cooperation with other MS	3	X		
Cooperation with third countries	4	X		
Assistance to SMEs	5		X	
Stimulation of innovation	6		X	
Promotion of efficient production	7		X	
Stimulation of employment	8		X	
Stimulation of investment	9		X	

RATIONAL USE OF ENERGY

The THERMIE regulation of the programme sets out as primary objective to achieve substantial energy savings in three areas for project support: buildings, industry & energy industry and transport.

Rational use of energy in buildings:

Project Support: In the building sector, energy savings were required to be achieved by projects designed to improve the energy efficiency of existing buildings, projects relating to new processes or products for heating and air-conditioning in new buildings and finally projects concerning new urban or district heating systems and the application of small-scale combined heat and power generation. The Call for Proposals specified the requirements of priority areas and foresaw mostly the support for new large commercial or public buildings or the retrofitting thereof. In 1993, particular emphasis was attributed to the building sector by asking for proposals for targeted projects leading to a substantial reduction in both energy consumption and CO₂ and other pollutant emissions in large building stocks either of residential, commercial or public nature. Projects had to include: low energy design, optimised envelope material and components, integrated load management for heating, cooling, and electricity consumption; optimised HVAC equipment with efficient integration of renewable energy systems where possible. The outlined objectives were met by selecting 71 projects in total between 1990 and 1994 for a support of 31 MECU. With a view to targeted projects, 4 projects have been supported. These projects, in the objectives of the Commission, are a first important step towards the creation of a critical mass able to influence important improvements in the Building sector, marked by a slow development and resistance to penetration of innovation.

One important achievement is the demonstration that it is possible to save up to 50% of energy consumption through the integration of innovative technologies already available on the market and through a co-ordinated work of different actors like architects, engineers, equipment suppliers, etc, which normally work separately. It is foreseen in the future to extend this integrated approach to urban scale through the involvement of Local Authorities, and Urban Planners.

Associated Measures: More than 200 actions have been carried out in the Building Sector. These include a number of seminars and training courses for Architects on Bioclimatic Architecture, which have been carried out in all the countries of the EU. In the area of Energy Efficient Lighting more than 25000 exemplars of publications have been produced and disseminated all over Europe. In the field of HVAC technologies, particular attention has been given to supporting actions with the involvement of the most important European Federations active in this area (for example installers and engineering consulting companies). In order to improve the awareness of the successful THERMIE projects, six newsletters, each addressing a particular type of building or technology (like housing, offices, CHP, ...etc.) have been disseminated to architects, engineers, developers, ... etc amounting to 36000 exemplars. In addition to these specific actions, in the framework of the OPET general tasks, several advisory groups have been set up in order to provide advice to decision-makers on key issues related to energy consumption in the Building sector.

Rational use of energy in industry and in energy industry

Project support: Similarly in industry, the scope for further energy savings remains considerable. In the first Call for Proposals from 1990 to 1992, emphasis was put on changes in manufacturing processes and equipment; the recycling of residual heat; the use of micro-

electronic units to improve energy management; the agrofood industry and restriction of energy consumption caused by environmental protection measures. Heat recovery for production processes, industrial waste recovery and schemes for cold energy production using waste heat gained priority in the Call for Proposals of 1993 and 1994. In total 144 projects have been selected and benefited from about 85 MECU financial support. The different projects have contributed to answering the technology requirements of various specific market niches. In the case of the fuel cell technology, the projects funded by THERMIE have contributed to open new prospects in this promising market, particularly for the molten carbonate systems. Recognising the strategic interest of the European industry in this market, the Commission has recently developed a 10 years strategy which includes elements for both R&D and Demonstration work aimed at reducing the investment costs and at improving the reliability of the different fuel cell schemes by year 2005.

In the energy industry, more effective methods of producing and using heat, reducing heat loss from motors, transformers and improved management of heating networks were the objectives laid down in the regulation. These were met by 11 projects between 1990 and 1994, to which a support of about 10 MECU was allocated.

Associated Measures: The main objectives within the industry sector was to analyse the feature and the potential of markets related to various sectors of industrial applications and for the application of specific technologies. Subsequently, and based on the market information obtained, the focus shifted towards dissemination of information. This dissemination was undertaken in Member States and in Third Countries and comprised a wide variety of types of activity. The strategy for dissemination was subject to continuous review within Marketing Groups, where Industrial and Professional Associations and independent experts co-operated to ensure the relevance of the activities undertaken.

