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# NUCLEAR POWER PROGRAMMES AND MEDIUM TERM PROJECTIONS IN THE OECD AREA

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Acknowledgment

The results presented in this paper are based, to a large extent, on the work of the NEA Working Party on Uranium Demand.

## 1. INTRODUCTION

In recent years, nuclear power systems have developed to the stage of maturity and nuclear power is steadily increasing its share in electricity production capacity. Therefore, it is important, not only within the context of energy resources, but also from the viewpoint of social and economic considerations to try to predict future trends and levels of nuclear power growth. These power growth data are also necessary to estimate the requirements for fuel cycle services such as uranium, enrichment and reprocessing, taking into account the long lead times involved in securing the required capacities.

The OECD Nuclear Energy Agency, together with the International Atomic Energy Agency, has endeavoured to fulfil this need by publishing reports on "Uranium Resources, Production and Demand" at regular intervals since 1965, the latest being published in December 1975 /1/.

At present, the situation regarding energy forecasts and public attitudes towards nuclear energy and the influence of political and economic pressures changes almost from one day to the next. These variations all have a significant impact on the growth of nuclear power and it is therefore necessary, if estimates of nuclear power growth are to be of real value, that they should be constantly brought up-to-date.

A more recent estimate by the NEA of short-term nuclear power growth is given in its report on reprocessing of spent nuclear fuels, published in January 1977 /2/.

## 2. ESTIMATES OF NUCLEAR POWER GROWTH THROUGH 1985 FOR OECD COUNTRIES

The basic nuclear power growth data utilised in this paper were obtained by an enquiry made by the OECD Nuclear Energy Agency on "Energy Growth and the Fuel Cycle" in 1976 /3/. Recipients of the questionnaires were requested to furnish a range of estimates of the growth of nuclear power in their respective countries, together with other germane information such as estimates of total energy growth, electricity requirements and breeder introduction dates.

The power growth data provided in response to this questionnaire have been designated as the "high estimates" for the purposes of this study. The following considerations have contributed to our derivation of a new "low estimate":

(a) The general tendency in the past for over-optimism in nuclear power forecasting.

(b) Announced delays in the licensing and construction of planned nuclear power plants, as well as the results of recent surveys reported in the literature /4,5,6/.

(c) The postulation of a reasonably smooth penetration by electric and nuclear power into the total energy market.

As a measure of the influence of these factors, our low estimates of nuclear power growth correspond to reductions of 15% from the high estimate in 1980 and 25% in 1985.

The high and low estimates of nuclear power in OECD countries thus obtained are shown in Table I. Similarly, in Figure 2.1, the high and low estimates of nuclear power growth in three regions of the OECD area, that is North America, Europe and Pacific, are displayed.

As is the case with other nuclear power forecasts that are updated periodically, the present NEA forecast is considerably below the levels predicted earlier. Comparison of the low estimates obtained in this study with the low estimates mentioned in the 1975 Uranium report shows reductions of 14% and 33% for 1980 and 1985 respectively.

Thus, both on a world-wide and on an individual-country basis, there have been large downward revisions in 1976. This must be explained to a large extent by the relatively slow economic recovery and to some shifting, in the shorter term, to fossil-fuelled plants as a result of high capital costs and long lead times required to implement nuclear power, and also partially as the result of insufficient public acceptance.

Such a trend, however, could very well be reversed in the future, as was seen following the 1973 oil embargo, when nuclear power came to be increasingly regarded as a substantial and necessary contributor to future energy needs and a means for many countries to become less dependant on oil imports. These considerations have not lost their importance.

When one examines the data on a country-by-country basis, the revisions in the forecasts vary considerably.

Figure 2.2 shows the low power growth estimates in eight countries in which capacities of more than 10 GWe nuclear power have been scheduled for 1985. The left ordinate shows the ratio between the low and the high estimate, the latter being based on data provided in the replies to the NEA questionnaire. The right ordinate shows the anticipated delays in the licensing and construction of nuclear power plants. From this figure it can be seen that during the next ten years there may be a possibility of a revision of as much as 40% downwards and a maximum of 4 years delay compared to the high estimate.

## 3. ESTIMATES OF NUCLEAR POWER GROWTH THROUGH 2000 FOR OECD REGIONS

In the previous section, we discussed short-term estimates through 1985, based on responses to questionnaires from each OECD country and on the basis of other considerations.

However, we had received so few nuclear power estimates beyond the year 1990 that we had to acquire additional data and to seek consistency in these data.

The basic information taken into account in this study to extend nuclear power growth estimates, includes the following:

(a) Estimates of total energy requirements, from 1975 to 2000, in each OECD region.

(b) Estimates of parameters related to nuclear power, such as the share of electricity in total energy requirements, electrical system load factors, and the share of nuclear power in total electricity requirements.

(c) Estimates by extrapolation of nuclear power growth from 1985 to 2000.

Estimates (a) and (b) were obtained through discussions in the NEA Working Party on Uranium Demand. The total energy requirement is based on published data /7/, modified to take account of long-term energy strategies /8/. This estimate is shown in Table II.

The parameters estimated in (b) were obtained by extrapolating corresponding data /9/ for the period 1960-1974 and are shown in Figure 3.1.

The extrapolation of nuclear power growth to the year 2000, was obtained by curve-fitting the short-term data from 1975 to 1985 listed in Table I.

