

PREM19

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ENERGY

(nuclear power
plant industry)

Confidential Filing

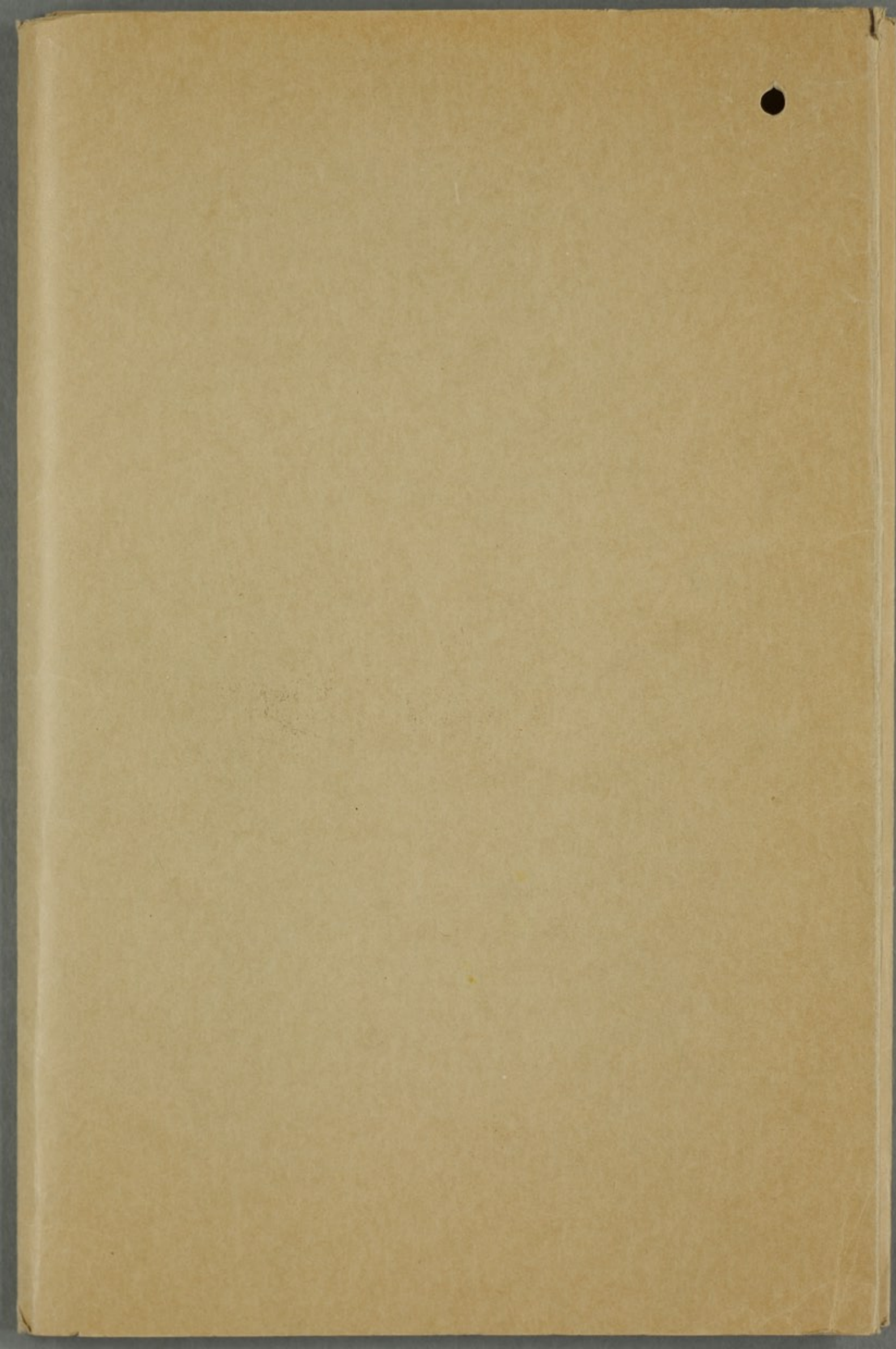
The Power Plant Manufacturing
Industry . Choice of Generators
for new AGR Power Stations

ENERGY

MAY 1979

Referred to	Date	Referred to	Date	Referred to	Date	Referred to	Date
	29.5.79						
	31.5.79						
	1.6.79						
	20.6.79						
	25.6.79						
	16.7.79						
	19.7.79						
	24.7.79						
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PREM 19/48





Energy
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10 DOWNING STREET

From the Private Secretary

14 August 1979

SIR JOHN KING: MEETING WITH THE PRIME MINISTER

When Sir John King met the Prime Minister yesterday, he told her of his views on the future of the steam generating industry and the nuclear industry more generally. He urged the case for a regular ordering programme from the CEGB sufficiently large to ensure the survival of these industries. He said that there was a real risk that without a re-organisation of the steam generating industry and a proper programme of orders, the industry might go to waste.

He also said that in his view the nuclear industry needed a much more vigorous education programme than anything which had been attempted so far. The public were afraid of the unknown and needed a better understanding of what nuclear power was all about.

The Prime Minister undertook to pass his views on to your Secretary of State.

I am copying this letter to Martin Vile (Cabinet Office).

N. J. SANDERS

KRB

W. J. Burroughs, Esq.,
Department of Energy.

NOTE OF A MEETING WITH SIR JOHN KING (BABCOCK & WILCOX) AT 1630
AT 10 DOWNING STREET ON 13 AUGUST 1979

Present:

Prime Minister
Sir John King
Mr. David Wolfson
Nr. Nick Sanders

cc. Master Set
Energy, Pt 2, Policy.

* * * * *

Sir John King said that a Government initiative was needed to reorganise the nuclear and steam-generating industries. There were a number of plans which had been proposed. In his view, the need was for a strong industry which could compete with Westinghouse or Kraft Werk Union. Unless there was a reorganisation of the steam-generating industry, it would go to waste. Clark Chapman and Babcock and Wilcox were at present competing for scraps of business. They needed a firm home base founded on a regular ordering programme from the CEGB.

He said that Babcock & Wilcox were one of the largest employers on the Clyde. They had received an order for the Peterhead power station in 1972 and another for Drax in 1979. They wanted to modernise their factories and invest in new plant and equipment. To do so, they needed a sound Government programme for the home market.

Babcock were hoping to get a further order from Hong Kong for the Castle Peak power station. But apart from Drax, they had no other major orders in prospect.

The Prime Minister asked about the Harrisburg accident. Sir John King said that the American firm of Babcock and Wilcox was wholly separate from the British firm. He understood, however, that the Harrisburg enquiry would show that the plant had withstood the most ghastly mismanagement. Everything would have been fine if the plant operators had done nothing, but they had panicked.

The Prime Minister asked about the prospects for PWRs. Sir John King said that if a PWR was ordered then the reactor and

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the steam-generating equipment would have to be imported. The same would be true if a second PWR was ordered.

In answer to a question about the breeder reactor, Sir John King said that Dounreay was a first class operation, but they should be pushed. The 1990s were almost here in ordering terms.

He said that the NNC and NPC were a design and contract manufacturing organisation with no real centre. They seemed to him to be a very temporary arrangement. The whole of the manufacturing industry needed to be brought together into one unit.

Finally, Sir John said that the nuclear industry needed a voice speaking for it and a much more vigorous education programme than anything which had been attempted so far. The public were afraid of the unknown and did not understand what nuclear power was all about. The dangers of fossil fuels were very great.

The Prime Minister said that she thought there was more work to be done in research on accelerating the disintegration of actinides. So far as publicity was concerned, Walter Marshall had done a lot of good work already and so had John Hill.

The Prime Minister thanked Sir John for giving her his views and undertook to speak to Mr. Howell about them.

MJS

PRIME MINISTER

You are to meet Sir John King on Monday at 1630. The meeting arises from his letter to you of 12 July (Flag A). The Department of Energy have provided a short note (Flag B) ^{23.7.79} on the current state of the negotiations about reorganisation of the nuclear industry. Sir John King's letter to Mr. Howell setting out his views in greater detail is at Flag C. ^{see 23.7.79} You might also like to be reminded of the discussions in E Committee ^{E(79) 2nd Mtg Mins. - 16.79} which led up to the decisions on Heysham and Torness (Flag D). John Hoskyns has also commented (Flag E). ^{12.7.79}

MS

10 August 1979

FILE

ml

Energy

24 July 1979

Your brief for the Prime Minister's meeting with Sir John King of Babcock and Wilcox has arrived and I am most grateful to you. As I think I mentioned to somebody in your office yesterday, the date of this meeting has been changed and is now to take place on Monday 13 August at 1630.