As far as cogeneration is concerned, the activity has taken place simultaneously with an important development of the market in the European Union. The associated measures undertaken in this field have contributed to show how it can be successfully applied to a number of manufacturing processes and services, and at the same time, to make the potential user aware of progress on legislation, regulatory and financial aspects. An important activity has also been developed for Eastern European where there is a big potential for converting heat only boilers systems to cogeneration systems in district heating, and for small decentralised cogeneration schemes.

Rational use of energy in transport:

Project support: The regulation foresees a promotion of projects significantly improving the efficiency of vehicles or transport systems; optimising the use of urban infrastructure and improving traffic management and the efficient use of fuel by road vehicles. New types of traction systems gained priority in the 1994 Call for Proposals. Special attention was attributed in the 1993 Call for Proposals to targeted projects offering technical and economic improvements of the overall efficiency of urban public transport systems including traffic management and control techniques, advanced information for users, improved model interchange infrastructure combined with efficient public transport vehicle fleets and measures to promote a shift from private to public transport. Considering that this sector accounts for an increasing share of energy end use and gaseous emissions (32% of EC final demand), one important objective of the 3 Targeted Projects is to contribute to reducing environmental pollution in urban areas where 80% of EU citizens live. Another major goal is to set some common requirements and technical specifications for transport systems, their operating standards and the associated procurement procedures. The definition of common needs at European level should act as an incentive for equipment suppliers who will have a large single market for their products and services. Equally, this should create a wider pool of suppliers for cities, reducing equipment costs and improving quality.

Associated Measures: Accompanying and reinforcing the overall strategy for project support, the dissemination activities within the transport sector aimed at the promotion of the use of new and efficient technologies covering urban transport management, traffic control in order to increase the modal shift towards public transport systems and thus environmental as well as micro- and macroeconomic benefits. One important objective was the establishment of links among cities of different EU countries which face common problems (such as congestion, pollution,...etc.), and foster the exchange of experiences based on the THERMIE projects. This was achieved through a number of seminars which took place in one city of each Member State. The programme focused on medium sized cities. There are more than 300 cities of similar size in the Member States, therefore the potential for replication of effective transport strategies for clean and efficient technologies is large. In order to provide Planners and Local Authorities in urban areas with specific information about mobility of people at scale of urban areas, it has been set up a database called "Mobiles". This database will help responsible for urban traffic management to perform comparative analysis among their experience and the experience of other towns.

RENEWABLE ENERGY SOURCES

Switching from the use of fossil fuels to renewable sources is a major option for ensuring sustainable development, especially by contributing to the diversification of supply and to the reduction of harmful emissions into the atmosphere. However, such technologies face important commercial barriers. The challenge for THERMIE was to encourage the penetration of these technologies into the EC markets and abroad.

In order to achieve this objective, the THERMIE regulation provided financial support for demonstration/dissemination projects in 5 subsectors: solar energy (thermal and photovoltaic applications), energy from biomass and waste, geothermal energy, small-scale hydro-electric energy and wind energy.

Solar energy: thermal and photovoltaic applications

Project Support: Requirements for thermal applications of solar energy focused on active and/or passive conversion processes located in buildings, industry and agriculture, while photovoltaic processes were aimed at supplying electricity at acceptable costs in remote areas for dwellings, water pumping, telecommunications and other similar installations. Grid connected installations were also favoured. In 1993 and 1994, thermal applications dealt with active solar energy systems for the production of large quantities of hot water for heating/cooling, as well as the production of large quantities of hot air for ventilation/drying. These requirements were met by the selection of 34 solar thermal projects and 73 photovoltaic projects which were granted 9 MECU and 26 MECU respectively, during the 1990-94 period. For photovoltaic applications, during the 1990-1994 period, besides a number of projects for remote applications which constitute the first natural market for these types of technologies, it is worth to mention an increasing number of grid-connected applications, such as solar roofs, which paved the way for a future large size PV market. Equally significant in this context are the PV power plants such as the 1 MW grid connected PV power plant in Toledo, Spain, resulting from the collaboration of three large European utility companies. For solar thermal as well as for photovoltaics applications, another important feature is the focus on "guarantee of results" which can overcome the possible lack of consumers confidence in the reliability of solar systems.