The task of establishing a nuclear power growth forecast to the year 2000 was then resolved into one of seeking consistency between independent data sets (a), (b) and (c). In order to achieve such consistency, the sub-routine diagrammed in Figure 3.2 was devised. Briefly, the sub-routine iteratively checks and adjusts samples of extrapolated nuclear power capacity against the total energy requirements and power parameters. The convergence criterion is satisfied when the stated energy requirements in each OECD region are met, while power parameters remain within limits of their original values. In this fashion, we arrive at the high and low nuclear power growth estimates for each OECD region from 1975 to 2000. These data are shown in Table III and Figure 3.3.

Comparison of the Figure 3.3 long-term and Figure 2.1 near-term nuclear power forecasts shows good agreement, particularly in the low case.

The estimate of the total energy requirement (Table II) was a dominant factor in the derivation of the nuclear power growth estimate, and deserves special mention.

Following the reasoning of Professor Grenon, who combined a new distribution curve of per capita energy consumption with recent assumptions of world population growth /8/, we assumed that the total world energy requirement in the year 2050 will reach a saturation level which is 8 times larger in the high case and 4 times larger in the low case than that of 1975. We assumed, at the same time, that these factors will also apply to OECD countries.

The effects of these assumptions are reflected in the low growth estimate in Figure 3.3 and especially in the European Region, near the year 2000.

When one examines the final results of these computations in Figure 3.3, it may be observed that the band-width of high and low estimates in the Pacific Region is larger than those of other regions. This may be due to the fact that the total energy growth rate in the Pacific Region is larger than that in the other regions, leaving a greater margin for uncertainty.

## 4. PROBABLE SCENARIOS FOR NUCLEAR REACTOR STRATEGIES

The large downward revisions in the estimates of nuclear power growth during the past few years does not alter the need to predict the commercial introduction of advanced reactor concepts, such as the fast breeder and high temperature gas-cooled reactors, following the established use of water cooled reactors. In an earlier report /1/, the introduction time of these reactor types was suggested as the mid-1980s. However, more recent information indicates a more probable introduction in the mid-1990s [10,11].

### 4.1 LWR and other thermal reactors

The probable scenarios for nuclear reactor growth in OECD countries through 1985 will be mainly based on the LWR. Although several other kinds of thermal reactors had been planned [12], only three countries have construction schedules: Canada (HWR-9 GWe), Federal Republic of Germany (HTR-1.5 GWe) and the United Kingdom (AGR-3.7 GWe).

With regard to other thermal reactor types under development, the United Kingdom initiated plans, now undergoing review, to install the steam generating heavy water reactor. An advanced thermal reactor that combines the characteristics of Canadian CANDU and the United Kingdom SGHWR design might find acceptance in Japan.

It is difficult to predict, from presently available information, the kinds of thermal reactors, other than LWRs, that will find commercial use through the year 2000. The one reactor type which appears clearly defined within a long term national programme is the HWR in Canada. High temperature gas-cooled reactors (HTR), for which all orders have been cancelled in the United States, may re-enter the market in the mid-1990s in view of its strong support in Germany and Japan for direct-thermal use [13].

However, it is the light water reactor which will dominate the reactor scenarios throughout the remainder of this century. We also believe that there will not be large changes in the current ratio of PWRs to BWRs through the year 2000.

### 4.2 FBR introduction and its growth

The OECD countries, where development programmes for FBR prototypes are well under way include France, the Federal Republic of Germany, Japan, the United Kingdom and the United States. With the exception of France and the United Kingdom, whose advanced reactors could permit a more rapid pace, the following sequence of events might be predicted:

(a) Until the late 1970s: Fuels and materials, safety analyses.

(b) Mid-1980s: Construction of a 300 MWe prototype reactor such as Phoenix.

(c) Late 1980s and beyond: Prototype reactor operation to obtain data necessary to systems optimisation, safety and licensing.

(d) Mid-1990s: Commercial introduction of 1000 MWe-class FBRs.

Early introduction and rapid growth of the FBR have been strongly advocated for a long time from the point of view of conservation of uranium resources. Therefore, it is important to determine the influence of FBR strategies on future requirements for uranium. Assuming the early introduction and rapid growth of the FBR, it is also necessary to provide for recovery of plutonium, not only from thermal reactors, but from the breeders themselves.

The NEA Working Party on Uranium Demand, after its discussion of various FBR introduction patterns, decided on two estimates of FBR growth (high and low, as shown in Figure 4.1). In this figure, it is assumed that commercial introduction occurs in the mid-1990s. In the low case, FBR introduction is taken essentially at the historical rate of LWR introduction, while in the high case, FBR growth is constrained only by plutonium supply.

## 5. FACTORS INFLUENCING THE GROWTH OF NUCLEAR POWER

In section 2, estimates were given for the growth of nuclear power up to 1985, based on short-term projections of present-day data as influenced by the economic and social factors relevant to each OECD country. In section 3, a longer-term estimate was derived on the basis of analytical data, influenced by factors of more general concern, such as world population growth, and adequacy of energy supplies. These factors, both short-term and long-term, will now be discussed.

Factors influencing the growth of nuclear power in the short-term, include the following:

- The trend towards power conservation. This trend, which has persisted to some extent since the oil embargo of 1973, has tended to preserve adequate reserve margins for many utilities and fewer utilities have found it necessary to add base load units, the prime market for nuclear power plants.

- The economic recession, and consequent reduction in the energy demand. The recession somewhat reduced the growth of industry through its reluctance to make new investments, and thereby slowed the increasing demand for power.

- Uncertainties in the availability of fuel cycle services. Because of uncertainties in the areas of spent fuel storage, reprocessing and recycle, prospective reactor operators must give greater consideration to the storage of spent fuels, and procure greater amounts of uranium feed than would be required under spent fuel recycle.

