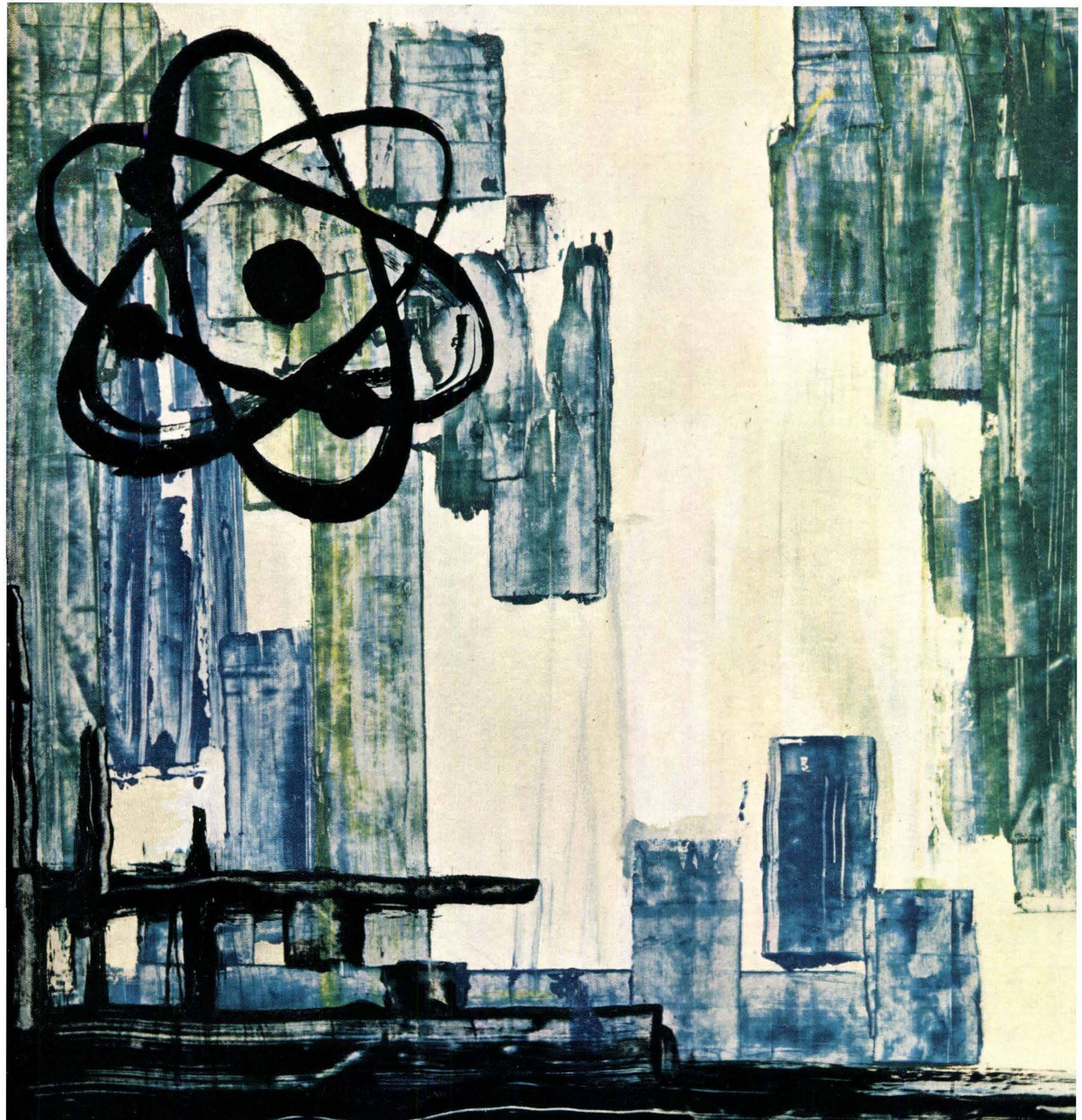
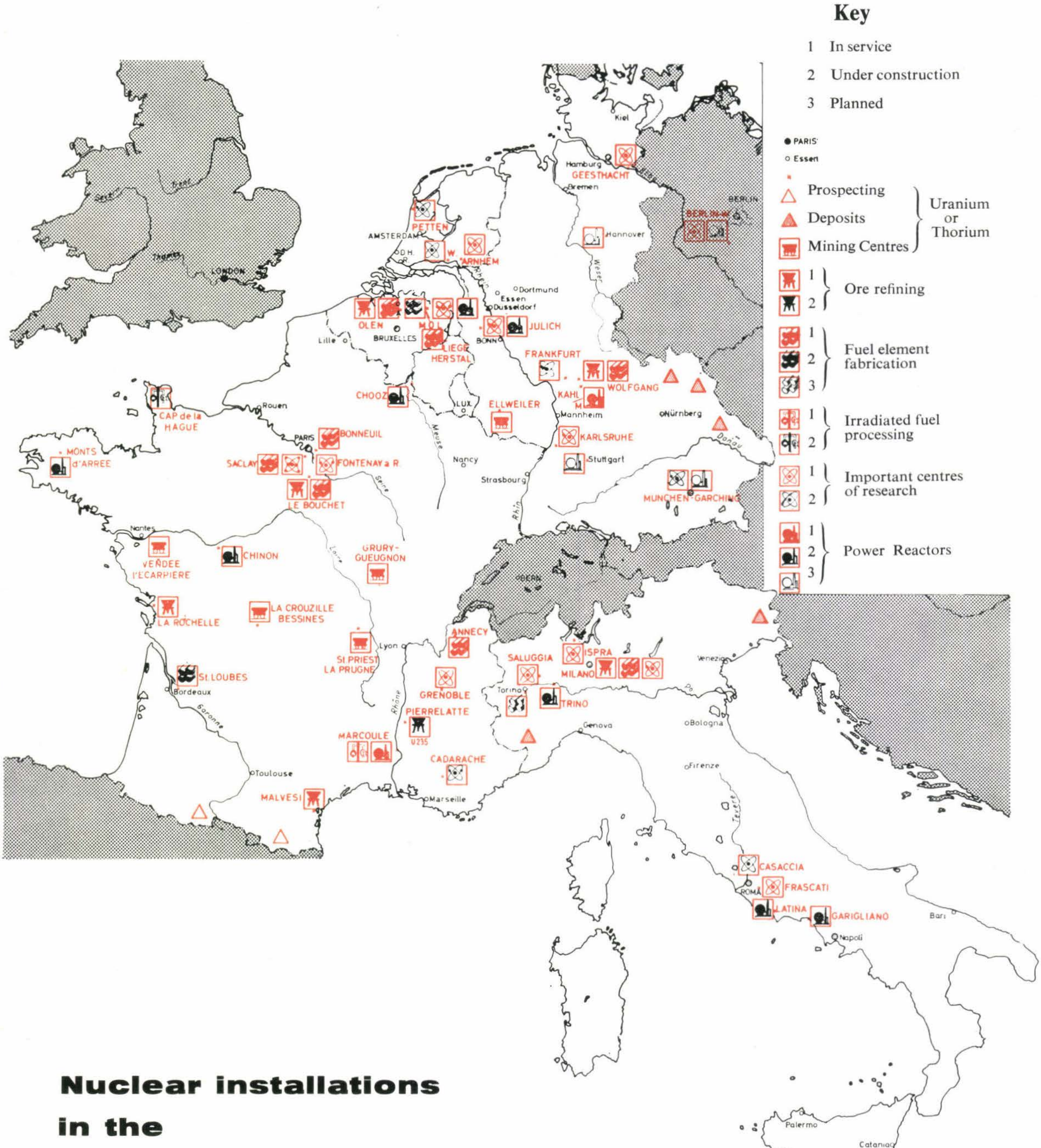


EURATOM

EURATOM

The European Atomic Energy Community

Official Spokesman, Euratom Commission
European Community Press and Information Service



Nuclear installations in the European Community

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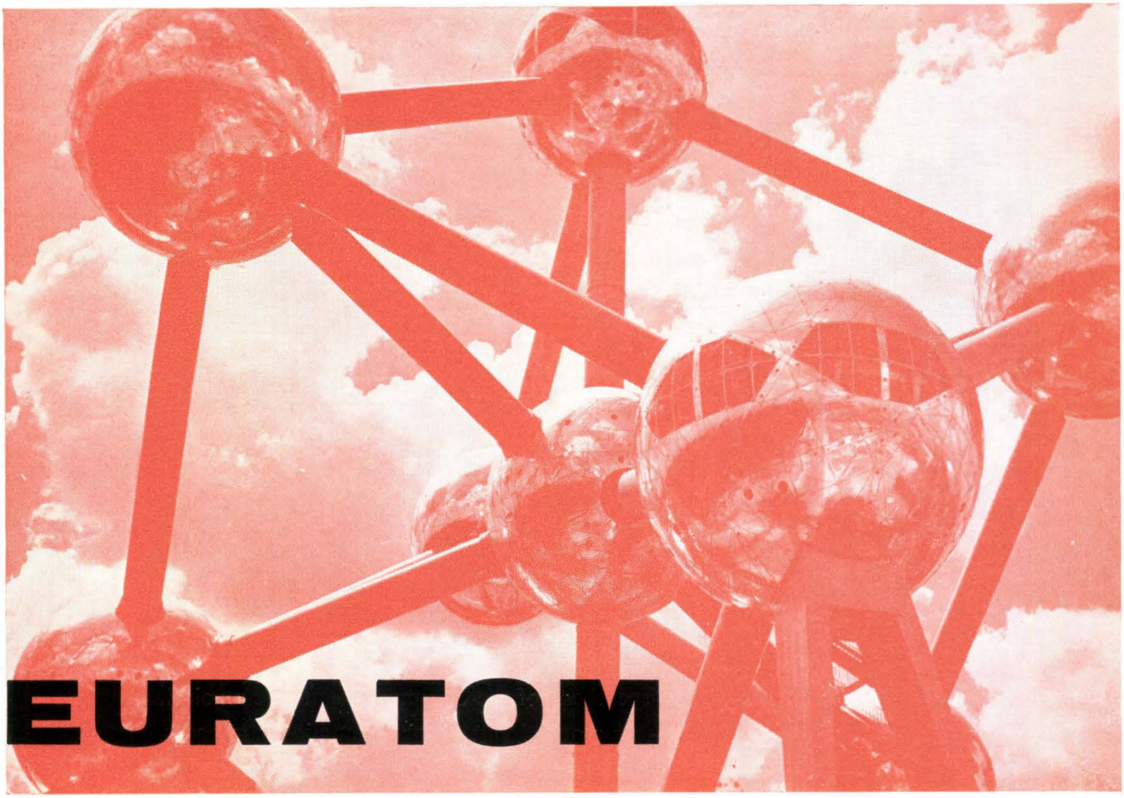
Front cover: Painting by Medard Tijtgat of Bruges



spearhead of the Community's atomic revolution

Photo above: the Atomium, built as the central motif of the Brussels World Exhibition 1958; it now houses a permanent Euratom exhibit

Energy is the key to modern industrial development. Without the energy provided by coal, water-power, oil and natural gas, the wheels of industry would stop turning, our prosperous cities and countryside fall into decay, and living standards shrink to a fraction of present levels. We should be back in the era of man-power and horse-power – provided, not by machines, but by men and horses.