CAROLINE STEPHENS

Miss Valerie Davis,
Department of Energy.

vib



SECRETARY OF STATE FOR ENERGY
THAMES HOUSE SOUTH
MILLBANK LONDON SW1P 4QJ

01-211 6402

AF 10/8.79

Miss Caroline Stephens
Private Secretary
10 Downing Street
LONDON
SW1

23.July 1979

Dear Caroline

As requested in your letter of ~~13 July~~ to Bill Burroughs, I
enclose a brief for the Prime Minister to use at the meeting
with Sir John King of Balcock & Wilcox Limited on 25 July.

Valerie Davis

VALERIE DAVIS
Private Secretary

BRIEF FOR THE PRIME MINISTER
MEETING WITH SIR JOHN KING ON 25 JULY

Line to take

1. Babcock and Wilcox have participated in our nuclear power programme since it was first launched in the 1950s and, like the other power plant manufacturers, can make an important contribution to the future development of the programme.
2. Our nuclear industry is weak and there must be early progress with its reorganisation. A substantial nuclear element is essential for our long-term energy policy, and we cannot achieve it without a strong industry.
3. The Government recognise that they too have a role to play. The Secretary of State for Energy has completed a round of discussions with the parties (including Sir John King) and is considering the next step, including what can be done to give the industry greater assurance of its future.
4. Sir John King's proposal that the Nuclear Power Company should concentrate on supplying the nuclear island and develop a manufacturing capability by integration with the boilermakers is very interesting, though it has not yet been fully explored with the other parties. The Government will not lose sight of it in determining policy.
5. The need for greater public understanding of nuclear power is certainly important, particularly on safety matters. Does Sir John King have any specific proposals for promoting this understanding?

BACKGROUND

6. The nuclear industry is centred on the National Nuclear Corporation (NNC) and its operating subsidiary the Nuclear Power Company (NPC). The present structure, established in 1973, is based on the concept of a partnership between Government which holds 35 per cent of the shares and GEC which holds 30 per cent of the shares. The remaining 35 per cent of the shares are held by British Nuclear Associates (BNA) a consortium of private manufacturing interests whose powers to intervene in the running of the NNC are very limited.
7. Sir John King is chairman of Babcock and Wilcox who indirectly hold a 12 per cent interest in the NNC through the BNA. He is also chairman of the BNA and a member of the NNC Board as an appointee of GEC.
8. Present pressure for reorganisation of the nuclear industry began eighteen months

ago when, following the last Government's discussions on thermal reactor choice, the GEC said that they wanted to and their supervisory management of the NPC. There is general agreement that the nuclear industry is weak and in need of reorganisation. The Secretary of State for Energy has now held an intensive round of discussions with the main parties, including the generating Boards, Babcocks and GEC, which suggest that it should be possible to achieve an agreed solution on the basis of a single company under strong management responsible for the supply of the nuclear island and perhaps in due course for some manufacturing. Several parties, including Sir John King, have stressed the importance of a commitment to future orders as a basis for reorganisation.

9. Sir John King's proposal to integrate NPC with the boilermakers (see para 4 above and his letter, attached) follows on from previous attempts to bring the boilermakers together into a single company. The 1976 CPRS report on the power plant industry said that there was a need to restructure the boilermakers into one manufacturer, but formal merger negotiations between Clarke-Chapman and Babcocks broke down in 1978. The companies claimed that this was because home orders were likely to be lower than previously anticipated. Though there is rivalry, it is less bitter than that between the turbine generator manufacturers.

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10. Power station orders. The last Government announced in January 1978 that they would authorise construction of two new AGR stations. Investment approval for Torness was given last year, and last month the Secretary of State for Energy announced that he had given the CEBG investment approval for Heysham II. Design phase contracts for the boilers for both stations have been placed with NEI; it is the intention that substantial sub-contracting work will be given to Babcock's.

11. The last Government also said that they had endorsed the electricity supply industry's wish to order a PWR station provided design work was satisfactorily completed and all necessary Government and other consents and safety clearances had been obtained. At present the CEBG and NPC are assessing the options for licensing PWR systems in the UK. No final decision has yet been taken on the choice of licensor.

12. The rate of future home ordering depends, amongst other things, on the forecast rate of growth of electricity demand. Assuming that demand grows at something over 2% per annum (which is the current prediction), the CEBG would expect to order some 2 GW per annum of new plant from the early 1980's onwards. The Secretary of State for Energy is having discussions with the CEBG about their future plans, particularly as regards the scope for orders for nuclear stations.

Dept of Energy

20 July 1979

Babcock & Wilcox, Limited

Cleveland House - St. James's Square - London SW1Y 4LN
Telephone: 01-930 9766

Sir John King

Chairman

21st June 1979

By Hand

Private and Confidential

The Rt. Hon. David Howell, M.P.,
Secretary of State for Energy,
Thames House South,
Millbank,
London S.W.1.

Dear Secretary of State

For many years the power plant industry, and in particular the nuclear component of it, has been in a state of change and uncertainty and this inevitably has led to poor performance. The recent problems in the oil industry have raised yet again strong warnings that we could well have very serious energy problems a few years hence. I believe therefore the time is propitious for a bold initiative by the Government both in terms of a commitment to a firm ordering programme and a positive involvement in the restructuring of the contractors and suppliers to the Generating Boards. No one more than I would like to see market forces provide the solution but with a monopoly customer this just does not happen and views are too diverse for a solution to emerge without industrial intervention either by Government or possibly by the Generating Boards. The political connotations are too strong in my view for one to expect action of this type to be promoted by the Generating Boards.

Our views on restructuring are given against the background that, for large energy sources, the UK will have to depend on nuclear energy and coal for the foreseeable future - and probably well into the next century. Over the next few years, because of an over-capacity in the manufacturing plants around the world for both conventional and nuclear plant, any UK industry must tailor its size to satisfy the domestic requirements within the UK and not be restructured in the hope that major export business is either readily available or can be won at attractive prices. The outlook for these two sources of energy are summarized below.

Nuclear Energy:

First priority must be given to thermal reactors. For historical reasons, rightly or wrongly, the UK has developed the gas-cooled thermal reactor system culminating in the present AGR type. It

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is a good system and with scope for further improvement. In our view it is a system in which one can prove the safety more rigorously than any other. The two phase (water and steam) aspects of the light water reactors will always give rise to more uncertainty in this respect. The cost advantage which PWRs have held over AGRs are likely to diminish as a result of the Three Mile Island accident and it is not inconceivable that gas cooled reactors will play a larger role in world power supply.

We believe that the present AGR design as is operating at Hinkley and Hunterston should be the basis of the initial UK programme. At some time in the future we have to decide whether there is to be substantial future programme of AGRs and if there is, a Mark II design should be developed to meet the latest requirements of the Nuclear Inspectorate, to incorporate the knowledge gained from operating plants and to make the design more suitable for manufacture and erection. We believe furthermore that the decision whether to go this way or to build PWRs need not be taken until we obtain a better feel for the effect on public opinion of the Three Mile Island accident.

We cannot stress too strongly the need to do a very thorough engineering validation of whatever reactor design the UK builds. We do not believe the UK has resources to do this on more than one system at a time and therefore we should concentrate our resources accordingly.

Fast reactors will be required later when uranium prices rise to the point where power from thermal reactors becomes relatively expensive. This will only occur when worldwide usage of uranium creates a shortage. Present indications suggest that fast reactors will not be required before the second half of the 1990's and so we need not start building a first large plant until the late 1980's. Thus fast reactors would not compete for resource and development of the system can proceed by making engineering improvements and proving these in the PFR at Dounreay.

Coal:

Coal is a major source of energy available within the United Kingdom and any ordering programme must include a proportion of new coal-fired stations. We have well proven designs operating successfully which at this present point in time can be commissioned in a shorter time than nuclear plant.

Standardization of these plants will be important not only to reduce costs and raise operating reliability in the UK but to act as a shop window for export. Large natural circulation coal-fired boilers are attractive to many overseas customers. There are difficulties in matching offered prices overseas where many of these are subsidised - our investment proposals for our Renfrew factory are directed at improving our competitive position.