- Uncertainties in the regulatory process. The continuing evolution of regulatory criteria has had an unsettling effect upon utilities. The net result has been a lengthening of the lead time required to implement decisions to increase nuclear power generation capacity.

- Public acceptance of nuclear power. Varying sectors of public opinion continue to question the need for nuclear power. More recently, interest has shifted from questions of reactor safety to the availability of fuel cycle services, including uranium supply as well as waste disposal.

- The variability of fossil fuel supplies. Recent events such as the oil embargo of 1973 and the discovery of Alaskan and North Sea oil resources have had differing and unexpected effects on various national programmes for nuclear power development.

Factors influencing the growth of nuclear power in the long-term may include the following:

- Societal factors of a world-wide nature. In this category a cumulative effect upon total energy growth is produced as the result of trends in population growth, lifestyle, and environmental protection resources. Ultimately, these effects must also influence the growth of nuclear power.

- Development of new energy technologies. The development of new energy technologies will naturally influence nuclear power growth. Coal gasification technologies may be the first to influence the pattern of the total world energy supply, followed by the development of geothermal, hydrogen-producing, solar and fusion systems. The effects of these technologies, although relatively small before the year 2000, cannot be ignored.

-National energy policies and international co-operation. National energy policies, such as those directed toward energy independence, can have a considerable effect upon nuclear power programmes, as evidenced by measures taken after the oil embargo of 1973. However, these policies may become less significant after the turn of the century, giving way to greater emphasis on international co-operation in energy development technology and the pooling of resources in a world environment of diminishing energy supplies.

It is very difficult to identify and estimate the impact of factors that might affect the future growth of nuclear power, but nevertheless we offer the following tentative suggestions:

-Impact of economic factors

World-wide economic recession has exercised a profound influence on nuclear power growth, and full recovery from the depression may not take place in a period of a few years in view of the long lead times required to obtain benefits from new investment and construction. It also is expected that several consequences of the recession, such as energy conservation and altering of life-styles will be of long duration and continuing significance.

-Impact of energy supply factors

Large replacement of existing energy sources should not be expected until the year 2000. If we succeed in introducing the plutonium-fuelled breeder to conserve our uranium resources, nuclear power will be a substantial contributor to future energy needs.

-Impact of technology development

In the short-term, fuel-cycle commercialisation and plutonium utilisation in thermal reactors will have an impact on nuclear power growth. In the long-term, the development of technology in new energy systems such as solar and fusion could have a large impact on nuclear power growth after 2000.

-Impact of policy

The policy of the industrialized countries concerning the desirable growth rates of nuclear power, their attitude towards the recovery of the energy contained in spent nuclear fuel and last, but not least, the thrust behind breeder development, will have a significant impact not only on the pattern of future energy production, but also on economic growth as such. Furthermore, co-operation in the energy field between industrialized and developing countries will also have a considerable influence on world economic development.

## 6. CONCLUDING REMARKS

From the estimates of nuclear power growth through 2000 for OECD Regions in this study, we can summarise the following conclusions.

(1) The high growth estimate assumes nuclear power capacities of 390 GWe in 1985, 680 GWe in 1990, and 1640 GWe in 2000. In the low growth estimate, capacities of 290 GWe in 1985, 470 GWe in 1990, and 830 GWe in 2000 are forecast. The average nuclear share in electric capacity will steadily increase to about 40% in the year 2000.

(2) These estimates represent substantial downward revisions from OECD estimates given in the 1973 Uranium Report (20% less in the case of the high power growth estimate, and 33% less in the lower power growth estimate for 1985). Since the conditions, on which present estimates of nuclear power growth are based, are rapidly changing, these estimates should be constantly brought up-to-date.

(3) The nuclear reactor strategies until 2000 will be principally based on the Light Water Reactor. Commercial introduction of FBRs will become significant in the mid-1990s.

(4) In some countries, the HWR and HTR may assume a substantial share of the market in the mid-1990s.

(5) After the year 2000, the growth rate of nuclear power, although continuing at a rapid pace, is assumed to approach an equilibrium value which it might reach in the middle of the next century.

The requirements for fuel cycle services (uranium, enrichment, reprocessing) which have been computed on the basis of nuclear power growth data reported in this paper will also be presented at this Conference /14/.

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Table I NUCLEAR POWER GROWTH ESTIMATE FOR OECD COUNTRIES (GWe)