Associated measures: As for the other renewable energy sources, the most important criteria governing the implementation of associated measures in RES were: efficient dissemination at the local level close to the final consumers or actors (including the local authorities), reinforcement of the links with industry and professional associations (notably through so-called "marketing groups" which gave advises on priorities for further associated measures), greater accent on financial aspects, synergy and complementarity with other programmes and the implementation of actions in a particular sub-sector according to a logical pathway: starting from market studies, going through general seminars followed by smaller size workshops, and then continuing by other types of measures which can run in parallel: publications, video, study tour, business mission, training.

In this general context, a significant number (approx. 15%) of associated measures were dealing with RES considered altogether instead of with one particular renewable source.

In the sectors of solar thermal and photovoltaic applications, during the period 1990-1994, besides the reinforcement of links with professional associations, the accent has been put on dissemination of high quality information through publications, video, TV campaign as well as on the importance of a good architectural integration of solar technologies in buildings.

Energy from biomass and waste:

Project Support: For the biomass sector, the applications addressed the direct or indirect use of biomass and different types of waste (except those associated to coal and related solid fuels) as well as the production of biomass for energy purposes. Various priorities were set out in the 1992, 1993 and 1994 Calls for Proposals such as the production and use of energy from energy crops and short rotation forestry, the production and use of biofuels for transport, recovery and use of landfill gas, etc.

A total of 50 projects were selected for a global grant of 62.5 MECU. Worth to mention here are the 3 targeted projects selected in 1994 for a combined support of 21 MECU. They concern the production of electricity or CHP in a combined cycle in the range 10 MWe by fluidised bed gasification of short rotation forestry based biomass. This topic is considered as offering a good and large potential for the future.

Associated measures: They were mainly belonging to two sub-sectors:

- various measures on energy from wood and wood wastes, which represent a large energy potential among all RES (publications such as a catalogue on wood fuel equipment and actors, videos for local authorities and industry, seminars on electricity and heat production from wood and wood waste, etc.)
- different measures associated to energy valorisation of (mainly urban) wastes: events and publication linked to Municipal Solid Waste treatment, seminars plus study tour and publication on energy efficiency in sewage plants and energy valorisation of sewage sludge, etc.

Geothermal energy:

Project Support: A total of 26 projects were supported under THERMIE, for a total support of 15.1 MECU. Geothermal energy proposals were not accepted in the 1990 or 1993 Calls. In terms of applications, the vast majority of projects (about 55%) are concerned with low enthalpy direct heating, whether for district heating, greenhouse cultivation or aquaculture, or a combination of these. There were, however, two major projects on electricity generation, one in the Azores islands and one in Italy's Lazio region.

Associated measures: In the geothermal energy sector, the technical objectives focused on the dissemination of information (with particular focus on Central Europe) on best-available-technologies for the drilling, extraction, treatment and reinjection of geothermal waters. For non technical aspects, the emphasis was given to the intensification of the collaboration with industrial and professional associations considered as being crucial.

Hydro-electric energy:

Project Support: In this subsector, 37 projects were accepted for a total support of just over 13 MECU - as in the case of geothermal energy, Small Hydro projects were not accepted in 1990 or 1993.

A number of projects concerned the refurbishment or updating of abandoned or existing plants, generally through the application of improved turbines and control systems. Other innovations included submersible turbines (including oil-free runners), fibre optic links for remote control, and the recovery of energy from water supply or sewage treatment flows.

Associated measures: The main technical objectives in this area were devoted to the dissemination of information on the development of small hydro for particular market segment (refurbishment of old sites, low-head sites), as well as for particular regions, especially the PECO's. Close collaboration with related industrial and professional associations was considered crucial.

Wind energy:

Project Support: A total of 34,2 MECU was given in support of 52 projects. Two main trends can be discerned in the wind energy subsector, both of which have contributed to reducing the unit cost of wind-generated electricity, namely: the large number (26) of Dissemination projects supported by THERMIE, (except in 1994 when they were excluded) for the erection of wind farms; and the steady evolution in wind turbine size and efficiency, achieved thanks largely to THERMIE support. In 1994 in particular, THERMIE supported a number of innovative large wind turbines, including one of 1 MW, and two other designs of 800 kW.