Over the next twenty years, the six countries of the European Community – Belgium, France, Germany, Italy, Luxembourg and the Netherlands – are likely to double their gross national income. The expansion of industrial production will be much greater even than that. Electricity consumption is doubling every ten years so that by 1980 it will be four times the present level.

There is no guarantee that supplies of coal, water-power, oil and natural gas – the conventional sources of energy – will be able to keep pace with this startling expansion in the needs of industry. Present indications are that adequate amounts of conventional energy could be found to meet these mounting needs, but only by increasing the Community's dependence on foreign supplies and placing a tremendous burden on the Community's import bill.

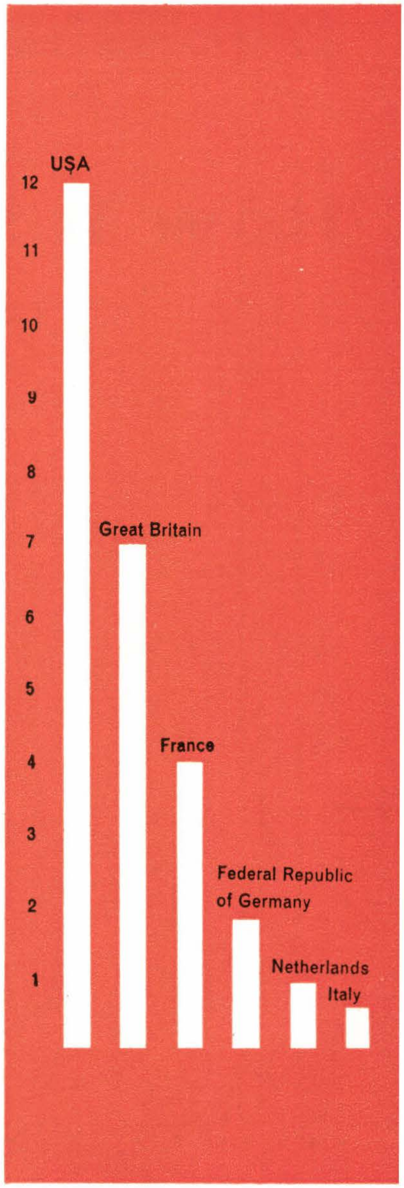
A revolutionary new source of energy has been discovered. Atomic energy – the result of half-a-century of patient research into the very core of matter by European and American scientists – offers mankind tremendous new possibilities. So far its main potential lies in the production of **electricity.** But atomic energy is still in its initial stages.

The United States, which in 1958 produced more than three times as much electricity as the Community, and Russia, which produced roughly the same amount as the Community, are both spending many thousands of millions of dollars to achieve economic production of nuclear electricity. Britain is straining her resources for the same purpose.

The countries of Western Europe could not be left behind in this second industrial revolution which atomic power will bring. The essential task was to unite their resources in an all-out effort.

Just as the Common Market is an attempt to spur rapid economic growth and industrial strength, in an age of continental economic powers, so Euratom – the European Atomic Energy Community – represents an effort to guide the Community forward surely and confidently into the atomic age. For the Community's 170 million inhabitants, Euratom will help fashion the new industrial revolution.

Expenditure on nuclear power per head of population, 1959 (in $)



Signature of the Common Market and Euratom Treaties in the Hall of the Conservators on the Capitoline Hill, Rome, March 25, 1957.

How it started

1950

Euratom is one of the three pillars of the movement towards Western European unity that began with the Schuman declaration of May 9, 1950. On that date Robert Schuman, then French Foreign Minister, proposed that the coal and steel industries of France and Germany and other Western European countries be placed under a common High Authority to which the governments would transfer sovereign powers. On April 18, 1951, the six countries signed a Treaty setting up the European Coal and Steel Community (ECSC). The first step towards European economic and political unity had been taken.

1957

Six years later, on March 25, 1957, the same six countries signed the Rome Treaties establishing the European Economic Community (the Common Market) and the European Atomic Energy Community (Euratom). The treaties came into force on January 1, 1958.

1962

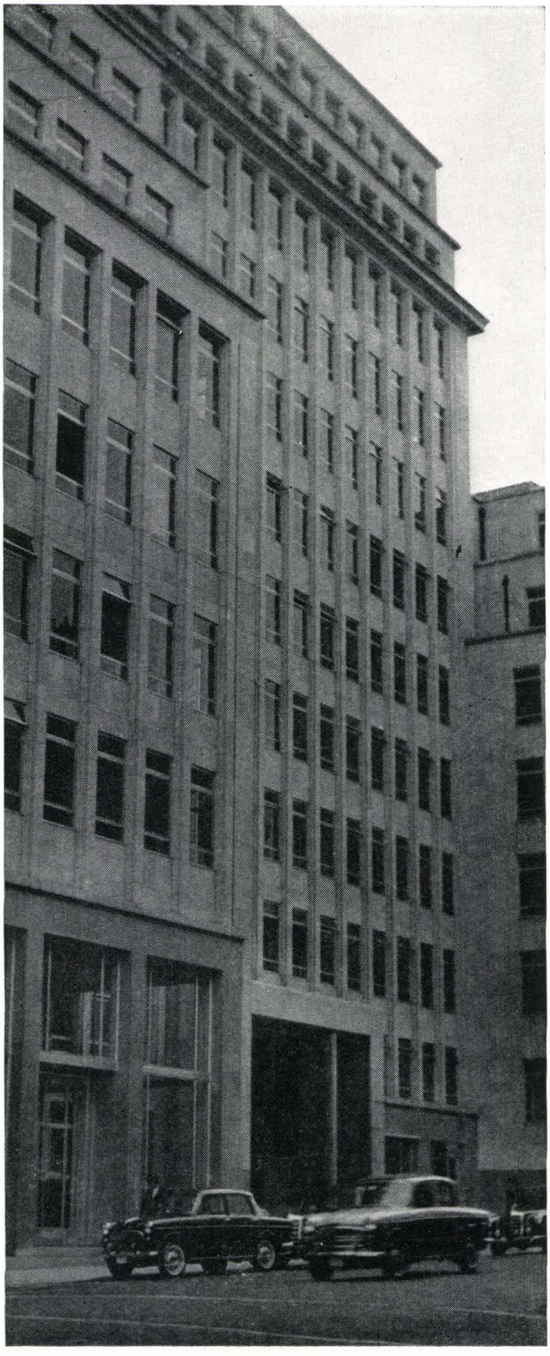
Together, Euratom, the ECSC and the Common Market are now establishing, through common institutions, a vast home market for all industrial and agricultural products, and common economic policies.

Their aims are twofold:

to put the Community on the same economic footing for expansion and low-cost production as the USA and the USSR;

to achieve full unity, so that the European countries may again play a full part in world affairs and, in particular, in aiding the less-favoured countries of the world in their economic development.

Why a combined effort is needed



Recent forecasts indicate that, by 1980, one-quarter of the Community's electricity needs – an amount roughly equal to the Community's **total** electricity consumption at present – will have to be supplied by nuclear power stations.

Even the larger Community countries could only with enormous difficulty provide the financial and technical resources sufficient to build a nuclear industry of this size. For the smaller countries, going it alone is impossible. And for all countries, both large and small, atomic power makes frontiers out of date.

Uncoordinated individual research and development programs are wasteful because, among other things:

nuclear investment demands an effort surpassing national financial resources;

trained scientists and technicians are too few to permit wasteful organization;

health and safety rules must be uniform and unexceptionable in an area as small as Western Europe.

Unlike the ECSC and the Common Market, which have had to start by breaking down long-established barriers between the member states, Euratom has had few existing barriers to demolish. Instead of welding together six existing industries, Euratom must spur the development of **a new atomic industry for the united Europe of the future.**

Headquarters of the Euratom Commission, rue Belliard, Brussels.

The task - an atomic industry for 170 million Europeans

' It shall be the aim of the Community to contribute to the raising of the standard of living in member states and to the development of commercial exchanges with other countries by the creation of conditions necessary for the speedy establishment and growth of nuclear industries ' (Article I of the Euratom Treaty)

The European nuclear industry which Euratom is called on to bring into being must, in addition, be concerned **solely** with the peaceful uses of atomic energy, under the terms of the Treaty.

In 1958, although a number of research reactors and other installations were already in existence in the other countries, France was the only country which had developed nuclear power to any extent. Euratom must ensure that the Community as a whole gets the nuclear power which will be required on an increasingly large scale from the end of the present decade.

EDF 2 at Chinon – a nuclear power station which will deliver power to the French electricity network.

Building a nuclear industry

Euratom must

facilitate investment in nuclear power production and ensure, particularly by encouraging individual enterprises, the construction of the key installations needed;

encourage secondary utilizations of atomic energy, such as the exploitation of radioisotopes and radioelements, which have a vital and growing rôle to play in agriculture, medicine and industry.

Research for high efficiency, low costs

Euratom must develop **research** and assure the widest possible **dissemination of technical knowledge.** The primary aim of research is to enable nuclear energy to be produced as cheaply as possible. The Community therefore needs experience of a number of different reactor systems; Euratom must broaden this experience, both through research within the Community and through cooperation with other countries and with international organizations.

Supply and control of ores, fissile materials

Euratom takes over the rôle of governments or national authorities as regards **supplies.** It must see that all consumers in the Community are regularly and equitably supplied with **ores** and **fissile materials.** Over **special fissile materials** it exercises **full rights of ownership.** And it must exercise appropriate **controls** to prevent nuclear materials from being diverted from **their declared purposes.**

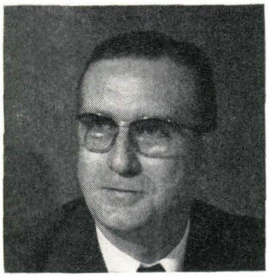
A nuclear common market

Euratom must ensure that national barriers do not impede the development of a Community atomic industry. It has therefore established a **common market** for nuclear materials and equipment and must ensure the **free circulation of capital** for atomic investment and **freedom for technicians to work** anywhere in the Community.

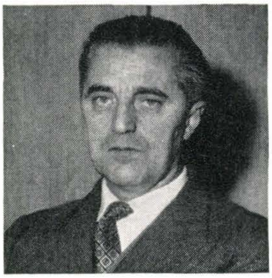
For health protection and safety

A nuclear industry could be a threat to public health if not kept under stringent control. Euratom must therefore ensure that the **basic standards for health protection and safety,** which it has drawn up, are applied by the member states.