| End of Year | 1975 | 1976 | 1977 | | 1978 | | 1979 | | 1980 | | 1981 | | 1982 | | 1983 | | 1984 | | 1985 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Country | | | Low | High | Low | High | Low | High | Low | High | Low | High | Low | High | Low | High | Low | High | Low | High |
| Canada | 2.5 | 3.1 | 4.0 | 4.0 | 4.9 | 5.0 | 5.8 | 6.0 | 6.7 | 7.0 | 7.5 | 8.0 | 8.0 | 8.8 | 8.5 | 9.6 | 9.6 | 11 | 11 | 12 |
| United States | 38 | 43 | 50 | 54 | 56 | 61 | 61 | 70 | 67 | 81 | 80 | 90 | 90 | 105 | 102 | 116 | 114 | 135 | 130 | 160 |
| North American Region | 41 | 46 | 54 | 58 | 61 | 66 | 67 | 76 | 74 | 88 | 88 | 98 | 98 | 114 | 111 | 126 | 124 | 146 | 141 | 172 |
| Australia | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| Japan | 6.6 | 7.4 | 10.3 | 11 | 12 | 13 | 13.2 | 15 | 15.2 | 17 | 17 | 24 | 20 | 30 | 22 | 36 | 25 | 41 | 27 | 49 |
| New Zealand | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| Pacific Region | 6.6 | 7.4 | 10 | 11 | 12 | 13 | 13 | 15 | 15 | 17 | 17 | 24 | 20 | 30 | 22 | 36 | 25 | 41 | 27 | 49 |
| Austria | - | - | 0.7 | 0.7 | 0.7 | 0.7 | 0.7 | 0.7 | 0.7 | 0.7 | 0.7 | 0.7 | 1.8 | 2 | 1.8 | 2 | 1.8 | 2 | 2.6 | 3 |
| Belgium | 1.7 | 1.7 | 1.7 | 1.7 | 1.7 | 1.7 | 1.7 | 2.6 | 1.7 | 3.5 | 3.5 | 4.5 | 4.5 | 5.5 | 5.5 | 6.8 | 6.8 | 8.1 | 8.1 | 8.1 |
| Denmark | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| Finland | - | - | 0.4 | 0.4 | 1.5 | 1.5 | 1.5 | 1.5 | 1.5 | 2.2 | 1.5 | 2.2 | 1.5 | 2.2 | 1.5 | 2.2 | 1.5 | 2.2 | 1.5 | 3.2 |
| France | 3.1 | 3.1 | 5.6 | 5.8 | 7 | 7.8 | 12 | 13 | 15 | 18 | 19 | 23 | 23 | 28 | 27 | 33 | 31 | 39 | 35 | 45 |
| Germany, F.R. | 3.5 | 6.4 | 8.6 | 9.5 | 10.8 | 11.1 | 12.4 | 13.8 | 12.4 | 13.8 | 14 | 19 | 16 | 24 | 21 | 29 | 24 | 35 | 28 | 39 |
| Greece | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 0.6 | - | 0.6 |
| Ireland | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 0.7 | - | 0.7 |
| Italy | 0.6 | 0.6 | 1.4 | 1.4 | 1.4 | 1.4 | 1.4 | 1.4 | 1.4 | 1.4 | 1.4 | 1.4 | 1.4 | 1.4 | 2.8 | 3.4 | 6.4 | 7.4 | 10 | 11.4 |
| Luxembourg | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 1.0 | 1.2 | 1.0 | 1.2 |
| Netherlands | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 1.5 |
| Norway | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| Portugal | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 0.6 | 1.3 |
| Spain | 1.1 | 1.1 | 2.5 | 2.5 | 4.0 | 4.3 | 6.2 | 6.3 | 7.4 | 8.2 | 8.5 | 11.2 | 11.5 | 14.2 | 13 | 17.2 | 14 | 20.2 | 14.5 | 23.2 |
| Sweden | 3.2 | 3.2 | 4.1 | 4.2 | 4.6 | 4.8 | 5.3 | 5.4 | 6.0 | 6.0 | 6 | 6.7 | 6 | 7.4 | 6 | 8.0 | 6 | 9.0 | 6 | 10 |
| Switzerland | 1 | 1 | 1 | 1 | 1 | 1 | 1.9 | 1.9 | 1.9 | 1.9 | 2.5 | 2.5 | 2.5 | 2.5 | 3.3 | 3.3 | 3.3 | 3.8 | 3.3 | 3.8 |
| Turkey | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 0.6 | 0.6 |
| United Kingdom | 6.1 | 6.9 | 8.3 | 8.4 | 9.4 | 10 | 9.4 | 11 | 9.4 | 11 | 10.3 | 11 | 11 | 12 | 11 | 12.5 | 11 | 13 | 13 | 15.7 |
| European Region | 21 | 25 | 35 | 36 | 43 | 45 | 53 | 58 | 58 | 67 | 68 | 83 | 80 | 100 | 93 | 118 | 107 | 143 | 125 | 168 |
| OECD | 68 | 78 | 99 | 105 | 116 | 124 | 133 | 149 | 147 | 172 | 173 | 205 | 198 | 244 | 226 | 280 | 256 | 330 | 293 | 389 |