The Necessary Organization:

We have consistently supported the view that a strong design and construction company is vital to the well-being of the industry and for this reason supported the amalgamation of BNDC and TNPG, which amalgamation took place against a low ordering rate, but in the anticipation of a higher rate to come and the pressing need to complete the then existing AGR contracts. Today the first of the AGRs have been commissioned but the ordering programme on which to rebuild an industry has yet to emerge and the morale of the industry has virtually disappeared while yet again the future of it is debated in public.

The existing arrangement of NNC/NPC, never favoured by B&W Ltd and BNA, has proved unsatisfactory. We have said to our partners in the industry, but primarily to our customer, that B&W Ltd will support any restructuring of the industry which will result in a stronger organization with a well defined task. We have indicated our readiness to participate in a restructuring of the capital of NNC but I have come to feel that this is only tinkering with the problem - changing the shareholding and perhaps removing the management contract. Surely something much more fundamental is needed.

If the NNC is to be a strong company then it must see a workload to be executed and an ongoing business into which it can attract young, high quality engineers. For this to happen it must have a much broader base than is possible with its present scope of supply. We favour a free standing company in the private sector operating like any other public company and accountable for its actions. This requires a clear line of responsibility between it and the Generating Boards. Such a line was drawn between the old consortia and the Generating Boards because they operated on whole station, firm price contracts. NNC/NPC in its present form is not strong enough to take this type of contract even for the nuclear island.

The UK is the only country in the world with an NNC/NPC type of organization. Elsewhere the nuclear supply system work is carried out by a manufacturer and there is little doubt that the best result comes from the closest association between the reactor designer and the manufacturer.

Suggestions have been made that CEGB Design & Construction Division at Barnwood should be broken into two groups - one to give CEGB the service it really needs, viz. to deal with problems arising on operating stations and to act only as an informed purchaser on new plant, and the other to group together the people concerned with design. The second group could then be incorporated in some way with NNC/NPC.

While this might be attractive in theory we really believe it to be impractical and therefore it is not part of our proposal.

Our proposal is that the boilermaking activities that we previously tried to merge together, namely, the Babcock boiler-making company and the Gateshead establishment of NEI, should be owned by NNC/NPC. To this could perhaps be added a company capable of manufacturing reactor internals to give a complete coverage of manufacture and erection activities for a nuclear island.

Such an arrangement would have the following advantages:-

1. The strong unit created would give a much better balance to the powers of the Generating Boards.
2. The high quality engineering resource which is in short supply in the UK heavy engineering industry could be made best use of by avoiding duplication of functions.
3. The wider range of activities covering fossil-fired boilers, both at home and overseas, would give a firm business base and thus present a more secure future to potential recruits.
4. Greater centralization of control of site work which would contribute to an improved performance in this difficult area.

Finally, it is important, however difficult, for the Government and the Generating Boards to commit themselves to a future ordering programme. With the arrangement we propose this would only need to indicate the total plant to be commissioned each year with a broad indication as to how much was to be nuclear and how much conventional. With the boilermakers as an integral part of NNC the engineering and factory resources could be readily directed to either type of plant because a great deal of both resources are interchangeable.

I would like to develop further these proposals with you when we meet on 28th June 1979.

*Your sincerely
Whalley*

John King



Secretary of State for Industry

CONFIDENTIAL

Rt Hon D A R Howell MP
Secretary of State for Energy
Department of Energy
Thames House South
Millbank
London SW1P 4QJ

Energy ✓
MAD
DEPARTMENT OF INDUSTRY
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123 VICTORIA STREET
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TELEPHONE DIRECT LINE 01-2123301
SWITCHBOARD 01-212 7676

19 July 1979

Dear David .

TURBINE GENERATOR ORDERS FOR HEYSHAM II

Thank you for your letter of 11 July in which you convey the decision of the CEGB and the SSEB respectively to select NEI (Parsons) and GEC as supplier of turbine generators for Heysham II and Torness.

I note that the Boards' decisions have been reached on commercial and technical grounds, and I agree that there is no reason for us to intervene.

I am copying this letter to the recipients of yours.

Ever,

Kew

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10 DOWNING STREET

THE PRIME MINISTER

18 July 1979

Original CR
file

Energy

Dear Sir Robert,

Thank you for your letter of 9 July about the nuclear power programme.

The Government has not yet taken decisions about the choice of thermal nuclear reactors for ordering in the United Kingdom beyond those already announced. But we consider that nuclear power has a vital role to play in energy policy, a view which was endorsed by the Strasbourg meeting of the EEC Council and by the Tokyo Summit.

Safety must of course be paramount, whatever reactor systems are built. President Carter's Commission into the accident at the Harrisburg nuclear station in the United States is due to report in the autumn, and it would be wrong to prejudge its conclusions. In the United Kingdom the Nuclear Installations Inspectorate as well as the Atomic Energy Authority and the Nuclear Power Company are providing considered assessments as soon as they are in a position to do so and the implications for United Kingdom designs and our future ordering programme will have to be examined carefully. The Health and Safety Executive would not license a PWR for construction or operation in the United Kingdom until the Nuclear Installations

/Inspectorate

Inspectorate had assessed the safety case for the proposed design and were entirely satisfied that the necessary standard of safety would be achieved.

I note what you say about AGRs. But the two latest AGR orders which are now going ahead show the confidence of the Generating Boards in this reactor type. It would be quite wrong to conclude the AGRs cannot make an economic contribution to our power needs.

The Department of Energy has a widely based R and D programme on new sources of energy, including wind power. Their development is, however, at a relatively early stage and it is unlikely that we shall be able to look to them for major contributions to our energy supply, at least to the turn of the century.

Energy conservation is, I agree, of central importance, and we are examining how existing policies can be reinforced. We are also making major investments in new and efficient capacity in the coal industry. But even with the full exploitation of these resources we cannot realistically dispense with a major and growing contribution from nuclear power to energy requirements over the next few decades.

Yours sincerely
Raymond White

Sir Martin Ryle, F.R.S.

R.W.

CONFIDENTIAL *Energy* *bw*

cc HO CH SEC
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16 July 1979

The Prime Minister has read your Secretary of State's letter of 11 July to Sir Keith Joseph about the turbine generator orders for Heysham II. She agrees that there is no reason to intervene to overturn the commercial judgement of the CEGB and the SSEB on this matter.

I am sending copies of this letter to the Private Secretaries to the members of E Committee, Kenneth MacKenzie (Scottish Office), Brian Borthwick (CPRS) and Martin Vile (Cabinet Office).

TL

W.J. Burroughs, Esq.,
Department of Energy.

CONFIDENTIAL *ds.*

FILE

BF 23.7.79

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10 DOWNING STREET

From the Private Secretary

13 July 1979

The Prime Minister is seeing Sir John King of Babcock & Wilcox Limited on 25 July and I am enclosing a copy of a letter from him about the subjects he wishes to discuss.

I would be grateful if you could let me have a brief not later than Monday, 23 July.

CAROLINE STEPHENS

Bill Burroughs, Esq.,
Department of Energy.

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PRIME MINISTER

NUCLEAR POWER COMPANY AND SIR JOHN KING

Twin haskester

I note that you are seeing Sir John King on Wednesday, 25 July.

Two days ago there was a speculative piece in the Financial Times about the future of NPC. The FT suggested that the first option emerging as a front runner was Government taking a 35% stake through the AEA with 5 other groups, ranging from GEC at one end to a shared stake by a number of small companies at the other, each stake being worth 13%.

I have since spoken to Duncan Burn who is worried that such an option might be seriously considered. His objections are based on industrial common sense rather than the peculiarities of the energy industry. The objections are obvious enough: what is Government doing taking 35% of what is essentially an industrial grouping? Why is there not one dominant partner with the competence and economic strength, who can control the operation (with suitable safeguards for minority shareholding groups of course)?

Burn regards it as the traditional attempt to satisfy the anti-GEC lobby, handing out a number of small holdings to a mish mash of companies all of whom will really be competing with each other for the available business when they are meant to be working in partnership for profit. The result will be doomed to failure, with the taxpayer picking up the bill as usual. I rang Burn this morning, and he told me that since we had spoken he found that King had been to see Weinstock with such a proposal, which Weinstock had firmly rejected. I have passed all this on to David Howell, via Michael Portillo, who assures me that the FT piece is very speculative and that the ideas for NPC's future are very much in the formative stages.

