

New energy sources for the Community

European File

Petrol costs are rising as is the price of heating oil. Both have been hit by the energy crisis. Industrial production costs have felt the burden of energy price rises and jobs have been hit as well, making economic recovery more difficult. Europe has been particularly affected. Importing 54% (mostly oil) of all energy consumed, it has been at the mercy of price increases decreed by oil producing countries as well as vulnerable to supply insecurity resulting from political uncertainty.¹

What should the Nine do?

- Above all, they should not waste energy. Saving energy will not hold back growth and can, by contrast, stimulate it.²
- They should make greater use of coal. Europe still has considerable resources in its coalfields but high production costs have held back exploitation. Community coal production must be made more competitive and the use of coal encouraged where possible.
- They should extend the use of nuclear energy, despite the obstacles of high investment costs and, above all, opposition from a section of public opinion. The Community is conducting a major research effort in this sector, particularly to guarantee higher safety standards.³

¹ *European file* No 8/79: Towards a European energy policy.

² *European file* No 15/79: Community action in nuclear safety.

³ *European file* No 16/79: Economic growth and energy conservation.

- They should also promote new energy sources such as solar and geothermal energy, and encourage research into long-term solutions: controlled thermonuclear fusion and the use of hydrogen as a means of storing and transporting energy.

Why Is the Community interested in new energy sources?

- Even if the European Treaties do not formally confer on the Community the responsibility for conducting a common energy policy, it is evident that the Community should. The Nine have common economic and social objectives and these goals are increasingly conditioned by the supply of energy. During the period when the Treaty of Rome was signed, Europe's energy supplies were based on coal which it produced itself and which was the subject of the first European Treaty (1951) establishing the Coal and Steel Community (ECSC). To reduce today's dependence on imported oil, the Community has to go for a policy of diversification and this requires a common strategy.
- The introduction of new energy sources depends, to a large extent, on Europe's research and development effort. Certain new energy sources such as fusion are still in the prototype phase. With others such as solar energy, it is more a question of carrying out pilot tests and demonstrations and through technological progress lowering costs to make it commercially marketable throughout the Common Market.
- Europe has turned towards the new energy sources generally rather later than the United States. And it has allocated less public money. Solar energy receives around 100 million dollars of support per year from the Nine whilst the USA spends 600 million. Europe now has to step up its effort. Community cooperation is needed because:
 - we expect greater effectiveness and rationalisation through the direct pooling of the necessary resources and through coordination to share the work and avoid duplication.
 - certain research and development projects are too expensive both in terms of funds or personnel to be undertaken by one single country. This is the case, for example, with the JET, the thermonuclear reactor currently being built by the Community.
 - joint projects enable countries to participate which would otherwise hesitate to become involved, due to lack of resources or quite simply lack of interest. In the latter case, the example set by neighbouring countries can help stimulate public opinion and national authorities.
 - the coordination carried out by the European Commission enables information and experience to be shared. But the Commission can also play a useful role in stimulating action and innovation either by leading the Nine into new areas of research or by accelerating industrial application through financial support or by demonstration projects.

What has the Community done?

- In the aftermath of the first energy crisis, the European Commission considerably extended its research and development programmes into new energy sources.
 - Some of these programmes have been implemented by the Community's Joint Research Centre, particularly at Ispra in Italy. Since 1973, 148 researchers and 58 million European units of account¹ have been allocated to new energy sources. The JRC's programme for 'new energies 1980-1983' should be endowed with more than 200 researchers and EUA 85.7 million: 25.8 million for solar research, 15.5 for hydrogen, 28.5 for thermonuclear fusion technology and 16 million for research into the high-temperature materials needed to cope with the fusion process.
 - Other research has been conducted in the form of shared-cost contracts concluded between the European Commission and industry, research centres and universities in the Nine. The first four-year programme (1975-1979), devoted to energy saving and new energy sources, has been allocated a budget of 59 million EUA by the Community, which represents 50% of the total cost. A new four-year programme (1979-1983) has been approved with a budget of 105 million EUA (the European Commission requested 125 million). These two programmes cover (in million EUA):

| | 1975-79 | 1979-1983 |
|-------------------|---------|-----------|
| Energy savings | 11.4 | 27 |
| Hydrogen | 13.2 | 8 |
| Solar energy | 17.5 | 46 |
| Geothermal energy | 13.0 | 18 |
| Systems analysis | 3.9 | 6 |
| Total | 59.0 | 105 |

- Community aid for developing new energy sources is not just limited to financing research. Since June 1978, the Community has also been granting financial aid to demonstration schemes for energy saving techniques or the exploitation of new energy sources. Once a project is accepted (following a public offer for tenders in the Nine) it is given up to 40% financial assistance by the Community, which is repayable in part or in full if the installation is commercially successful. Such Community subsidies enable projects submitted as plans or models to be worked out at full scale. The expenditure ceiling set for assistance for these demonstration projects over the 1978-1982 period amounts to 22.5 million EUA for geothermal energy and 22.5 million for solar energy. 50 million EUA have been allocated to projects developing new processes for exploiting coal resources (gasification, liquefaction).

