II

(Acts whose publication is not obligatory)

COUNCIL

COUNCIL DECISION

of 9 September 1991

adopting a specific research and technological development programme in the field of non-nuclear energy (1990 to 1994)

(91/484/EEC)

THE COUNCIL OF THE EUROPEAN COMMUNITIES,

Having regard to the Treaty establishing the European Economic Community, and in particular Article 130q (2) thereof,

Having regard to the proposal from the Commission (1),

In cooperation with the European Parliament (2),

Having regard to the opinion of the Economic and Social Committee (3),

Whereas by its Decision 90/221/Euratom, EEC (4), the Council adopted a third framework programme for Community activities in the field of research and technological development (1990 to 1994), specifying *inter alia* the activities to be pursued for developing the scientific knowledge and technical know-how needed by the Community, in particular to carry out its role relating to non-nuclear energy; whereas this Decision should be taken in the light of the grounds set out in the preamble to that Decision;

Whereas Article 130k of the Treaty stipulates that the framework programme is to be implemented through specific programmes developed within each activity;

Whereas basic research in the field of non-nuclear energy must be encouraged throughout the Community;

Whereas, in addition to the specific programme concerning human resources and mobility, it might be necessary to encourage the training of research workers and engineers in the context of this programme;

Whereas in the context of this programme it is desirable that an assessment be made of the economic and social impact as well as of any technological risks;

Whereas, pursuant to Article 4 and Annex I of Decision 90/221/Euratom, EEC, the funds estimated as necessary for the whole framework programme include an amount of ECU 57 million for the centralized dissemination and exploitation of results, to be divided up in proportion to the amount envisaged for each specific programme;

Whereas Decision 90/221/Euratom, EEC provides that a particular aim of Community research must be to strengthen the scientific and technological basis of European industry, and to encourage it to become more competitive at the international level; whereas that Decision also provides that Community action is justified where research contributes, *inter alia,* to the strengthening of the economic and social cohesion of the Community and to the promotion of its overall harmonious development, while being consistent with the pursuit of scientific and technical excellence; whereas this programme should contribute to the achievement of these objectives;

Whereas small and medium-sized enterprises (SME) should be involved to the maximum extent possible in this programme; whereas account should be taken of their special requirements without prejudice to the scientific and technical quality of this programme;

(1) OJ No C 174, 16. 7. 1990, p. 77 and OJ No C 76, 21. 3. 1991, p. 9.
(2) OJ No C 48, 25. 2. 1991, p. 130 and OJ No C 240, 16. 9. 1991.
(3) OJ No C 31, 6. 2. 1991, p. 20.
(4) OJ No L 117, 8. 5. 1990, p. 28.

Whereas it is necessary, as Annex II to Decision 90/221/Euratom, EEC provides, to contribute to the development of new energy options that are both economically viable and more environmentally friendly;

Whereas the R&D activities in this programme occur upstream of the 'project for the promotion of energy technology', defined in Article 2 of Regulation (EEC) No 2008/90 (1) concerning the Thermie programme, which are eligible for financial support under that programme only if the research and development stage has for the most part been completed;

Whereas the Scientific and Technical Research Committee (Crest) has been consulted,

HAS ADOPTED THIS DECISION:

Article 1

A specific research and technological development programme in the field of non-nuclear energy, hereafter referred to as the 'programme', as defined in Annex I, is hereby adopted for a period running from 9 September 1991 to 31 December 1994.

Article 2

1. The funds estimated as necessary for the execution of the programme amount to ECU 155,43 million, including expenditure on staff and administration amounting to ECU 18 million.

2. An indicative allocation of funds is set out in Annex II.

3. Should the Council take a decision pursuant to Article 1 (4) of Decision 90/221/Euratom, EEC, this Decision shall be adapted accordingly.

Article 3

Detailed rules for the implementation of the programme and the amount of the Community's financial contribution are set out in Annex III.