Associated measures: In addition to studies (notably on the potential of wind energy technologies in Eastern countries), publications (e.g. the European Wind Turbines catalogue) and video, the main objectives in this sector were oriented to co-operation with professional associations, siting, financing and public acceptance. Moreover, great importance was given to grid interaction and connection.

HYDROCARBONS

Project support: The primary objective with respect to hydrocarbon projects is to ensure the optimal exploitation of existing reserves and to secure supplies of hydrocarbons at reasonable price. These projects have the aim to develop techniques, tools and processes designed to improve the efficiency of operations, reduce costs and increase the safety of equipment and personnel while offering environmentally appropriate solutions. The THERMIE regulation groups the technologies eligible for financial support into 4 categories: exploration, production, transport and storage.

- **Exploration:** In the area of exploration priorities are set by the regulation for prospecting of basins in order to locate reservoirs, increase of knowledge of oil deposits and drilling cost reductions.
- **Production:** The priorities for production technologies cover processes for improving the rate of oil recovery; monitoring methods; offshore production plants; submarine production systems; production equipment and submarine operating equipment. The 1991 and 1992 Call for Proposals highlighted processes for improving the rate of recovery; monitoring of the reservoir development; the safety and decommissioning of fixed platforms, systems for bringing marginal fields into production and submarine production. The 1993 and 1994 Call for Proposals focused in addition strongly on the improvement of safety through robotics, control systems, inspection equipment and risk identification and on environmental protection.
- **Transport:** Eligible projects are expected to include techniques and processes for transporting processed flow by pipeline and by slip including loading installations.
- **Storage:** Installations and processes for storage of fluid products connected with production operations, particularly in offshore exploration.
- In order to meet these objectives, a total of 167 projects were supported between 1990 and 1994; whereas the majority of projects focused on production technologies (more than 50%).

The difficulties of locating and exploiting smaller oil and gas accumulations in the North Sea and Mediterranean provinces have led to the development of several new exploration and production techniques:

- 3-D seismic acquisition and reservoir modelling software
- horizontal drilling
- multiphase flow technology with specific subsea applications
- flexible flow lines in combination with tension leg platforms.

Associated Measures: The principle aim for the hydrocarbon sector were set out as dissemination of information to target groups within the oil & gas industry in order to support an optimisation of exploitation of reserves, to encourage the EU industry to approach new markets in oil and gas producing countries and to ensure environmental protection.

The main achievements in this sector can be summarised as follows:

- participation in the most important oil and gas trade shows related to offshore technology world-wide: the Offshore Technology Conference in Houston with more and more success for THERMIE contractors and SMEs, and also Offshore Northern Sea alternatively in Aberdeen or Stavanger, Holland Offshore in Amsterdam, and more recently Offshore South East Asia in Singapore,
- organisation of several important specific actions in Russia with contribution from the EC Energy Centre Tyumen and the main OPETs involved in the hydrocarbons sector: participation in the 2nd Oil and Gas Exhibition Tyumen'94, several workshops on EU

technologies as applied to needs of the Siberian industry, business missions and a series of training courses for 120 Russian geologists and reservoir engineers.

- approach of the Chinese oil and gas industry in the wake of the EU-China Energy Industry Conference through several technical workshops.

SOLID FUELS

Project Support: Coal and other solid fuels remain a major energy source available to the Union. However, with today's increasingly stringent environmental requirements, it is necessary to develop and demonstrate technologies using coal cleanly. The aim of THERMIE in the solid fuels sector is the reduction of emissions of CO₂, SO₂, NO_x and particulates from combustion processes and the improvement of the treatment of ash waste. To meet these objectives, the THERMIE regulation identified four priority areas: combustion, conversion, waste treatment, gasification integrated with a combined gas/steam cycle.

