COMMISSION OF THE EUROPEAN COMMUNITIES

SEC(75) 2770 final Brussels, 23 July 1975

REPORT OF THE COMMISSION

SITUATION AND PROSPECTS OF THE INDUSTRIES
PRODUCING HEAVY ELECTRICAL ENGINEERING AND NUCLEAR
EQUIPMENT FOR ELECTRICITY GENERATING IN THE COMMUNITY

(Working paper of the Commission departments)

Summary

The present report of the Commission fits into a double framework. On the one hand, the Commission in its communication to the Council concerning industrial and technological policy (SEC/73/1090 final) included the heavy electrical and nuclear equipment industry as being one of the sectors confronted with special problems whose development should be studied as a priority; on the other hand, the Commission indicated in its communication to the Council on the implementation of the guidelines and priority actions for a Community energy policy - the so called "Nuclear Action Plan"- (COM(74)10 final, February 1974) the need to reinforce the industrial basis of the Community in this sector in order to achieve the objectives for nuclear energy proposed by the Council and included in its resolution of 17th December 1974.

The report takes stock of the position and prospects of the heavy electromechanical equipment industry connected with the production of energy in the Community; it represents the first thorough study of this sector carried out by the departments of the Commission, which explains its considerable bulk, its defects despite the close contacts with interested professional associations to which it gave rise and the proposal for an annual updating in a reduced from referred to in its conclusions.

The latter can be summed up as follows:

- Industry in the Community is able to meet demand, including some exports, until the end of the present decade; the adaptation of production methods to technological development should be inclined towards nuclear power. Only by pursuing on exclusive "all nuclear" policy in the beginning of the 1980's would there be problems which could not be fitted without difficulty into the plan of progressive adaptation which is being followed at present by the majority of industries in the Community.

- The manufacturers in the Community are willing to respond to any large increases in demand in so far as these are known sufficiently in advance and presented so as to give them some security against all or part of the doubts involved in forecasting; in actual fact manufacturers have to invest several years ahead in order to change their production methods.

- The intra-community market is not sufficiently open for reasons which it is difficult to determine; this should be followed up. The Commission will examine the sectoral obstacles which are holding up an effective opening-up.

- The export market represents in the order of one third of the yearly turnover of the sector; as regards the nuclear field it is dominated by American industry; a common policy on export credit - and the setting-up of an European Institution for financing exports, in particular - would be favorable for all European industry, would encourage export joint-ventures, and would be likely to avoid internal distortions in competition.

- The structure of the heavy electromechanical and nuclear industry in the Community is more fragmented than that of American industry and for a more limited internal market; it remains for industry to follow up its movement of concentration within the European framework; for reaching joint-ventures launched on a Community level could help this movement; whilst ready to promote the efforts of industry in this direction the Commission will monitor that these allow the maintenance of an effective competition and favour the opening-up of markets.

The arrival of advanced technology and especially the development of fast reactors presents an opportunity to be grasped for the setting-up of a Community industrial strategy which will allow it to face world competition in the nuclear field in the coming decades.

- The profitability of the sector should be improved so as to ensure the necessary dynamism in the field of growth of advanced technology; the search by the industry for rationatisation of structures, in particular in the nuclear field should help this.

*

* *

In order to arrive at a better knowledge of the market, to better define the prospects for expansion for the heavy equipment industry and to back-up industrial policy for this sector with appropriate proposals in line with the common energy policy, the Commission will draw up each year in collaboration with interested parties a document summarizing the development of the sector; for this purpose it will call periodic meetings of professional associations and/or industries concerned. It will periodically examine how open are the markets and the existence of technical disparities in the sector considered.

SITUATION AND PROSPECTS OF THE INDUSTRIES PRODUCING HEAVY ELECTRICAL ENGINEERING AND NUCLEAR EQUIPMENT FOR ELECTRICITY GENERATING IN THE COMMUNITY

INDUSTRY PRODUCING HEAVY ELECTRICAL ENGINEERING AND NUCLEAR EQUIPMENT FOR ELECTRICITY GENERATING

1. INTRODUCTION

The industry producing electric power equipment for power stations owes its importance to the central position it occupies in the modern economy; the certainty that the demand for electricity can be met at any time because supplies of the necessary equipment will be available - despite the exigencies of a very sophisticated technology and long lead times - is an essential prerequisite for the development of the highly industrialized Community countries. This certainty can only be provided by a strong industry.

The rapid swing towards nuclear power in the energy economy - planned for the years ahead - will speed up the sales of new nuclear plants based on a highly advanced and constantly developing technology and calling for substantial capital expenditure, which makes it all the more essential to have competitive companies in this industrial sector.

These were the reasons that led the Commission, in its communication to the Council on the technological and industrial policy programme of May 1973 (SEC(73)1090 final), to include the heavy electrical engineering and nuclear equipment industry amongst the sectors with special problems whose development was to be studied first. The recent oil crisis and the energy objectives proposed by the Commission* to counter it, taken up by the Council in its Resolution of 17 December 1974, have made it more necessary than ever to analyse the situation of the sector and the prospects of the industry.

Generating equipment for power stations is manufactured both by private companies and by part state-owned undertakings. They generally produce a whole range of equipment for purposes other than electricity generating, both electrical (e.g., electric

* "Community Energy Policy; objectives for 1985" (COM(74) 1960 final of 27 November 1974)

traction motors, etc.) and mechanical (e.g., diesel engines), and sometimes also industrial hollow-ware (apparatus for the chemical or petrochemical industries). It is therefore very difficult to separate the power equipment side from the other industrial activities of the companies concerned.

Table 1 contains a list of the main European companies producing heavy power equipment with details of their various activities*. It shows how diversified these activities are.

In 1972, the total annual turnover of these companies was about twelve thousand million units of account and they employed some 750,000 people. Also in 1972, the proportion of turnover accounted for by heavy power equipment may be estimated at about 1,500 million units of accounts, about one-hird of which was obtained from export markets outside the Community.

* Companies whose activities are limited to either conventional steam generating equipment or to hydraulic turbines have been omitted from this first survey.

2. ESTIMATES OF ELECTRICITY CONSUMPTION AND POWER STATIONS TO BE INSTALLED (IN THE COMMUNITY) FOR THE PERIOD 1975-1985

Electricity consumption governs the rate of installation of new power stations and therefore directly affects the activities of the industry producing heavy electrical engineering and nuclear equipment.

2.1. Estimates for the Community

2.1.1. Estimates of electricity consumption and installed capacity

In its Resolution of 17 December 1974 on the Communication from the Commission entitled "Community Energy Policy; objectives for 1985"*, the Council of Ministers of the Community decided to adopt the following objective : "to provide stations with an installed capacity of at least 160 GWe and, if possible, of 200 GWe by 1985".

Consequently the following estimates have been taken as a basis for the purposes of this document.

Estimates - European Community

1975			1980			1985		
TWh	GWe total	GWe nucl.	TWh	GWe total	GWe nucl.	TWh	GWe total	GWe nucl.
1200	300	20	1680	400	65	2400	550	170

According to the above estimates, 100 GWe of new capacity (conventional thermal and nuclear power stations) will be installed between 1976 and 1980 and 150 GWe new capacity (conventional thermal and nuclear power stations) from 1981 to 1985. Nuclear plant commissioned during the latter period would then be account for a share of about 70 % of the above estimates, rising to around 90 % if the maximum target given by the Council were attained; in both cases, by the beginning of the '80s nuclear power would have acquired a firmer foothold on the Community market than anywhere else in the world (see 2.2)**.

* See COM(74) 1960 final

** Assuming that no non-member countries decided to step up the programmes already announced.

Table 2 contains an estimate of the breakdown of these new installations ("conventional thermal and nuclear" sectors) by country and by year according to the total estimates given above.

Table 3 takes the figures for the Community in Table 1 and shows what they would be if the maximum target of 200 GWe installed capacity were attained in 1985, assuming an annual distribution such that no conventional power station would be commissioned in the Community after 1982. According to Table 2, France already appears to have set itself this target, but the situation varies considerable in the other Community countries, especially in the United Kingdom. In any case, the present estimates show that on the basis of installed capacity in GWe more nuclear than conventional power stations will be commissioned in 1985 in all Community countries.

2.1.2. Estimates of new power stations

The demand (expressed in GWe) for power stations does not vary in proportion to electricity demand* because the unit capacity of the stations is constantly increasing.

Table 6 shows the increase in size of certain plant from 1951-72; the development of high-capacity nuclear reactors is further accelerating this trend. The unit power of turbines, for example, increased tenfold from 1951 to 1972. The maximum capacity of existing installations is :

- 600-800 MWe for fossil fuel power stations
- 1000-1300 MWe for nuclear power stations.

Taking into consideration power station investment projects already announced and assuming a continuation of the tendency for unit capacity to increase, it is possible to make a rough estimate of the number of power stations to be established annually in the Community.

---

* It should be remembered that estimates for electricity demand relate solely to the conventional thermal and nuclear sectors.

Number of new power stations commissioned per annum in the Community

	76	77	78	79	80	81	82	83	84	85	86-90
Conventional a	30	31	23	21	19	13	12	13	15	20	15
Conventional b							7	-	-	-	-
Nuclear a	7	7	7	13	17	18	18	18	24	19	25
Nuclear b							21	25	32	29	35
Total a	37	38	30	34	36	31	30	31	39	39	40
Total b							28	25	32	29	35

Notes a : according to the forecasts in this document

b : according to the maximum nuclear target.

According to this estimate, the number of power stations commissioned in the next ten years will probably decline slightly (about 175 power stations commissioned in the first five years, about 170-140 power stations commissioned in the following five years depending on whether case a or b is adopted), but should then increase slightly after 1985*.

However, it should be noted that the number of new power stations commissioned each year by country differs substantially from one Community country to another (see following table) and that the degree to which nuclear power will take over as shown in the above general estimate is not always a reflection of national trends as they are subject to often extensive fluctuations which tend to offset each other in the overall estimate.

---

* This shows that the use of nuclear power makes it possible to reduce the number of power stations to be installed and consequently to reduce the number of sites.

Breakdown by country of the new nuclear power stations to be commissioned in the Community according to existing estimates

Country \ Year	76	77	78	79	80	81	82	83	84	85
Germany	4	2	3	4	4	6	(5)	(4)	(5)	(4)
France	2	2	2	6	8	7	(7)	(7)	(7)	(7)
Italy	-	-	-	2	3	2	(3)	(4)	(5)	(5)
United Kingdom	1*	3*	2*	-	-	1	-	1	4	-
Belgium				1	1	1	1	(1)	(2)	(1)
Netherlands				-	-	(1)	-	(1)		(1)
Luxembourg					1	-	-	-	-	-
Denmark							(1)	-	(1)	-
Ireland							(1)	-	-	(1)
Community	7	7	7	13	17	18	18	18	24	19

Note : Figures in brackets are estimates
* AGR type reactors

2.2 Situation in other countries or regions; comparison with the Community*

The growth rate of electricity demand is likely to decline in the 1980s in many industrialized countries or regions, with the exception of some non-member countries, generally developing countries, in which it should continue at a high level; the Community will also be an exception because of its commitment to nuclear power** (Table 4).

The following points are worthy of note with regard to the size of export markets in terms of the demand for power stations in various non-Community countries :

- the size of the American market, approximately double the Community market, although Community industry has limited access to it for nuclear plant;

* With the exception of the Community, the figures are estimates published in 1973.

** The rate of 7,5 % per annum (Table 4) applies to the estimates; if the maximum target of 200 GWe recommended were to be attained in 1985 and a similar nuclear policy continued, the rate would be 8 % in 1985 and 9 % in the period 1985-90.

- the installation of about one hundred GWe new capacity in the next ten years in non-Community European countries (OECD region);
- the large increase in new plant in non-member countries (an extra 25 GWe in 1975-80 and 40 GWe in 1981-85).

The share of nuclear energy in the new plant will probably remain close to 50 % in the early 1980s in most industrialized countries, compared with 70 %* in the Community for the same period; the share of nuclear energy in the developing countries around 1980-85 is an imponderable - it will largely depend on the competitiveness of possible medium capacity nuclear power stations and whether plant manufacturers are willing to take the risk of expanding their current production range.