The best definition I have heard of joint venture companies (which applies even more strongly to this type of conglomerate) is: "each partner puts in 50% of the finance and 48% of the necessary will to succeed".

JA

JOHN HOSKYNS
12 July 1979



10 DOWNING STREET

MR. LANKESTER

Does the Prime Minister
require any special briefing
for this meeting and if so
would you like me to organise
it?

es.

yes pls .

12

12 July 1979



10 DOWNING STREET

From the Private Secretary

12 July 1979

This is just to let you know that Sir John King's letter to the Prime Minister with the details of what he wishes to discuss on Wednesday, 25 July has arrived.

CAROLINE STEPHENS

Private Secretary to
Sir John King.

A handwritten signature in blue ink, appearing to be 'C. Stephens', located in the bottom right corner of the page.

Babcock & Wilcox, Limited

Cleveland House · St. James's Square · London SW1Y 4LN

Telephone: 01-930 9766

Sir John King

Chairman

12th July 1979

By Hand

Private and Confidential

The Prime Minister,
The Rt. Hon. Mrs. Margaret Thatcher, MP,
10, Downing Street,
London S.W.1.

Dear Prime Minister

Thank you for your invitation to lunch on July 25th and the opportunity to meet you for a talk beforehand about the nuclear and power generating industry.

I find myself in the centre of the latest round of discussions through requests by the Chairmen of the Electricity Council and the Central Electricity Generating Boards and as you will know, there has been much discussion with the previous Government about the need to deal with the problems of NNC and NPC. Having been involved in endless discussions for almost a decade, I have come to believe that we should set up an organisation along the lines of successful nuclear steam suppliers in the United States, Germany and France where design and manufacture are brought together.

I have set out the proposals more fully in a letter to the Secretary of State for Energy.

I would like to discuss also how we can better explain to the public what nuclear power is about. Those opposed to its use would seem to be able to get their case across since they are not constrained to put forward a viable alternative strategy and therefore can play upon the public's fear of the unknown.

*with best wishes
Yours sincerely -)*

John King *John*



gc to Hawkins

SECRETARY OF STATE FOR ENERGY

THAMES HOUSE SOUTH

MILBANK LONDON SW1P 3AJ

211 6402

Rt Hon Sir Keith Joseph MP
Secretary of State for Industry
Department of Industry
Ashdown House
123 Victoria Street
London SW1

Prime Minister
CPAs advise that
there is no reason
why the Government
should intervene.
An order for Parsons,
and an order to
GEC.
11 July 1979

Content?

Joe Kirk

Yes pls. R

1317

TURBINE GENERATOR ORDERS FOR HEYSHAM II

E Committee invited me (E(79)2nd Meeting) to inform the CEGB of our conclusions, and to report back the Board's decision on the above orders.

The Chairman of the CEGB has now informed me that the Board have decided, on commercial and technical grounds, including their plant mix and system configuration, to select NEI (Parsons) as the supplier for two 6-flow machines for Heysham II. They intend to let a design contract for these machines to NEI, and they seek confirmation that the Government has no matters of concern to raise which would cause them to stay their hand.

I understand, though this is of course for George Younger, that the SSEB have decided to select GEC as their supplier for two 4-flow machines for Torness. What follows is based on that understanding.

The Boards' proposal to share the work between the two manufacturers will not lead directly to rationalisation of the two turbo-generator firms but, as Sir Kenneth Berrill said in his minute of 30 May to the Prime Minister, it would be compatible with a future merger between them. Moreover, it will avert the serious regional and employment consequences which could have followed a decision to place all the orders with either supplier. The Boards have agreed that they will jointly approve the turbo-alternators to be supplied by both manufacturers, a useful step which should help both manufacturers in export markets. The Boards do not ask for compensation, which in my view demonstrates that they have taken their decision on their own commercial responsibility, while taking proper account of the future health and shape of the plant manufacturing industry.

I therefore see no reason for us to intervene to over-turn the Boards' commercial judgment. If you and other colleagues agree, I will so inform the CEGB.

I am sending copies of this letter to the Prime Minister, our colleagues on E Committee, George Younger, Sir Kenneth Berrill and Sir John Hunt.

Wm. C.
Davis

D A R Howell



DEPARTMENT OF ENERGY
Thames House South
Millbank
London SW1P 4QJ

Tel: Direct Line: 01-211
Switchboard: 01-211 3000

With the Compliments of

the

Secretary of State

NOTE OF A MEETING BETWEEN THE SECRETARY OF STATE FOR ENERGY AND
SIR JOHN KING OF BABCOCK & WILCOX LIMITED HELD AT 16.30 HOURS ON
28 JUNE 1979 IN ROOM 1237 THAMES HOUSE SOUTH, MILLEBANK, SW1.

Present:

Secretary of State,
PUSS (Mr. Lamont MP),
Mr. Wilson,
Dr. Burroughs,

Sir John King,
Mr. T. Carlisle.

The Secretary of State opened the meeting by thanking Sir John for his letter of the 21st June and then explained that he now wanted to make rapid progress on the re-organisation of the nuclear industry. Sir John said that these discussions had been going on for a number of years. This was why he had made the more radical proposals in his letter. He thought that re-arranging the shareholding as the CEGB wanted was not enough. Mr. Carlisle added that what was wanted was a power business which attracted good people. This required a comprehensive re-structuring of the industry but not one that went as far as including the question of the future of Barnwood. In his view there was no need to extract the design/architect team from Barnwood in order to achieve such re-structuring. Anyway it was probably not worth trying to tackle the question of Barnwood as part of the re-organisation given that the CEGB would insist on maintaining a capability to be a "well informed customer".

2. The Secretary of State asked whether the re-organisation proposed by Sir John required a steady ordering programme. Sir John observed that with such a programme there was some chance of achieving a viable company. The recent experience of trying to combine Babcocks and Clarke Chapman as recommended in the CPRS Report demonstrated the difficulties of achieving such a rationalisation without a steady ordering programme. The work provided by the two AGRs was not enough. In his view a minimum

programme was probably something of the order of 1000 MW per annum for any type of nuclear plant. This would require the generating boards to make a definitive statement of their replacement programmes and for the construction industry to pool its resources. Against such a background it was probably best to stick with the AGRs as a switch to the PWRs would mean substantial delays in the domestic programme and no realistic hope of export orders.

3. Mr. Wilson asked whether the series ordering of the AGR would require major new safety work. Sir John said that this would not be necessary. What was needed was an up-dating and modernisation of the existing design over and beyond that ordered for Heysham and Torness. This would not involve a major re-design. Furthermore, the continued manufacture of AGRs would exploit the advantage of the turbines being interchangeable between nuclear and conventional fossil-fired plant.

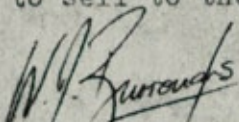
4. The Secretary of State asked whether Babcocks had a future in the UK nuclear industry if a decision was taken to build PWRs. Sir John said that the company might not have any future as its Renfrew plant had many advantages for building AGRs but would require major investment to make PWRs. Furthermore, the economic case for PWRs was less clear after Harrisburg. While AGR costs would rise, PWR costs could well go up much more to meet consequential safety requirements.

5. Mr. Lamont asked what were the prospects of reducing the construction time of nuclear plant. Sir John noted that getting approval for new stations was a major element in current delays. When series ordering was adopted improvements in construction time should be achieved. Moreover, site management should be rationalised with increasing experience.

6. In summing up the discussion, the Secretary of State thanked Sir John for his advice. He would carry on with his consultations with all parties in the industry with the aim to reach an early decision on the future of the nuclear industry.

Contd/3.

This was aimed at defining where the industry should be going beyond the construction of Heysham and Torness. It would of course be for the Government to make up its mind about political problems of justifying any nuclear decision. While it was accepted that the construction of AGRs might be easier to sell to the public, the PWR option must be given proper weight.



W.J. Burroughs,
PS/Secretary of State.

4th July 1979.

