

EUROPEAN COMMUNITY

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\*\* A PRACTICALLY INEXHAUSTIBLE FUEL (deuterium) AVAILABLE ALL OVER THE PLANET, the use of which would thus solve all supply problems. A VERY LOW DEGREE OF ENVIRONMENTAL POLLUTION as compared with other energy-producing plants, so that power could be generated close to the towns where it is required. These, together with the prospect of a considerably cheaper kilowatt/hour, are the two outstanding advantages of the future FUSION REACTORS, which are the subject of unremitting research efforts in all the major countries of the world.

In the Community these efforts have so far been coordinated through Euratom. In practically all the laboratories in the six countries which are taking part in the research on thermonuclear fusion, useless and costly duplication has been avoided and there is a fruitful exchange flow of information and experience: COMMUNITY RESEARCH ON FUSION IS TODAY A GENUINELY INTEGRATED ACTIVITY.

The Commission of the European Communities has therefore decided to submit to the Community Council of Ministers, without waiting for the full list of its proposals for the Euratom multiannual research programme (which is being prepared in accordance with the Council's instructions), A MULTIANNUAL COMMUNITY RESEARCH PROGRAMME ON THERMONUCLEAR FUSION AND PLASMA PHYSICS which should be able to get going by 1 January 1971.

For further information please apply to the

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the Scientific and Technological Information Service, 200 rue de la Loi, 1040 Brussels, Belgium.

- \*\* AUTOMATION OF THE STEEL INDUSTRY will form the subject of the International Steel Congress to be held at Luxembourg and Dusseldorf on 13-18 April by the Centre national de recherches metallurgiques (Benelux) and the Verein Deutscher Eisenhüttenleute (Germany).
  
- \*\* The Proceedings of the conferences held at Aix-en-Provence in December 1967 and at Nice in December 1968 will be on sale from June onwards, in French only, under the title "LES CADRES DE LA COOPERATION SCIENTIFIQUE INTERNATIONALE ET LE PROBLEME EUROPEEN", from the European Communities Publications Office (37 rue Glesener, Luxembourg). In the meanwhile a detailed summary of these Proceedings can be obtained on request, free of charge, in French only, from the Scientific and Technological Information Service, 200 rue de la Loi, 1040 Brussels, Belgium.

The Origins of Technical Innovations in the Industries  
Equipping the Energy Sector in France

The four main branches of industry that supply equipment for the energy sector in France spend five times as much as they earn in their sales and purchases of manufacturing licences in other countries. This emerges from a survey which the Commission of the European Communities has had carried out by experts of the French Centre National de la Recherche Scientifique on the origins of technical innovations in the industries supplying equipment for the energy sector in France.

1. Origin of technologies

The technological developments used in the industries that supply plant to the energy sector in France may be of domestic or foreign origin: in the case of energy-generating plant, the origin is more usually foreign,

a) domestic origin

Even so, there are innovations of domestic origin.

In certain cases, admittedly the minority, there is a longstanding technological tradition whose foundations did not alter overmuch during the Second World War. Most examples of this unbroken continuity are to be found in the electrical and electromechanical range, notably in the field of hydroelectric energy and transport. The "bulb" turbine set, for instance, was an innovation rooted in research and experiment started before 1940 and continued during the war.

The other form of home-grown innovations, by far the most important, stems from the scientific and technical research schemes launched in France directly after the war and stepped up at the beginning of the 'sixties. The liquefaction of natural gas (built-in cascade process), for example, comes under this head.

b) foreign origin

More often, however, the technology is of foreign origin and is introduced into France by one of three routes, namely, by subsidiaries of foreign companies, by patents and licences, and by imports of new plant and adaptations thereof.

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The first route does not appear to have played any important part. But the introduction of foreign technology by French firms working under licence has certainly been the most frequent one, and numerous examples can be quoted.

Whilst the extent of such recourse to foreign technology cannot be evaluated exactly, the figures given below are nevertheless significant:

Royalty Figures for the Four Major Industrial Branches  
Manufacturing Equipment for the Energy Industries (1963)  
(in millions of F.Fr.)

|   | Revenue | Expenditure | Principal beneficiary countries |
|---|---------|-------------|---------------------------------|
| Foundries, boilerworks, mechanical engineering and pumps      | 6,344   | 42,245      | USA, Switzerland, Germany, UK   |
| Machine construction and mechanical equipment                 | 13,004  | 47,253      | USA, Switzerland, Germany, UK   |
| Electrical engineering, electronics and precision instruments | 10,424  | 70,303      | USA, Netherlands, Switzerland   |
| Building materials, building and civil engineering            | 3,583   | 9,730       | USA, Switzerland                |

Thus the four industrial branches in question spend five times more than they earn with manufacturing royalties and account for 28% of France's expenditure in this field in 1963.

As for the third route (imports of foreign equipment followed by adaptation with or without improvement), this has been widely used, chiefly in fields which, though scientifically the least complex, demand thorough knowledge of the conditions for use of the equipment.

2. Generating of innovations

Having seen the origins of this technology, we must now consider how it has been incorporated into the products and processes used by the utilities. This latter aspect of innovating activities is particularly interesting because it is the least well known and yet the efficacy

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of an industrial development policy depends on that knowledge. Any country which is not up among the leaders has to resort to foreign technology, but the degree to which this is absorbed varies from one economy to another.

As regards the industries which supply the energy sector in France, up to recent years and even today in certain branches the majority of firms are typically small or medium-sized, with a wide diversity of products but not of activities, a somewhat traditional organization and notoriously weak research resources. In contrast to these firms, the nationalizations that took place after the Second World War brought into being massive concerns, with or without monopoly rights in their respective fields, but endowed with funding and research facilities which give them a very real economic strength.

A study of a few actual cases of innovation reveals that the system of user-maker relations which grew up in France when the big public utilities found there was no industry capable of responding to their constant need for technical and economic progress, has proved effective for a given industrial structure. This effectiveness increased with the utility's ability to bring strong pressures and inducements to bear by virtue of its size, its centralized orders for equipment, and the extent of its research facilities.

A system of this kind, however, carried the seeds of its own limitations within it, and these emerged as soon as the country's own market could no longer provide room for further growth of the energy equipment firms. At that point it becomes obvious that the constructors' difficulties in adapting to this new situation are amplified by the fact that, over and above the restructuring of the production units, they have to cope with the need for transfers of initiative and innovating capacity and for changes in the motivation for innovation.

The three problems are connected, of course, and have to be solved jointly, but it is not certain that the current industrial restructuring is enough to bring about the other two changes quickly, the counter-effect of organizational and social factors being so powerful. This development, indeed, is already shaping, and will do so more sharply in the years ahead, the new role of the public sector in an open economy which nevertheless intends to preserve a certain technical and economic independence.