- *Combustion:* the THERMIE regulation focused on new or improved clean combustion methods and the clean combustion of waste resulting from the processing of solid fuels.
- *Conversion:* priority was given to the conversion of solid fuels into gaseous or liquid energy products which would, from the economic and technical points of view, improve the Community's energy supply by reducing the importation of hydrocarbons.
- *Waste:* the emphasis was set on the use, treatment or enhancement of gaseous, liquid, and solid wastes resulting from the use of solid fuels. The 1994 Call for Proposals extended this area to the use of carbonaceous material in combination with coal lignite or peat.
- *Gasification integrated with a combined gas/steam cycle:* were considered as eligible the projects designed to produce electricity in a module consisting of a gasifier producing a gas which is burned directly in a gas turbine and a thermodynamic steam cycle. These projects had to use totally new configurations.

In order to fulfil the above-mentioned objectives, during the 1990-94 period, 28 projects were supported in the solid fuels sector for a total amount of 122 MECU, among which the targeted project related to the IGCC power plant at Puertollano. The IGCC technology is very promising and independently of the expected results, the Puertollano Project an excellent example for European collaboration and communication.

The replication potential of THERMIE solid fuels projects is expected to be very high but it is still too early for them to be replicated. However, the Fluidised Bed Combustion (FBC) technologies are already being replicated worldwide, notably the 'THERMIE Gardanne Circulating FBC Project' is a replication at the scale of 250 MWe of the 'Parling Project (125 MWe)'.

In terms of emission reduction, in general an increase in efficiency of 15% average means roughly a 15% decrease in CO₂ emissions. Assuming an increase of the share for steam and power generation plants to 5% for IGCC and 15% for FBC technologies by the year 2005, the following results could be achieved:

SO₂: 95% abatement of present emissions.

NO_x: 80-95% abatement of present emissions.

CO₂: 2% abatement due to FBC and 1% due to IGCC (without CO₂ separation devices).

Associated measures: Utilities are generally very cautious when introducing new technologies thus appropriate instruments need be found to facilitate wider dissemination. The main general objective of promotional actions within the EU was the dissemination of information on clean and efficient solid fuels combustion. In third countries, dissemination activities were aimed at promoting a major use of solid fuels in industrial boilers and district heating, especially retrofitting and low cost technologies.

*Rational Use of Energy - Examples for project support*¹**Buildings: BU/1041/93 and BU/1041/94 Energy Comfort 2000**

Energy Comfort 2000, a major targeted project involving one firm from each of the UK, Netherlands, Germany and Denmark aims to demonstrate how energy savings of up to 50% can be achieved in commercial and public buildings by adopting an integrated design approach. The concept depends on the building itself being exploited to make maximum use of passive and active solar energy, daylight and ventilation and cooling systems. Horizontal measures such as design workshops will ensure co-ordination between the projects and facilitate full utilisation of the collaborators' different skills.

THERMIE contribution: 3.5 MECU Expected energy savings/production: 1,150 TOE/y

Industry: IN/510/93 Optimisation and management of energy sources in textile industry

A Portuguese textile factory, in collaboration with an Italian company, expects to save 10% of its fuel costs by capturing and treating waste heat from the drying process; this saving will also benefit the environment by reducing emission levels. A new unit will capture the hot fumes from the drying chambers and recover heat for recycling to the chambers, with the excess fed into a distribution network supplying other parts of the factory. The heat recovery will use electrostatic filters to break down some of the polluting emissions created by the factory processes. The project will incorporate continuous monitoring and management of the heat recovery plant, the cogeneration unit and various heat pumps employed on the site. This will ensure that the factory's energy needs are met as efficiently and cost-effectively as possible.

THERMIE contribution: 0.15 MECU Expected energy savings: 600 TOE/y

Transport: TR/519/94 Compressed Natural Gas Powered buses for Berlin City Centre

The Senate of Berlin, with the help of a Belgium company intend to run a small fleet of natural gas-powered buses. The aim of this dissemination project is to provide valuable evidence on the efficiency and economic viability of using natural gas rather than diesel for city bus systems. The project entails the purchase of 10 compressed natural gas (CNG) powered buses including the necessary equipment and installations and the construction of a fuelling station. The emissions of the CNG engine are well below EU emission limits already set for the end of the decade. A number of parameters will be monitored in detail: the energy and environmental effects of the buses, the cost and economic efficiency, the acceptability to passengers and staff and the maintenance and operational properties of the system. The project proposers have already set up co-operation procedures with projects which already use CNG and dual-fuel buses and with other European cities who are interested in developing similar bus systems.