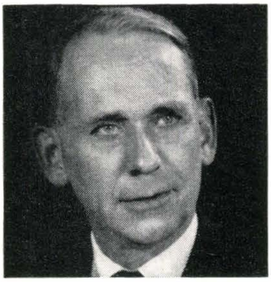
How Euratom works



Commission President
Pierre Chatenet (French)



Commission Vice-President
Prof. Enrico Medi (Italian)



Commissioner
Paul-Hubert de Groote
(Belgian)

Commissioner
Heinz Krekeler (German)

Commissioner
Emanuel Sassen (Dutch)

The Commission

The Euratom Commission is the executive body responsible for carrying out the Euratom Treaty. It is the mainspring of the Community, preparing proposals on which the Council of Ministers takes decisions, keeping a day-to-day watch on all aspects of the Community's work and planning its future development. The Commission consists of five members, independent of national governments and sectional interests; it takes its decisions by majority vote in the interest of the Community as a whole, and is answerable to the European Parliament. It has close links with the Executives of the other two Communities and cooperates closely with them in much of its day-to-day work.

The five members of the Commission are:
President: Pierre Chatenet (French)
Vice-President: Prof. Enrico Medi (Italian)
Members: Paul-Hubert de Groote (Belgian)
Heinz Krekeler (German)
Emanuel M. J. A. Sassen (Dutch)

The Council of Ministers

The Council ensures co-ordination between national policies and the policy of the Community. It is the only Community institution whose members are representatives of national governments; a member of each government attends its meetings. It is usually the Council that takes the final decisions, but it can only do so on proposals from the Commission, and the latter's proposals can only be modified by unanimous vote. Most Council decisions are taken in unanimity, but in some cases a weighted majority vote is employed.

Consultative bodies

In addition, Euratom's work is aided by:

The Scientific and Technical Committee of 20 experts (scientists and leaders of the atomic industry),which advises the Commission on scientific and technical problems.

The Economic and Social Committee of 101 members, representing all sides of the Community's economic and social life: producers, consumers, business interests, workers and the professions. One section specializes in nuclear problems. This Committee serves both Euratom and the Common Market and acts as a consultative body for the Commissions and the Councils.

The Consultative Committee for Research, which has been set up by the Council to bring together national experts and members of the Commission to discuss the Community research program. It meets under the chairmanship of the Commission's President.

The Commission must report annually to the Parliament, which can remove it from office on a vote of censure, passed by a two-thirds majority. The Parliament must be consulted before certain specific decisions are taken and it has the right to scrutinize Euratom's budget. It meets in plenary session at frequent intervals and maintains thirteen standing committees.

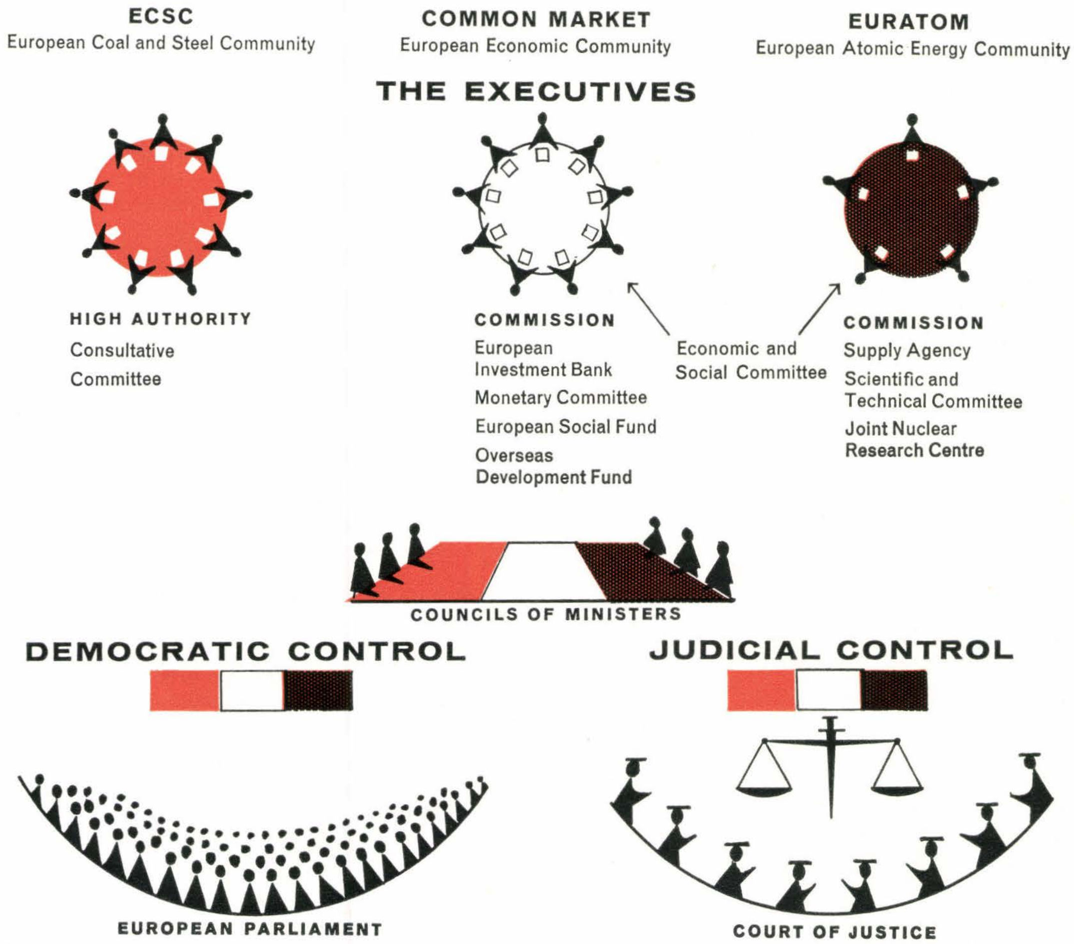
The European Parliament

The 142-member Community Parliament, which at present meets in Strasbourg, exercises democratic control over Euratom, the ECSC and the Common Market. Its members are at present appointed by and from the parliaments of member countries, but plans for direct elections are under discussion. The members sit in the Chamber in three political groups (Christian Democrat, Socialist and Liberal).

The Court of Justice

The Court of Justice, the guardian of the Treaties, ensures the 'observance of law and justice in the interpretation and application' of the Community Treaties. Its seven judges, who sit in Luxembourg, have sole power to uphold or annul decisions of the Executives. Their judgments are binding on all parties, including individuals, firms, national governments and the Executives themselves.

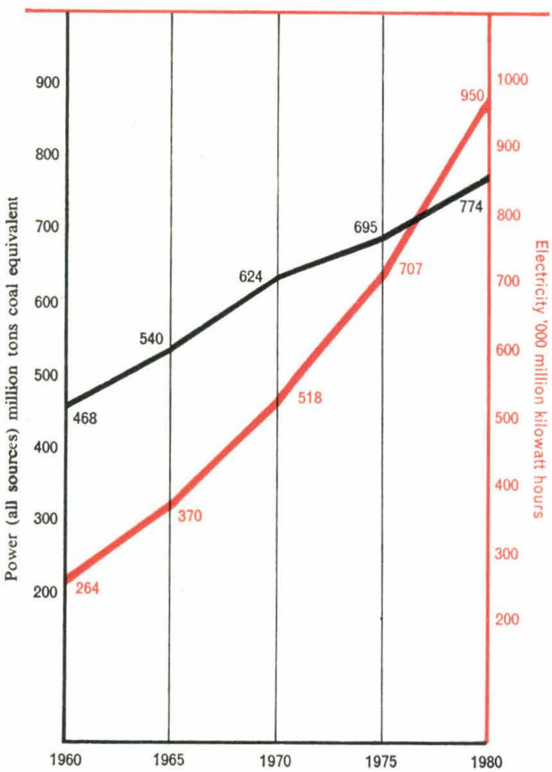
Community Institutions



How much nuclear power?

Today there seems to be too much power. Stocks of coal at pitheads are high and new deposits of oil and natural gas are being discovered all over the world. But today's plentiful supplies should not obscure the great increase in demand likely to occur over the next twenty years.

Rising energy needs



In the Community, total industrial production has been rising at the phenomenal average rate of about $8\frac{1}{2}\%$ a year in the fifties: using as a basis of calculation the conservative assumption that it will rise by 5% a year in the sixties and 4% in the seventies, the three Communities' Working Group on Energy has forecast a substantial expansion in the Community's power needs over the next 20 years (see graph on this page).

Rising power needs

In the expansion in energy requirements, electricity will play a predominant part. The graph shows that, while total power requirements are expected to rise by about two-thirds in 20 years, electricity needs will expand much more rapidly: nearly four times as much will be needed in 1980 as in 1960. The great energy problem of the next twenty years is to decide how to meet these rapidly rising needs, and, above all, which source of energy – coal, oil, natural gas, or water power – to use.

Coal will certainly retain an important share, but pit closures and high stocks are ample evidence that the amount of coal which can be produced at economic, competitive prices is falling rather than rising, and the share of oil in industry's total power supply is constantly increasing. The amount of water power available is strictly limited.

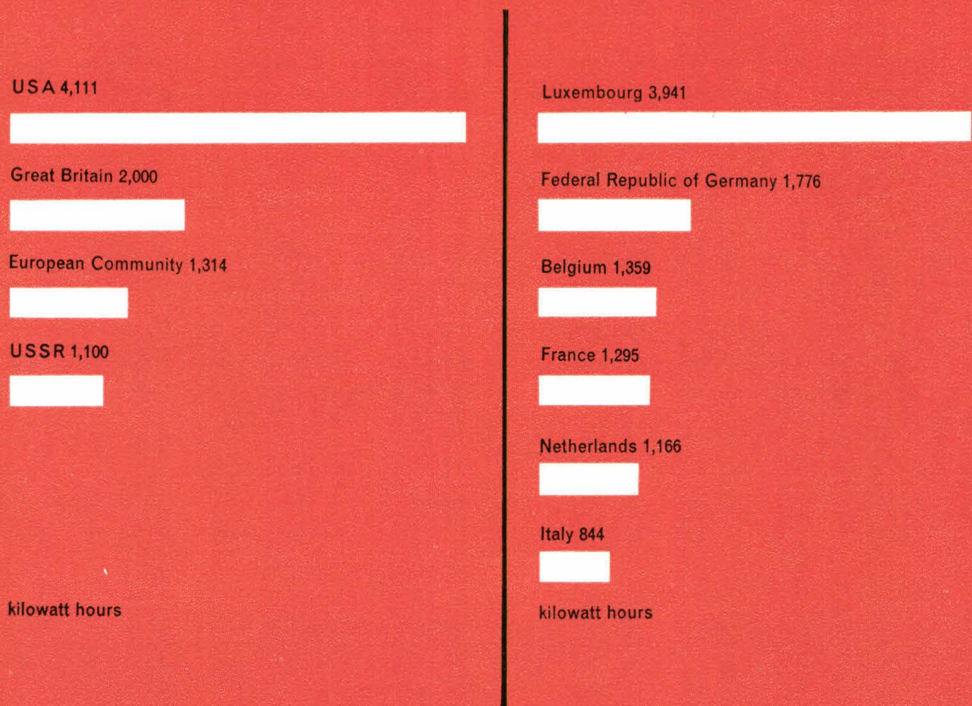
One way out would be to meet increased needs by oil and natural gas. The great disadvantage of such a solution is that Community sources of these forms of energy are strictly limited; by far the greater part of her oil needs is supplied by imports.