2.3 In conclusion, electricity demand in the Community should show an annual growth rate of close to 7 % at the beginning of the next ten-year period, possibly rising to 8 % towards the end of that period, and maybe even continuing to increase if the Community were to adopt a deliberate policy in favour of nuclear energy.

In any case the number of power stations to be installed annually will vary very little, as the increase in unit capacity will make up for the growth in electricity demand; orders for nuclear power stations will tend to overtake orders for conventional ones.

The trend on export markets should be similar, although less marked.

---

* Or even 90 %, see Section 1.

3. THE HEAVY POWER EQUIPMENT INDUSTRY AND THE COMMUNITY'S ENERGY OBJECTIVES

To meet the Community's energy objectives, the industry must have sufficient production capacity or adequate guarantees of the realistic nature of such objectives to invest in new capacities.

There follows an analysis of :

- existing (or planned)production capacity compared with the prospects for the installation of new power stations in the Community as described in Section 2 and with export prospects;

- certain special problems that might cause bottlenecks in supplies;

- the requisite conditions if the industry is to meet demand.

3.1. Comparison between production capacities and estimated demand for heavy power equipment

The analysis of the comparison between production capacities and demand for power equipment will relate mainly to the heavy equipment for both conventional and nuclear thermal power stations, such as steam turbines, alternators and transformers and specific equipment for nuclear steam-raising plant such as pressure vessels.

Heavy equipment peculiar to conventional thermal or hydroelectric power stations such as conventional boilers, water turbines and smaller items such as gas turbines and switchgear will be dealt with more summarily (3.1.5.), the former because demand for them in Europe will steadily diminish in the future and the latter because they do not and will not in the foreseeable future constitute an importance share of the market for heavy power equipment.

The comparison is based on Figures 7, 8 and 9 which were produced from the following information or assumptions :

- total deliveries by Community Member States for the period 1960-1973 are taken from existing OECD statistics (Tables 10 and 11);
- the Community countries' own needs for 1972-1985 are deduced from the annual increases in installed electric capacity given in Section 2.

Once again two cases are considered : "estimates" and the "maximum nuclear target" given in the Council Resolution of 17 December 1974;

- total Community deliveries for the period 1972-1985 were estimated by adding to the Community's own requirements exports corresponding to 30 % of total production*;
- demand for equipment was obtained by estimating deliveries for a number of years suited to each item of equipment (turboalternators 4 years, transformers 1.5 years, pressure vessels 4 years);
- production capacities existing in the Community in 1973-1974 have been estimated on the basis of documentation published or supplied by the relevant national trade associations and are set out in Table 5.

3.1.1. Turboalternator sets (10 MWe over)

Community production capacity was close to 43,000 MWe in 1973 for both turbines and alternators (Table 5).

Demand has been marked - and this trend will continue to increase - by a continuous growth in the unit size** of equipment and by the growing share of the nuclear sector.

---

* The high share accounted for by exports shows their importance to the Community's power equipment industry; it therefore appears justified to maintain in the future (and even to increase as far as possible) the existing share of the market accounted for by exports.

** See Table 6.

The share of "nuclear" steam turbines was about 15 % of total deliveries (expressed in MWe) for Western Europe from 1970 to 1972. The share of "nuclear" turbines ordered was 35 % of total orders in 1973 and should be about 50 % in 1980 and 70 % in 1985 if current estimates prove correct (and could even be 100 % after 1983 if the maximum nuclear target were attained).

The unit capacity of "nuclear" turbines ordered is increasing very rapidly : it has risen from an average of 230 MWe per unit for units ordered in 1966/67 to an average of 780 MWe per unit for units ordered in 1973. The equivalent figure for "conventional" turbines ordered in 1973 was an average of 236 MWe per unit. The average size of "nuclear" turbines will continue to grow; units of 1200 MWe and more are already under construction.

This trend has and will continue to have extensive repercussions on the organization of the industry's production plant, which will have to be adapted to trends in demand as regards both volume and characteristics. Some production plant may by its nature (crane hoisting capacity, shop floor space, etc.) be restricted to the manufacture of equipment of a given size and be incapable of meeting the demand for new and larger equipment*.

A simplified capacity/demand analysis (Fig. 7) shows that :

- in the range of small and medium-sized equipment (100-800 MWe/conventional) Community production capacity for turbo-alternators is at present (1973/74) well able to meet demand**; surplus capacity may well become evident in the years ahead if new export markets are not found or if some effort is not made to convert.

- In the range of large equipment (900 MWe and over/nuclear) existing production capacity reveals a temporary surplus as a result of recent investment projects by a few large manufacturers who have anticipated demand trends; it will become inadequate as from 1976. However, new investment projects in progress or announced should postpone the saturation point to 1982/83.

---

* Some Community firms are unable today to provide sets of maximum capacity, i.e., 1200-1300 MWe.

** Community market + export market of about 30 %.

In the longer term (1985), adaptation of the structure of production facilities on which manufacturers have already embarked should be continued and speeded up by new investment projects in order to ensure that most of the production plant is suited to the very high capacity equipment used by nuclear power stations.

Taking an extreme view, if an "entirely nuclear" approach were adopted in the Community - corresponding to the maximum target of 200 GWe nuclear in 1985 - structures would probably have to be radically modified as demand would become so small in the medium range of equipment (conventional power stations) and so high in the top range (nuclear power stations) that mere adaptation would not be sufficient.

The industry should seize the opportunities offered by the rapid evolution of the existing structure of demand for electrical engineering and nuclear equipment to combine and coordinate at Community level, thus avoiding the risk of over-investment at national level owing to excessive and uncoordinated anticipation of the nuclear market*.

3.1.2. Power transformers (10 MVA and over)

In 1973, production capacity for power transformers was about 173,000 MVA in the Community; it is greater than capacity for turbo-alternator sets because demand is higher. For each new power station, new transformers are required not only in the station but also in the electricity transmission system. The ratio between installed transformer capacity in MVA and installed power station capacity in MWe varies from one country to another because of differences in design and different voltages.

For the purposes of the capacity/demand comparison that follows, a mean factor MVA/MWe of 3.5 was used for the Community as a whole**.

---

* See Section 6 below

** This ratio is currently about 3.5 in France, 4.5 in Germany, 4 tending to rise to 5 in Belgium (influence of the increase in transmission system voltages from 150 to 400 kV), 3.5 in Italy; the large-scale introduction of major nuclear power stations will tend to push these figures down.

Figure 8 shows that 1973 production capacity (173,000 MVA corresponds to about 49,000 MWe to be installed in power stations) was about 45 % utilized*. Allowing for the increase in the unit capacity of transformers and the increase in productivity (about 4 % par annum), this capacity would in theory rise without major investment to about 225,000 MVA in 1980, corresponding to a power station installation capacity of about 65,000 MWe. The utilization of production facilities would then rise to over 60 %. However, the surplus capacity in the transformer sector would remain very high.

Consequently the efforts to rationalize industrial structures already started in some Community countries must be continued in order to cut back excessive overcapacity, which is also a worldwide phenomenon.

3.1.3. Pressure vessels for light water reactors

LWR pressure vessel production capacity in the Community is estimated at 21 per annum, corresponding to the installation of 21-27,000 MWe per annum in light water nuclear power stations**.

With the extensive investment programme in France, this capacity will be increased to 25 per annum in 1976/77, corresponding to the installation of 25-33,000 MWe per annum in LWR power stations.

This capacity should be adequate up to about 1980 to supply the Community's own market for pressure vessels plus 20 % for export (Figure 9).

3.2. Other equipment

3.2.1. Conventional boilers

Some ten Community firms are active in this sector; their annual production capacity is between 5,000 and 15,000 t steam per hour.

---

* Community market + export market estimated at 30 %.

** Assuming an export share of 20 % (rather than the 30 % taken for turbo-generators and transformers), the domestic market can be supplied with 17-22,000 MWe per annum in LWR power stations.

Total deliveries of conventional boilers in 1971 amounted to a steam capacity of 70,000 t per hour. Although they rose at the rate of 8 % per annum from 1966 to 1971, orders are expected to fall (at least on the internal market) in the years to come. The share of exports in 1971 attained the high figure of 30 % of total production. With the rapid emergence of nuclear pressure vessels on the power equipment market, it is to be expected that the industry will continue to convert its plant or will increasingly turn towards export markets or industrial heat applications.

3.2.2. Water turbines

Water turbines supplied by the European industry represent about 20 % of the total capacity of all power turbines (steam, gas, water) produced in the Community from 1970 to 1972.

Whereas in 1970 only 25 % of production was exported, this figure rose to 45 % in 1971 (exports to South America and Africa mainly). This trend will become stronger as suitable hydroelectric sites in Europe become scarcer. It should be noted that the technology for this plant is entirely European.

3.2.3. Gas turbines

Gas turbines supplied by the European industry represent 6-8 % of the total capacity of all power turbines (steam, gas, water) produced in the Community from 1970 to 1972. 35-50 % of this production was exported - mainly to Middle East oil producing countries - in the same period.

The world gas turbine market is expanding considerably and should continue to do so in the future; the Community industry should secure a substantial part of this expansion, despite keen competition.

3.2.4. Circuit breakers

Unfortunately the available statistics are too fragmentary to allow any assessment of the production capacity for this type of equipment in the Community. European production far exceeds the Community's internal requirements but there is an extensive export trade - about 20 % of total output - both within and outside the Community. European technology appears to be very highly developed in this sector, as is reflected in the size of the export market* secured in North America.

3.3. Conclusions

The above estimates indicate that there is available industrial capacity in the Community for the manufacture of heavy electrical engineering and nuclear equipment; this capacity should in general be sufficient (if account is taken of forthcoming investment projects on which decisions have already been made) to meet requirements, including exports, up to the end of this decade.

The surplus capacity in existing production facilities revealed at Community level for some equipment may not reflect the actual situation in some national contexts, mainly because of the compartmentalization of markets. It is also partly a consequence of this compartmentalization.

The adaptation of production facilities to technological developments (in particular the increase in unit capacity) should be continued for nuclear equipment; some coordination is desirable in this sector to avoid overinvestment at Community level as a result of the cumulation of expected demand in different national contexts.

The growong importance that will be attached to meeting national requirements, mainly in this sector, should not, however, have an adverse effect on the export market.

---

* Direct or through a subsidiary (COGENEL SA, US subsidiary of the French manufacturer DELLE-ALSTHOM).

The adoption of a "completely nuclear" objective at the beginning of the 'eighties might raise problems difficult to reconcile with the strategy of gradual adaptation currently followed by the majority of Community industry.

3.4. Special problems; supply bottlenecks

Two types of supply bottlenecks may occur :

- bottlenecks resulting from a sudden substantial increase in demand; this is the case at present for certain primary or semi-finished products such as heavy plate, large valve or pump casings, heat exchanger tubes, stainless steel valves and fittings, etc. They can be overcome by careful planning of the necessary production facilities*;
- temporary "technological" bottlenecks resulting from the lack of suitable production facilities in the Community**.

Only the second type will be examined in greater detail below.

3.4.1. Steel ingots for turboalternators

Production of large-capacity turboalternators will probably continue on the basis of the same technology until the end of the century***.

For each increase in unit capacity, there must be an increase in the weight and dimensions of the rotor; it appears possible with the existing technology to construct alternators with a maximum unit capacity of 3000 (1500 r.p.m.)**** MVA. For example, a 2500 MVA alternator rotor would weigh about

---

* Planning of this kind is in hand at EDF to ensure continuity of the supplies needed to carry out the French nuclear programme.

** Could this be caused by too great a fragmentation of markets and the lack of a genuine single European market ?

*** A study of the introduction of new techniques such as the application of cryogenics has nevertheless been started with a view to obtaining large increases in unit capacity.

**** Speed of rotation of the turboalternator sets in LWR power stations.

280 tonnes. To make it, a forging blank of 380 tonnes and a cast steel ingot of 600 tonnes would be required; steel blocks of these dimensions cannot be produced in the Community at the present time, the limits being :

- cast steel ingots up to 300 tonnes
- one-piece rotors 120-150 tonnes,

corresponding to alternators of a maximum of 700-900 MVA.

All the steel ingots required for large-capacity generators have to be imported from the US or Japan today. A community nuclear power station constructor has ordered from Japan ten forged blocks for the turboalternator sets of 900-1500 MWe power stations. It seems that other Community manufacturers are doing the same.