Circulation:

PS/PUSS (Mr. Lamont),

PS/PUS,

Mr. Tucker,

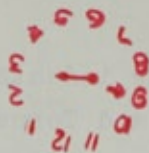
Mr. Manley,

Mr. Monger,

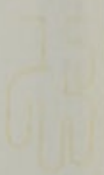
Mr. Wilcock,

Mr. Wilson,

Mr. Portillo.



13 AUG 1979





DEPARTMENT OF ENERGY
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With the Compliments of

the

Secretary of State

CONFIDENTIAL



Energy

SECRETARY OF STATE FOR ENERGY

THAMES HOUSE SOUTH

MILLBANK LONDON SW1P 4QJ

01-211 6402

Rt Hon John Biffen MP
Chief Secretary to the Treasury
H M Treasury
Treasury Chambers
Parliament Street
LONDON
SW1P 3AG

R 25/6

23 June 1979

Dear John

HEYSHAM II

Thank you for your letter of 20 June agreeing that subject to certain points, I could give the CEGB investment approval for the construction of the second stage of this AGR station.

I shall now convey approval to the Board, attaching to it conditions (i) and (iii) in your letter. On (ii), my officials are already in touch with the Electricity Council, who act as the central body for the electricity supply industry on matters of this kind, about the medium term financial target for the industry. The industry raised the matter with my officials in the context of discussions on the Nationalised Industries investment review, with particular reference to the need for the target to be reconciled with the Government's wish to keep the industry's external borrowing at a level proposed in the 1978 review, and if possible lower. My officials will be continuing these contacts with the Council with a view to producing a paper as quickly as possible.

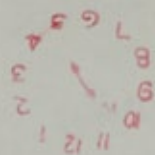
My officials will also take up with the Generating Board in the context of continuing discussions your suggestion that an improvement in plant availability should be included amongst the industry's published performance indicators. As I think you know performance last winter was a substantial improvement over that in previous years (availability of plant at winter weekday peak was 83.3% last winter, compared with 78.1% the previous year), and the Board attach the highest importance to further improvement.

I intend to announce our decision to give investment approval to Heysham II at the earliest opportunity, probably by means of an arranged PQ and Answer on 26 June.

I am sending a copy of this letter to the recipients of yours.

Yours
DAR

D A R HOWELL



25 JUN 1979

Energy



Treasury Chambers, Parliament Street, SW1P 3AG

The Rt Hon David Howell MP
Secretary of State
Department of Energy
Thames House South
Millbank
London SW1P 4QJ

2PPS

20th June 1979

MSM
Rmk

Dear David,

HEYSHAM II

Thank you for your letter of 30 May seeking confirmation that you should give the CEGB investment approval for new Heysham AGR.

This is a very substantial project, costing £918 million, of which some £760 million is forecast to fall in the next 5 or 6 years. It will place a substantial burden on public expenditure during this Parliament and I therefore have considered carefully whether a start could be postponed in order to minimise public expenditure costs in the years immediately ahead.

First, on the economics of the station, I understand that on the Board's assumption of a 2.3 per cent growth in electricity demand over the next 7 years, the project can be justified on cost saving grounds. The assumption about electricity growth is, I am told, optimistic. Nevertheless, it seems that even with somewhat lower growth assumptions, the new station can still be built at a negative effect cost because the discounted cost savings exceed the capital cost. The savings would, however, be reduced if construction costs increased in real terms.

I accept that delays in ordering the station would have damaging effects on the nuclear industry and would make even more difficult the problems which we discussed in E Committee in our consideration of the power plant industry (E(79) 2nd Meeting, Item 5). As you say, delays with Heysham would lead to difficulties with the SSEB's station at Torness, perhaps increasing that station's costs. Some weight must also be given to the CEGB's argument that they may increasingly need to look to their AGR stations, including Heysham II to provide security of electricity supply in the 80's in view of the age of their Magnox stations and possible oil shortages.

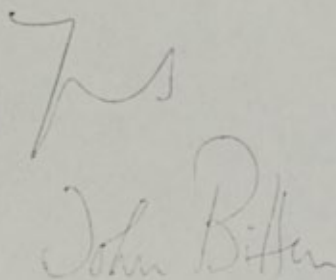
On balance therefore I agree that investment approval should be given, but I think that it should be made subject to the following conditions:-

- (i) The Board have already intimated that tendered prices for the station may exceed their cost estimates. Furthermore, their timetable for construction looks ambitious in view of the construction time achieved at other stations. I therefore think that it is most important that the Department should keep in close touch with the Board in order to monitor costs, and indeed should make it a condition of the investment approval that you should receive periodic progress reports, say at least every 6 months and more often if anything significant occurs, with particular reference to significant cost changes or timetable delays. I should be grateful if your officials could keep mine in touch. If tendered prices were exceeding cost estimates significantly, we might have to reconsider matters.
- (ii) I understand that the electricity supply industry accept that their total investment programme does not meet the Required Rate of Return of 5 per cent set out in our predecessors' White Paper on the Nationalised Industries (Cmd 7131). The industry has argued that they can only make progress towards the 5 per cent RRR if they are set a proper medium term financial target (which incidentally is probably one way of setting the industries "the clearer financial discipline" referred to in the Manifesto). I therefore suggest that your Department should open consultations with the electricity industry (and also the Gas Corporation) about medium term financial targets so that decisions on their targets for 1980-81 and beyond can be taken in good time. Such consultations will of course in no way commit Ministers to any figure for the eventual financial target. But we should aim to have the financial target settled before we publish our public expenditure plans. Indeed, ideally we should consider a paper on targets for electricity (and gas) at the same time as we consider the Nationalised Industries Investment Review in July.
- (iii) I entirely agree that the Board should be told that they must finance the station within whatever limit is set for the electricity industry as a result of our review of nationalised industry expenditure.

Subject to these points I am content for investment approval to be given. I would however like to take this opportunity of raising one matter which has considerable implications for the CEGN's orders following Heysham II. I understand that the CEGB's plan is for winter weekday plant availability to improve to 85 per cent by 1985-86 compared to 79.4 per cent in 1975-76, 79.8 per cent in 1976-77 and 78.0 per cent in 1977-78. I believe that the Board improved on their recent performance during the last winter, but there is still some way to go to meet their 1978 plan. If they do

not, the Board's future capital expenditure (or retention of high cost grant) will be the greater, and public expenditure the higher. I would therefore like to suggest that an improvement in their plant availability should be included among the industry's published performance indicators which the White Paper, Cmnd 7131, indicated should "provide regular and systematic information as a contribution to discussing their [the industries'] success in controlling costs and increasing efficiency". I think that you should put this to the industry with a view to endorsing this as one of their performance aims for the next 3 or 4 years.

I am sending a copy of this letter to Keith Joseph and George Younger and also to the other members of E Committee and Sir John Hunt in view of our recent discussion on the power plant industry.

A handwritten signature in cursive script, appearing to read "John Biffen". The signature is written in dark ink and is positioned above the printed name.

JOHN BIFFEN

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PRIME MINISTER

Structure of the Power Plant Manufacturing Industry

(E(79) 7)

(Sir Kenneth Berrill's minute to you of 30th May is also relevant)

The power plant manufacturing industry represents a continuing problem. We now have two major manufacturers of turbo-generators - GEC and NEI Parsons - and two boiler-makers - Babcock and Willcox and NEI Clarke Chapman - capable of designing and manufacturing the enormous machines now used for power generation. By common consent there is now only really room for one major turbine maker and one major boiler-maker in the United Kingdom - especially if we are to have any hope of continuing to compete in world markets - but efforts so far to bring about a merger of the interests concerned have not succeeded. As it happens collaborative arrangements between the boiler-makers for the next CEGB and Scottish Electricity Board orders (for the AGRs at Heysham and Torness) give this part of the industry at least a breathing space. The urgent problem is that of the turbine manufacturers.

2. Basically the problem is that:-

- (a) GEC is the strongest: their basic design (for four-flow turbines) is best attuned to world markets.
- (b) For reasons specific to the particular sites and the AGR technology it is likely that the CEGB and SSEB will prefer Parsons 6-flow design for these two stations.
- (c) If this happened GEC might well be forced out of the turbine business altogether, and Parsons succumb later on to world competition.
- (d) But if the Government were to influence the electricity supply authorities to buy GEC turbines this would mean the end of Parsons as a turbine manufacturer and the Government would take the stick for the resulting loss of jobs in Scotland and the North East.