Article 4

1. In the course of the second year of implementation of the programme, the Commission shall review it and send a report on the results of its review to the European Parliament and the Council. This report shall be accompanied, where necessary, by proposals for amendment of the programme.

2. At the end of the programme, an evaluation of the results achieved shall be conducted for the Commission by a group of independent experts. This group's report, together with any comments by the Commission, shall be submitted to the European Parliament and the Council.

3. The reports referred to in paragraphs 1 and 2 shall be established having regard to the objectives set out in Annex I to this Decision and in accordance with Article 2 (4) of Decision 90/221/Euratom, EEC.

Article 5

1. Contracts concluded by the Commission shall govern the rights and obligations of each party, in particular the arrangements for the dissemination, protection and exploitation of research results, in accordance with the provisions adopted pursuant to the second paragraph of Article 130k of the Treaty.

2. A work programme shall be drawn up in accordance with the aims set out in Annex I and updated where necessary. It shall set out the detailed objectives and types of projects to be undertaken, and the corresponding financial arrangements to be made for them. The Commission shall make calls for proposals for projects on the basis of the work programme.

Article 6

1. The Commission shall be responsible for the implementation of the programme. It shall be assisted by a committee of an advisory nature composed of the representatives of the Member States and chaired by the representative of the Commission.

2. In the cases referred to in Article 7 (1), the representative of the Commission shall submit to the committee a draft of the measures to be taken. The committee shall deliver its opinion on the draft within a time limit which the chairman may lay down according to the urgency of the matter, if necessary by taking a vote.

3. The opinion shall be recorded in the minutes; in addition, each Member State shall have the right to ask to have its position recorded in the minutes.

4. The Commission shall take the utmost account of the opinion delivered by the committee. It shall inform the committee of the manner in which its opinion has been taken into account.

Article 7

1. The procedure laid down in Article 6 shall apply in particular to:

— the preparation and updating of the work programme referred to in Article 5 (2),
— the contents of the calls for proposals,
— the assessment of the research projects provided for in Annex III and the estimated amount of the Community's contribution to them,
— departures from the general rules set out in Annex III,
— the participation in any project of non-Community organizations and enterprises referred to in Article 8 (1) and (2),

(1) OJ No L 185, 17. 7. 1990, p. 1.

— any adaptation of the indicative allocation of the funds set out in Annex II,

— the measures to be undertaken to evaluate the programme,

— the arrangements for the dissemination, protection and exploitation of the results of research carried out under the programme.

2. The Commission shall inform the committee on the implementation of the accompanying measures and concerted actions referred to in Annex III.

Article 8

1. The Commission is authorized to negotiate, in accordance with Article 130n of the Treaty, international agreements with third countries members of COST, in particular with member countries of the European Free Trade Area (EFTA) and the countries of Central and Eastern Europe with a view to associating them with all or part of the programme.

2. Bodies and enterprises established in European non-Member States may, on the basis of the criterion of mutual benefit, be allowed to become partners in a project undertaken within the programme.

No contracting body based in the countries referred to in paragraph 2 and participating as a partner in a project undertaken under the programme may benefit from Community financing for this programme. Such a body shall contribute to the general administrative costs.

Article 9

This Decision is addressed to the Member States.

Done at Brussels, 9 September 1991.

For the Council

The President

W. KOK

ANNEX I

SCIENTIFIC AND TECHNICAL OBJECTIVES AND CONTENT

This specific programme fully reflects the approach embodied in the third framework programme in terms of the scientific and technical goals and underlying aims which it pursues.

The objective is to contribute to the development of new energy options that are both economically viable and more environmentally safe, including energy-saving technologies, by means of joint activities to assist Member States in this direction. In this connection, increased attention must be paid to work on those energy technologies which, despite their high potential and the fact that they have no adverse effects on the environment, particularly the climate, cannot be used under satisfactory economic conditions at present as this work cannot yet be fully funded by industry.