This situation will have to change; one Community constructor has already concluded the necessary agreements to obtain the plant required.

3.4.2. Steel forgings of nuclear pressure vessels

Another bottleneck occurs in the fabrication of large forgings, for example very thick, large-diameter seamless forged rings* and flanges (250 mm thick, 5 m dia.) for LWR pressure vessels. These components are also supplied by Japanese industry, as there are no adequate presses in the Community.

3.4.3. Transport

The increase in the unit size and weight of equipment makes it more and more difficult to transport; water transport does not yet give rise to any problems but can obviously only be used where the power station to be constructed is suitable located. Special wagons have been developed for rail transport; alternator stators of 1400/1700 MVA (1500 r.p.m.) and rotors of 3000 MVA (1500 r.p.m.) are expected to be the limit of their capacity.

---

* These rings are in increasing demand to reduce the total number of welds in the pressure vessel to a minimum.

The existing limit on the transport of transformers was reached when the largest transformer in the world (50 Hz) for the Phillipsburg I nuclear power station (864 MWe) was transported on a special wagon with 32 axles (this 1020 MVA, 27/415 KV transformer weighs 420 tonnes). 1500 MVA transformers can be transported only by water and when this is not possible two 740 MVA transformers or three single-phase transformers are used for a 1300 MWe nuclear power station.

Special vehicles are now being designed to carry loads of up to 900 tons by road. A vehicle operating on an air cushion (Hovercraft principla) has been developed in Britain to carry transformers and alternator stators by road.

3.5. Necessary conditions to enable Community industry to satisfy demand

The above analysis shows that demand for capital goods can be satisfied in the next ten years. Nevertheless the industry must continue to invest sufficient capital - often very large amounts, expecially for accelerated nuclear programmes - to adapt its production facilities to demand.

Is the Community industry prepared to do this and does it have the capital ? The answer, based on recent experience, appears to be in the affirmative, provided a degree of continuity and a certain guarantee of demand are assured over the next ten years; it is also possible that in some particular cases there will be problems in financing the investments.

3.5.1. Guarantees of continuity of demand

a) Theoretical future demand for power stations and heavy equipment described earlier is derived largely from estimates by electricity producers of the maximum annual output that might be required from their systems in coming years. Estimates of this kind, which have to be made about ten years in advance, are extremely difficult and have already proved too inaccurate on several occasions in the past; it is their industry that suffers the consequences (for example, a 1 % error in the annual growth rate of electricity demand

leads to 15 % error in the assessment of orders). It is necessary to adjust estimates such as those in Section II every year; annual changes in the expected levels of production and demand resulting from them are greatly amplified on the capital goods market and result in chronic cyclical fluctuations in the actual demand for power equipment*; these fluctuations are further amplified by the steady increase in the size of the units concerned.

It also appears that the larger the market the smaller these fluctuations; an analysis covering the period 1960-70 showed that fluctuations in actual annual turboalternator deliveries were around 30 % in each of the Community countries (markets of a few thousand MWe per annum) and about 10 % in the US and in Europe as a whole (markets of about 15,000 MWe per annum).

b) For some years, major interruptions in the execution of programmes for the installation of nuclear power stations have in some Community countries added to the effect of the chronic cyclical fluctuations in demand described above.

National industries that have suffered from such interruptions in the past therefore require certain guarantees from the government ("programme contracts") before setting up production facilities for nuclear equipment for new types of reactors.

c) In the past few years, a "nuclear controversy" concerning the installation of nuclear power stations has become evident in Europe and is slowing down government licensing procedures so that manufacturers suffer long delays before orders already incorporated in their production schedules are confirmed, thus incurring considerable financial losses.

Despite these fluctuations, interruptions and possible delays, the heavy power equipment industry is forced by its very nature to set long-term financing targets (it takes about ten years - or even more - before the capital invested is amortized). This involves a high level of risk for

* See for example "The World Market for Heavy Electric Power Equipment", SPRU, University of Sussex, 1972.

manufacturers' investment programmes, further accentuated in the nuclear field by technological uncertainties*. With present rates of inflation, the profitability of long-term investments often appears too low to encourage industry to take large risks.

Consequently, it appears that Community manufacturers are ready to meet any substantial increase in demand provided it is formulated in such a way as to provide them with certain assurances regarding some or all of the abovementioned uncertainties.

The launching of the vast LWR power station programme by Electricité de France is a good example : manufacturers in the sectors involved (nuclear island, turboalternator sets, power transformers, etc.) did not negotiate unit orders, but concluded a "programme order" covering several years for sufficient units to ensure that the capital investment they had to make would be profitable.

3.5.2. Financing of capital investment

The capital to be invested by the industry to meet a substantial increase in demand is ten to twenty times less than that expended by electricity producers on the equipment.

It is very difficult to quantify this problem.

On the basis of financial estimates published when the most recent investments were made in France, the financial needs of the Community industry for 1975-85 can be estimated at approximately 3,500 million u.a. to carry out the Community power station programme outlined in Section 2.

---

* For example, at the beginning of 1974 Shell set aside £ 96 million to meet its 50 % share in the expected losses of General Atomic in connection with orders for ten HTGR power stations.

3.5.3. Financing of R & D

The heavy electrical engineering industry is an advanced technology sector (see Section 6) that is changing rapidly; consequently it is essential for the Community industry to be in a position to provide the newest plant both on the home market and on the world market.

Research work is financed largely by the companies themselves (4-6 % of turnover per annum) but there is also a complex system of more or less direct contributions from public funds which varies greatly in struture and scope in different Member States.

A Community R & D policy for the energy sector must certainly take this situation into account.

4. THE COMMUNITY MARKET

4.1. Open bidding for contracts

The internal Community market has no tariff barriers between the old members (the Six); the existing tariff barriers in respect of the new Member States will be completely dismantled by 1977, at the end of the transitional period.

Despite this, national markets for power stations are not in practice open to the whole of Community industry. On the other hand, it must be admitted that there is a sort of "tacit" admission of American companies through links or licences and financial holdings that they have established with some Community companies, solely in the nuclear field.

The Commission informed the Council of this state of affairs in 1972 in its first Communication on"progress in liberalizing public contracts and contracts awarded by undertakings responsible for the operation of services of general economic interest in respect of supplies"*. In this document, the Commission considered that intra-Community trade in the industrial sector covered by this report did not appear to exceed 10 % of apparent consumption and was considerably less for certain equipment.

This walling off of national markets has not changed for complete power stations as, with the exception of one nuclear power station and part of a fossil-fuelled one, no stations have been built in a member country under the responsibility of a company from a different country. Even those two contracts contain compulsory conditions regarding the participation of the domestic industry in supplies.

---

* Document SEC(72)2601 final of 24 July 1972. The Commission is now preparing an updated version.

On power station components there are no statistics suited to the purposes of this report, but the Commission intends to collect figures directly from the industry when it prepares its annual consolidated report mentioned in Section 9. In the meantime, note can be taken of intra-Community trade in the nuclear sector in particular in the form of sub-contracting for components (e.g. pressure vessels, internal structures, steam generators), parts of components (e.g. parts of pressure vessels and turbines) and basic products (e.g. heavy plate). The existing methods of ordering nuclear power stations (turnkey contracts or by island) mean that sub-contractors are selected by the companies responsible for supplying the complete power station or the island.

It should also be noted that the advantageous effects of order programming could be accompanied by a certain closing off of markets. The French decision to have its chain of LWR nuclear power stations constructed by two French groups is likely to shut off the EDF market for proven reactors from foreign competition for probably a long time to come, but on the other hand when EDF placed the order with SOGERCA it asked the company to expand to a European dimension. It will be interesting to see how that request is followed up.

Considerations of this kind do not in any way reduce the importance of demand programming by electricity producers since market conditions are no different in countries with less advanced programming : recent attempts at worldwide invitations to tender made by German electricity producers culminated in the award of LWE power station orders to the German firm KWU. However, the smaller countries have opened up their markets to international competition by necessity, but also to suit their own interests, although they run the risk of frequently seeing their own manufacturers fall under the control of foreign groups without thereby gaining access to the intra-Community market.

The reasons for the walling off of national markets are many and were set out in the abovementioned Communication to the Council. They are connected with the motivations of the authorities, electricity producers and manufacturers.

After the authorities have fostered the establishment and growth of national industries, they cannot abandon them without a thought for the social and economic consequences of that attitude; moreover, national technological capabilities are often used for purposes of political relations with non-member countries.

Electricity producers, responsible for a public utility, have long since established links with national manufacturers having a vast fund of technical and commercial knowledge and have no incentive to break off these traditional relations - quite to the contrary (after-sales service and supply of spares; contractual guarantees; knowledge of standards and regulations, etc.).

With the existing structure of the sector, manufacturers attach the highest importance to their national markets because in all sectors these are the source of the basic income of any company producing capital goods for a public service industry. In addition, contracts in the home country are an essential "qualification" for export markets, especially in the case of advanced technology products*.

In brief, the motivation of all the parties concerned, although differing in many cases, favours maintenance of the status quo and there are not yet any clear signs of the liberalization of contracts in this sector.

However, a genuine liberalization, one of the objectives of the EEC Treaty, would facilitate :

- a better balance between supply and demand**

Contracts genuinely open to all would reflect a collective security of supply for energy-producing plant. This aspect could become important if an imbalance develops between demand by electricity producers and manufacturers' capacity or in the event of a "accident de parcours". In any case if a market of Community dimensions were opened up in conjunction with - and facilitated by - transnational cooperation of adequate scope, it would be possible to rationalize industrial investment in the short and long term. In the short term, because it would be possible to avoid or reduce new investment by better utilization of existing capacity (or surplus capacity.

---

* See Section 6

** See 3.5.1.

In the long term, as nuclear energy is now developing very rapidly (and programming is becoming necessary), the industry will have to its investment effort to avoid finding itself faced with serious surplus capacity at the end of the period of acceleration.

- an increase in the available sales area

viewed from the angle of the development of the industry and expansion of its financial status.

An ad hoc sectoral study will be undertaken by the Commission departments to elucidate the technical aspects of the problem.

4.2. Accessibility for outsiders

Access to the Community market from outside is subject to customs duties ranging from 5 % to 10 % depending on the conventional plant concerned*. These duties are slightly lower than those protecting the US and Japanese markets. Despite this lower customs protection, the Community is not an importer but an exporter of heavy power equipment, as pointed out in Section 3, except in certain particular sectors of limited scope in which there are shortcomings (e.g., alternator shafts). As for nuclear reactors, fissile materials and fuel elements, the Community reserved the right, after the Kennedy Round, to restore or reduce its tariff protection; these products have not been bound under GATT.

---

* For example, the customs duties in force on 1 January 1975 are :

Turbines and generators	5 %
Transformers	6.5 %
Circuit breakers	6.5 %.

5. ACCESSIBILITY OF VARIOUS WORLD MARKETS

5.1. General

The major regions of the world are not equally accessible to all potential suppliers. This is because :

- if the region concerned is a large industrialized area with a high demand for electricity, there is a domestic industry and it is generally sufficiently large to supply most if not all of the market; access to the market depends on the tariff and other barriers protecting it and the degree to which domestic industry is overburdened (US);

- if the region concerned consists of developing countries or small industrialized countries, much of the market may be accessible to outside firms if preferential trade flows have not been established between this region and other exporting countries by historical links.

To attain an adequate profitability level, all the companies producing heavy power equipment try to secure a foothold on the major export markets. Table 10 and 11 give the share of exports, expressed as a percentage of national production, for turboalternator sets and transformers.

The major industrial nations export extensively to most regions of the world, at least as far as conventional equipment is concerned, although there are some areas where special influences prevail (UK/Commonwealth, Japan/Pacific region, etc.).

The world market for heavy nuclear plant and nuclear power stations, however, is too new a market to be considered as already exhibiting established spheres of influence and it must be examined separately; at the present time it is in practice dominated by the United States as far as the supply of light water reactors is concerned. A firm must be able to refer to large national projects successfully completed and possibly even be able to guarantee certain fuel supplies - this is just starting to apply in Europe - before it can hope to export.