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(e) The alternative, canvassed as one option by the Energy/Industry joint paper, is to seek to influence the Boards to split the turbine orders between the two companies. This would keep them both in being. It would do little to assist rationalisation in the short term but it would at least leave open the option of rationalisation later.

3. The issues are set out in paragraph 13 of the paper. The essential choices are:-

- (a) For the Government to stand back and let matters take their course.
- (b) For the Government to decide which companies should get the orders (Parsons, GEC or both).
- (c) For the Government to postpone a decision until it has a clearer idea of what the Electricity Supply Boards would prefer to do in the light of their examination of tenders and of any other consideration they consider relevant (they have an interest in the long term future of the power plant industry which should influence their short term decisions).

HANDLING

4. You might invite the Secretary of State for Industry to introduce the joint paper and ask the Secretary of State for Energy whether there is anything he wishes to add. The Secretary of State for Scotland - as Minister responsible for the South of Scotland's Generating Board's Torness station - would also wish to speak, as no doubt would the Secretary of State for Employment. The Secretary of State for Trade, who also has a Departmental interest, will be away; he may write to you with his views before the meeting.

5. You might then seek views on the Committee's preferred course of action. If it is to stand back and let matters take their course you will want to consider whether, and if so by whom and when, the various interests should be so informed. If a decision is postponed pending further information from the Generating Boards or if colleagues wish the Government to take an early hand in the decision you will want to consider whether there is more that can be done to

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provide Government with a basis on which to take decisions. Responsibility for bringing a considered view in these circumstances to colleagues should be placed firmly on the shoulders of the three Secretaries of State most closely concerned - Energy, Industry and Scotland. It would be for them to organise any further information and opinion-gathering which may be necessary.

6. There are two other issues which may emerge in discussion:-

(a) Compensation for the Boards if they are required to take action which they regard as not being in their own commercial interests.

The Committee will certainly not wish to encourage such compensation in present circumstances but you might care to probe how far the Ministers concerned have any doubt about their ability to withstand such pressure.

(b) The Research Capacity of the CEGB.

There is an argument that the CEGB is over-involved in research and development work on electricity generation and that this has led to excessively parochial specifications and ordering policies. If the point is raised you might ask the Secretary of State for Energy to provide a paper.

CONCLUSIONS

7. Subject to discussion you might lead the Committee to:-

Either:

(i) agree in principle that the Government should stand from the situation in the power plant industry and let matters take their course. In this event you will want to consider how the decision should be conveyed to those concerned;

Or:

(ii) that the Government should postpone a decision on whether to seek to interfere until further information is available on the course of action likely to be favoured by the Generating Boards;

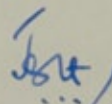
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Or:

- (iii) that the Government wishes to be put in a position to take a decision on the placing of the CEGB and SSEB orders for Heysham and Torness. In this event you will want to invite the Secretaries of State for Energy, for Industry and for Scotland to produce joint recommendations on the destination of the orders;

And

- (iv) (if necessary) invite the Secretaries of State for Energy and for Scotland to produce recommendations on the question of compensation for the Generating Boards if they are asked to act contrary to their own judgment in placing their turbine orders;
- (v) (if necessary) invite the Secretary of State for Energy to produce a paper on the case for and against the present degree of involvement by the CEGB in research and development into electricity generation.


John Hunt

31st May 1979



SECRETARY OF STATE FOR ENERGY
THAMES HOUSE SOUTH
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01 211 6402

cc AS/MS
PS/M/LAMONT
ES/DUS
Mr TUCKER
Mr CAMPBELL
Mr MANLEY
Mr MONAGHAN
Mr WILSON

A
T.A. JONES

The Rt Hon John Biffen MP
Chief Secretary to the Treasury
Treasury Chambers
Parliament Street
LONDON SW1P 3AG

30 May 1979

Dear John

HEYSHAM II

The CEGB have asked me to give them investment approval for the new Heysham AGR by the end of the month.

The order for the station followed the last Government's decision, announced in January 1978, to authorise the CEGB and the SSEB to begin work with a view to ordering one AGR station each as soon as possible. Work began at once and has now reached the stage where the CEGB need to place substantial contracts now if the project is not to slip.

The timing is awkward, but I think we must allow the Board to go ahead. The last decade has seen three major reviews of thermal reactor strategy; hesitation on our part now would be seen as re-opening thermal reactor choice, thus undermining the AGR programme. Delay could also lead to slippage and cost escalation, for which the Government would be blamed, and would lead to difficulties for the SSEB, who got approval for their parallel project at Torness in 1978 and are keen to press on with it. Delay could work through to the commissioning of the project, necessitating additional fossil-fired generation at substantial cost. The CEGB estimate that every year the three AGRs under construction are delayed costs them £300m in this way.

Moreover, any delay of more than a few weeks could create grave difficulties for the power plant industry, for which the 2 AGRs are the only home projects promising immediate work. Our review of this industry should not be allowed to jeopardise them.

The CEGB are concerned about the cost of Heysham II, presently estimated at £918m at March 1979 prices. They point out that owing to the long gap since the last AGR orders, firms are in many

cases likely to have to create new manufacturing facilities for necessary components. Firms are sceptical about the continuation of the AGR programme and are asking the CEGB to indemnify them against the costs of manufacturing facilities. The Board also fear that tenders will be heavily loaded with overheads. For these reasons they cannot be sure that the estimate of £918m will not be exceeded. I must point out however that delay in giving approval will not help with any of these factors, and indeed could make them worse.

My officials are discussing some of the detailed economic aspects of the project with yours. I would of course tell the Board that they must finance the station within whatever limit is set for the electricity industry as a result of our review of expenditure. The important point is that the Board's commercial judgement is still that the station ought to go ahead despite the uncertainties on costs. There is nothing in the present position which leads me to question that judgement.

There is a strong case for giving the CEGB this approval now, as they ask. I should be grateful if you could confirm that you agree that I should do so.

I am copying this letter to George Younger and Keith Joseph.

D A R HOWELL

Jan

11 11 11
A.M. 11 11 11

21 JUN 1954

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Faint, mostly illegible typed text, possibly a letter or report, covering the upper half of the page.

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Handwritten scribbles and marks, possibly initials or a signature.

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CONFIDENTIAL

Qa04125

To: PRIME MINISTER

From: SIR KENNETH BERRILL

Structure of the Power Plant Manufacturing Industry

1. In their memorandum E(79/7) the Secretaries of State for Industry and Energy ask their colleagues to consider whether, in the interests of restructuring the UK Turbine Generator industry, the Government should intervene in the allocation of orders for the two new AGR stations at Heysham and Tomes. The CPRS was asked by the previous administration to examine the methodology used by the electricity board to evaluate alternative turbine designs and the prospect for export of 4 and 6 flow turbines.

2. The CPRS report is attached. Much of the material in it is relevant to the decision whether or not to intervene in the allocation of orders. Broadly, the conclusion is that there is no case on methodological or export grounds for intervening. But if both the turbine orders for both the new AGRs were to go to the company with the weaker export prospect (Parsons) the implications for the longer-term viability of the UK turbine manufacturing industry would be severe.

3. In the view of the CPRS it is not at this late stage possible to use the orders for the two new AGR stations to induce a merger between GEC and Parsons but the placing of the orders should be such as to be compatible with a merger in the future. This would point to a division of the work between them.

.../...

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4. If this is the strategy the tactical question remains of how to get the electricity boards to come to this decision and how to respond to the inevitable request by the boards for compensation. It is a nice judgement whether it would be better to offer to discuss compensation now - albeit at a very low figure - or to refuse to contemplate compensation in the expectation that the boards will in practice divide the work without it. (The boards would not want GEC to go out of the large turbine business.)

5. In the view of the CPRS it is too soon for the Government to commit itself to compensation. More needs to be known about the boards' preferences and intentions.

6. I am sending copies of this minute and the enclosure to members of the Ministerial Committee on Economic Strategy and to Sir John Hunt.