For the purposes of this Decision, the subprogrammes and projects established pursuant to this programme are defined as joint research and technological development actions which contribute to the formulation of new energy options that are both economically viable and environmentally safe, including energy-saving technologies.

The activities envisaged include : either technological projects designed to explore, establish a structure for or test the technical feasibility of minority concepts prior to any industrial development, or strategic fundamental research projects aimed at developing new areas of basic knowledge likely to became the focus for industrial research work.

The projects for the promotion of energy technology, situated downstream of the projects eligible under this programme, will be financed wholly pursuant to Regulation (EEC) No 2008/90 concerning the Thermie programme, with which they must be closely coordinated.

Coordination must also be established with the other specific research programmes, particularly the 'agricultural and agro-industry' and 'industrial and materials technology' programmes.

Research into modelling is a horizontal research area which will be carried out to gain more knowledge of the processes involved and to enable technological strategies to be assessed.

The following presents an analytical description of the content of the specific programme, based on and taking account of the above elements.

Area 1 : Analysis of strategies and modelling

The aim of the modelling activities is to define energy R&D strategies and to analyse national or Community policies dealing with energy and environment. The programme will expand the existing capacity to draw up energy forecasts and evaluate energy policies by introducing the new environment and internal market dimensions. It will develop new concepts not envisaged or inadequately covered by previous activities.

Analysis of strategies

Models will be used to assess the strategic role of energy efficiency at demand and supply level and renewables towards a reduction of the damaging effect of energy production and utilization on the environment, emphasis being put on greenhouse gas emissions, in particular CO_2. Energy policy options taking into account different scenarios of CO_2 constraints will be made available.

Given the inherent problems of the environment and the greenhouse effect, the analyses carried out in this area will allow for a Europe-wide and international dimension in view of the role played by third countries.

Development of new methods

This task will consist of conceptual research to account for the impact of the internal market on the energy system, for the social constraints involved in policy decision making, for the treatment of uncertainty and for the economic impact of the policies modelled. New working tools will be tested and made operational for the analysis of strategies.

Area 2 : Minimum emission power production from fossil sources

Subject to the development and extension of projects already carried out pursuant to the Joule programme, this research aims at optimizing energy production from fossil sources and reducing the adverse effects on the environment resulting from the widespread use of fossil fuels.

Two main lines of activity are planned, firstly in the fields of advanced technologies for energy production and secondly in removal and fixation of CO_2, as well as work on combustion models. Technico-economic evaluation of the several possible routes, their ecological effects and the action needed to offset those effects will be performed in parallel with development of geophysical methods and tools. On the basis of the outcome of these technico-economic evaluations, experimental work will be performed on the more promising high-efficiency power producing systems with CO_2 capture and an CO_2 disposal.

Energy production from fossil sources using advanced technologies

The objective is to increase the efficiency of energy production from fossil sources, by means of advanced technologies. Both the theoretical and experimental work will establish the technical feasibility and the costs — cost per unit kWh produced, capital cost — of these advanced technologies. The work will contribute to the development of high-efficiency multicycle conversion systems including fluidized-bed combustion systems for electricity production from fossil fuels with a potential efficiency of 50 % or more, as compared with the present 38 % level, in order to reduce greenhouse gas emissions per kWh produced and to compensate for energy losses and expenses related to minimum emission measures. For this purpose the development of fossil fuel combustion with oxygen and CO_2 recirculation will be studied because of its potential impact on efficiency and on the limitation of emissions.

Taking into account the essential role of hydrocarbons and to ensure the future energy security of the Community, R&D actions in the field of hydrocarbons will be continued with attention being paid to the need to protect the environment. Activities will also cover basic research on techniques for the discovery, appraisal and exploitation of new fields, especially smaller and more complex fields, as well as for the early recovery of hydrocarbons in such fields and the ultimate use of fuels.