Cost of energy imports

Already, at present, 27% of **all** energy consumed is imported, at a total annual cost of well over $2,000 million. By 1980, **without nuclear power,** the proportion of imports would reach 50%. **Unless nuclear power can be produced cheaply enough, the Community would risk a trebling of its fuel import bill.**

Everything will therefore depend on the cost of nuclear power. Euratom's provisional forecast is that until 1965 nuclear power will cost 20–30% more than power produced from conventional plants, that between 1965 and 1970 it will be roughly on a par, and

Electricity consumption per head of population, 1959



that from 1970 onwards it will be cheaper. But it is possible that the extensive reactor research programs now under way will discover satisfactory, low-cost reactors which will be competitive as power producers even before 1970.

A tentative timetable for nuclear power

Euratom's policy for the present is not to undertake a large-scale nuclear power-station program, as conventional fuel sources are more than adequate. Instead, a very limited number of full-size power-stations and of 'pilot' plants of a number of different types are being built.* By 1965, total capacity should be about 2,000 megawatts (mW) – equal to about ten middle-sized power-stations. But by 1980, nuclear power capacity will have to be 40,000 mW† – twenty times as much – if expected power needs are to be met.

* About 1500 mW of capacity had been authorized or was under construction in June 1962.

† 1 megawatt (mW) = 1000 kilowatts (kW)
1 kilowatt (kW) = 1000 watts.

Theoretically 1 mW of power capacity will produce 1 (megawatt) × 24 (hours) × 365 (days) = 8,760 megawatt-hours (mWh) a year. In practical calculations, the degree of utilization of this theoretical capacity – the load factor – is taken generally as 80%. Therefore, 40,000 mW of capacity will produce 40,000 × 80/100 × 8,760 = 280,320,000 megawatt-hours (mWh) per year.

The production of nuclear power

The production of nuclear electricity is theoretically a very simple process. An atomic reactor produces heat from the controlled disintegration of its fuel: it is the equivalent of a conventional furnace, but with coal or gas replaced by uranium in varying degrees of enrichment. The heat produced has to be harnessed to the operation of a turbine which in turn produces electricity or, to take another example, operates the propeller of a ship.

But many practical difficulties must be overcome; reactors, machinery and materials must be tested and proved and technicians and experts trained. Euratom's task is not to build power-stations; this is the job of private or public organizations. Euratom's rôle is to encourage and help them to do so:

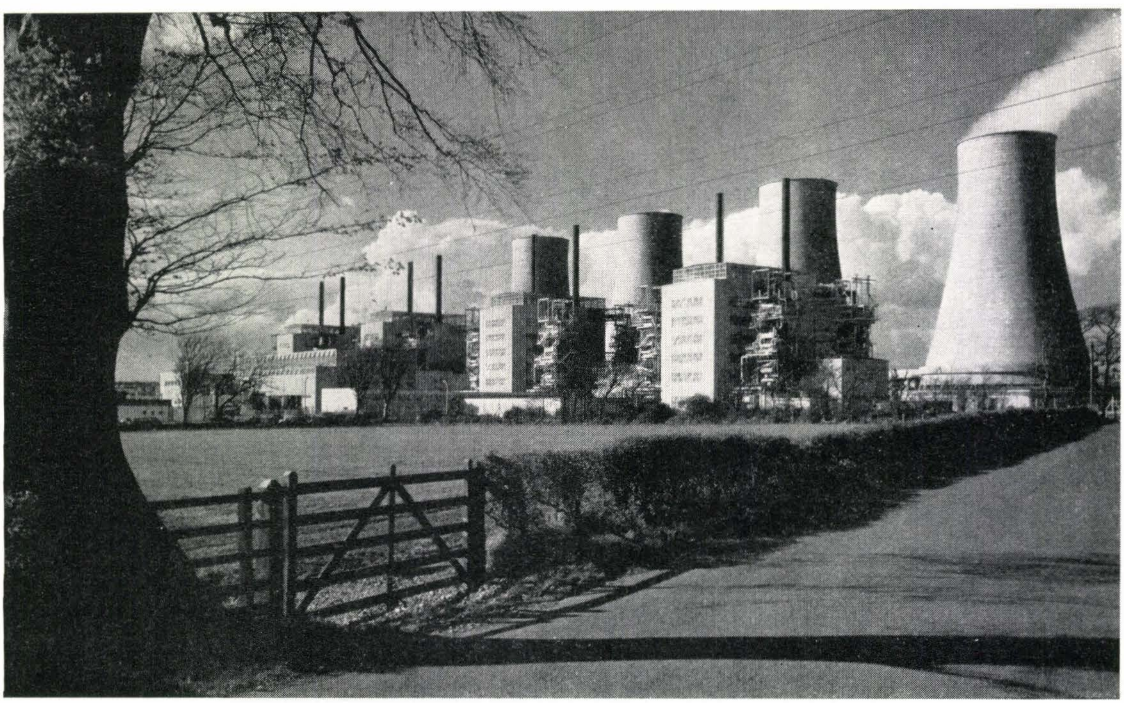
by contributing to the knowledge of power reactor technology;

by providing investment aid and otherwise assisting in the construction of nuclear power-stations;

by publishing periodically programs showing production targets for nuclear energy and the types of investment required in order to meet them.

For the latter purpose, firms and other bodies must keep Euratom informed of their investment plans in all sections of the industry.

Chapel Cross atomic power station (UK AEA)



Progress so far

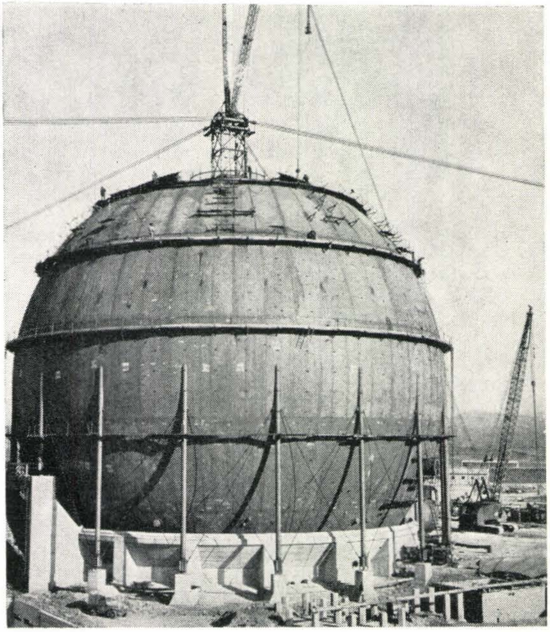
One of Euratom's contributions to power-station construction so far is the conclusion of the **US-Euratom Agreement** in November 1958. This provides for a joint $350-million program for nuclear power stations in the Community equipped with reactors developed in the USA. Of the total, $135 million can be provided in the form of long-term loans from the US government, to be re-loaned to enterprises; the rest being raised by enterprises themselves.

So far, work is under way on two firm projects which together provide around 400 mW of generating capacity. One of them is the SENN project for a 150-mW plant to be built on the Garigliano river, 40 miles north of Naples, Italy.

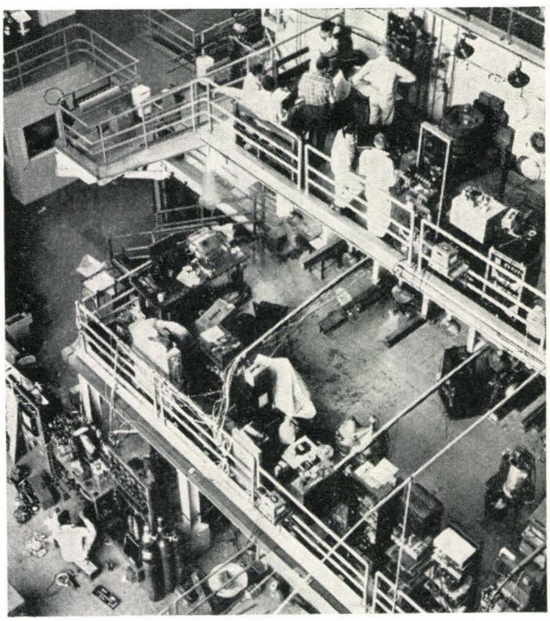
The second is the SENA project for a 242-mW plant to be built by Electricité de France and the Belgian Centre-Sud Group at Chooz, near Givet, on the Franco-Belgian frontier. The latter will be Euratom's first Joint Enterprise: because of its importance to the Community, it will benefit from substantial taxation and investment aids. Other power projects are also under consideration for this program.

Building for the future

Power production is not the immediate priority, however. Euratom is building for the future. More experience is needed of the performance of power reactors – at present only two or three basic types are being installed. Euratom's research program aims to put the technology of nuclear power production on a firmer footing. Prototype power reactors are therefore the corner-stone of Euratom's research program and of its cooperation with other countries.



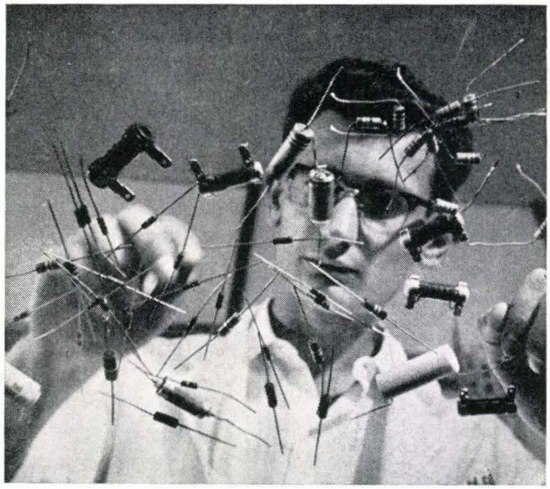
Top: The Senn project: the 150-mW power reactor under construction on the Garigliano river north of Naples.



Bottom: Inside a power reactor.

Euratom research program goes ahead

Although scientists from the Euratom countries made many of the basic discoveries which introduced nuclear power, the Euratom countries lag behind the USA, the USSR and Great Britain in its development. Now the Community must make up for lost time. It must speed up and co-ordinate research, and intensify the training of the scientists and technicians who will be needed for the atomic industry of the seventies. For this task, the foundations must be laid now.



Researcher in the electronics laboratory,
Ispra establishment of the Joint Research Centre.

Three-pronged attack

Research in the Community is being undertaken in three different ways:

by public and private concerns in member countries: Euratom does not issue directives to them – it encourages them to avoid duplication of effort, awards contracts for specific tasks, or carries out research jointly with them;

by Euratom's own joint research centre (four establishments) which supplement their work by undertaking research not being performed by national centres or industry. Out of Euratom's $215-million research budget for the period 1958 – 1963, up to a third is being devoted to the joint research centre;

by joint research with non-member countries: directly with individual countries, as with the USA, UK and Canada; or through organizations such as the European Nuclear Energy Agency (ENEA).

The scope of the programs

Nuclear power

Fuelling and performance are the central targets in Euratom's efforts to find the cheapest and most efficient power reactors.

The main fields covered by Euratom research projects are:

Fuel: natural uranium, from which the fissile uranium 235 is extracted, is the basic source of fuel, but the much more plentiful thorium, from which the fissile uranium 233 is produced, is a potential alternative source.

