CABINET

NUCLEAR POWER PROGRAMME: 1970-1975

Note by the Secretary of the Cabinet

By direction of the Prime Minister I circulate a memorandum which the Chancellor of the Exchequer has circulated to the Economic Policy Committee. The Prime Minister would be glad if members of the Cabinet who are not members of the Economic Policy Committee would regard themselves as included in the Chancellor's invitation to send him comments on the draft White Paper at Annex II of the memorandum, with copies to the Secretary of State for Education and Science, the Minister of State for Education and Science (Sir Edward Boyle) and the Minister of Power, by noon on Monday, 13th April.

(Signed) BURKE TREND

Cabinet Office, S.W.1

10th April, 1964
CABINET
ECONOMIC POLICY COMMITTEE

NUCLEAR POWER PROGRAMME

Memorandum by the Chancellor of the Exchequer

Following discussion in the Committee (E.P. (64) 14th Meeting, Minute 3) I have had further discussions on the proposed White Paper on the Nuclear Power Programme with the Secretary of State for Education and Science, his Minister of State and the Minister of Power. As my colleagues will see from the attached minute (Annex I) which I have sent to the Prime Minister, we have been able to agree on the line which the White Paper should take. We are also convinced that it is necessary that the White Paper should be published as early as possible next week.

2. We have agreed upon some amendments to the text of the White Paper. I circulate it now (Annex II) with an invitation to my colleagues on the Economic Policy Committee to send to us any amendments which they think it necessary to suggest. Would they kindly do so not later than mid-day on Monday, 13th April?

R.M.

Treasury Chambers, S.W.1

9th April, 1964
MINUTE BY THE CHANCELLOR OF THE EXCHEQUER TO
THE PRIME MINISTER

THE NUCLEAR POWER PROGRAMME

In answer to a Question by Mr. Pentland on the 17th March you told the House that you hoped that an announcement of the Government's conclusions following their study of the report of the Powell Committee on the Nuclear Power Programme would be made immediately after the Easter Recess.

2. On 25th March the Economic Policy Committee considered a draft White Paper. This followed generally the line recommended by the Powell Committee: technical and economic assessment of the main reactor types had led to the conclusion that the economic advantages to be gained by further development of the present Magnox system were likely to be smaller than those offered by new systems; and that the advanced gas-cooled reactor developed by the Atomic Energy Authority was likely to prove one of the most promising types for the continuance of our nuclear power programme; for planning purposes a programme of 5,000 MW of nuclear generating capacity should be adopted for commissioning during the six years 1970-75; but it was impossible at this stage to make a firm choice of a particular system because information had lately become available about American water-moderated reactors which were said to have lower capital costs although higher running costs than those of the advanced gas-cooled reactor; and the next step should be to obtain tenders from British industry for reactors of two different systems, the advanced gas-cooled reactor and the water-moderated reactor, the latter to be manufactured under licence to American design.

3. The Economic Policy Committee was troubled by the possibility that an announcement that we were willing to contemplate reactors of American design would kill the prospects of our own
of our own nuclear power industry and involve us in writing off the very substantial sums of money which have been devoted to nuclear power research in the past. They took the point that if, at this stage, no nuclear system was competitive with the latest conventional power stations the choice should lie between a British nuclear system, even if this were more expensive than an American alternative, and conventional power.

4. In the light of these reactions in the Economic Policy Committee, I have had further discussions with the Secretary of State for Education and Science, the Minister of State for Education and Science and the Minister of Power. The Minister of Power has been pursuing enquiries and in our discussions has produced the following information:

(a) The British industrial consortia which build nuclear plant are themselves interested in water-moderated reactors. One of them intends in any case to offer a tender for such a reactor to the Central Electricity Generating Board (C.E.G.B.), and not to offer a tender for an advanced gas-cooled reactor station. Another intends to submit a tender for a water-moderated reactor along with a tender for an advanced gas-cooled reactor, as a speculation.

(b) The C.E.G.B. intend to invite tenders not merely for one advanced gas-cooled reactor but for a second as well in order to bring out any reduction in price which could be obtained by buying more than one. This should help towards making tenders for the two systems comparable.

(c) Until we have tenders there simply is no basis for judging the merits of the two systems.