THERMIE contribution: 0.8 MECU Expected energy savings: 166 TOE/y

*Rational Use of Energy - Examples for Associated Measures***Industry:**

- 'Cogeneration '92 to '95': Two international conferences partly supported by THERMIE covering the technological, regulatory and economic framework for cogeneration bringing together technology providers and users;
- 'Textiles newsletter': Prepared jointly with EURATEX, the European textile association, containing information on THERMIE projects, research projects and other activities in the sector disseminated by national associations to textile manufacturers including SMEs.

Building:

- 'Training courses': Targeted to architects and promoting bioclimatic architecture, these two-days training course was carried out in almost all European capitals. A large number of architects were addressed and actively involved through the establishment of real case studies.

¹ The listing of the projects presented hereafter should be only considered as *examples* of THERMIE project support which are cited out of a wide range of projects and do not claim to be the most representative.

Renewable Energy Sources - Examples for Project Support

Wind energy: WE/119/94 Wind turbines for all sites, all winds, all weather

Demonstration of a versatile and competitive 25 kW wind turbine aims to show its suitability for use in all sites, all winds and all weathers. In this innovative THERMIE project, the manufacturer expects to achieve an improvement in performance including a significant reduction in the cost of the electricity generated. Up to now, the French Aerowatt Vergnet inertial regulation technology has only been proven for smaller turbines in the 2-12 kW range. The construction of a larger turbine will involve the incorporation of several new elements, such as carbon fibre blades; a new concept for the nacelle and a less noisy and more reliable design for the mounting. The turbine should be able to operate at wind speeds up to 110 metres-per-second and in all weathers. By doubling the power of the existing turbine, the project promoter hopes to show that the new turbine can produce electricity at 0.1 ECU per kWh, a 20% improvement on the existing costs. Moreover, the technology will be particularly suitable for remote areas, where the infrastructure is poor. The new turbine could, for example, be utilised in conjunction with a diesel grid or for strengthening the power at the end of a low tension line. Although market interest in wind turbines has been dominated by the larger capacity technology, the promoter believes there is an important opportunity for low-cost reliable individual turbines.

THERMIE contribution: 76.280 ECU

Biomass: BM/496/93 Fruit and nut waste fuel combined cycle generation

Fruit and nut wastes collected in central and southern Italy will be used to fuel a demonstration plant producing electricity for the grid and heat for on-site industrial processes. The three proposers of this biomass project - from Italy, Spain and the Netherlands - will build on results of earlier feasibility studies and component tests. It involves the design and construction of a complete industrial complex incorporating the following elements: a centre for the collection, treatment, drying, grinding and storage of shells and stones from fruit and nut processing industries; a waste heat boiler with fluidised bed combustion; a gas cleaning system; an 11.4 MW turbo-generator; a heat condenser; and a waste treatment and disposal unit. The construction of hi-tech greenhouses to use the heat is also envisaged. Overall thermal and electrical efficiency is expected to reach 82%. Once the economic viability of this industrial-scale complex has been proven, the promoters believe it could be replicated widely in the Union. Moreover, the technology could be equally well adapted to the other agro-industrial wastes, such as olive stones and chips from forestry works.

THERMIE contribution: 2.1 MECU Expected energy production: 39,400 MWh/y

Solar energy: SE/168/93 Solar panels on residential roofs linked to electricity grid

Demonstration of a system linking photovoltaic (PV) solar panels on domestic roofs to the local electricity grid could lead to the large-scale introduction of PV technology. Companies from Denmark, Spain, the Netherlands and Italy are working together to design and install an integrated 250 kW PV system using the roofs of 100 houses being built in a new city district of Amsterdam. Owners of the property will be compensated for use of their roofs. An important objective is to forge links leading to future co-operation between building companies, local utilities which operate distribution networks, town planners and PV manufacturers. Such links are essential if large-scale PV systems are to be considered and accepted in new urban building projects. The project also aims to demonstrate the safety of these systems to the public and to local authorities. A detailed final report, a user-friendly handbook, and a workshop for European research institutes are among the dissemination schemes already planned. Replication of the results will also be ensured by the participation of organisations from several Member States, and by the involvement of three cities - Copenhagen, Madrid and Genoa - which will be able to gain early experience of the technology before making large investments.