Of the 300 reactors already built or covered by firm orders at the beginning of 1974, only 17 do not make use of US technology; 117 use Westinghouse technology (18 of them being ordered from licence holders) and 101 G.E. technology (20 being ordered from licence holders). The US has exported 44 LWR (to Europe, Korea, Taiwan, India, South America, Japan) compared with three exported by KWU (to Austria, Switzerland and the Netherlands), two (to Finland) by Technopromexport and one (to Finland) by ASEA-ATOM. On the component market, there are some exports of pressure vessels from the Community to the US, mainly to make up for a temporary shortage of capacity in America.

Finally, it should be noted that commercial agreements negotiated between States* play an important role in the development of heavy power equipment exports; this will change the possibilities of access to certain markets in a way that cannot be predicted in the scope of a sectoral study. Nevertheless care must be taken to avoid a situation in which the European industries try to outbid each other in these negotiations; this could not but be harmful to the whole European Community and could only benefit non-member countries.

5.2. Accessible markets in non-member countries; difficulties

5.2.1. The United States market

American electricity demand is the highest in the world and in 1980-1985 will be about double the total demand in the nine Community countries. The expected growth rate is close to the average rate expected in the Community for the same period, but it should be noted that the rate at which nuclear energy will take over is likely to be lower than that forecast for the Community in the years 1980-1985**.

---

* On 3 October 1973 the Commission submitted to the Council a communication (COM(73) 1275 final) on the problems raised by bilateral agreements for economic, industrial and technological cooperation with non-member countries, together with a proposal for a Council Decision establishing a consultation procedure. This proposal was approved by the Council on 22 July 1974. Trade negotiations with State trading countries have to be conducted by the Community (see Council meeting of 7 May 1974).

** Increase in installed nuclear capacity from 1980 to 1985 : factor of close to 2 in the USA and close to 3 in the Community.

The American power equipment market is therefore the largest in the world; in recent years European firms have enjoyed their share of it, with the exception of nuclear reactors*.

Access by European firms to the American market has been facilitated in recent years by the overloading of the American industry. However, a reverse trend appears to be emerging now for the following reasons :

a) administrative obstacles : although the US participated in the drafing of the international anti-dumping code during the Kennedy Round, the criteria of the code have never been applied. Specific American rules and their misuse can act as non-tariff barriers to trade. In particular, the Commission has already drawn attention, in informal contacts, to the damage caused by the American habit of instituting an anti-dumping enquiry - which influences imports whilst it is in progress - without first investigating whether there are genuinely grounds for such an enquiry**. What is more, the decisions that dumping existed taken by the Department of the Treasury in the years 1972-73 in respect of very high voltage transformers and circuitbreakers (from France, Italy, Japan, Switzerland, UK) have already reduced the activities of foreign firms on the US market.

Some US firms also have reccurse to Article 232 of the 1962 Trade Expansion Act which authorizes the President to curb certain imports*** if in the opinion of the Office of Emergency Preparedness they are likely to constitute a danger to national security.

The Buy American Act and the protectionist attitude of certain States (e.g. California) could have more effect in the future as the US industry ceases to be so overworked.

---

* For which the Us industry has access to the Community market through subsidiaries or licences.

** The US electricity industry lobbies the Ways and Means Committee of the House of Representatives through NEMA (National Electrical Manufacturers Association).

*** Example : GE : 1958 : electricity generators
1960/65 : steam generators
1972 : EHV power circuit breakers and power transformers
OEP found that US requirements could be met up to 1981 and that national security was not endangered.

b) increased technological development of American firms and their capacities*

American industry's annual capacity at the end of 1972 was about 45,000 MWe for turbo-alternator sets and appears to be keeping in line with the development of demand in general (oligopolistic market shared between GE, Westinghouse and Allis Chalmers Power Systems, Inc.). Power transformer capacity in the same year was 210,000 MVA but should increase rapidly in the near future as a result of large-scale expansion programmes.

Nuclear pressure vessel capacity was 30 per annum in 1974 and should meet demand up to 1980. The industry should plan to increase capacity to 40 per annum if it is to meet demand in 1985.

With the temporary slackening of the rate of commissioning nuclear power stations in the US owing to difficulties with operating licences and environmental problems, it is difficult to say how far American capacity will be able to satisfy a large share of the American market in the short term, thereby reducing the share going to equipment imported from the Community.

c) The devaluation of the dollar in recent years

Since the monetary crisis in May-August 1971, the currencies of the Community Member States(with the exception of the pound sterling and the lira) have gained in value against the dollar.

There are even grounds for believing that American industry will become still more aggressive on markets outside the United States in view of the current slackening in the pace of the nuclear power plant investment programmes of American electricity producers**.

To gain access to the American market, the largest European groups have either set up (German AEG-Siemens group with Allis Chalmers Co through the joint subsidiary Allis Chalmers Power Systems) or are planning (Swiss Brown Boveri group) production facilities in the United States with or without an American partner.

---

* Ref (1) WASH 1174-74 "The nuclear industry"
(2) US Industrial Outlook 1974 (US Department of Commerce)

** This is chiefly the result of administrative difficulties in obtaining building permits and the high cost of money.

5.2.2. Canadian Market

This market appears to be fairly accessible to British industry, by tradition.

5.2.3. European markets outside the Community

a) Scandinavia

Access to this market is difficult because of Swedish capacity in this field, mainly in the hands of ASEA and, in the nuclear sector, its part stateowned subsidiary, ASEA-ATOM, for the supply of BWR power stations of the ASEA type, and of Uddcomb for the supply of reactor pressure vessels*.

The position enjoyed by Sweden on the world market is due mainly ot its quality image and intensive and well-established international marketing since the domestic market represents only a moderate percentage of demand and state aid for exports is very modest.

Then there is the Russian foothold on the Finnish market, reflected in the nuclear sector by the order for the first Finnish LWR power station of 440 MWe (USSR : nuclear steam supply system plus turboalternators, KWU : instrumentation and control equipment).

b) Other

The nuclear power station market in other European countries is accessible to Community manufacturers. However, American industry has so far dominated these markets, mainly in Spain and to a lesser extent in Switzerland.

5.2.4. Japanese market

This market is completely inaccessible. What is more, Japanese industry has expanded so fast in the past ten years that there is genuine danger of very serious competition from Japan on export markets.

---

* Capacity of 5-7 vessels per annum planned for end of 1974; Combustion Engineering has a 25 % holding in this company.

5.2.5. Eastern European markets

Trade with Eastern Europe is still light despite the détente, because of economic and commercial problems (financing of purchase, sales structure).

Trade generally takes place under long-term cooperation agreements signed between States (West Germany/USSR, West Germany/Romania, France/Poland, France/USSR and very recently UK/Romania).

Recently West Germany and the USSR have been studying the possibility of increasing cooperation in the energy sector; the supply of nuclear power stations to be erected on the shores of the Baltic and paid for by Russian deliveries of electricity*, is envisaged.

5.2.6. Other countries

Over the next fifteen years, the developing countries should have a higher growth rate of electricity demand than the industrialized countries (see 2.2.).

Access to most of these markets appears to be largely dependent on the situation of the countries concerned in relation to the American and Russian spheres of influence, or on their desire to remain non-aligned.

Central and South America

Argentina, Brazil and Mexico are likely to have the highest per capita growth rate of electricity demand in the world and will therefore be rapidly expanding markets.

Argentina's policy is one of independence of the United States, and the Eastern bloc countries benefit from it. It has recently concluded agreements with the USSR and Czechoslovakia for the construction of the hydroelectric power stations which form the major item in its short-term infrastructure programme. Nuclear energy is represented by the natural uranium heavy water project of Canadian origin; Brazil and Mexico also expect to make use of nuclear energy in the medium and long term and have already ordered reactors from the US**.

---

* The supply of PWR power stations to the USSR by Framatome is also under study in France. The UK intends to supply heavy water reactor power stations to Romania under the abovementioned agreement.

** Brazil; PWR of 600 MWe from Westinghouse; Mexico : BWR of 900 MWe from General Electric.

Market trends in the countries of the Andean Group* will depend on the success of the regional integration efforts now under way and of the various development programmes (especially the programme for the mechanical and electrical engineering sectors) within which there should be a place for European industry.

Middle East

Access to these markets is a political matter and is negotiated at government level. Following the military events and oil crises of recent years, outline agreements covering the supply of nuclear power stations have been concluded bilaterally between governments (USA/Israel, USA/Egypt, France/Iran, etc.). The Euro-Arab dialogue should provide the Community with an opportunity of adopting a coherent policy in this sector.

Far East

South Korea and Taiwan, in the American sphere of influence, have ordered nuclear power stations of 600-900 MWe from the US in recent years.

5.3. Export aid policies in Community countries

Export aid policies differ greatly from one Community country to another. In particular, interest rates may vary from 6-12 % and the duration of the credit is also very elastic. This situation leads to efforts at outbidding which benefit no-one but the United States.

Faced with this situation, the Commission has tried to bring about a degree of harmonization in the export credit financing and credit insurance policies in the Member States. It is trying to eradicate or at least slow down the efforts of States to outbid each other in interest rates and credit duration so as to avoid distortion of competition between industries in different countries. For some branches of industry to which interest rates and the duration of credit are of particular importance, it has proposed sectoral arrangements suitable for ratification by the largest possible number of countries, i.e. the member countries of the Organization for European Cooperation and Development (OECD). This has been done for civil aircraft, ground stations of telecommunications satellites, nuclear power stations and the fuel they use.

---

* Bolivia, Chile, Colombia, Ecuador, Peru and Venezuela.

In brief, the Commission is active both on a general plane, with its efforts to obtain agreement on credit terms or insurance principles applicable to all exports, and also at sectoral level, with its proposals for credit terms suited to those sectors and differing from its general proposals.

Sectoral agreement on nuclear power stations

The Community's position in OECD regarding a sectoral agreement on nuclear power stations was defined by the Council, on a proposal from the Commission, at its meeting on 5 February 1974. The Community proposed limiting the length of credits for exports of complete nuclear power sations to ten years for orders to industrialized countries and to twelve years for deliveries to developing countries.

In addition, the orders had to incorporate minimum down payments of 10 % and 15 % respectively for developing and industrialized countries.

For nuclear fuel, there is a consensus amongst OECD member countries in favour of the following credit terms : down payment of at least 10 % and maximum period of 5 years.

Credit insurance

The Council has already approved the Directives on the adoption of common credit insurance policies for medium- and long-term transactions with public or private buyers* and the rules applicable, in the fields of export guarantees and finance for export, to certain sub-contracting in other member or non-member countries. So far the decision concerning sub-contracting is the only one that has entered into force in the Member States**.

---

* OJ No L 254 of 23.10.1970.

** OJ No L 284 of 30.12.1970.

The Commission has also made a number of other proposals on credit insurance : introduction of a common policy for medium- and long-term buyer credits, adoption of a common system of premiums for supplier credits, whole turnover and selected transaction policies, exchange shortfall guarantee, guarantee against cost increases, etc. These proposals have been or are being discussed by the relevant Council working party.

As so little progress has been made towards the harmonization of credit insurance, the Commission staff, in an endeavour to expedite harmonization, have prepared a working paper* on the application of uniform principles in export credit-insurance policies. This has been circulated to members of the Coordinating Committee on Credit Insurance. The Commission will also be consulting UNICE, chambers of commerce and the Banking Federation on this new step, which they hope will make a substantial contribution towards the harmonization of credit insurance.

In conclusion the lack of a common export credit policy and in particular of a European Institute for the financing of exports similar to that in the United States, for example, is of great disadvantage to European industry in general, discourages export joint ventures and is liable to create internal distortions of competition.

---

* COM(74) 383/6 of 3 April 1974.

6. STRUCTURE OF THE HEAVY POWER AND NUCLEAR EQUIPMENT INDUSTRY IN THE COMMUNITY

6.1. The conventional sector

The structure of the power equipment* industry - leaving aside the nuclear field - has been changing constantly over the past fifteen years to enable production facilities to be enlarged, growth prospects maintained and the ability to compete improved, bearing in mind the characteristics of the equipment produced :

- they are high quality products which must operate for 20-30 years without serious incident, since the customers (electricity producers) are national public utilities; confidence based on numerous previous achievements, credibility and the quality of the brand image are essential factors in competition;
- they are physically very large products, of a unit size that is rapidly increasing (see Table 6, Section 3), requiring large factories for their production, in other words extensive capital backing; the ability to make substantial capital investment and find adequate financing is a third factor in competition;
- finally, they are products considered by the major industrialized States to be of strategic importance (see introduction), for which national self-sufficiency is essential.