Moderators: these materials are used to slow down the fast neutrons released in nuclear fission. Heavy water, graphite and the expensive metal beryllium are three moderators on which research is taking place.

Coolants: a wide range of substances, including air, gas, water, organic liquids and liquid metals are being used as cooling agents.

Reactor design and operation: including the physiochemistry of reactors (for example, studies of the effects of heat and irradiation on the materials used in construction); the control of reactor operation; and the study of nuclear reactions.

Power production: comparative and theoretical studies of the merits of different species of reactor.

Radioactive materials: including the chemistry and metallurgy of plutonium and the extraction and chemistry of other transuranium elements (elements produced by artificial means, and having a greater atomic weight than uranium).

Isotopes and radiation

Euratom's research program is also concerned with the large and increasing number of applications for radioactive isotopes in agriculture, industry and medicine; studies of the harmful effects of radiation on the living body; and the improvement of reactor and laboratory equipment.

In quest of economic reactors

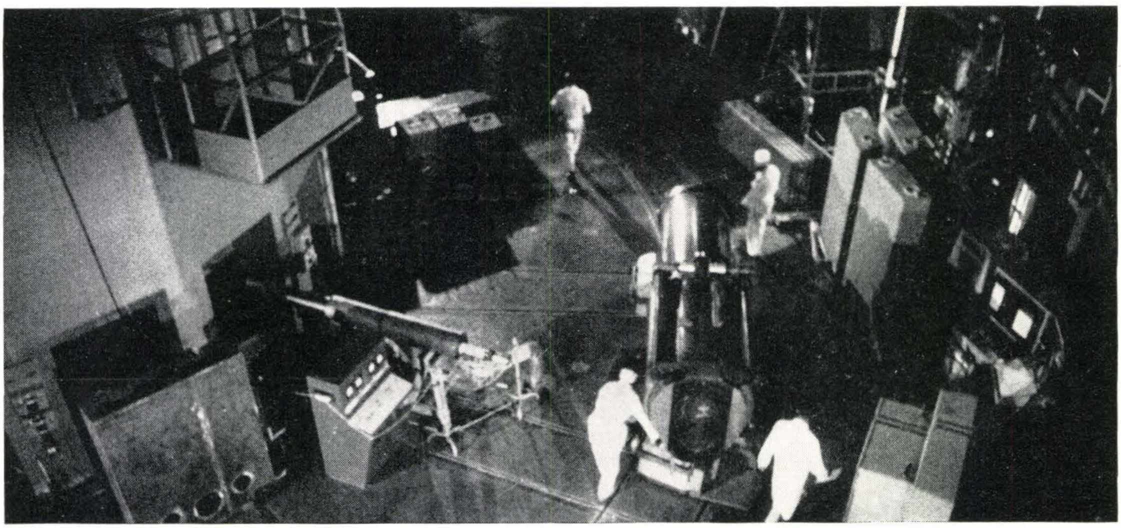
Only two or three basic reactor types are as yet being installed in the Community. This is an inadequate basis for the large-scale nuclear industry of the future and Euratom seeks to expand it through its research program. Here are some of the projects on which Euratom is conducting research for future power plants.

Orgel: an experiment in heavy-water reactors

The Orgel* project at the Ispra centre is intended to supplement the Community's knowledge in the promising field of heavy-water reactors. So far, France has three heavy-water research reactors and is planning to construct a 100-mW gas-cooled power reactor, moderated with heavy water, and fuelled with natural uranium. Germany may also build a heavy-water reactor.

Orgel will go one step further: with natural uranium fuel and heavy water as moderator, the coolant will be an organic liquid. The research for this project will provide the Community with the technical knowledge necessary for the construction of large-scale power reactors functioning on this system. The information obtained from Orgel will also form Euratom's contribution to the Canada-Euratom research agreement; the Canadians contribute information from their own experience with heavy-water reactors.

* Orgel — Reactor cooled by organic liquid and moderated by heavy water.



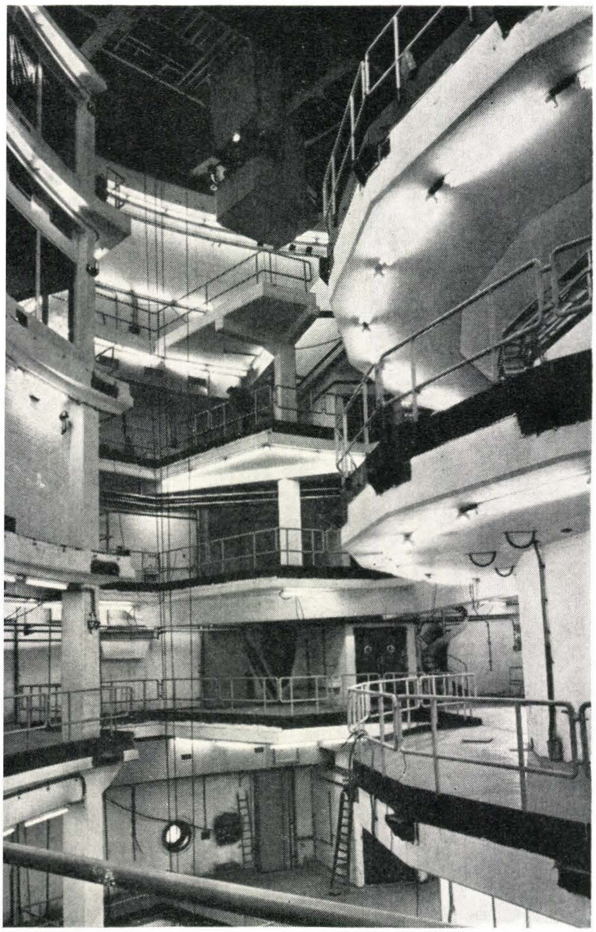
Interior of EL3 research reactor, Saclay, France.

RESEARCH

Contracts with member states

250 research contracts

Much of Euratom's research work is being carried out under contracts with national research centres or public or private industrial undertakings. Altogether 250 contracts have so far been signed. Twelve of them are association contracts for which the two parties contribute staff to joint research teams and funds for a budget administered by a joint steering committee. Altogether, Euratom is spending around 60% of the $215-million 1958–62 budget on work under contract – work which gives a valuable stimulus to the Community's developing nuclear industry. The following three pages give some examples of this work.



BR2: powerful materials-testing reactor

Euratom has concluded a twenty-year contract of association with the Mol Centre in Northern Belgium. Under an agreement with the Belgian Government approved by the Council of Ministers in July, 1960, Euratom is sharing in the operation of this Centre's high-flux materials-testing reactor BR2. This 50-mW reactor possesses the highest neutron flux of any reactor in Europe and is one of the most powerful in the world; it is also one of the most flexible in that a large number of experiments can take place simultaneously or can be started or ended without interfering with each other. BR2 is an invaluable asset for the testing of materials, particularly those used in the construction of power reactors. The 46 Euratom researchers at present working on BR2 will eventually be increased to 70.

Fast reactors

Fast 'breeder' reactors, which produce as much fuel as they burn and possibly can produce more. This type of reactor, one example of which has already been built at Dounreay, Scotland, holds great promise as a 'new generation' of reactors to come into operation towards the end of the decade. Euratom participates in fast-reactor research under an exacting program of association contracts, including one for the joint study, construction and operation of the 'Rapsodie' reactor at the French Cadarache centre.

Dutch KEMA (SUSPOP) reactors

Euratom is participating in work on a 250-kW homogeneous suspension reactor (SUSPOP) for which it signed a three-year agreement in July, 1959, with the Netherlands firm KEMA.

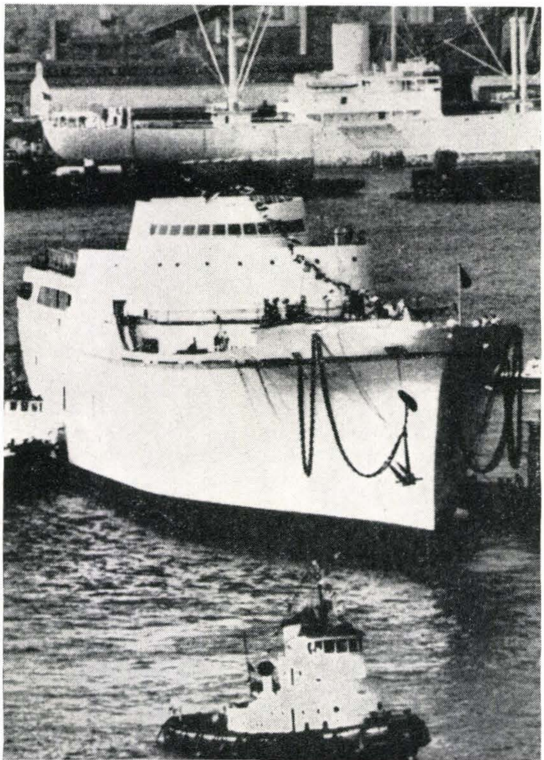
BR2: interior of reactor building

Atomic ships

Atomic energy can also be used for propelling ships. It is not yet economic, however, to do so and Euratom is therefore participating in the development of reactors specially designed for ship propulsion. The Commission has signed four association contracts with research groups: two in Germany and one each in Italy and Holland, with Euratom contributing research staff and a substantial part of the study costs.

One project is for an organic-moderated organic liquid-cooled reactor for a 15,000-ton merchant ship, in which Euratom is working in partnership with German shipbuilding and nuclear groupings; another is a draft design for a nuclear-powered tanker in which the partners are two Italian companies; the third is the Dutch RCN's design study for an advanced pressurized water reactor for a merchant ship; and the fourth for general research into nuclear ship propulsion problems at the German Geesthacht Centre. Euratom has set up a Nuclear Marine Coordinating Committee, consisting of representatives from the projects, the governments and Euratom, to prevent unnecessary duplication of work.

The world's first nuclear-propelled cargo ship, USS Savannah.



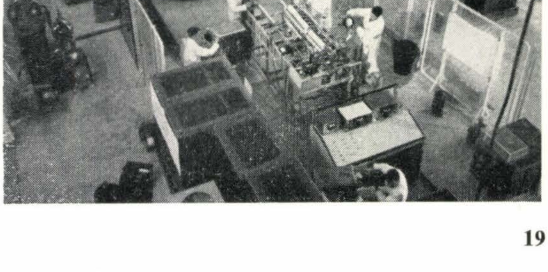
Fusion

So, far, the use of **thermonuclear** power – the power generated when atoms fuse, as compared with **nuclear** reactions in which they split up – has been limited to the H-bomb. The possibilities of harnessing its enormous potential for peaceful purposes are now being studied in all the leading atomic countries, though there is still a long way to go before a thermonuclear power station can be built. A major handicap is that fusion can only take place when the ionized gas (known as plasma) is heated to a temperature of tens of millions of degrees Centigrade.

Euratom is working on the peaceful application of fusion and has signed a research agreement for work in association with the French Atomic Energy Commissiariat (CEA). A second agreement was signed in March, 1961 with the German Institut für Physik und Astrophysik of Munich with which the Max-Planck Institute is associated.