Reduction of emissions

The objective is to reduce emissions through the capture and stable disposal of pollutants. This work comprises two elements : first, technico-economic evaluations, study models and related technical studies for minimizing emissions in fossil fuelled power production systems and in methanol and hydrogen production from fossil fuels. This work could also be relevant to R&D on appropriate techniques which are used to reduce emissions from fossil-fuelled power stations and from oil refineries. Second, the development of safe and stable geological disposal for CO_2 in new reservoirs, as well as in spent or operating oil and gas fields. This will entail research on the interaction of CO_2 with mineral materials in the geological sites. CO_2 storage in the ocean depths and the problems of the siting of large power stations with regard to the possibilities for storage, recycling and processing of CO_2 will also be studied. In support of this part of the programme, advanced geophysical methods and tools will be developed for CO_2 storage assessment, hydrocarbons prospection and reservoir engineering. Scrubbing, absorption or other methods to separate CO_2 from flue gases with subsequent fixation of CO_2 will also be studied.

Area 3 : Renewable energy sources

The aim is to accelerate technological readiness and to prepare for early market integration of all the most promising technical options. Within a global systems approach, particular objectives are to increase the conversion efficiency of solar, wind, mini-hydraulic, wave, tidal, biomass and geothermal systems, decrease their costs and improve their attractiveness to developers, industry and consumers.

The solar house

The objective is to contribute to solar design concepts by integrating heat use and photovoltaic conversion for new and old dwellings and buildings. Research will aim at maximizing the use of solar radiation and ambient heat for heating and power in such buildings, offering improved living and/or working conditions to the occupants, and employing modular and cost-effective building elements using new or traditional materials.

Emphasis will be on the further development of solar components, heat storage devices and concepts, and the development and integration of photovoltaic cells and modules. Design concepts and pilot systems will be developed as part of a broad attempt to stimulate solar architecture in new and renovated buildings and the utilization of new technologies in architecture at large. 'Pre-standardization' research in the building sector and on urban planning will be encouraged.

Renewable power plants

The objective is to develop renewable energy for future large-scale application in electric utility systems, such as the development of grid-connected solar power plants, wind generators, wave power systems, tidal power schemes, small hydro-electric power systems and co-generation plants for heat and power based on biofuels and organic waste, including safe storage and environmentally acceptable back-up systems, e.g. solar hydrogen.

Research will be carried out on the optimization in size and technology of large wind generators whose power is in the megawatt range, in order to effect further cost reduction. This will include work on new materials and components, e.g. composite blades, design criteria and possibly a set of new pilot systems suitable for large-scale utilization on land and off-shore. In addition, a comparative assessment will be made of the cost, efficiency and ecological effects of the two families of large-size wind generators (in the megawatt range).

Research aimed at optimizing grid-connected photovoltaic systems and the associated components will be carried out. Emphasis will be on further improvement of the efficiency and cost of solar cells. Due attention will be given to fundamental R&D and innovative concepts. Research on solar thermal power, wave power and tidal schemes in the form of studies and exploratory research will be aimed at exploiting the considerable potential of these sources of energy at the earliest possible date. Analysis work will be devoted to the combined use of the various renewable power systems in future utility systems.

Biomass

The objective is to promote the development of energy produced from the biomass for research on the techniques applicable to its conversion and use, including experimenting with autonomous, regional energy systems. The Commission, assisted by the two programme committees concerned, will coordinate with the actions carried out under the specific agricultural and agro-industrial research programme.

Renewable energies for rural electricity, local fuel and water

The objective is, for electricity and water, to provide an integrated approach to rural development. This will concern stand-alone rural power systems employing photovoltaics and other systems as well as wind (electrification of remote houses and new agro-industrial enterprises, solar water pumps, solar sea water desalination, etc.). The development of electricity storage devices will be a particularly important feature for such off-grid systems. For fuels, technologies for using biomass residues and energy crops in cost-effective and environment friendly energy generation systems, on-site or for local networks, will be further developed. An important aspect will be the combined use of these systems and integration with other renewables. In particular, the needs of rural zones, e.g. in the Mediterranean Member States of the Community and of some developing countries, will be taken into consideration.