These four vital characteristics, combined with the desire to maintain a minimum degree of competition within each country, account for the oligopolistic structure, at national level, of this sector and the trend towards ever-increasing concentration.

---

* Steam turbines, alternators, power transformers.

For example, Alsthom accounts for about two-thirds of French heavy power equipment capacity, the remainder being divided between CEM and Jeumont-Schneider; in 1972, KWU shared the German turbine generator market with BBC, 76 % going to the former and 24 % to the latter*, etc.

The structure in the United States is very similar, with Westinghouse, General Electric and Allis Chalmers Co sharing the market.

But at Community level the juxtaposition of national structures means that there are about 10 to 15 firms in each of the main sectors (transformers, turbines and generators). This is 3 to 5 times more than in the United States for a market only two-thirds the size of the American one. There are financial and technical links between the different European firms which make the structure less fragmented than the above figures might indicate.

It is therefore highly desirable to press on with the industrial restructuring already under way in this sector.

6.2 The nuclear impact

The sudden emergence of light water nuclear reactors on the power equipment market at the end of the sixties was a new and vitally important factor which should expedite still further the restructuring of the power equipment industry, both because of the vast scope of the technological and financial problems involved and because of the pressure of a heavy immediate demand, reflecting the desire to diversify fuel supplies expressed by the Community after the oil crisis of Christmas 1973.

An examination of the characteristics of the conventional power industry outlined in 6.1 from the "nuclear" angle shows that:

- As regards experience, the predominance of American firms is impressive; of the 300 LWR reactors built or covered by firm orders at the beginning of 1974, only 17 do not make use of American technology. To compete on a world scale, therefore, European firms have to take advantage of the reputation (brand image) they have acquired for conventional equipment (e.g. Siemens + AEG = KWU) and/or develop their own nuclear technological competence.

* However, MAN accounted for 15-20 % of the Steam turbine market in Germany.

- As regards technological know-how and skill, R & D is even more important than in the conventional sector, in view of the fact that nuclear energy is so new; the major source of LWR know-how is still the United States and this entails the establishment of many financial ties with and the granting of licences and know-how to Communiyt manufacturers (see Table 12).

  The fact that Siemens/KWU is not dependent on American licences, implying that at some time a difference in know-how evolved between Community manufacturers, might have been expected to encourage suitable intra-Community agreements, but this did not happen.

- As regards capital investment and financing, costs are even higher than in the conventional sector; the size of nuclear power stations already ordered varies from 1000 to 1300 MWe, almost double that of the large conventional power stations. Even the soundest firms in the Community do not expect their nuclear activities to be out of the red for two to three years.

- Finally, the strategic importance of a national commitment in the civil nuclear sector is acknowledged by all governments.

The response of existing industrial structures to the commercial advent of nuclear power stations (mainly light-water reactors) is taking the form indicated below; for the reasons outlined above, government influence on this restructuring is strong.

a) Integration* of nuclear equipment into the existing range of production; Table 1 shows that the companies concerned were initially active in the electrical engineering sector (top left of Table) or the heavy engineering and boilermaking sector (bottom right of Table) and in some cases both. There is a trend for the electrical engineering industry to include nuclear equipment (pressure vessel) in its production range and a similar trend for the heavy engineering industry; these two industries then find themselves competing in their nuclear activities. For example, KWU, a subsidiary of AEC and

* Integration of production means the capacity of a company to manufacture itself (or in its parent company) all or some of the components of the power stations it sells.

Siemens (Electrical engineering industry), supplies LWR power stations for which it manufactures the turbo-alternators but not the nuclear pressure vessels and Framatome, a subsidiary of Creusot-Loire, the heavy engineering company, supplies LWR power stations for which it constructs the pressure vessels but not the turbo-alternators*. These companies generally make good any gaps in their integrated product range by ad hoc cooperation agreements (CGE/Breda agreement for pressure vessels, Framatome/CEM agreement for turbo-alternators, for example).

In Italy, there is complete integration in the IRI group, probably because it is state-controlled.

b) Ever-increasing industrial combination at national level

The industrial policies of most of the main Community countries have confined the industrial combination process to the national setting. This may even go as far as the establishment of a single national firm, thus abolishing all domestic competition.

In such cases, the State participates (National Nuclear Corporation in the United Kingdom), in order to provide a degree of supervision. Similar combination processes have taken place in the smaller countries but there it is often necessary to look abroad** in order to join up with industrial groups of sufficient size.

The juxtaposition within the Community of the structures in existence today in the national framework as a result of earlier trends means that some ten firms are actively engaged in the supply of complete LWR power stations or the manufacture of nuclear pressure vessels; the corresponding American structure has half as many firms in the power station sector and a third as many in the pressure vessel field for a market about twice the size. This tallies with the comparative financial standing of the companies involved : the total turnover (including all categories of products) in 1972 was $ 15 x 10^9

* This integration pattern is also found in the US : W. and G.E., in the electrical engineering sector, supply light water reactor power stations equipped with their own turbo-alternators but subcontract the vessels, while BW and CE, in the steam generator hollow-ware sector do the reverse.

** For example, take-over of ACEC by Westinghouse.

for Westinghouse and G.E. against $ 12 x 10^9 for all the European firms in Table 13. In addition there is:

c) The influence of American firms owning techniques for LWR power stations

When they first tried to penetrate the European continent, the American firms ran up against national policies and in the end had to adapt to them; they abandoned their hopes of setting up European-wide subsidiaries and followed parallel policies in each country. As Table 12 shows, most manufacturers* and/or sellers of power stations and/or nuclear components in Europe have established links (licences) with the large American firms in order to obtain both know-how and credibility in the eyes of electricity producers looking for reliable equipment. For this purpose, the licensor either acquires a large holding in the manufacturing firm (as with Framatome) or accepts some responsibility for the project as joint contractor.

6.3 The prospects: advanced nuclear technologies

The development of advanced nuclear technologies** which is under way in several countries of the Community will still provide the opportunity for a few years yet to direct the structural development described in section 6.2 towards greater cohesion and greater independence of European industry on the world nuclear markets of the future.

---

* Siemens in the Community and ASEA in Sweden are the two outstanding exceptions, although even they have cooperation agreements in R & D with American firms.

** Fast breeder reactors; high temperature gas cooled reactors. Fusion reactors have too uncertain a future to be considered.

6.3.1 High temperature reactors (HTR)

The technology of this type of reactor was developed within the Community up to a point which could have enabled them to be introduced on the market independently of American participation. (The experimental OECD Dragon and German AVR reactors; the construction of the prototype 300 MWe-German THTR). However, the fragmentation of the European effort in comparison with American concentration makes it appear that it is perhaps too late. The development of HTRs was, in fact, taken up in the USA right at the start by General Atomics, which was first of all a subsidiary of General Dynamics, then purchased around 1967 by Gulf Oil, who were joined by Shell in 1972 to form General Atomic Company (GAC) on a 50/50 participation basis. The extent of the activities (construction of an experimental reactor, then of a 330-MWe prototype) and the financial status of the parent companies gave rise around 1972, to letters of intent or options amounting to 7 600 MWe from American electricity producers concerning the supply* of power stations of this type.

It also seems that there is a trend towards bilateral cooperation between certain constructors and organizations in the Member States of the Community and GAC. The association of various Community electricity producers (B, F, G, I, UK) within the Euro-NKG Company in 1971 could possibly help, as far as the European constructors are concerned, in the creation of a structure more on a Community level which would better preserve European interests in the event of cooperation with the United States.

6.3.2 Fast breeder reactors

The situation is very different as regards fast breeder reactors. In other words: The effort involved is considerable and has authentically European origine. Where breeder reactors are concerned, the experience and know-how peculiar to the Community countries leave nothing to be desired in comparison with those acquired from the development being independently pursued in the United States; it could even be said that Europe is ahead in this field (the Phoenix Programme in particular).

---

* The supply of these plants has now been jeopardized by the development of the nuclear controversy in the United States and by technical delays.

Fast breeders have not been introduced yet on a commercial scale; although the three major development programmes within the Community have been definitely adopted at national levels up to the stage of operation of medium-sized prototype power plants (British Programme: start-up of the 270-MWe PFR in March 1974; German-Benelux Programme: start-up of the SNR 300-MWe prototype, scheduled for 1980; French Programme: operation of the Phoenix 250 MWe prototype since 14 July 1974), there is still flexibility available regarding the construction programmes for the first large-scale power stations opening the commercial phase of the 1990s*. The development and the implementation of a rational structure for the large-scale production and the marketing of fast reactors on the part of the Community are thus still possible.

Those concerned are benefitting from the lessons of the past gained from the development of other types of reactor. The technological risks, the financial burdens and risks, and the marketing problems have proved to be very great at an individual-state or company level.

The electricity producers, to whose lot the major step must fall of introducing at an opportune time a new type of electric power plant into their networks, are particularly aware of this: in 1971 Electricité de France (EdF), the Rheinisch-Westfälisches Elektrizitätswerk (RWE) and the Ente Nazionale per l'Energia Elettrica (ENEL) signed an agreement on joint financial participation in the construction;

- on French territory, of the first large-scale fast breeder power station of the Phoenix type;
- on German territory, of the first large-scale fast breeder power station of the SNR type.

A tripartite agreement, signed in December 1973, set up two companies for the implementation of two European projects.**

---

* The first large scale fast reactor power station of the Phoenix type is in the meantime scheduled to enter into service in 198 on the EdF site of

** Company formed under French law "Centrale Nucléaire Européenne à Neutrons Rapides S.A."(NERSA): EdF 51%, ENEL 33%, RWE 16% for the power station of the Phoenix type. Company formed under German law "Europäische Schnellbrüter-Kernkraftwerksgesellschaft mbH." (ESK): RWE 51 %, ENEL 33%, EdF 16% for the power station of the SNR type.

As regards industrial organization, the Internationale Natrium-Brutreaktor-Bau GmbH., formed in 1972, combines the following firms: Interatom (D), Neratoom (NL) and Belgonucléaire (B) for the industrial and commercial development of SNR-type reactors; the Groupement pour les Neutrons Rapides (GNR) (F), Technicatome (F) and Nira (I) became associated in 1974 in order to construct the nuclear steam supply system of the first large-scale power station of the Phoenix type.

With regard to governmental research organizations, CEA (F) is collaborating with CNEN (I) in the construction by the latter of a reactor for testing fuel for breeder reactors (PEC).

These measures for reorganization and cooperation are promising, but not yet sufficient to ensure the commercial expansion of Community interests on the world nuclear markets of the future.

During the next few years, the industry of the Community must seize the opportunity offered by the introduction of the new technology of fast breeder reactors in order to consolidate its own identity so that it is able to face world competition completely independently during the next few decades.

6.3 Conclusion

From the above analysis, in conjunction with the inescapable fact that nuclear equipment will gradually but ineluctably take over from conventional equipment*, creating growing difficulties on export markets largely dominated by American firms (Section 4) and calling for large-scale industrial research and development programmes, it is clear that the Community's heavy power equipment industry runs the risk either of seeing its growth and technical potential, or even competitiveness, gradually decline or of being restructured into multinational systems under the American influence. This industry would therefore be well advised to conclude appropriate international agreements within the Community to ensure that it is large enough to be competitive - this is perfectly feasible, as was stated earlier. Much has been made recently of certain intra-Community cooperation projects, for example between CGE and Ansaldo M.N. - Breda and between French or German companies and NNC, but it will take more than that.

* Average annual increase of 20-25% in new installed nuclear capacity (MWe) against a reduction of about 7% in conventional capacity for the period 1975-1985, according to Table 2.

The Commission considers it essential for the heavy power equipment sector to continue its restructuring process and even, on the nuclear side, to succeed in forming two or three groups for the whole Community; while prepared to encourage measures by the industry on the lines of a restructuring policy of this kind, the Commission will ensure that it enables effective competition to be maintained and helps to open up the markets.

In any case, the advent of advanced reactors, especially fast reactors - whose commercial unit sizes should be double that of existing reactors and whose technology is firmly based in Europe - should make it possible to draw up a Community industrial strategy in the nuclear field, even if it proved too late to do so for light-water reactors.