¹ 1 EUA = about £ 0.65 or Ir.£ 0.67 (at exchange rates current on 4 January 1980).

Solar energy

What will be the proportion of solar energy in our energy supply in the year 2000? 5-10% according to Community experts, 2-3% according to others. Over the long term, in any case, the possibilities for solar energy are spectacular. The sun emits in our direction 10 000 times more energy than man can consume. In one day, we receive the energy equivalent of the total fossil fuel (oil and coal) which man has ever consumed, Central Europe, however, receives only half as much solar energy per square metre (in the form of sunrays) as the Sahara, which means that solar energy is not the Utopian solution for Europe. The question, however, is one of using it when sufficiently economic.

Community research has six principal directions:

- the evaluation of solar rays: a map of the month by month solar radiation received in Europe will be published at the beginning of 1980. To refine these results and determine to within 10% the solar radiation in each region, European researchers are examining the possibility of using satellite photography;
- the use of solar energy in the home, in particular for heating and cooling buildings: some schemes have already been commercialised. The Community also supports work of common interest for all researchers and manufacturers. Researchers in the Nine have thus been able to assess the success of solar houses that already exist and they are evaluating the yield of solar collectors (thermal or photovoltaic). They are also busy trying to resolve the delicate problem of storing heat for sunless days (and weeks);
- solar power stations (thermal): the Community has undertaken at Adrano, in Sicily, the construction of a one megawatt power station. At the end of 1980 this will be the first power station of its kind actually in operation;
- photovoltaic power generation: solar light can be directly transformed into electricity by semi-conductor cells. This process is of particular interest to Europe since these cells operate even when the sky is overcast. The Community is already devoting considerable effort to reducing the production cost of these cells and increasing performance, to ensure that solar power stations can be really cost-competitive. The Community is financing four 5 watt pilot systems which will supply electricity to installations as varied as mountain huts in the Alps and a British land-based satellite control station. The Nine are also studying plans for a half megawatt photovoltaic power station;
- photoelectrochemicals: Community-subsidised laboratories are developing artificial photochemical systems which imitate the natural process whereby plants capture solar energy and convert it into chemical energy. For example, water can be separated into oxygen and hydrogen (using solar energy) and the hydrogen subsequently used as a synthetic fuel;
- biomass: the biomass or 'green fuel' consists of organic matter (straw, crop residues, wood, brushwood, manure, algae) which is converted by photosynthesis

(using solar energy) into gas through a variety of processes: gasification of fermentation, for example. Biomass offers enormous possibilities and these are just beginning to be examined. It can replace oil in all its conventional applications (methanol can be mixed with petrol) and it is thought that it could meet 5% of the Nine's short-term energy requirements. Community research has already enabled the importance of biomass in our overall supplies to be assessed. Amongst other subjects examined, we can mention methods for converting waste into gas, the exploitation of currently unused forests for energy (five million hectares in France alone) and the cultivation of photosynthetic cultures (algae, fast growing trees etc) on poor quality soil or on marginal land.

The first offer for tenders from the European Commission for solar energy demonstration projects met with considerable success. 135 requests for assistance were made by companies and local authorities, and 26 projects were awarded grants. These cover, for example, the production of methane from pig wastes, running a post office vehicle on photoelectrical batteries, or building experimental houses utilising the sun's rays. A second call for tenders has just been launched.

Geothermal energy

Geothermics is the exploitation of the heat from the depths of the earth. This takes the form of:

- high energy geothermic: boring holes in the hottest areas of the earth's crust (volcanic regions) provides water at over 150°C which can drive turbines and provide electricity. The first project of this kind is at Lardarello, Tuscany, and has been in operation since 1904. The Community is currently giving support to deep-earth drilling;
- low energy geothermics: pumping up warm or tepid water from underground to heat houses or greenhouses. Water is pumped through a heat exchanger which heats up water in a second circuit (like an enormous radiator). Geothermal heating is used for example in the Parisian Basin (Creil, Melun). The greater the depth, the hotter the water, but it also tends to be more salty and more corrosive. The Community is also financing the development of a convector which should enable us within two years to heat buildings using warm water (40° C radiators currently use water at 70°C or 80°C);
- hot rock geothermics: over the long term the energy potential of geothermal heat for water can amount to about 5% of total energy supply in the Community, whilst extracting the heat contained in rocks can, if it proves profitable, contribute as much as 20%. These rocks can be exploited through fracture and injection of pressurised water.