(d) It is not necessarily intended that all the reactors in the new programme should be of one type; and if both types were running in Britain this might help our export industry, since we could show both types operating.

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5. In the light of this information my colleagues and I have concluded that the line taken in the draft White Paper is the right one, subject to some minor amendments which we have made in the text attached. None of us regards this text as prejudging the eventual decision on the system or systems to be adopted. It is even possible that in the end conventional power may be preferred for the time being, and we are satisfied that the invitations to tender would not rule out this course.

6. I am circulating copies of this minute and of the revised draft White Paper to my colleagues in the Economic Policy Committee, and I am also arranging for those members of the Cabinet who are not members of this Committee to be consulted. I have asked them to send any comments they may have on the draft White Paper to me and to the Secretary of State for Education and Science, his Minister of State, and the Minister of Power, not later than noon on Monday, 13th April. In this way we intend to have the draft White Paper ready for publication on Wednesday, 15th April, the day after Budget day. So, when you answer your Questions on Tuesday, 14th April, you will be able to say that the White Paper is to be published on the following day.

R.M.

9th April, 1964
Orders have now been placed for all the nuclear power stations under the present nuclear power programme; the last of them was ordered in 1963 and will be commissioned in 1968/69. This White Paper sets out the programme which has been adopted for planning purposes for commissioning in the six years 1970 to 1975.

The Present Nuclear Power Programme

2. The nuclear power programme "A Programme of Nuclear Power" (Cmd. 9389), was first prepared in 1955, at a time when there had been a prolonged shortage of coal which was expected to continue. It provided for the installation of 1,500-2,000 MW of nuclear capacity by 1965, but emphasised the need for flexibility to take account of later developments. In 1957, when oil supplies also seemed at risk, the programme was trebled to provide for the installation of 5,000-6,000 MW of nuclear power by 1965. This was announced in Parliament in March, 1957, and details were given later in the Appendix to "Capital Investment in the Coal, Gas and Electricity Industries" (Cmd. 132). By 1960 the strain on our coal supplies had eased and the prospects of oil supplies also had improved. At the same time there was a substantial reduction in the estimated capital costs of conventional stations from about £55 per kW for those planned in 1955 to about £37 per kW for stations planned in 1960 because of technical advances which permitted the use of larger units employing higher steam pressures and temperatures; and these advances have been reflected in lower running costs. Moreover, the estimated relative cost of nuclear power had risen since 1955, not
because of any change in technical assessment, but because of the increased emphasis on the importance of earning a proper rate of return on the capital investment, the rise in interest rates and the reduction in the credits for plutonium. As a result it appeared that nuclear power would not compete in costs with conventional power as early as had been expected. The period of the programme was extended to provide for the construction of about 5,000 MW by 1968. This was announced in "The Nuclear Power Programme" (Cmd. 1083, June, 1960). The second part of Wylfa, the last station under the first programme, is now expected to be completed in 1969.

3. There are nine commercial stations in the present programme, all of the Magnox type initially developed by the Atomic Energy Authority at Calder Hall. They use carbon dioxide gas as coolant, graphite as moderator and natural uranium as fuel. The first two, Bradwell and Berkeley, were commissioned in 1962 and Hunterston has now begun to supply power to the Grid. Another two, Hinkley Point and Trawsfynydd, are nearing completion; and four more are under construction. Although these stations will produce power at a higher cost than was originally expected, the generation of nuclear power, from the technical standpoint, has achieved all that was expected of it. Bradwell and Berkeley made a valuable contribution to electricity supplies during the difficult period of the 1962/63 winter and the estimates of capital costs and total generating costs of the later stations show marked reductions; thus whereas Berkeley and Bradwell cost about £180 per kW, Wylfa, which will be commissioned in 1968 and 1969, is estimated to cost about £100 per kW. Against the relatively high capital cost of nuclear power must be set running costs which are substantially below those for conventional stations.
Types of Reactor