7. ECONOMIC SITUATION OF THE SECTOR

The factors that help to make the heavy power and nuclear electricity-generating equipment industry profitable have been outlined in previous chapters; for an assessment of this profitability it is necessary to have an overall view, even if only an approximate one, of the economic and financial situation in this industrial sector.

It is very difficult to make a representative choice of a cross-section of firms in the power equipment sector as most of them do not confine their activities to the manufacture of power equipment. Nevertheless, these companies can be classified in two groups : the first consists of those who primarily produce electrical and electrical engineering equipment and the second of those mainly constructing industrial hollow-ware components.

From these two groups, the companies listed in Table 13 have been selected. They account for about 75% of the sector's activities*, and consequently figures relating to them may be considered to reflect the financial and economic behaviour of the companies constructing capital goods for the power industry.

Table 13 also shows the relative size of these firms and gives the turnover for all activities obtained in 1972 with the total labour force for the same year.

7.1 General trends

These have been derived from balance sheets published by the companies (period 1968-72 or in exceptional cases 1969-73), after harmonization at European level by a specialist firm. The companies selected have an average turnover growth rate** of 8.9% (close to that for other large industrial sectors); the Dutch companies chosen are, however, below the average.

---

* The extent of the heavy equipment activities of these firms is estimated in Table 1.

** These average growth rates are calculated from the formula : $A = a(1 + r)^n$ (where A = amount at end of period (a) plus interest at the annual rate (r) accumulated after (n) years).

The increase in manpower is very low (1.9% per annum); almost half the companies - and in particular five out of six of the German companies - experienced reductions in manpower during the period under review. However, payroll costs increased by 9.6% per annum on average; they rose even where the total labour force declined. These costs are very level with a few exceptions (Dutch companies in particular were above the average) and range from 4,230 to 5,582 EUR per person employed.

Added value is very high in this sector, about 40% of turnover. The companies with electrical or electrical engineering activities as shown in Table 1 do better from this point of view than those which fabricate heavy plate or are engaged in the steel industry.

For financing, the companies in this sector make extensive recourse to borrowing*; only five of the 27 companies studied finance all their investment themselves. Of the others, endebtedness in some special cases may be so high as to rule out the possibility of repayment by self-financing in the foreseeable future.

It is very difficult to assess the profitability of the companies in the sector**; seven of the firms considered show a loss, 14 show a profit on their own capital that is below the margins normally required*** and six have satisfactory profits (7.5-12.6 %).

7.2 Conclusions

It should first be pointed out that the study could not cover the full five-year period for all the companies considered. Consequently for some firms the results may reflect a state of affairs that is not representative of the longer-term trend.

---

* Assessed from the ratios 1) self-financing/fixed investment (acquisition of physical assets and other gross capital assets for the year) and 2) total endebtedness/self-financing.

** Assessed from ratios such as net profit/turnover and net profit/own capital (share capital + reserves attributable to shareholders).

*** Financial profitability on own capital of the 1000 leading American companies is around 10 %.

It should also be remembered that the industries in the sample often have very different structures.

Nevertheless, it appears plain that the profitability of companies engaged in the power equipment sector is low.

Financial profitability governs company expansion : if return on own capital is low, the company will probably have difficulty in borrowing, while conversely a high level of return on own capital will make it easy to find finance to develop the company and possibly to achieve self-financing.

This is especially true in the advanced technology sector considered here, the vigorous growth of which calls for high profitability.

It is therefore desirable for the Community industry to continue its efforts to rationalize its structures - and the recent nuclear commitment will provide an additional opportunity - in order to improve its financial situation.

8. EMPLOYMENT AND SOCIAL ASPECTS

The companies listed in Table 13 together provide employment for about 750,000 people, although not all of them are engaged on the fabrication of power equipment. This labour force is generally highly skilled and in recent years has suffered from the adaptation of the industry to technological development; in particular the increase in the unit capacity of conventional equipment has resulted in a reduction in the ratio of labour (man-years) to KWe of equipment produced. Generally speaking, employment has tended to decline (see Section 7).

However, the substantial increase in orders for nuclear equipment and power stations should improve this situation :

- by introducing manpower requirements commensurate (apart from increased productivity) with the scope of the programmes; the size of nuclear equipment is already so great that the labour/KWe of equipment produced ratio referred to earlier should tend to become stable, even if the unit capacity of equipment were to increase still further;

- by creating a need for highly skilled technical personnel; some shortage of labour is to be feared in certain fields (welders of thick nuclear plate for example), since the training of new skilled workers is generally carried out in the company itself by some of the experienced staff, which limits the rate at which their numbers can be increased.

The licence policy has, however, reduced the employment prospects for skilled men that this type of activity could normally be expected to generate. A policy of encouraging the large American groups that grant licences to set up their research establishments in Europe and not to content themselves with production centres there would help to increase employment prospects.

The policy of combining companies into larger units so as to make them more profitable because of the larger market and sounder financial status would also increase the demand for highly skilled personnel for independent R&D programmes and more generally avert the possible shutdown of establishments that are too small.

9. CONCLUSIONS

9.1 The industry producing the heavy power and nuclear equipment required for electricity generating is a major factor in the development of the Community. The rapid shift of the energy economy towards electricity of nuclear origin - planned for the years ahead - will increase the importance of this industrial sector, which must continue the efforts to adapt that it has already started.

9.2 The Community industry is able to meet the demand for power and nuclear equipment required for attainment of the objectives of the Community's new energy strategy.

Nevertheless, on the basis of past experience (especially in the nuclear sector), equipment manufacturers are making the necessary extensive investments in production facilities only insofar as they obtain adequate guarantees of the volume and continuity of demand over a reasonably long period. Decisions on investments involve a high level of risk as they have to be taken long before the commissioning of the power stations which, according to estimates, should use the equipment produced as a result of the new investment.

Consequently the industry must have an accurate idea of the market prospects over some ten years and must be assured of some continuity in the demand for equipment.

To give tangible form to these prospects, the governments should commit themselves to ten-year power station installation programmes which would enable outline contracts to be drafted in conjunction with the industries, containing commitments on the number of power stations to be constructed and adequate technical conditions.

The Commission intends to submit to the Council a proposal on the publication of power station installation programmes covering a period of about ten years.

9.3 At world level, the Community's power and nuclear equipment industry will have to face :

a) an increase in demand, but accompanied by an increase in the unit size of the major equipment; this will result in a standstill or slower growth in the number of items produced and a large rise in their unit value;

b) increasingly radical technological changes; the R&D efforts designed to retain the technological independence and the technical progress necessary if European firms are to remain able to compete with American ones will therefore have to be stepped up still further and may well become too great a burden for isolated companies.

Only the very large companies will be able to compete on the world market and will have sufficient financial backing to take the risk of investing in such ventures.

9.4 Recent developments in the restructuring of the power equipment industry in Community countries differ very little from the trend in past years towards the perpetuation of self-contained national markets and the restriction of industrial combination to the national setting. This is mainly in the large Community countries. The smaller countries have, through need and also to their own advantage, opened up their market to international competition, with the risk of frequently seeing their manufacturers falling under the control of foreign groups without thereby gaining access to the intra-Community market.

The result of this situation is :

- to reduce or eliminate competition in specific areas;
- to force industrial combinations into too narrow a national setting;
- to make financing of companies' own large-scale R&D programmes more difficult.

It is therefore Industry which must continue its movement towards combination and cooperation in the wider setting of the Community. Although in the opinion of some national authorities combination at national level is often the prelude to the establishment of larger groups and certain bi- or multilateral attempts at cooperation are being made, there is today far too little incentive to combine on a European scale.

As of now, large-scale joint ventures should be launched at Community level; some R&D projects being studied by Community companies could serve as a basis - by giving them an international slant it would be possible to standardize designs and specifications from the start, to combine the technical and financial resources of the partners involved and to ensure them of an industrial future on a European scale.

The creation of industrial groups of this kind would also help to establish a genuine common market in which manufacturing specialization within multinational economic entities would replace national self-sufficiency, with the following advantages:

- improvement in the return on investment and the quality of products;
- better utilization of scientific and technical personnel; the gradual limitation of licence policies would make it necessary to invest in R&D;
- more vigorous penetration of export markets as a result of the sounder industrial basis provided by a vast internal market.

9.5 The export market accounts for a substantial proportion (about one third) of deliveries by Community firms; the part it plays in off-setting the risks on national markets and the high value added on exported products make it all the more necessary to promote this market.

It is to be feared that the European industry will encounter very keen competition from the American, Japanese and Eastern European countries on foreign markets.

The lack of a common export credit policy - and in particular a European Institute for the financing of exports, similar to that in the United States for example - is of great disadvantage to European industry in general, discourages export joint ventures and is liable to create internal distortions of competition.

9.6 To obtain a better knowledge of the market, to identify development prospects for the heavy equipment industries and to underpin an industrial policy in this sector with suitable proposals in harmony with the common energy policy, the Commission will produce an annual review of the development of the sector in conjunction with interested parties; it will hold periodic meetings of the trade associations and/or industries concerned for this purpose. It will make a study of the progress in liberalizing contracts and on the existence of technical disparities in the sector concerned.

Table 1 Activities of the main European companies producing heavy power equipment

- Share of these activities as percentage of the turnover of the companies (1972)

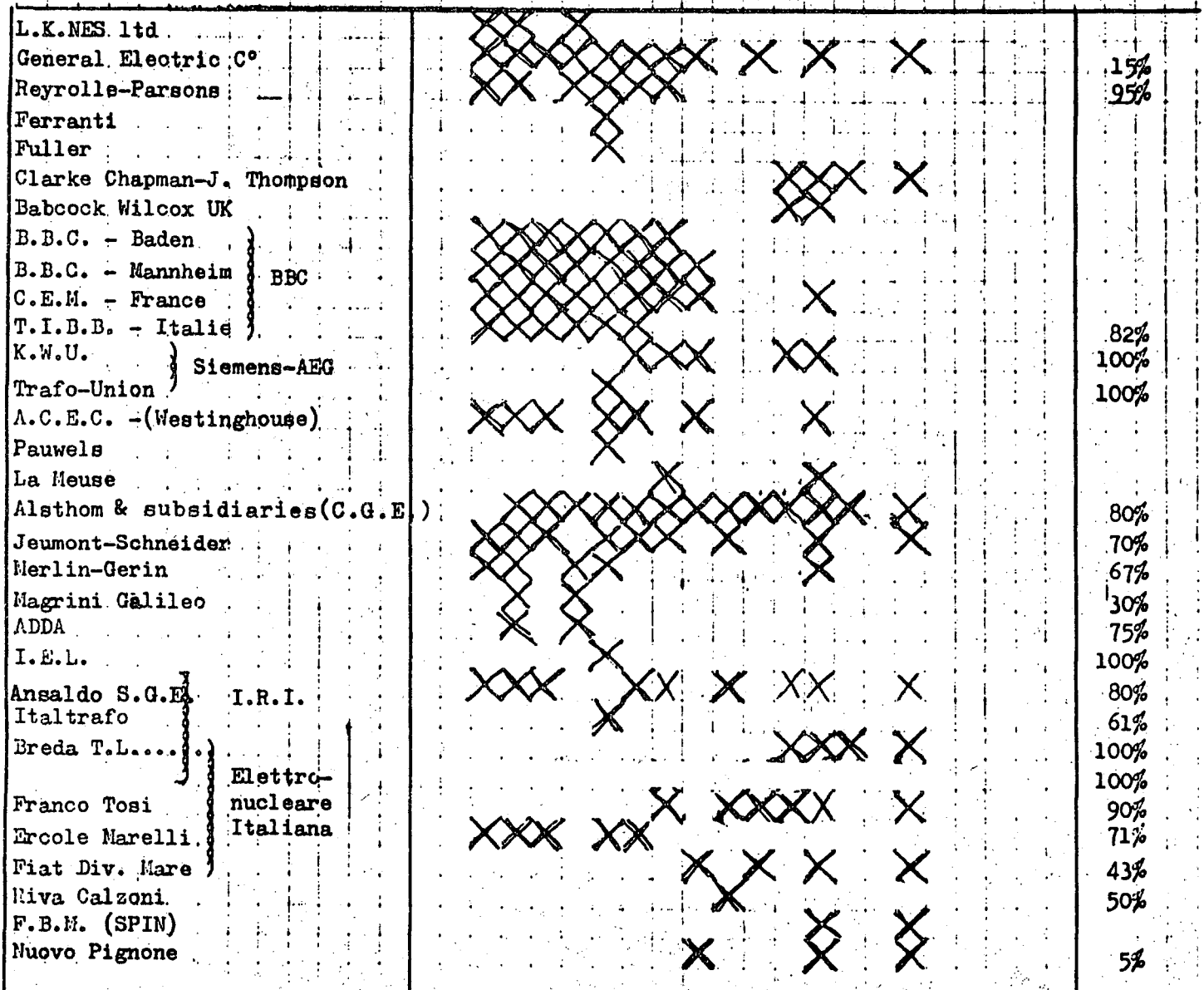


Table 1 (cont.) Activities of the main European companies producing heavy power equipment