KE

30 May 1979

Att

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THE CHOICE BETWEEN 4 AND 6 FLOW TURBINE GENERATOR
DESIGNS FOR THE NEW AGR POWER STATIONS AT
HEYSHAM AND TORNESS

Report by the Central Policy Review Staff

May 1979

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Summary and Conclusions

1. As the CPRS 1976 report on the future of the United Kingdom power plant industry showed, the collapse of the world market for new power station construction and the heavy competition from overseas suppliers has left the United Kingdom power plant industry in a parlous state. With a greatly reduced home market and fierce competition overseas it is unlikely that the United Kingdom can support two efficient and profitable firms making turbines and two making boilers.
2. There is an urgent need for mergers, but these are difficult to achieve, especially between the two turbine manufacturers, GEC and NEI (Parsons). The struggle between them for the small amount of United Kingdom home market business from the CEGB and the SSEB is understandably intense. When the order was placed last year for a new coal fired station (Drax B) most of the work went to Parsons, partly on the grounds of the severe unemployment problems in North East England. The placing of the turbine orders for the two new AGRs (worth say £150 million) is a matter of the greatest importance to the two companies. If both these orders also went to Parsons, GEC (which probably is potentially the more viable manufacturer of large turbines) would take a bad knock in this section of their business.
3. It is not surprising therefore that both companies should watch with great care the way the generating boards go about choosing the turbines for the new AGR stations and be particularly sensitive to any signs of what they regard as unfair treatment.
4. Last November Sir Arnold Weinstock came to see the then Prime Minister to explain his unhappiness at the apparent desire of the generating boards to standardise on 6 flow turbine generator designs for the two new AGR stations at Heysham and Torness. GEC can manufacture and have submitted a tender for a 6 flow design but their basic and preferred system has only 4 exhaust flows at this level of power output (660 MW). According to Sir Arnold no overseas utility was likely to consider 6 flow turbines for 660 MW sets and the boards, by their actions, were about to damage the export prospects of the turbine manufacturing industry and of GEC in particular. He challenged the boards' methodology for evaluating 6 flow versus 4 flow claiming, in fact, that they had revised their methodology to achieve the result they preferred.

5. The CPRS was asked to report on the two issues raised by Sir Arnold: (i) the methodology used by the United Kingdom generating boards to assess competing turbine designs; and (ii) the export prospects for 4 and 6 flow machines.

Methodology of choice between 6 flow and 4 flow turbines

6. Assessment of tenders for these huge turbines is a complex and technically difficult operation. In fulfilling our remit to look at methodology it was not necessary - nor would it have been sensible - for the CPRS to try to second-guess the boards and make our own detailed analysis of the tenders as submitted by the manufacturers. Our remit was with the methodology of the choice and for that we have made a more general examination of the characteristics of 4 and 6 flow machines and of the arguments on the methodology put forward by the parties involved.

7. 4 flow machines have a lower overall efficiency than 6 flow machines in converting steam energy into electrical energy, but they are cheaper to manufacture and install (smaller and mechanically somewhat less complex). The methodological argument is about how the Boards' evaluation of the fuel savings of the larger more complex 6 flow machines compares to the extra capital cost.

8. The Boards have to assess (i) the likely difference in cost and (ii) the likely differences in efficiency. In estimating likely differences in efficiency a considerable degree of judgement is required, based on previous design and operating experience, and the uncertainties are large in relation to the theoretical differences in efficiency. They include uncertainties over the performance of the AGR nuclear island (ie its ability to produce the amount of steam for which it is rated), and the operating problems of large turbines (blade and rotor failures) which have sometimes led to long periods of breakdown.

9. Originally the CEGB seemed so certain that the 6 flow solution was preferable that they asked only for tenders for 6 flow machines. It took pressure from GEC to make them agree to both 4 flow and 6 flow tenders. Naturally GEC was left worried lest the CEGB's mind was already made up, and this worry was confirmed when they saw the formula that the CEGB proposed to use for comparing increased efficiency with increased capital costs.

10. It is true that the CEGB appear to have had, from the start an instinctive preference for 6 flow machines at Torness and Heysham but this is understandable. These are base load stations on coastal sites with plenty of cold sea water available for cooling - important elements in efficiency differences and economic comparisons. Also the GEC 4 flow machines are new designs for which there is as yet no operating experience.

11. It is true too that the methodology used by the generating boards for the new AGRs is different from that commonly used overseas and different from that used on some previous occasions by the United Kingdom generating boards themselves. It results in figures much more favourable to 6 flow machines than any previously seen and was understandably worrying to GEC. Nevertheless for the reasons described in detail in this report, the CPRS believes that, for the two stations in question, the boards' approach is logical and defensible.

Exports

12. The second part of the CPRS's remit was to examine Sir Arnold Weinstock's contention that if the generating boards chose 6 flow machines for the two new AGRs it would badly damage the export prospects of the United Kingdom power plant manufacturing industry. A consortium of United Kingdom engineering consultants has confirmed to us GEC's contention that only 4 flow machines have realistic export prospects in this range of power output.

13. GEC's 4 flow turbine is more advanced than is Parsons' 4 flow model and might be expected to outmatch Parsons' version fairly consistently in overseas competition. But GEC cannot claim more than a precarious foothold in the export market and Parsons have not sold a machine of this size overseas for more than two years.

14. The consultants who advised us did not believe that the Heysham and Torness decisions would have any direct influence on an overseas customer in his choice of supplier, providing the United Kingdom decision were not expressed as a vote of no confidence in the losing tenderer. Further, since GEC should have examples of their 4 flow design in operation, in the United Kingdom and in South Africa, long before the new Heysham and Torness stations are complete, they cannot claim they need this order as a demonstration to overseas customers of the GEC turbine technology. Though, of course, the greater the number of home orders a manufacturer can show the better his chances of convincing an overseas customer and the keener will be the price he can offer. 3

15. The United Kingdom generating boards do not at present take much account of the export market, but Sir Arnold's accusation that the boards are being wildly unreasonable in their approach at Torness and Heysham cannot be sustained.

Conclusions

16. In the view of the CPRS there is no substantial technical case for the Government to get involved in the ordering process, nor are there overwhelming export arguments in favour of intervention.

17. The previous Government accepted the conclusions of the CPRS report that in the long run there is no place for two independent turbine generator manufacturers in the United Kingdom and that a merger is desirable. At this relatively late stage it would not be easy to use the Heysham and Torness orders to realise this objective. The opportunity to submit a joint design was offered to the manufacturers and rejected.

18. If both AGR turbine orders go to one company, the other is unlikely to be able to continue in the business of large turbine generator manufacture for much longer. At present GEC is probably the better placed to survive. But if, following Drax B, it should be the boards' preference to give both AGR orders to NEI (Parsons), the wisdom of again supporting the weaker company will be called into question.

19. As soon as the results of the boards' analysis of the tenders are available, the Government will need to take account of the industrial implications of allocating the orders according to the boards' preferences, and the case for alternative ways of distributing the work.

29 May 1979

I. INTRODUCTION

1.1 Two new nuclear power stations, based on the advanced gas cooled reactor (AGR) are to be constructed as the next stage in the expansion of British nuclear generating capacity. One station will be built by the Central Electricity Generating Board (CEGB) at Heysham on the Lancashire coast and the other by the South of Scotland Electricity Board (SSEB) at Torness on the Firth of Forth. The two Generating Boards are co-operating in the design and planning of these stations.

1.2 Each station will contain two 660MW turbine generator sets. The work represents some £150 million of business for the turbine industry which faces a serious shortage of orders.

1.3 Following the CPRS report on the Future of the Power Plant Manufacturing Industry (1976), the policy has been to try to rationalise the industry by the formation of a unified turbine generator manufacturing capability (similarly for the boilermaking industry). So the two generator manufacturers, GEC and C A Parsons (now part of Northern Engineering Industries (NEI) were asked to submit a joint tender for the turbine generators at Heysham and Torness. The manufacturers declined to do so. The Generating Boards then had no option but to ask for independent tenders from the two manufacturers.

1.4. The Boards judged initially that it was only worth considering designs of turbine generator with six exhaust flows, and the tender specifications were framed accordingly. However, GEC protested that their own design was conceived and optimised around four exhaust flows and the tender basis would put them at a competitive disadvantage. Following these representations the Boards revised their tender conditions to cover both four and six flow designs.

1.5 Nevertheless GEC remained convinced that the Boards were wedded to a six exhaust solution, and that other designs would not be assessed impartially. Their suspicions were reinforced by the very high value which the Boards said they would put on marginal advantages of efficiency of 6 flow over 4 flow. As a result Sir Arnold Weinstock wrote to the then Prime Minister, and subsequently met him, to express GEC's concern at the attitude of the Boards and to ask the Government to make an independent judgement, such an independent judgement should take into account not only the Boards' own preferences but also the impact of their decision on the ability of the turbine manufacturing industry to export - GEC contended that overseas utilities are only interested in 4 flow designs.