Figure 2.1

THE HIGH AND LOW ESTIMATES OF NUCLEAR POWER GROWTH IN EACH REGION THROUGH 1985

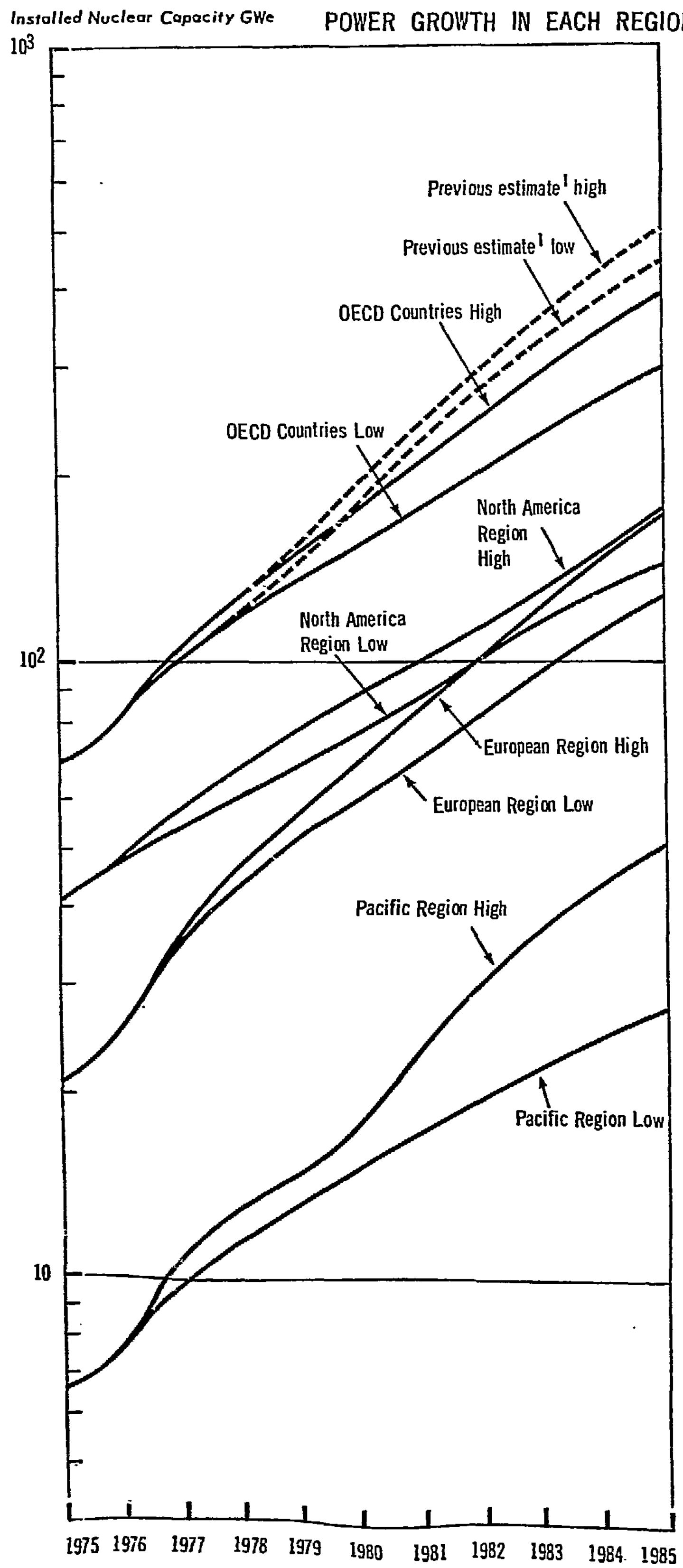


Figure 2.2 ESTIMATION OF REDUCTION FROM HIGH SCHEDULE OF NUCLEAR POWER GROWTH IN MAIN OECD COUNTRIES (> 10GWe at 1985)

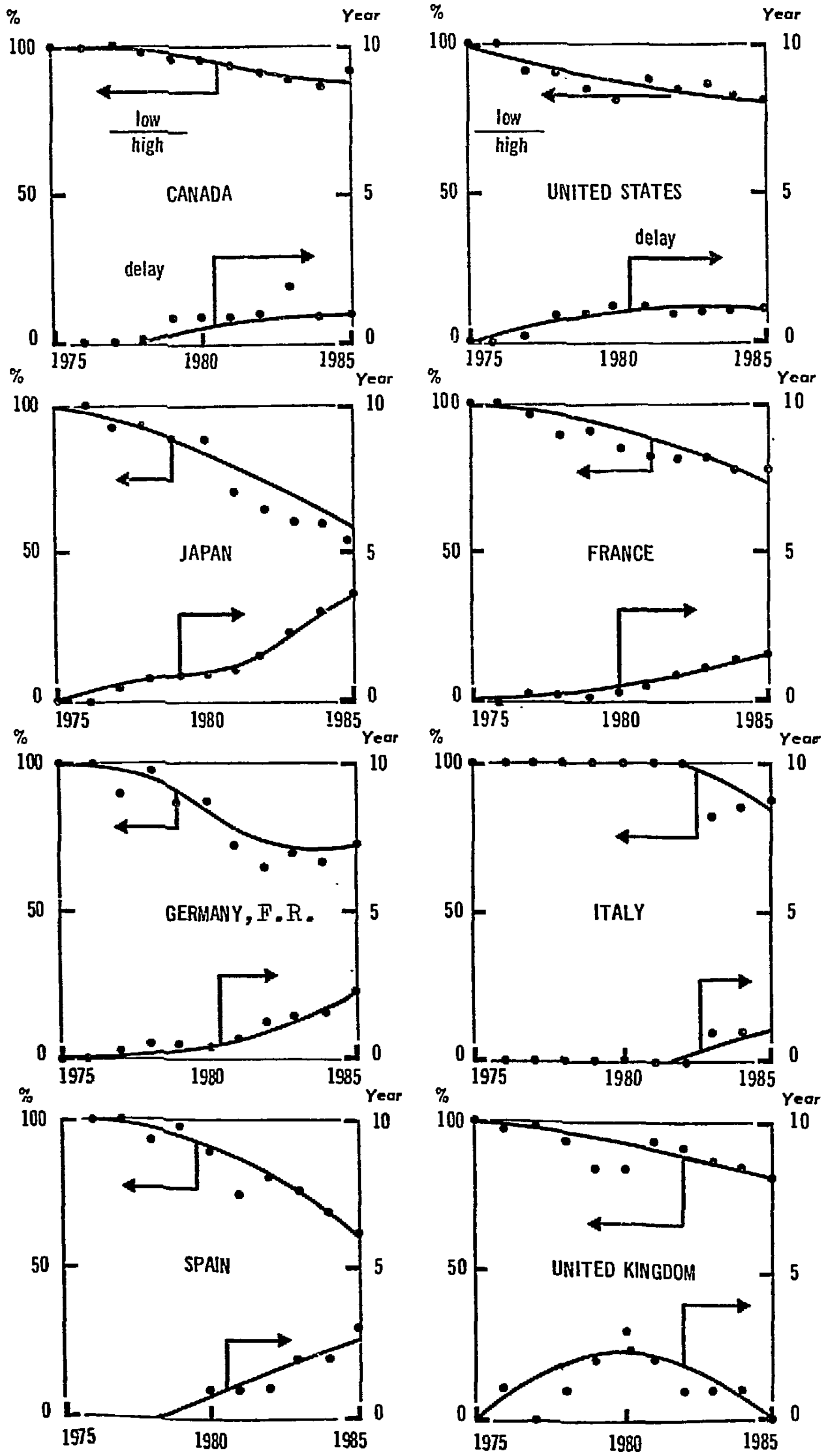


Table II <u>TOTAL ENERGY REQUIREMENTS [$10^{13}$ Kcal]*</u>
<u>AND GROWTH RATES [% yr]**</u>