The CEA contract was signed in July, 1959, initially for a three-year period, and covers an expenditure of $9 million, of which $6 million will be contributed by Euratom. The research is taking place at the Fontenay-aux-Roses centre, 15 miles from Paris, and altogether 70 specialists – 30 from Euratom – are working here in a joint CEA-Euratom team. Additional work is being performed under a subcontract with the Italian Comitato Nazionale per l'Energia Nucleare (CNEN) centre at Frascati.

Fusion laboratory at Fontenay, France.



RESEARCH

International research projects

Euratom's technological progress depends to a large extent on the experience which can be gained outside the Community, either through joint projects with the other member countries of the European Nuclear Energy Agency (ENEA), or through bilateral agreements with third countries.

Halden

The Halden reactor was built for the Norwegian Atomic Energy Institute and went critical* in June, 1959. Under a three-year research agreement (which has since been prolonged for eighteen months) the operation of the reactor has been taken over by the ENEA countries.
Euratom's share involves an outlay of $1.6 million.

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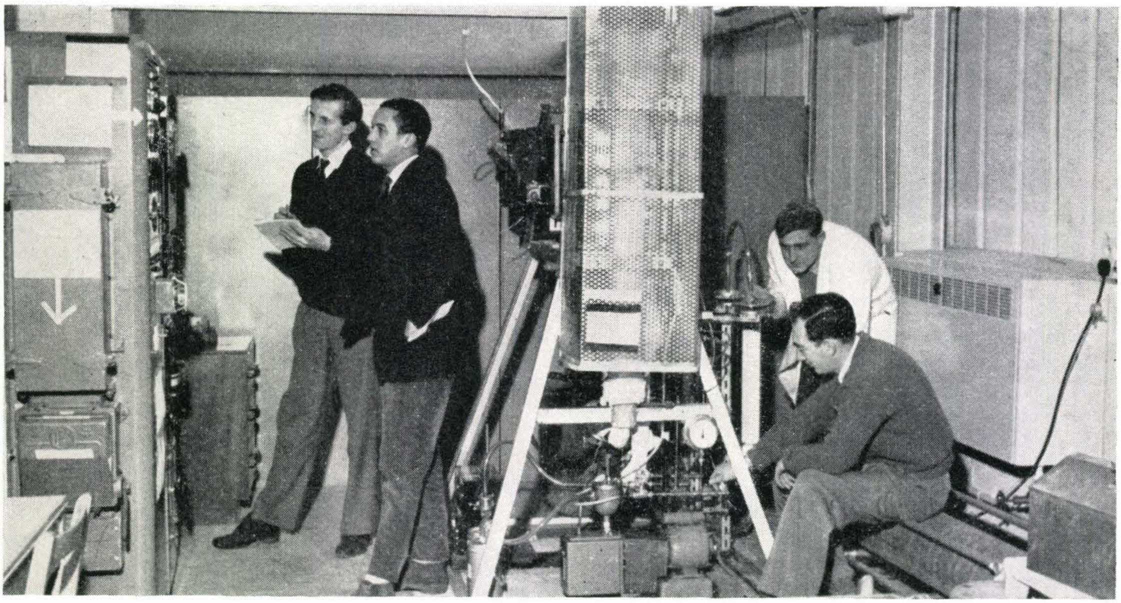
* the start of a chain reaction (fission)

This reactor should serve as a prototype for the study of problems raised by the operations of boiling-water power reactors.

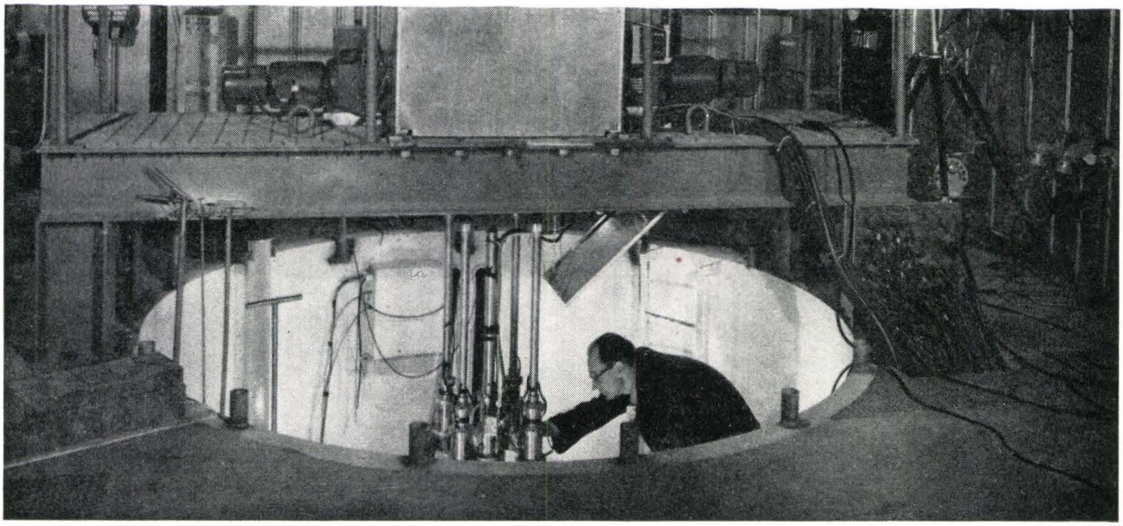
Dragon

Through the ENEA the OEEC countries are also working on the British-designed high-temperature gas-cooled reactor (HTGR) 'Dragon' at Winfrith Heath, Dorset (where a zero-energy HTGR has already been built). Thirty of the 250 or so scientists employed for the preliminary work on 'Dragon', which is expected to be completed in 1963, are from Euratom. The importance of 'Dragon' is that a reactor operating at a high temperature (around 750°C gas exit), compares with around 350°C for existing reactors, may well give a greater energy yield and so reduce power costs.
Euratom and the UK are each contributing 43.4% of the total expenditure of $28 million for the initial five-year period of the agreement.



Euratom and British technicians at work on the Dragon project.

Bilateral agreements



An American boiling-water reactor – nuclear power station under construction at Dresden, United States.

Euratom - US

An agreement signed on November 8, 1958, envisaged, in addition to the power-station program (see page 15), a \$100-million joint research and development program over a ten-year period, each side contributing \$50 million. Research projects are invited from Community and American firms, and a Joint Board has been set up to evaluate them. By end 1961, around 400 such projects had been put before the Board and 67 of them approved, covering an outlay of \$17.5 million. Among the fields covered by the proposals are the improvement of boiling-water reactors (improvements in reactor fuel, and heat-transfer studies) and the recycling of plutonium.

The real significance of the agreement lies in the fact that many of the results of American atomic discovery and experience are now available to Euratom – and vice-versa.

Euratom - UK

This agreement, signed on February 4, 1959, also covers the exchange of information and training facilities and sets up joint committees. Euratom can thus benefit from British experience.

Among the subjects of joint study or exchanges of information have been fast breeder reactors, fusion, health and safety problems and reactor physics. The two sides have exchanged personnel: for instance Euratom scientists have been working at Harwell and British scientists have participated in the start-up work of the BR2 reactor at Mol. The UK has also supplied small quantities of fissile materials for Community research projects.

Euratom - Canada

Agreements signed on October 6, 1959, cover joint research on the natural uranium, heavy-water moderated reactors of which the Canadians have wide experience. They provide for a 5-year joint research and development program, with each side contributing up to \$5 million, a joint advisory committee, and the exchanges of information.

Euratom - Brazil

This agreement, signed on June 9, 1961, provides for cooperation over a wide field of activities, including the exchange of research information and the improvement of prospection techniques for nuclear raw materials.

Joint research in Euratom centres

Euratom's Joint Research Centre, with its four establishments, is the main instrument in the Community's drive to co-ordinate and supplement national research, on the one hand, and, on the other, to put the fruits of all Community research at the disposal of all who wish to exploit it.

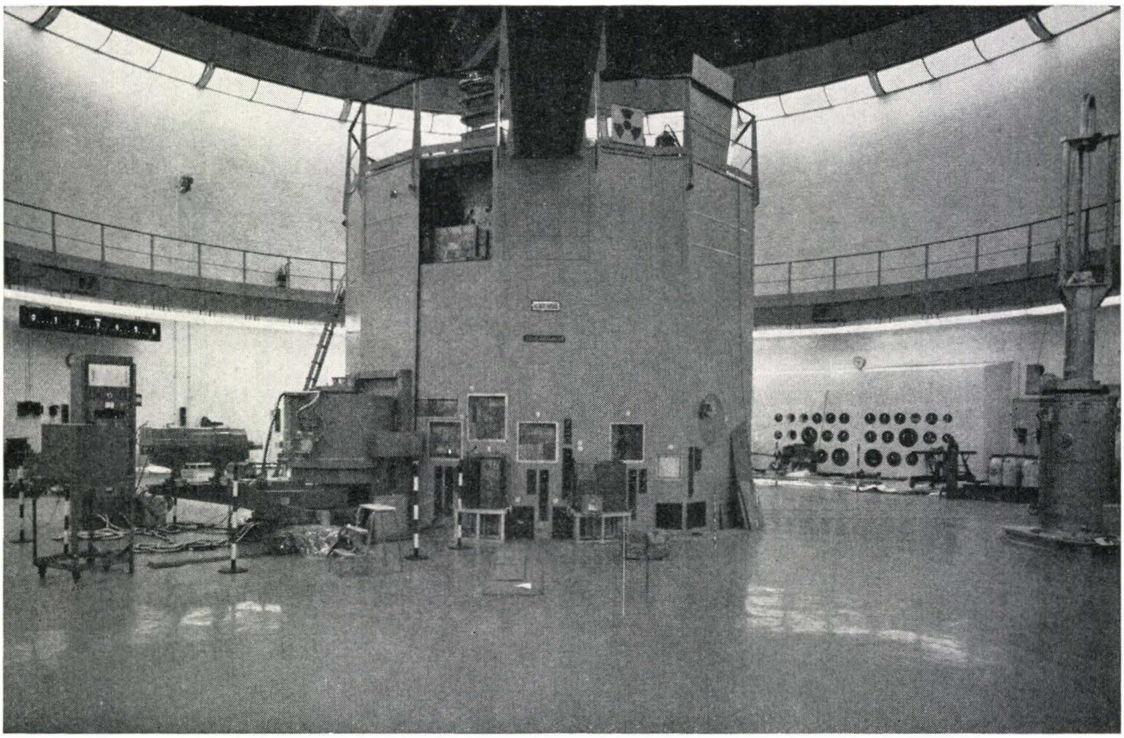
The Joint Research Centre Ispra, Italy

An agreement signed between the Italian government and Euratom on July 22, 1959, and ratified a year later, passed control of the Italian Nuclear Research Centre at Ispra by stages to Euratom. The Ispra Joint Research Centre, 25 miles north of Milan on Lake Maggiore, is equipped with a 5-mW heavy-water cooled and moderated reactor using 20% enriched uranium fuel. For 2½ years its operation will be shared equally by the Italian authorities and Euratom; subsequently it will be entirely at the disposal of Euratom.