THERMIE contribution: 1 MECU Expected energy production: 225,000 KWh

Renewable Energy Sources - Examples for Associated Measures

- '*A strategy for the Promotion of Renewable Energy Technologies to Local Authorities*': Having identified local and regional authorities as key actors and decision makers in the field of renewable energy technology applications, the activity was aimed at assessing the particular characteristics and needs (information, training etc.) of the sector. This EU-wide study led to several follow-up actions: a major seminar (Greece, June 1994), study tours, maxi-brochures, guides etc..
- '*Renewable Energy Yearbook*': Conceived as a technical promotional tool aimed at a broad spectrum of decision makers, the yearbook presents 100 outstanding RET projects in an attractive, reader-friendly presentation, which can be up-dated and expanded in the future.
- '*Renewable Energy Journal (Quarterly newsletters)*': Over the period 1993-1995, the Journal presented concise information and news on all major developments and events in RES/RET to a wide audience.

Hydrocarbons - Examples for Project Support

OG/168/91 Cable sawing and cutting system for decommissioning

The diverless cable sawing and cutting system has been developed by two companies from France and Belgium to bring to the offshore oil and civil engineering markets a new product which can perform cutting tasks on very large wall thickness materials, such as sandwich composites and reinforced concrete, which are often found when decommissioning subsea structures. The system is fully controlled from the surface, with a Remote Operation Vehicle (ROV), and uses a diamond beaded cable as a cutting device. To date, this technique has mainly been used in quarry stone cutting, but has not been adapted for the offshore industry as such or more particularly for an underwater environment. The system has been already successfully tested and is capable of cutting multiwall coated pipelines of up to 40 inch diameter and 54 inch pile with a 2.5 inch wall thickness both in 16 hours. The technique should be of particular interest for pipeline and platform decommissioning, pipeline repairs and other civil engineering markets. It offers these industries a new means of performing cutting tasks more safely and more efficiently than existing methods.

THERMIE contribution: 0.7 MECU

Hydrocarbons - Examples for Associated Measures

- *'Participation in oil & gas trade shows'*: On world-wide level the promotion of European offshore technologies (Offshore Technology Conference/Houston; Offshore Northern Sea/Aberdeen-Stavanger; Offshore South East Asia/Singapore, Oil & Gas Exhibition/Tyumen)
- *'Technical workshops on innovative technologies'*: Slim-hole drilling/Paris; Multiphase Flow Modelling/Aberdeen; New Technologies for the development of marginal fields/Athens; Platform Decommissioning/Houston.

Solid Fuels - Examples for Project Support

335 MWe Integrated Gasification Combined Cycle (IGCC) Power Plant:

SF/337/91, SF/198/92, SF/422/93, SF/2/94:

At Puertollano (Spain), the world's largest Integrated Gasification Combined Cycle (IGCC) power plant is being built with the financial support of the THERMIE Programme. For the implementation of the project, major electricity companies from France, Germany, Italy, Portugal, Spain and the UK have formed a consortium, ELCOGAS, in order to share their experience and expertise and their resources, risks and rewards.

IGCC represents the most promising technology for clean electricity production from coal. Compared to conventional plants, coal consumption can be cut by 30% and CO₂ emissions can be reduced by 25%. The most innovative aspect of the IGCC technology is the integration of a coal gasification process into a combined cycle power plant. Combined cycle power plants have both gas and steam turbine generators and have increased overall plant efficiency when compared to conventional technologies. In the past, they have been successful using natural gas as primary fuel. The IGCC technology now allows coal to be used whilst at the same time bringing SO₂ and NO_x emissions down to almost zero.

Solid Fuels - Examples for Associated Measures

- *'Lecture series on clean coal technologies'*: In different countries of the EU organised in the course of 1994, these seminars attracted high interest by both academic and industrial sectors. Thus, a follow-up has been conducted in 1995 at European universities including municipal and regional utilities.
- *'Seminar for third countries' engineers'*: In 1993, training seminars were organised for Polish engineers on cement, iron and steel industries consuming solid fuels. Due to the clear success achieved, the seminar was replicated 1994 in Poland, and for Czech and Slovak engineers in 1995.