Geothermal energy

The main objective is the development of a single European prototype hot dry rock system ; following selection of the site(s) and subject to satisfactory evaluation of results, the major task will be the creation and management of an artificial reservoir based on the pattern of natural fractures in the basement rock. In order to achieve the main objective scientific studies on the appropriate sites will focus on fracture location, reservoir development and management and water-rock interactions.

Corrosion and scaling in conventional high- and low-enthalpy geothermal systems will also be studied, as will problems related to the reinjection of used fluids, with the objective of widening the availability of suitable geothermal resources.

In addition, the deep geology of Europe will be studied, using appropriate geographical and geochemical methods, in order to obtain a better understanding of the processes which have led to the development of geothermal and hydrocarbon reservoirs.

Area 4 : Energy utilization and conservation

New options in energy conversion

The general aim is to develop highly efficient and clean electrochemical energy conversion systems for electricity generation, cogeneration, hydrogen and methanol production, transport and industrial electrochemical reactors.

As regards large fuel cells for electricity production, cogeneration and ship engines, the long term goal is the development of MW size solid oxide (SOFC) and molten carbonate (MCFC) fuel cell plants fired by oil, gas or coal. The objective is to develop fuel cell plants which, compared with conventional systems, bring about energy savings of 30 to 40 % and a 10 to 100 times lower pollution. Targets are the development of a 20 kW SOFC prototype plant as a part of a plan aiming at 200 kW cogeneration units for industry in 1997, and the development of internal and external reforming MCFC prototype plants of 10 and 100 kW respectively.

Small (20 to 50) kW methanol and hydrogen fuel cells will be developed for small-scale electricity production and transport.

Reserach will also be carried out on clean and energy-saving production of hydrogen and methanol with SOFC-based technologies, aiming at 40 % electricity savings in the case of hydrogen. Industrial electrochemical reactors for production of chemical compounds by electrolysis and oxidation will also be considered.

Technologies for energy saving

The goal is to develop and improve technologies which are expected to have a major impact on heat and electricity savings and on a reduction of pollution. These technologies should lead to energy savings of 20 to 25 % in new equipment, buildings and processes.

Current work on energy-saving in industry has allowed new goals to be determined. In particular, process intensification and process integration will be extended to include environmental aspects. As a result, the following priorities have been established in close collaboration with industry : unit operations, e.g. separation techniques heat exchanges, process intensification, chemical reactors ; process integration leading to energy-saving and decreased pollution ; energy conversion equipment such as catalytic combustion, industrial high temperature heat pumps for heating and refrigeration, addressing also the problem of CFC substitutes ; electricity saving.

Given the potential for energy savings and consequential reductions in greenhouse gas emissions through new and improved technologies in the domestic sector, R&D work will be directed at realizing this potential.

Research on energy-saving in buildings will include in particular passive cooling, aiming at reducing the electricity demand for cooling, in particular for southern European countries. New daylighting techniques will be developed to reduce lighting and cooling requirements. Work on heat pumps will in future be focused on integration of catalytic combustors and cheap compact heat exchangers. Aerogel research will be extended to the development of highly insulating transparent and adaptable windows. Air management systems in buildings will also be given consideration.

New energy-saving schemes will be devised to provide architects with tools to introduce energy-saving techniques in the building sector and urban planning. Particular attention will be paid to 'pre-standardization' research on building schemes which use passive solar energy and thus give rise to considerable energy savings.

Energy efficiency in transport, including suitable substitutes for conventional fuels

The aim is to develop advanced technologies which can lead to highly efficient and clean transport. This area, which will involve the participation of industry, deals with short, medium and long term research and includes both combustion engines and fuel-cell and battery-driven electric vehicles. Coordination with transport projects carried out under the Industrial and Materials Technologies programme will be the responsibility of the Commission, assisted by the two programme Committees concerned.