By the end of March, 1962, there were 1,100 Euratom staff at the Joint Research Centre; by the end of 1962 it is expected that 1,500 will be employed there.

The Orgel project is, initially, the Centre's main concern. But research at Ispra also covers numerous other fields including a scientific data processing centre which is equipped with electronic machines capable of, among other things, automatic translation.

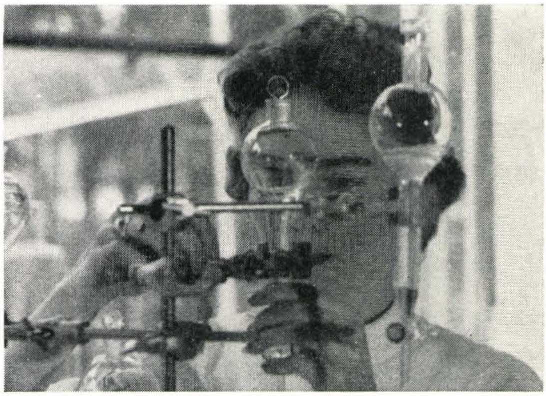
Ispra No. 1 reactor, Lake Maggiore, Northern Italy.



Mol, Belgium

The Belgian Centre at Mol is the site of Euratom's second research establishment. The Euratom Installation is the Central Nuclear Measurements Bureau. Its task is to carry out research in the field of nuclear measurements: studies on the improvement and enforcement of standards for the nuclear industry, and the development of instruments and measuring methods.

The Bureau represents the Commission and member countries on the American-European Nuclear Data Committee, set up by Euratom and the OEEC. This Committee is the first example, in the nuclear field, of the Western countries collaborating to marshal their combined resources. The staff of 84 now working at the Bureau will be increased to 170 by the end of 1963.

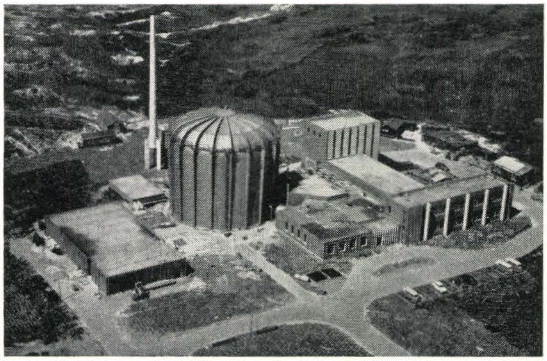


At work in the chemistry laboratory, Mol research centre, Belgium.

Petten, Netherlands

The Netherlands Government has agreed to the transformation of part of the Petten Nuclear Research Centre (35 miles north-west of Amsterdam) into a general research centre for the Community.

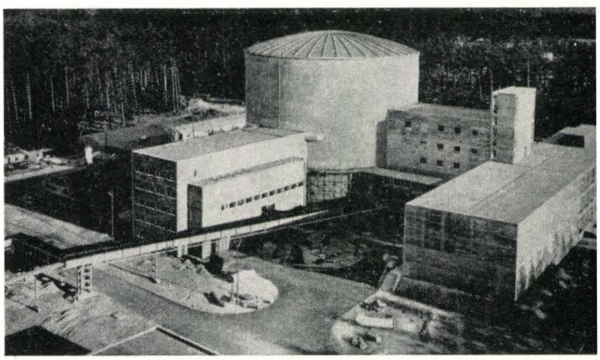
A materials-testing reactor, which went critical in 1962, will permit the study of the behaviour of materials used in the construction of an atomic reactor. Euratom intends to devote $10 million to the Petten Centre, which within three to four years should be employing 600 technicians, 400 of them from the Community.



Materials testing reactor, Petten.

Karlsruhe, Germany

Following a proposal by the Federal German Government, and an agreement signed in December, 1960, Euratom is establishing alongside the German Atomic Centre at Karlsruhe a joint centre (the European Transuranian Institute) specializing in the study of plutonium and other transuranian elements. It will employ about 250 research workers and cost about $15 million. Plutonium is potentially a first-rate nuclear fuel, but its use in power reactors is as yet beset with numerous technical problems. Karlsruhe will be mainly concerned with the design of plutonium-based fuel elements but it will also be the headquarters for Euratom's transuranian work in general.

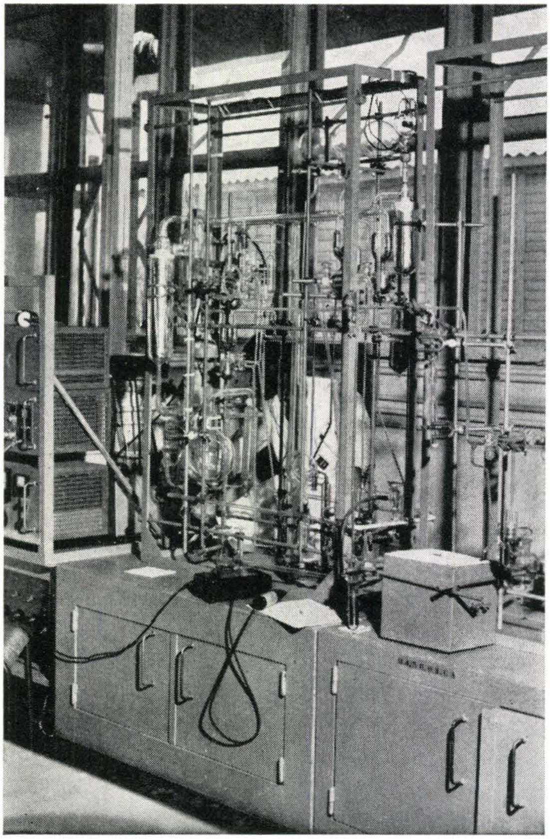


The German reactor at Karlsruhe, beside which the Euratom research establishment is under construction.

Radiation and isotopes at work

The effects of ionizing radiation* and of the applications of radioactive isotopes are of great consequence for industry and agriculture. Isotopes have made possible many scientific discoveries, some of which may prove as important as those which followed the invention of the microscope. Euratom is actively encouraging development in this field.

* Radiation, such as alpha, beta and gamma rays, causes ionization in the materials through which it passes. Ions are the particles which constitute an electrical charge.



Part of the Isotope service at Chatillon.

Vegetable and animal radiobiology

Certain minerals, such as radium and uranium, as well as certain artificial products (radioactive isotopes) emit ionizing radiation. According to the extent of the dose, these can be either beneficial or dangerous for the human organism. Euratom has signed a contract with the Dutch 'Organisatie Toegepast voer Natuurwetenschappelijk Onderzoek' (TNO) for a study of the physiological disorders due to radiation in animals. Research for Euratom is also being undertaken on the use of radio-elements in agriculture under an association contract with the Wageningen (MAC) Research Centre in the Netherlands, where a special reactor will be built.

Industry and agriculture

Radioactive isotopes (manufactured in atomic installations) have been of great value to agriculture, particularly in furthering the efficient use of fertilizers. They have also helped Australian sheep-farmers by drawing their attention to the need for copper salts in the diet of sheep if the quality of their wool is to be improved. In addition, ionizing radiation can be used in preserving perishable foodstuffs.

It is in industry, however, that radioactive isotopes are most widely used. Examples are: control of the thickness of sheets of paper or cardboard during manufacture, the study of the wear and lubrification of machinery, the sorting and preparation of minerals and the location of blockages in pipelines. According to one estimate, radio-elements save the US economy about $500 million a year.

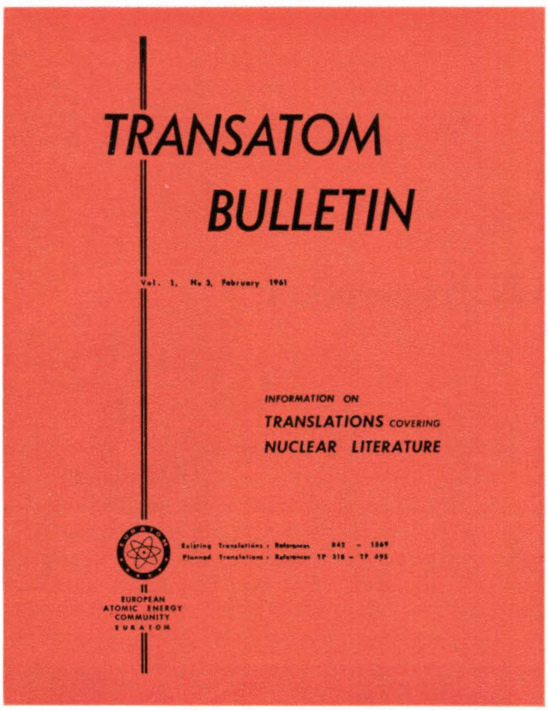
Euratom has therefore set up an isotope information bureau ('Eurisotop'), which distributes to industrial users documentation on the ways in which isotopes can be employed.

Innovations in medicine

Cooperation with doctors and physiologists to widen the medical applications of radioisotopes and ionizing radiation is also a concern of Euratom. In medicine radioisotopes are being used in therapy and diagnosis, to localize tumours, and to provide information on the functioning of certain organs.

Pooling the results of research

It is essential that the Community's research workers and technicians have access to important articles and documents on the peaceful uses of atomic energy which are published elsewhere in the world. Otherwise Community researchers would be working at a disadvantage. Euratom's Dissemination of Information department provides for the Community an information and documentation service of which increasing use is being made by individuals, firms and national organizations.



The Documentation Centre

Euratom has set up an Information and Documentation Centre which gathers atomic information from all over the world, classifies and analyses it and makes it available to bodies within and outside the Community who require information on nuclear matters.

The Centre includes a technical and scientific library of more than 64,000 books and 81,000 reports. It undertakes documentary research and, in close cooperation with the American authorities, distributes scientific and technical information. It also publishes three periodicals, one of which, the *Transatom Bulletin* indexes and circulates each month information on existing and planned translations from Slavonic and Oriental languages into Western European languages; this Bulletin enables atomic researchers in member and in the other countries in which it circulates (particularly the USA and the UK) to find articles describing the results of research in their own field of interest.

The Supply Agency

Euratom must ensure, through its supply policy, that all consumers in the Community have equal access to supplies of raw and fissile materials, and that adequate amounts of these materials are available for the Community's nuclear industry. These tasks are the responsibility of the Supply Agency.

The Agency came into being on June 1, 1960; it comes directly under the control of the Commission, and operates on a commercial basis. It has an option on all raw and fissile materials produced in the Community and the exclusive right to make purchase or sales contracts outside the Community. All fissile materials are in fact the legal property of the Community and the Agency is responsible for their use.

Exercising its right of option, the Agency may build up its own stocks of other nuclear materials and sell them to consumers. But, owing to the excess in world supplies, the Agency's rôle is limited to that of 'broker', bringing supplies and consumers into contact. Consumers inform the Agency of their requirements and producers indicate the materials they have on offer; the Agency's rôle is to inform potential consumers of the offers and the conditions on which they are made. During the first year of its existence, the Agency has been carrying out a survey of the market in the Community and other countries, so as to acquire a full picture of the market's present state and to be able to forecast the supply position over the coming years.