$10^{13}$ Kcal≙Mtoe

| | | 1975* | 73/75** | 1980* | 75/80** | 1985* | 80/85** | 1990* | 85/90** | 1995* | 90/95** | 2000* | 95/2000** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| OECD Europe Region | H | 1136 | - 1.8 | 1450 | 5.0 | 1807 | 4.5 | 2198 | 4 | 2643 | 3.8 | 3100 | 3.2 |
| | L | | | 1382 | 4.0 | 1642 | 3.5 | 1904 | 3 | 2182 | 2.8 | 2320 | 1.2 |
| OECD America Region | H | 1877 | - 2.0 | 2339 | 4.5 | 2846 | 4 | 3380 | 3.5 | 3957 | 3.2 | 4542 | 2.8 |
| | L | | | 2176 | 3.0 | 2523 | 3.0 | 2854 | 2.5 | 3213 | 2.4 | 3312 | 0.6 |
| OECD Pacific Region | H | 400 | - 0.2 | 615 | 9 | 863 | 7 | 1154 | 6 | 1487 | 5.2 | 1880 | 4.8 |
| | L | | | 535 | 6 | 683 | 5 | 831 | 4 | 987 | 3.5 | 1117 | 2.5 |
| OECD Total | H | 3413 | - 1.7 | 4404 | 5.2 | 5516 | 4.6 | 6732 | 4.1 | 8086 | 3.7 | 9552 | 3.4 |
| | L | | | 4093 | 3.7 | 4876 | 3.4 | 5589 | 2.9 | 6382 | 2.7 | 6749 | 1.1 |

H = High Estimate
L = Low Estimate

Table III ELECTRICAL REQUIREMENTS AND CAPACITIES /Twh, GWe7

NUCLEAR POWER GROWTH ESTIMATE /GWe7

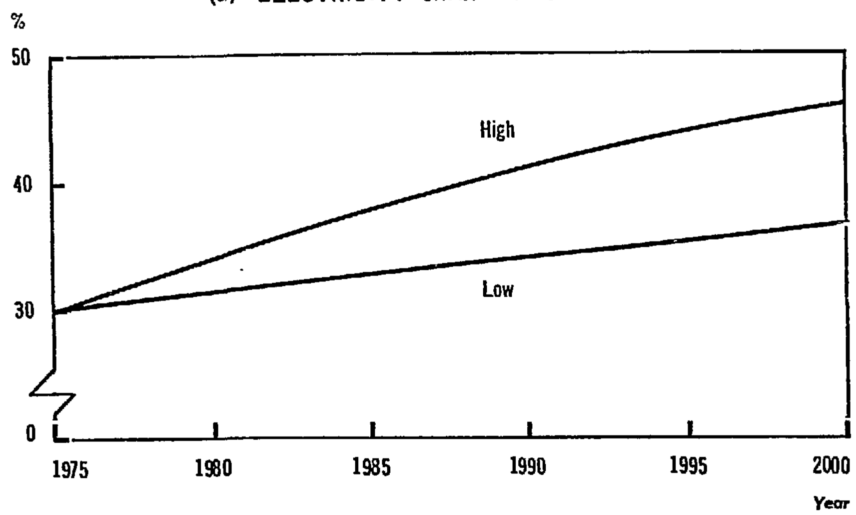
| | | 1975 | 1980 | | 1985 | | 1990 | | 1995 | | 2000 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | High | Low | High | Low | High | Low | High | Low | High | Low |
| Electricity Req. (Twh) | OECD Europe | 1414 | 2094 | 1854 | 3015 | 2405 | 3936 | 2945 | 5108 | 3438 | 6243 | 3748 |
| | OECD America | 2338 | 3046 | 2657 | 4170 | 3281 | 5365 | 3846 | 6764 | 4482 | 8503 | 4852 |
| | OECD Pacific | 498 | 776 | 653 | 1188 | 862 | 1690 | 1034 | 2318 | 1326 | 3213 | 1591 |
| | TOTAL | 4250 | 5915 | 5164 | 8373 | 6549 | 10991 | 7825 | 14189 | 9246 | 17960 | 10191 |
| Electric Capacities (GWe) | OECD Europe | 323 | 469 | 423 | 662 | 528 | 848 | 672 | 1080 | 785 | 1296 | 855 |
| | OECD America | 534 | 682 | 607 | 915 | 720 | 1156 | 878 | 1430 | 1023 | 1765 | 1108 |
| | OECD Pacific | 114 | 174 | 149 | 260 | 189 | 364 | 236 | 490 | 304 | 668 | 367 |
| | TOTAL | 971 | 1325 | 1179 | 1837 | 1438 | 2368 | 1787 | 3000 | 2111 | 3728 | 2330 |
| Nuclear Power Capacity (GWe) | OECD Europe | 21 | 67 | 58 | 168 | 125 | 286 | 200 | 418 | 284 | 560 | 307 |
| | OECD America | 40 | 88 | 74 | 172 | 141 | 309 | 215 | 514 | 305 | 810 | 370 |
| | OECD Pacific | 7 | 17 | 15 | 49 | 27 | 85 | 52 | 158 | 92 | 270 | 152 |
| | TOTAL | 68 | 172 | 147 | 389 | 293 | 680 | 467 | 1090 | 681 | 1640 | 829 |