When the British nuclear power programme was launched in 1955, the Magnox reactor system, developed in the United Kingdom and using natural (unenriched) uranium as fuel, was in advance of other systems. Now there is a wider choice for the second programme, because several new types of reactor, most of which use enriched uranium fuels, have been intensively developed in this country and abroad. The Central Electricity Generating Board and the Atomic Energy Authority have made a joint technical and economic assessment of the main reactor types, namely developments of the Magnox system, the CANDU® heavy water system, the American Boiling Water Reactor (B.W.R.) and other water systems, and the Advanced Gas-Cooled Reactor (A.G.R.). Their conclusion is that the economic advantages to be gained by the further development of the present Magnox system are likely, in the circumstances now prevailing in the United Kingdom, to be smaller than those offered by new systems. Of the rest, the Advanced Gas-Cooled Reactor developed by the Atomic Energy Authority from the same concept as the Magnox reactor is accepted as one of the most promising for the continuance of the British nuclear power programme. Recently, however, information has been received that some American water moderated reactors are said to have lower capital costs, although higher running costs, than those of the A.G.R., and these reactors warrant further consideration before a firm choice is made. The emergence of these new types of reactors does not mean that the Magnox type should be regarded as obsolete; it is indeed the best-proven reactor for large stations and in some conditions it would still be the most appropriate type available.

* Canadian Deuterium Uranium Reactor
5. The information about available reactor systems has been examined by the Government with the Atomic Energy Authority and the electricity supply industry. As a result, the Government are satisfied that it is right to continue with a substantial nuclear power programme, and that the British line of development has an important part to play in this.

6. The Central Electricity Generating Board will issue an enquiry for tenders for an Advanced Gas-Cooled Reactor station. They will also be ready to consider tenders from British industry for water-moderated reactor systems of proved design, provided that full supporting evidence is submitted with the tenders and that requirements of safety and performance comparable with those of the A.G.R. are met. They will ensure that these tenders are judged on a comparable basis.

7. The Government will review with the supply industry and the Atomic Energy Authority the results of this enquiry in order to decide the type or types of reactor to be built. This procedure will allow time for the further consideration without which a firm choice of reactor cannot properly be made; at the same time it will permit orders for new stations to be placed promptly enough to ensure the continuity of the nuclear power programme and the flow of work to the manufacturing industries.

Size of Programme

8. The unit cost of electricity depends on the characteristics of the load on the generating system, the location of power stations, the cost of construction, the assumed life of the station and the cost of different kinds of fuel, in addition to other costs of operation. Comparisons of the costs of building alternative types of stations using different methods of electricity generation must be based on particular economic
and technical assumptions, and may convey no true indication of the burden of costs of different methods of generation on the whole generating system. There are many uncertainties about both the economic and technical assumptions used, but detailed studies show that nuclear power is likely to have an economic place in the British electricity system by the early 1970's and suggest that, thereafter, it will become cheaper than conventional power for the generation of base load.

9. Nuclear power stations at present have a heavy capital cost, but their running costs are low. Coal and oil-fired plants have lower capital costs, but higher running costs. The economics of both types of plant benefit from intensive running, but this is particularly important with nuclear power. The nuclear stations to be commissioned during 1970-1975 will be in use at least until the 1990's. Together with the Magnox stations of the first nuclear programme they will form a significant portion of the nation's generating capacity but should not exceed base-load requirements for the expected electricity demand. The only qualification is that, if new nuclear power stations after 1975 became so cheap in capital and running costs that the purchase of an extremely large proportion were justified, pre-1975 stations of all types would be displaced to less intensive service because of the lower running costs of the new power stations.

10. Because of the heavy capital cost of nuclear power and the many calls on the country's scarce capital resources, it is necessary to steer a course between committing the country to an excessive immediate burden of capital costs and failing to take advantage of the prospective low total costs of nuclear power. It is also necessary to ensure that the programme is large enough to provide adequate experience and to sustain facilities for rapid expansion in later years.
11. In the light of the technical and economic assessments it has been decided, in agreement with the Authorities concerned, that for planning purposes a programme of 5,000 MW of nuclear generating capacity should be adopted in England and Wales for commissioning during the six years 1970-75. The programme is intended to be flexible and it will be reviewed at regular intervals in the light of later information. The question of a further nuclear station in Scotland will be considered in these reviews. Reactors to be installed in the later stations of the programme may be larger than those in the earlier stations to enable advantage to be taken of advances in technology and economies of scale.