Euratom's inspectors

Euratom must keep a close watch on the use of nuclear materials and equipment in the Community, and above all on fissile materials. Moreover, each of Euratom's agreements with third countries stipulates that materials supplied to Euratom should be used only for non-military purposes. All enterprises therefore have had to report on the equipment of their installations and have to make regular declarations to the Commission of stocks, transfers and transactions of nuclear materials.

To ensure that declarations are being correctly made, Euratom maintains an inspection team, whose job it is to visit installations and to undertake physical and accountancy checks on the materials held. Enterprises which fail to carry out their obligations are liable to various types of penalty, including, in the last resort, the denial of access to fissile materials. Euratom's security control system is the first ever to have legal force over a number of nations. Other international organizations – the International Atomic Energy Agency of the United Nations and the OEEC – have drawn up control rules; but these are not binding on governments unless they are either receiving aid or are submitting themselves to supervision voluntarily. Euratom's control system is thus an important step forward in the voluntary submission of national states to international rules.

The nuclear common market

No frontiers for the atom

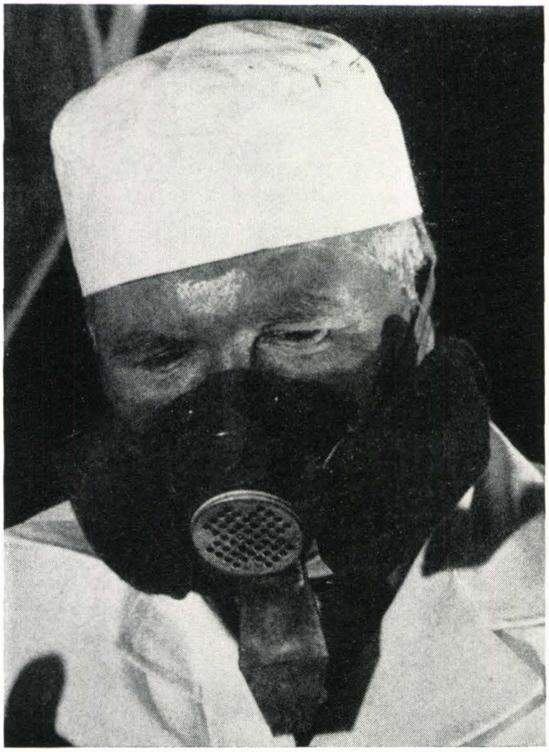
International trade barriers are out of the question for the Community's atomic industry. Since the end of 1958, Euratom has been a common market for nuclear materials and equipment: there are no trade barriers between member countries, nor can any be introduced. A common market also means a **common trade policy** towards non-member countries and a single tariff. Euratom has no tariff on raw or fissile materials, and, although there is a tariff on most items of equipment; this has been reduced or suspended for the next three to five years.

Free movement of labour and capital

Similarly, restrictions on employment on grounds of nationality have no place in the Community. The Treaty stipulates that there must be freedom for qualified nuclear workers from member countries to take employment anywhere in the Community. A plan to this effect has been prepared and was approved by the Council of Ministers in March, 1962. The Euratom Treaty also provides for free movement of capital, though in fact no important obstacles have so far been encountered.

Safeguards against radiation

A-bomb and H-bomb explosions warned the world of the dangers of radiation. Nuclear energy could also be a potential danger to the health of workers and the population at large when used for peaceful purposes. Nor do the dangers of radioactivity stop at frontiers. Negligence in one country could jeopardize the health and lives of people elsewhere. The need for international legislation and for its strict enforcement by national governments is crystal clear.



Working with protective mask at the uranium-metal purifying installations, Le Bouchet, France.

Bringing safety rules into line

Euratom is co-ordinating national nuclear legislation by insisting on the application of certain basic rules to protect workers and the public from radiation dangers. In February, 1959, the Council of Ministers approved the **Basic Health Standards,** which the six Governments are obliged to incorporate in their future nuclear health legislation. These standards, which are already being fully applied under the new German atomic law and are being incorporated into legislation in the other Community countries, are the first international nuclear safety laws to be binding on governments.

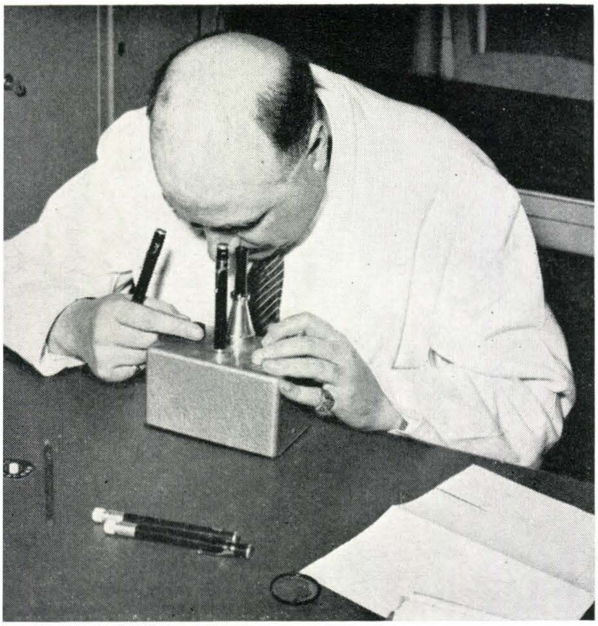
Control of radioactivity

Euratom keeps a close watch on radioactive contamination of the air, sea water, drinking water and soil by indexing and classifying reports received from the monitoring posts of national authorities and by sending its own specialists to check on the work done at these posts. Euratom is also making special studies of radioactivity in some of the Community's large rivers and in the atmosphere.

Safety in nuclear installations

Lastly, new projects for nuclear installations must be submitted for the Commission's opinion, the latter examining them from the standpoint of health and safety. A watertight procedure obviates any possibility of loopholes in these examinations.

Nuclear insurance



Examining the fountainpen-style radioactivity counters with which the staff is equipped at the Mol nuclear installation, Belgium.

Although the risk of accident in nuclear installations is in fact smaller than in conventional ones, it remains a risk. Should an accident occur, damage might be on an enormous scale; and, because it is impossible to evaluate the risk, private insurance companies are unwilling to arrange comprehensive insurance. Supplementary insurance is therefore needed on an international basis.

The Euratom countries are parties to an OEEC Convention according to which enterprises are liable for damages up to $15 million, regardless of who is at fault, and are also liable for damages incurred by third persons. The Government in question undertakes, however, to ensure that enterprises are covered for this amount, for instance through private insurance or governmental guarantees, though it is left to each state to decide on the means of doing this.

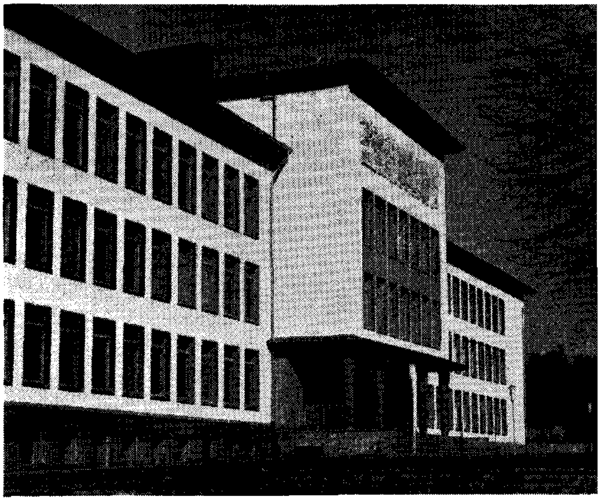
Euratom regards the $15-million limit as insufficient. A supplementary convention has therefore been negotiated, and its signature is expected in the near future. When it comes into force, the Government concerned will be required to take responsibility for up to $70 million in damages in the event of an accident; should this prove insufficient, the parties to the Euratom Convention would be required to intervene jointly to provide coverage up to a total of $120 million.

The European Schools

One of the most notable experiments in European education is already well under way. Over 2000 boys and girls in all are attending four European Schools set up primarily to meet the educational needs of children of Community officials. Other children are welcomed, however, and account for nearly one-quarter of the total.

Of the four schools opened so far, one in Luxembourg serves the Coal and Steel Community, one in Brussels Euratom and the Common Market, the others, at Mol, Belgium, and Varese-Ispra, Italy, the children of Euratom research workers.

The school in Luxembourg was the forerunner and the model. Founded in 1953 by a Parents' Committee, it is today, like the other three European Schools, administered and inspected by the Education Minis-



tries of the six Community countries. Its curriculum has been carefully worked out as a synthesis of those of the six member countries; the *Baccalauréat Européen*, which its pupils sit for before completing the secondary course, is recognized by the six Community countries and by Austria as a qualification for entry into their universities.

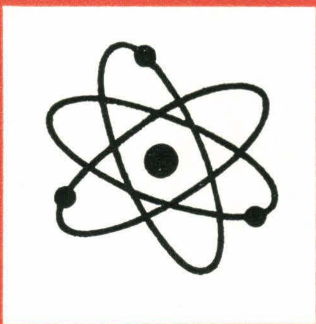
Particularly in their history, geography and modern-language teaching, the European Schools are breaking new ground. History teaching aims at giving an objective European view of the differences that have divided European countries in the past, and at setting aside the distortions and prejudices which biassed national textbooks have been instrumental in perpetuating. A geography book now in use treats the Community as a unit. Great emphasis is placed on the teaching of modern languages, though every child of Community nationality has the right to receive its basic education in his or her mother tongue. The European Schools are a fascinating experiment; the lessons they are providing will go far to show how the Europeans of tomorrow should be educated.

Above and above right: The first European School, in Luxembourg. The building was constructed specially and placed at the disposal of the School by the Luxembourg Government.

Bottom right: Presentation of the European 'baccalauréat' at the European School, Luxembourg, 1961.

Opposite: At work in the primary school, Varese.

TWO revolutions in **ONE**



Euratom is the spearhead of the nuclear revolution in the Community. Countries which have fought each other time and again through the centuries, and who only seventeen years ago were locked in a cruel and destructive war, have pooled their resources to exploit the peaceful development of nuclear energy. Together they will enter the industrial revolution which nuclear energy is bringing.

For in Europe the nuclear revolution is part of a political revolution which is no less important. The countries of the European Community have abandoned the resort to force and opted for unity. Euratom harnesses the atomic revolution to the peaceful political and economic revolution; together, they are changing the face of Western Europe.

Building atomic Europe: the German reactor at Karlsruhe during construction.

Right: The Dragon reactor under construction at Winfrith Heath, Dorset.

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Other publications

"Euratom"

illustrated brochure

"Europe 235"

pictorial brochure based on shots from a film (French and German only)

"The Euratom Bulletin"

quarterly Bulletin (subscription: UK. 10/-, US $3.50 a year) spotlighting different aspects of the peaceful applications of nuclear energy; intended for all those interested, even indirectly, in the peaceful applications of nuclear energy. Specimen copies may be obtained from: Presse Académique Européenne, 98 Chaussée de Charleroi, Bruxelles.

Subscriptions: A. W. Sijthof, Postbox 26, Leiden, Netherlands

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