Conversion factor: 2457 kcal/kWh

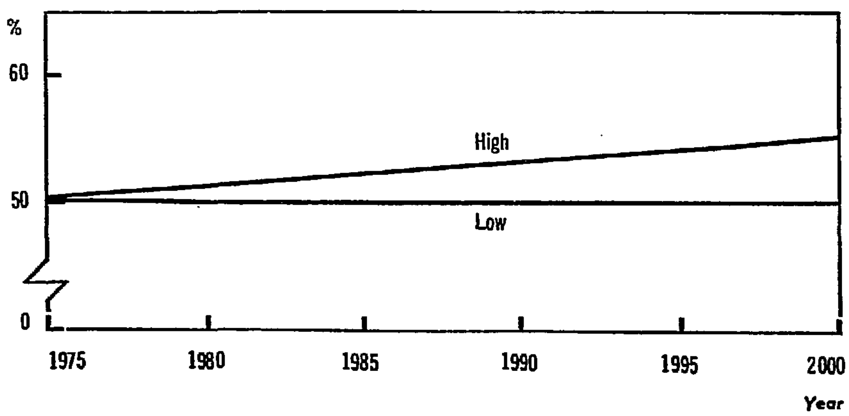
Figure 3.1

OECD AVERAGE

(a) ELECTRICITY SHARE IN TOTAL ENERGY




(b) SYSTEM LOAD FACTOR




(c) NUCLEAR SHARE IN ELECTRICITY CAPACITY

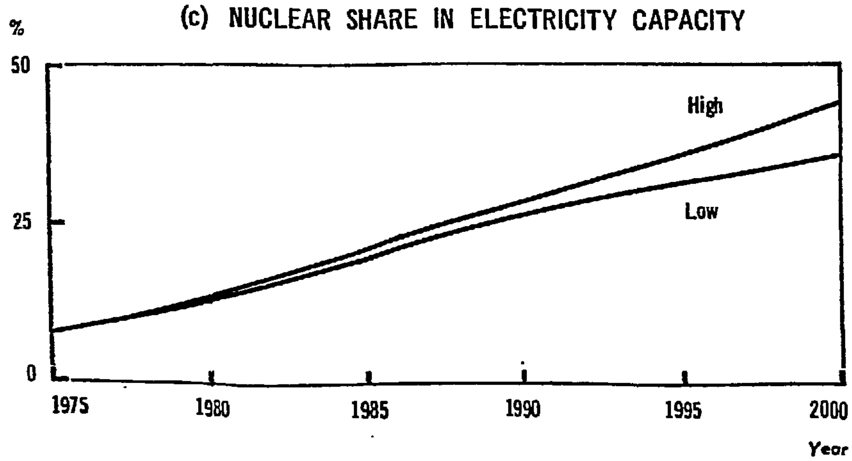
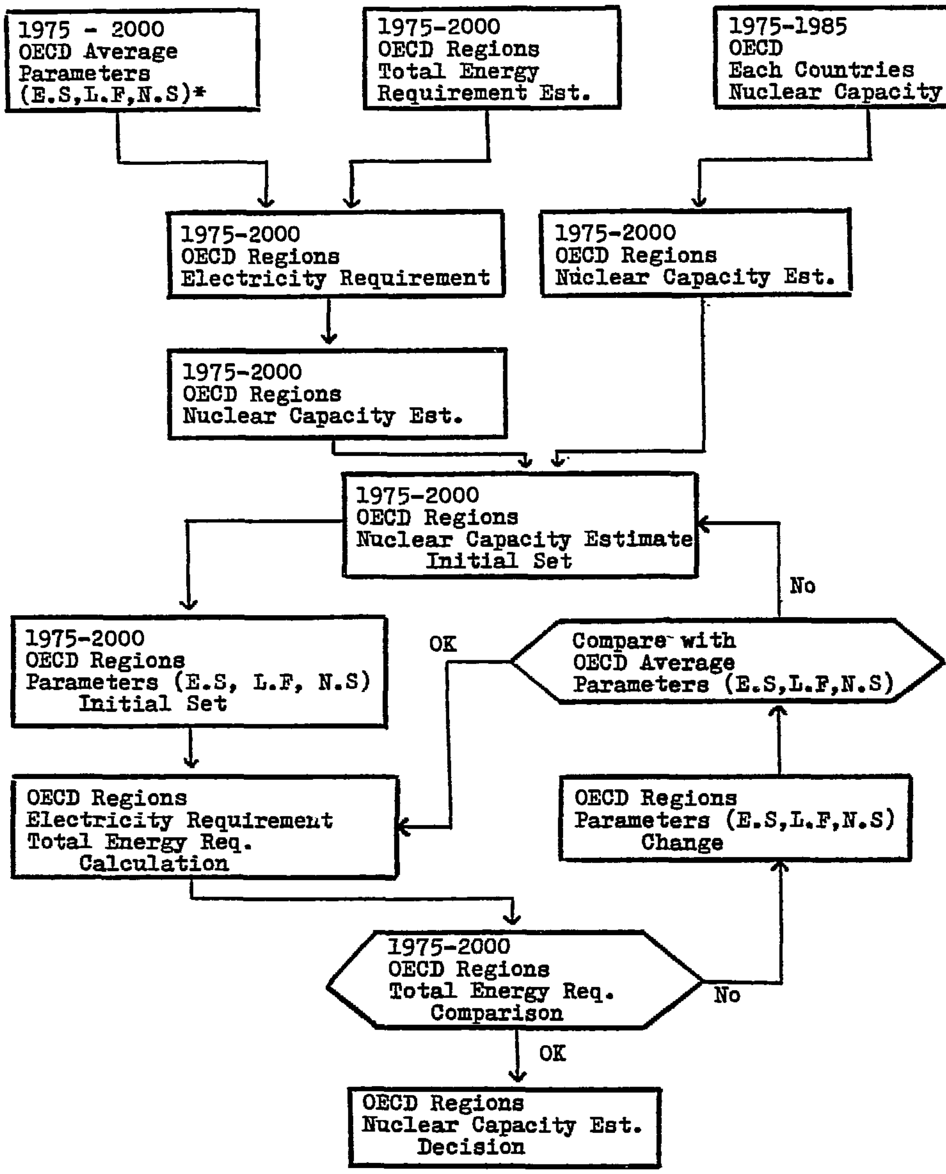