As a follow-up to past work on the optimization of combustion engines, research will include : advanced petrol engines such as learn-burn, two-stroke and stratified-charge engines ; catalyst exhaust systems and their integration and optimization with the engine ; continued basic combustion research ; internal combustion engines using clean fuel (hydrogen, methanol, compressed natural gas (CNG), fuels from biomass). Research on diesel engines will be focused on energy efficiency and on the reduction of soot and particulate formation to levels which will be required in the future.

Research on hydrogen-fuelled polymer fuel cells and their integration in electric vehicles aims at achieving efficiencies of 60 to 65 % (three to four times better than petrol engines). In order to allow the use of methanol and methane in such electric vehicles, compact and cheap methanol and methane reformers will be developed. Another research route will aim at the use of fuel cells which directly oxidize methanole while not requiring a reformer. Work will be focused on scaling up to 1 kWh by 1994.

Research will aim at scaling up new cost-effective solid Lithium batteries with polymer electrolytes to 20 kWh and at their integration into electric vehicles, in order to achieve a range of 300 kilometres on one charge.

ANNEX II

INDICATIVE ALLOCATION OF FUNDS DEEMED NECESSARY

(in millions of ecu)

Area	Allocation
1. Analysis of strategies and modelling	9
2. Minimum emission power production from fossil sources	36
3. Renewable energy sources	57,43
4. Energy utilization and conservation	53
Total	155,43 (1) (2)

(1) Including staff costs amounting to ECU 11 million and administrative costs amounting to ECU 7 million.

(2) An amount deemed necessary of ECU 1,57 million, not included in the ECU 155,43 million, would be set aside as a contribution from the specific programme on non-nuclear energies to centralized action for disseminating and exploiting the results.

The breakdown between different areas does not exclude the possibility that projects could cover several areas.

ANNEX III

RULES FOR IMPLEMENTING THE PROGRAMME AND ACTIVITIES FOR DISSEMINATING AND EXPLOITING THE RESULTS

1. The Commission will implement the programme on the basis of the objectives and the scientific and technical content described in Annex I.

2. The rules for implementing the programme, referred to in Article 3, comprise research and technological development projects, accompanying measures and concerted actions. Selection of projects must take account of the criteria listed in Annex III to Decision 90/221/Euratom, EEC and of the objectives set out in Annex I to this programme.

   A. **Research projects**

   The projects will be the subject of shared-cost research and technological development contracts and Community financial participation will not normally be more than 50 %. Universities and other research centres participating in shared-cost projects will have the option of requesting, for each project, either 50 % funding of total expenditure or 100 % funding of the additional marginal costs.

   Shared-cost research projects must, as a general rule, be carried out by participants established within the Community. The projects, which may involve, for example, universities, research organizations and industrial firms, including small and medium-sized enterprises, must, as a general rule, provide for participation by at least two mutually independent partners established in different Member States. Contracts relating to shared-cost research projects must as a general rule be concluded following a selection procedure based on calls for proposals published in the *Official Journal of the European Communities.*

   Where projects are of equal scientific value, the Commission, by agreement with the Committee, will pay special attention to projects which can be integrated into regional energy planning.

   B. **Accompanying measures**

   The accompanying measures referred to in Article 7 will consist of:

   — the organization of seminars, workshops and scientific conferences,
   — internal coordination through the creation of integrating groups,
   — advanced technology training programmes, with emphasis being placed on multidisciplinarity,
   — promotion of the exploitation of results,
   — independent scientific and strategic evaluation of the operation of the projects and the programme.

   C. **Concerted actions**

   Concerted actions consist of action by the Community to coordinate the individual research activities carried out in the Member States. They may benefit from funding of up to 100 % of coordinating expenditure.

3. The knowledge acquired in the course of the projects will be disseminated both within the programme and by means of a centralized activity, pursuant to the Decision referred to in Article 4 (3) of Decision 90/221/Euratom, EEC.