Community research into geothermal energy is entering a new phase. The first programme served to map out the most favourable sites and test exploration methods. Now the promising geothermal regions must be studied (e.g. close to Vesuvius in Italy, at Mont-Dore in France etc). A project is being conducted in Cornwall (UK)

to resolve the problems involved in the exploitation of hot rocks. This research could lead, at a later stage, to a number of demonstration schemes to add to the 13 projects already accepted (from 36 applications) following the European Commission's first call for tenders. Some of these projects deal with heating buildings and greenhouses, others with the production of electricity. In four countries, Belgium, Denmark, Germany and the Netherlands, they are experimenting with the first applications of geothermal energy. A second call for tenders has just been launched.

Controlled thermo-nuclear fusion

We see the thermo-nuclear fusion process every day. This is the process which supplies the sun and the stars with the light needed to shine. Scientists intend to reproduce this natural process by releasing the fusion energy in controlled conditions, in reactors capable of containing it. This is a long way from the classic nuclear reactors which produce energy through fission, by splitting one atom to produce two. The materials used are also different: whilst the nuclear fission uses uranium, fusion uses isotopes of hydrogen: deuterium, extremely abundant, particularly in the sea, and tritium which only exists in small quantities in nature and must be 'made' from lithium of which there are probably inexhaustible supplies. In contrast to deuterium, tritium (produced from lithium) creates radioactive waste. The aim is consequently to replace the deuterium-tritium reaction with a deuterium-deuterium reaction — more difficult to obtain but less polluting, and this would ensure Europe's energy independence. The industrial exploitation of controlled thermo-nuclear fusion will not come about tomorrow unfortunately. The development of an industrial reactor will still require a few more decades yet. The main difficulty is that to obtain a sufficient number of fusion reactions, the plasma or deuterium-tritium mixture must be brought to a temperature of more than 100 million degrees Kelvin and confined for a specific time in a limited volume. Two approaches are being examined by researchers: inertia and magnetic confinement, and this is the basis of the European programme. The aim is to confine the particles in a limited space through a magnetic field in a doughnut-shaped cylinder known as the Torus. The most promising experimental designs at the present moment are the Tokamak type invented by Soviet scientists in 1958.

Europe is amongst the leaders in fusion research:

- principally, and this is a unique fact, the work of the Joint Research Centre and the programmes of Member States, of Sweden and of Switzerland are totally integrated in one European programme, which is coordinated and subsidised by the Community (to the extent of 190 million EUA, 1979-1983, out of a total budget of about 750 million). Research undertaken by the 'eleven' deals particularly with the different methods of heating and confining plasma. In particular, the Joint Research Centre should have about 28 million EUA in funds between 1980 and 1983 to study fusion technology and 16 million EUA for the work on the resistance of high-temperature materials;
- in addition, Europe is jointly building at Culham, near Oxford, one of the most powerful Tokamak machines in the world: the JET or Joint European Torus.

Of the 180 million EUA budget needed over the next five years, 80% of the funds will come from the Community, 10% from the UK's Atomic Energy Authority and 10% from the other members of the joint enterprise.

Hydrogen

The heat produced from these various sources of energy can be transformed into electricity. It is also of interest however to transform this heat into synthetic fuel to facilitate storage and transport. The production of hydrogen is a particularly promising way of doing this: hydrogen can be produced from water, it can be stored in great quantities, it burns without causing pollution. Of course hydrogen is only a means of transportation. Energy is also needed to break down water into oxygen and hydrogen. For this we can use either electrolysis (using solar energy, nuclear, wind power or hydroelectric) or a thermochemical process using a nuclear reactor.

In 1978, for the first time in the world, hydrogen was produced in a continuous fashion by thermo-chemical means as a result of the work conducted since 1970 by the Community Joint Research Centre (16.3 million EUA were allocated over 1977-1980). Also the Community coordinates and subsidises the work of numerous national laboratories which are involved with the thermochemical process and, in particular, electrolysis techniques as well as other aspects of the use and storage of hydrogen.



A new field with a lot of new ground to be covered, the new energy sources offer great scope for researchers and for industry. The pooling of the Nine's efforts in this area makes more sense and offers more possibilities than in other fields. Faster progress is thus possible in a sector which is of interest not only to consumers but is also crucial for the future of Europe: if Europe's energy supplies are not diversified, our prosperity and independence could be at risk ■



The contents of this publication do not necessarily reflect the official views of the Institutions of the Community.

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