- Share of these activities as percentage of the turnover of the companies (1972)

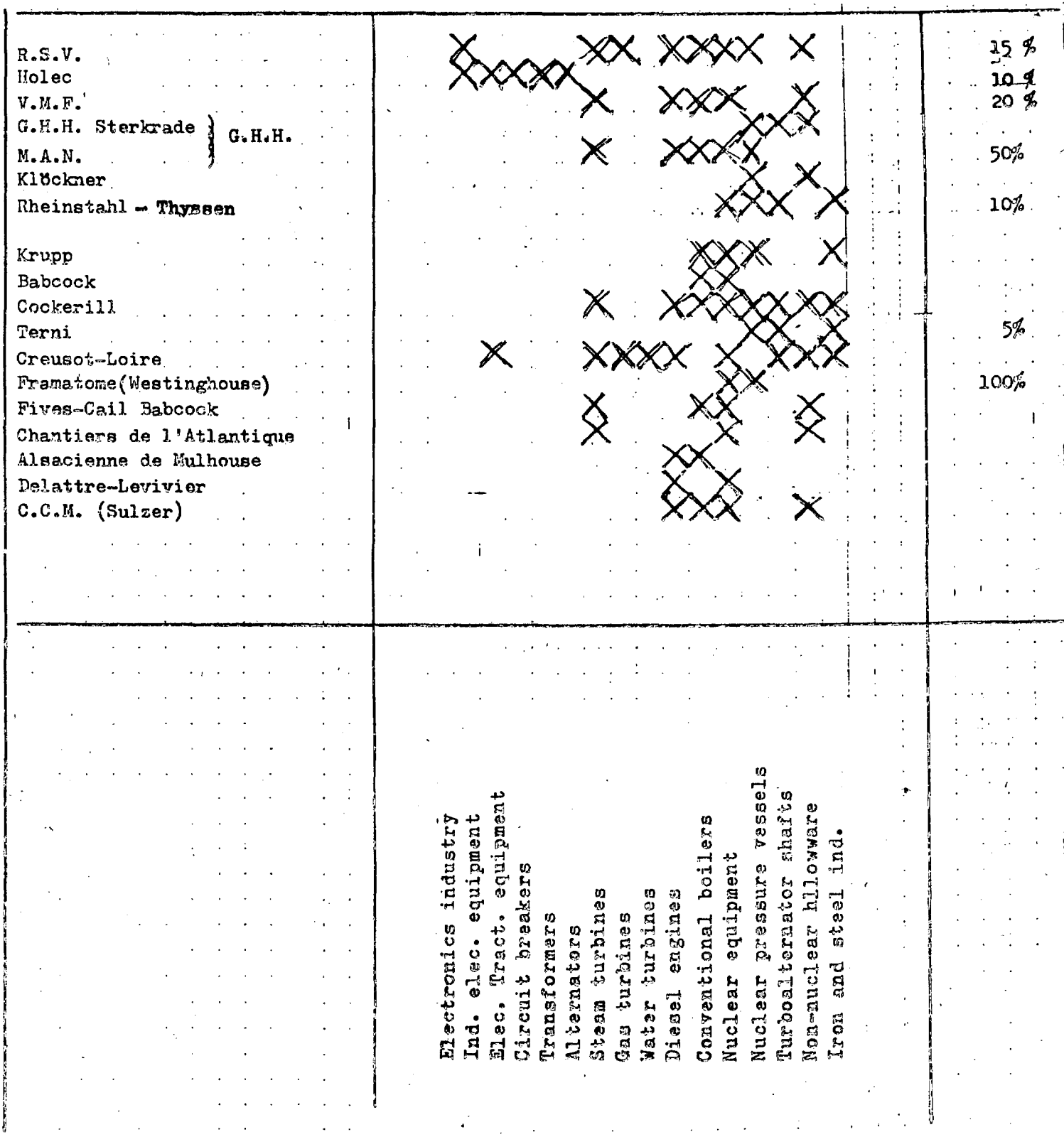


Table 2

Annual installation of conventional and nuclear power stations in the Community (MWe)

Year	France		Germany		Italy		United Kingdom		Other countries		EEC total		
	Conv.	Nucl.	Conv.	Nucl.	Conv.	Nucl.	Conv.	Nucl.	Conv.	Nucl.	Conv.	Nucl.	Total
1975	600	400	4000	800	1000	900	1800	2400	2800	900	10200	5400	15600
1976	1400	1800	5300	3800	3200	-	3200	600	800	-	13900	6200	20100
1977	2100	1800	3000	1500	4500	-	3200	1900	2700	-	15500	5200	20700
1978	700	1800	4000	3300	3600	-	3200	1400	700	-	12200	6500	18700
1979	-	5600	3000	4100	2800	2000	3200	-	1800	900	10800	12600	23400
1980	-	7100	2500	4500	1700	3000	3200	-	1800	2100	9200	16700	25900
1981	-	6800	-	7500	3000	2000	4000	700	1600	2000	8600	19000	27600
1982	-	6600	-	6900	2000	3000	5000	-	1000	2500	8000	19000	27000
1983	-	7000	1500	5000	1000	4000	5000	700	1000	2000	8500	18700	27200
1984	-	7000	1500	6900	1500	5000	5000	3000	1700	2900	9700	24800	34500
1985	-	7000	1500	5000	1000	5500	6000	-	2500	2700	11000	20200	31200

Table 3

Installation of conventional and nuclear power satiens in the Community

(GWe)

Year	Current estimates			Maximum target *		
	P nucl.	Δ P nucl.	Δ P conv.	P nucl.	Δ P nucl.	Δ P conv.
1975	17,3	5,4	10,2	17,3	5,4	10,2
1976	23,5	6,2	13,9	23,5	6,2	13,9
1977	28,7	5,2	15,5	28,7	5,2	15,5
1978	35,2	6,5	12,2	35,2	6,5	12,2
1979	47,8	12,6	10,8	47,8	12,6	10,8
1980	64,5	16,7	9,2	64,5	16,7	9,2
1981	83,5	19,0	8,6	83,5	19,0	8,6
1982	102,5	19,0	8,0	106,0	22,5	4,5
1983	121,2	18,7	8,5	133,0	27	-
1984	146,0	24,8	9,7	168,0	35	-
1985	166,2	20,2	11,0	200,0	32	-

* Does not include nuclear power stations for production of industrial heat.

Table 4. : Estimated increase in electricity consumption (TWh); from total and nuclear installed capacity (GWe)*

	1975			1980			1985			Growth rate of electricity consumption % per annum		
	TWh	GWe		TWh	GWe		TWh	GWe				
		total	nucl.		total	nucl.		Total	nucl.	1975/80		1981
EEC (Nine)	1200	300	20	1680	400	62	2400	550	170	7,0	-	7,5
Other European members of OECD (1)	(400)	(90)	5,2	604	(140)	30	860	(200)	60	8,5	-	7,5
North America (USA, Canada)	(2540)	(580)	56,7	3510	800	139	4830	(1100)	295**	6,7	-	6,5
Pacific region (Australia, Japan, New Zealand)	(630)	(140)	8,6	970	(215)	33	1300	(290)		9,0	-	6,0
Other non-member counstries (2)	(210)	(45)	0,4	327	77	4	(450)	(117)	(29)	(8,5)	-	8,5
U.S.A.	(2210)	(520)	54	3185	(700)	132	4400	(980)	280	7,7	-	6,7
Japan	(515)	(120)	8,6	740	(170)	32	970	(220)	60	7,5	-	5,6
Canada	(280)	(65)	2,7	395	(90)	7,5	520	(120)	15	6,9	-	5,7

(1) Austria, Spain, Finland, Greece, Iceland, Norway, Portugal, Sweden, Switzerland, Turkey.

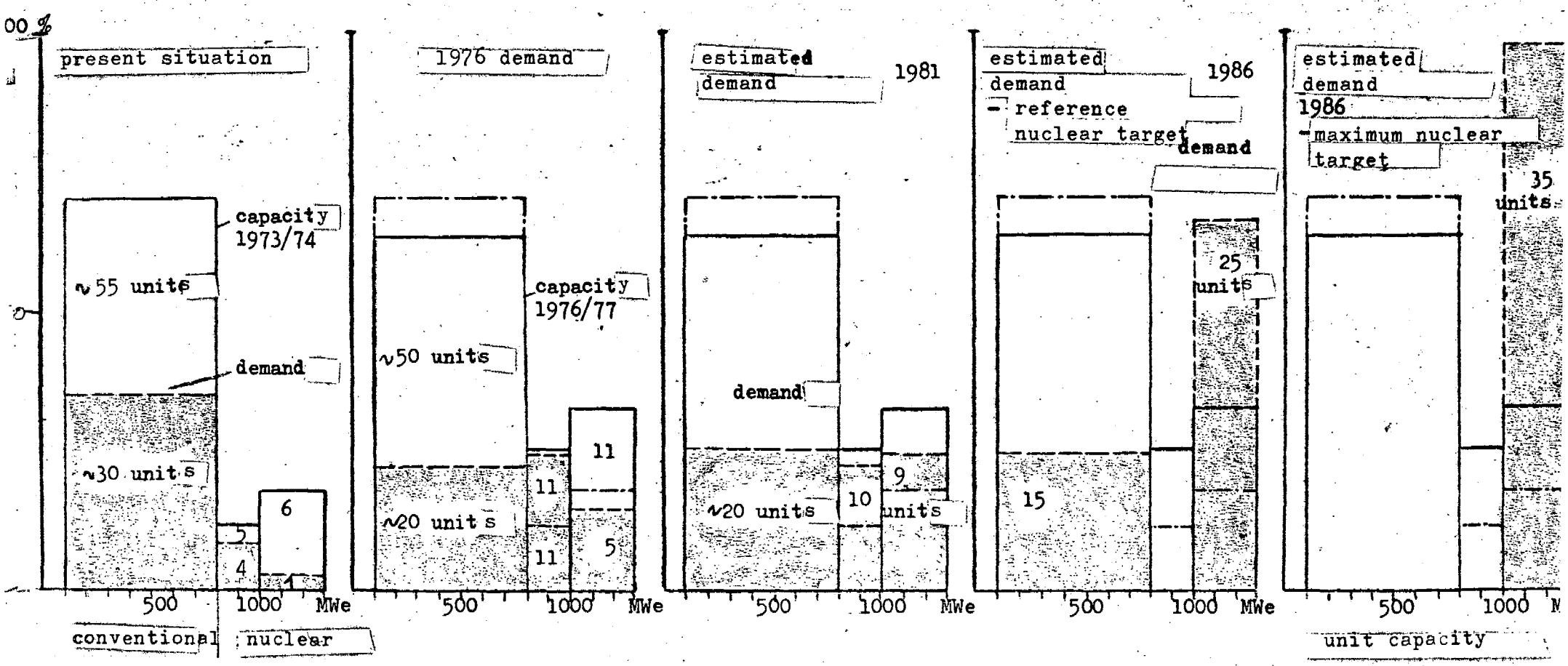
(2) Egypt, Argentina, Bangladesh, Chile, Jamaica, Yugoslavia, South Korea, Mexico, Pakistan, Philippines, Singapore, Thailand ("Market survey for nuclear power in developing countries" 1974 - IAEA).

* The TWh figures in brackets were obtained by interpolation, while the figures for installed capacity in brackets were obtained by extrapolation or estimates assuming an average load factor of 50 %.