Figure 3.2

FLOW DIAGRAM TO ESTIMATE NUCLEAR CAPACITIES
IN OECD REGIONS THROUGH 2000




* E.S. Electricity share
L.F. Load factor
N.S. Nuclear share

Figure 3.3

THE HIGH AND LOW ESTIMATES OF NUCLEAR POWER GROWTH IN EACH REGION THROUGH 2000

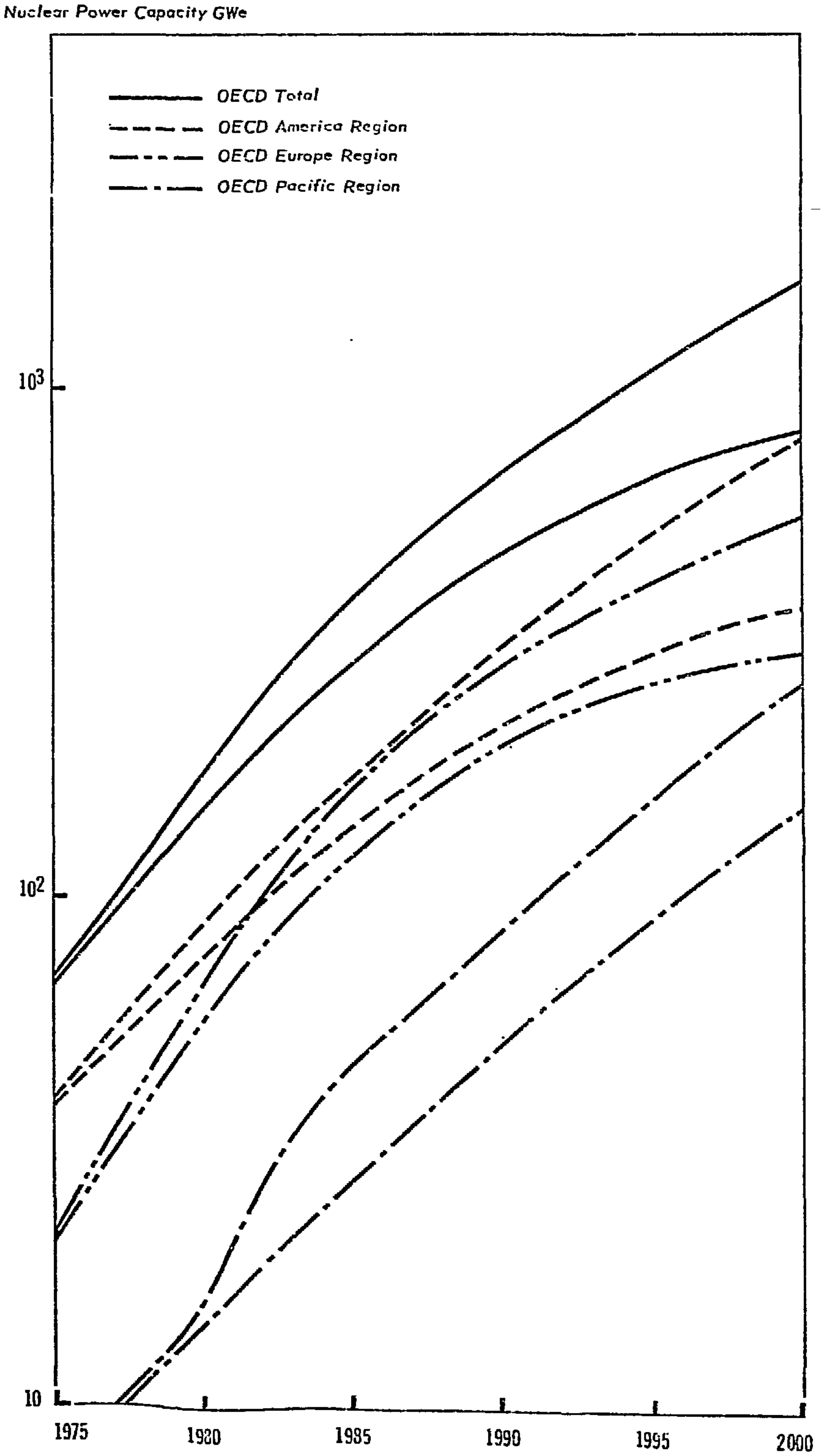


Figure 4.1

TWO ESTIMATES OF FBR GROWTH IN OECD COUNTRIES