** This does not allow for the current lag in the American programme.

Fig. 7

Comparison between existing industrial capacity for turboalternator sets (by unit capacity of conventional thermal and nuclear power stations) in the European Community and estimated future demand on the internal market



capacity in 1973/74 43 GWe = 100 %
capacity in 1976/77 52 GWe

Table 5

Estimate of available production capacity

in the Community in 1973*

Component country	Steam turbines MWe/annum (10 MVA) no. of manufacturers	Alternators MWe/annum (10 MVA) no. of manufacturers	Transformers MVA/annum (10 MVA) no. of manufacturers	Nuclear pressure vessels** units/annum no. of Manufacturers
Germany	14.000/3	14.000/2	50.000-55.000/4	2/2
France	8.000/3	9.000/3	26.000/3	6/1
Italy	6.500/2	6.500-8.000/3	35.000/4	7/2
Belgium	1.000/2	1.000/1	10.000/2	1/1
Netherlands	2.000 (at 50%)/2	2.000/1	4.000/1	5/1
UK	12.000/2	10.000/2	40.000-50.000/4	***
Community	42.500/14	42.500-44.000/12	165.000-180.000/18	21/7

mean value 43.000

* For existing unit capacities (1973)

** for light water reactors

*** The United Kingdom is not engaged in the construction of light water reactors; this does not reflect on the nuclear potential of the United Kingdom.

TABLE 6

Maximum unit capacity of equipment

Equipment	Unit	1951	1961	1972
Conventional boilers	t/h	400	1.700	2.085
Nuclear power stations	MWe	-	375	1.300
Turboalternator sets*	MW	125	550	1.300
Water turbines	MW	150	170	485
Gas turbines	MW	-	40	150
Transformers	MVA	200	1.000	1.344

* Conventional and nuclear sectors
Ref. OECD-25th survey of electric power equipment.

Fig. 8

Comparison between existing industrial power transformer capacity in the Community and estimated demand (internal) and export markets)

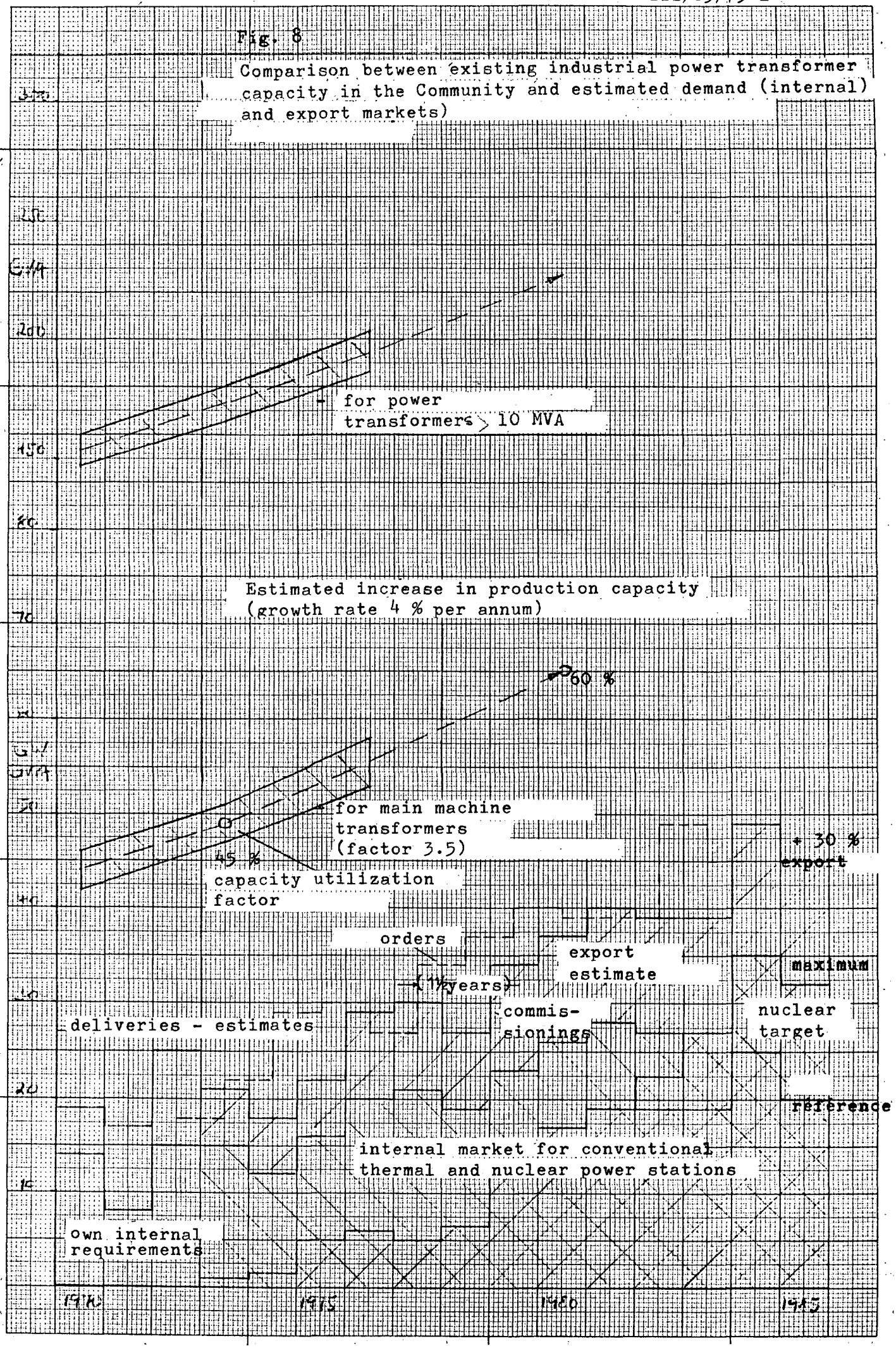


Fig. 9

Comparison between existing industrial capacity for nuclear power station pressure vessels (light water reactors) in the Community and estimated demand (internal and export markets)

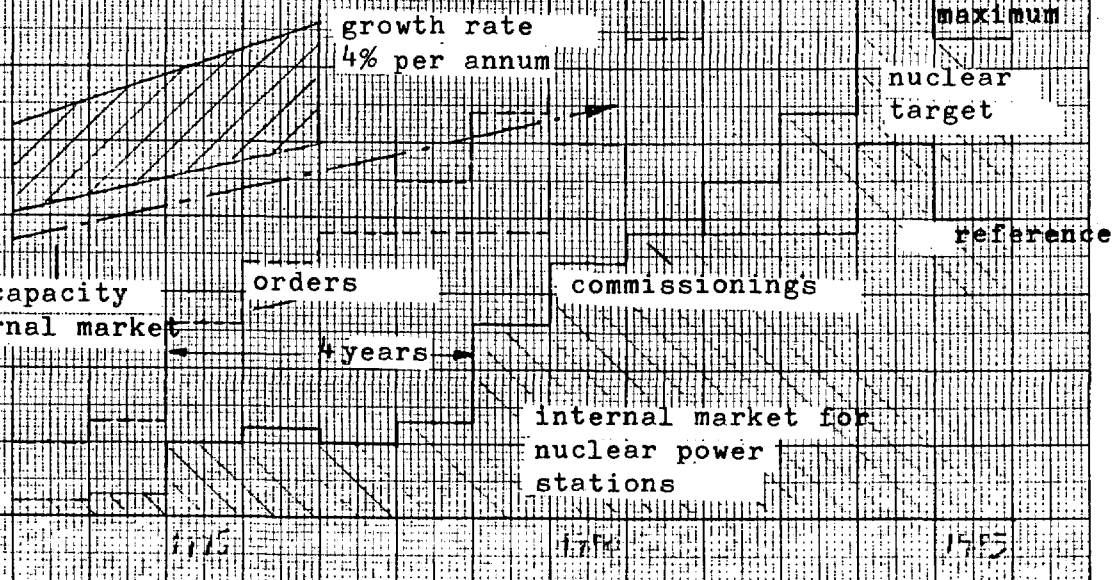


Table 10

Deliveries of turboalternator sets (steam)
by zone (in MWe)

Year / Zone	1960	1965	1970	1971	1972	1973
USA	9.300	14.000	26.000	35.000	43.000	35.000
of which Export	400	1.900	1.300	1.200	500	4.600
as %	4	14	5	3	1	13
Community 9*	10.000	16.000	19.000	17.000	~ 25.000	~ 28.000
of which Exp.	2.900	3.600	5.000	9.000	~ 10.000	~ 13.000
as %	29	23	26	53	~ 40	~ 46
Japan		3.200	12.000	12.000	12.000	11.000
of which Exp.		500	2.600	1.500	2.700	3.600
as %		16	22	13	23	33

* Deliveries from the nine countries now members of the European Community represented 82 % of European deliveries in 1970 and 75 % in 1971.

Table 11

Power transformers, deliveries by zone

(in MVA)

Year / Zone	1960	1965	1970	1971	1972	1973
USA	38.000	80.000	140.000	156.000	149.000	162.000
of which exp.	1.300	5.200	2.000	2.500	2.800	3.200
as %	3	7	1	2	2	2
Community of 9*	38.000	81.000	91.000	107.000	~115.000	~120.000
of which exp.	11.000	17.000	26.000	30.000	~ 32.000	~ 32.000
as %	29	21	29	28	28	27
Japan		21.000	52.000	50.000	43.000	66.500
of which exp.		6.100	13.500	9.900	6.200	6.900
as %		29	26	20	14	10

* Deliferies from the nine countries now members of the European Community represented 74 % of European deliveries in 1970 and 72 % in 1971.

Table 12

Undertakings carrying out complete LWR power stations or nuclear systems in the Community - financial links and licences

Country	Undertaking	Reactor PWR	Reactor BWR	Financial links (F) and licences/know-how (L) W F	W L	G.E. F	G.E. L	B.W. F	B.W. L	B.B.C. F	B.B.C. L	KWU F	KWU L
B	WENESE / ACECOWEN	x		x	x								
Da													
D	SIEMENS	x											
	KWU / AEG		x			x	x						
	BBR	x						x	x	x	x		
F	FRAMATOME	x		x	x								
	CGE		x				x						
Ir													
It	AMN		x				x						
	EI	x			x								
	SPIN	x						x	x		x		
L													
N	RSV Nucon B.V.		x										
	VMF Siemens NL	x	x									x	x

Table 13 : Companies making up the selected sample

Turnovers and total labour force in 1972

Company	Country	Turnover exclusive of tax (million EUR)	Total labour force
G.H.H. (C)	Germany	1.847,6	93.122
M.A.N. (SM)	"	630,9	37.063
KLOCKNER (C)	"	566,0	25.704
B.B.C. (Mannheim) (SM)	"	520,9	38.900
K.W.U. (SM)	"	201,5	24.123
G.H.H. STERKRADE (SM)	"	154,7	7.183
DEUTSCHE BABCOCK-WILCOX (SM)	"	130,1	24.673
TRAFO-UNION (C)	"	120,1	6.198
COCKERILL (SM)	Belgium	915,0	36.605
A.C.E.C. (SM)	"	149,9	11.142
CREUSOT-LOIRE (SM)	France	493,1	32.962
ALSTHOM (SM)	France	251,4	15.168
C.E.M. (SM)	France	182,0	11.143
MERLIN-GERIN (SM)	France	122,1	8.073
TERNI (SM)	Italy	131,4	6.484
ANSALDO (SM)	"	113,9	4.475
ERCOLE MARELLI (SM)	"	107,9	6.768
A.S.G.E.N. (SM)	"	97,3	5.964
FRANCO TOSI (SM)	"	80,4	4.627
T.I.B.B. (SM)	"	48,0	3.625
BREDA (SM)	"	40,9	2.166
RIJN-SCHELDE-VEROLME (C)	Netherlands	579,1	28.839
V.M.F. (C)	"	344,6	20.197
HOLEC (C)	"	107,6	7.754
GENERAL ELECTRIC CO. (C)*	UK	2.456,2	181.000
REYROLLE PARSONS (C)*	UK	182,6	21.089
BROWN BOVERI (Baden) (SM)*	Switzerland	276,1	19.340
		10.851,3	684.387

C = all figures consolidated

C* = all British companies consolidate at world level, except for labour force figures which show the total employed in the United Kingdom.

SM = Figures for parent company only

SM* = Figures for parent company only. The turnover is shown all taxes included before tax.