1.6 The CPRS was therefore asked to assess:

- i. the method which CEGB and SSEB intended to employ to compare four and six flow exhaust designs;
- ii. the export prospects of the two systems.

1.7 The CPRS was not asked (nor would it be competent) to undertake an independent assessment of the tenders. Neither the Boards nor NEI (Parsons) were prepared to divulge details of the tenders to the CPRS and we are not therefore aware of for instance, the prices at which the manufacturers have offered their machines. The Boards are completing a detailed analysis of the tenders. We cannot predict the results of this analysis, or the final preferences of the Boards.

1.8 In our study on methodology we have talked to representatives of the Generating Boards and the manufacturers, who have also provided us with a good deal of written information. We were greatly assisted by Dr L Rotherham, formerly head of research for the electricity supply industry and Vice-Chancellor of the University of Bath. Advice was also received from a number of other expert sources.

1.9 On the exports side of our remit, the four main British firms of consultants in this area. Kennedy and Donkin, Merz and McLellan, Preece Cardew and Ryder, and Ewbank and Partners, have acted in concert to provide us with a review of recent activity in the export market for machines of the class under consideration and to provide some indications of the likely future markets.

1.10 Although it is known publicly that the CPRS has been examining the problem, we would recommend against publication of this report. ~~In~~ The world market for large turbines is intensely competitive and this report could be used to the detriment of British manufacturers - as was the CPRS 1976 report when it was published.

2. TECHNICAL BACKGROUND

2.1 A turbine is a device for converting energy in a gas or fluid into mechanical rotational energy. In steam turbines the heat energy contained in the steam is converted to mechanical energy by allowing the steam to expand through a series of turbine wheels attached to a central rotor.

2.2 In large steam turbines, it is not feasible that the steam should undergo its complete expansion within one cylinder. Normally the bigger turbines consist of a high pressure (HP) cylinder, an intermediate pressure (IP) cylinder, and, because the volume of steam is by then so large, two, three or possibly more low pressure (LP) cylinders all on one rotor shaft. For the size of generating set being considered for the two AGR stations (660MW) an HP, IP and either two or three LP cylinders represent the normal configuration. Because the LP cylinders are fed from the centre, with steam expanding outward towards the two ends, machines with two LP cylinders are said to have 4 flow exhaust systems, and those with three LP cylinders a 6 flow exhaust system.

2.3 Essentially the amount of energy which may be extracted from a given steam input will depend upon the extent to which the steam is allowed to expand within the turbine. Although internal mechanical design will have an effect, broadly speaking, the larger the exhaust area of the turbine the greater should be its efficiency in converting steam heat energy into mechanical, and hence electrical, energy. Six flow systems (3 LP cylinders) have more exhaust area (room for expansion) than 4 flow and hence have, in principle, higher efficiency.

2.4 But there is an important complication. The steam leaving the last row of turbine blades passes to a condenser, where it is converted back to water. The vacuum existing in the condenser has a significant influence on efficiency. The greater the vacuum the more heat energy is converted into mechanical energy, but another effect acts in the opposite direction: the better the vacuum the greater the velocity with which the steam leaves the last stage blades (the so-called "leaving loss"). In general the power available for electricity generation increases as the condenser vacuum is increased, until the velocity of the steam leaving the last row of turbine blades approaches the local speed of sound, at which point no further conversion of heat energy into mechanical energy occurs although the leaving loss continues to increase. Maximum power therefore occurs just below the local speed of sound. The larger the exhaust area the higher the vacuum needed for this condition to be reached.

2.5 If a 6 flow machine is to maintain an appreciable efficiency margin over the 4 flow alternative, a good vacuum in the condenser is therefore essential. The vacuum obtainable is dependent upon the temperature of the cooling water available to operate the condenser. Vacua needed by 6 flow machines can be obtained when plenty of cool water is available from rivers and seas in high latitudes. Where power stations are sited inland and away from rivers so that air cooled condenser towers must be used for cooling the condenser water, or where stations are in tropical or sub-tropical climatic zones, it is rare that the right vacuum can be provided economically within the condenser to make 6 flow machines a sensible proposition.

2.6 At present then, for 660 MW operating where plenty of cool water is available, a 6 flow machine should give a higher overall efficiency than a 4 flow. But in future this may not always be so. There is considerable extra capital cost associated with the third LP cylinder, with its water condenser and associated equipment, and with the extra space required to house them. Turbine manufacturers would like to get the exhaust flow area at present obtainable in 660 MW sets only from 3 LP cylinders from a 2 LP system by having larger LP stages with larger turbine blades - though the mechanical and metallurgical problems are severe.

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2.7 Brown-Boveri (Switzerland), KWU (Germany), Mitsubishi and Hitachi (Japan) are all working towards 40" last stage turbine blades. In the United Kingdom both GEC and Parsons have development work underway but for some time to come their commercial sets will be based on the Parsons 36" and GEC 37.2". The Parsons LP unit, with a 36" last stage blade, is more of a gradual evolution from past practice - derivatives of those installed in Drax A in 1966 - they are flexible in being adaptable to 6 flow or 4 flow machines at the customer's choice. GEC's LP units (37.2" last stage blade) are stronger, more highly rated and more recent in design than Parsons. They are also more of a break with the past. Prior to the 1969 merger of AEI and English Electric into GEC the two companies had independent turbine designs. After 1969 GEC appointed a new designer and developed a new range of machines based on standard LP modules where one module would be used in 300 MW sets, two in 600 MW sets, and three in 900 MW. Stations incorporating the new design and technology are under construction for the ^{CEGB}~~GECB~~, the SSEB, in Northern Ireland, and in South Africa, but there is, as yet, no operating experience with them. It will be seen, however, that GEC approached the 660 MW set with a two LP stages (4 flow) system in mind.

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3. ASSESSMENT OF ALTERNATIVE DESIGNS

3.1 If adequate cold water is available, there is no doubt that a 6 flow machine will offer a greater overall efficiency than a 4 flow design. But this extra efficiency is obtained at the price of an additional capital cost. The problem is one of computing a worth for the extra efficiency to compare with the extra capital required.

3.2 The evaluation of the efficiency margin is carried out in two stages -

i. An Economic Assessment

The calculation of the worth in present day terms of a unit of extra station efficiency.

ii. A Technical Assessment

The calculation of the actual efficiency margin to be expected in operation between tendered designs.

3.5 Normally the economic assessment is carried out by the customer before he seeks tenders. The result of his assessment, expressed in £ per marginal kilowatt (£/kw), is given in the tender specifications (it is called "the economic parameter"). The higher the £/kw economic parameter the higher the premium put upon the greater efficiency of 6 flow as compared to 4 flow. When the Boards asked GEC and Parsons to tender for the new AGRs the "economic parameter" they set down was so very much higher than anything seen before (eg as compared with the parameter for the Littlebrook oil fired station in 1972-73) that GEC were understandably worried. In what follows we shall describe why the generating boards' £/kw figure is so much higher than GEC's own expectations and calculations.

Calculation of the Economic Parameter

3.4 The £/kw calculation depends on a series of assumptions -

i. the manner in which the new station is expected to be used - base load, peak lopping or some combination of the two;

ii. the expected price of power station fuel over the life of the station;

iii. the rate of interest used to discount future costs to present day values;

iv. whether the fuel saved by extra-efficiency will be internal to the station (ie station output constant but lower steam raising requirements) or whether the fuel saved will be external to the station (ie the extra efficiency will mean a larger output from the new station and a lower output from another station - ideally from the least efficient station in the system).

3.5 The differences of approach between the Boards and GEC on these four sets of assumptions are as follows -

i. The use of the new stations

3.6 AGR nuclear stations have very low running costs (ie use little fuel) but are expensive to build (£6/700m). They should therefore be used as intensively as possible, ie on base load. Both the Boards and GEC assume that this will be the case with the two new AGRs.

ii. The expected price of fuel over the life of the station

3.7 GEC have assumed only small real increases in fuel price over the life of the stations. The Boards, in common with most international and United Kingdom opinion, have assumed considerable real increases. The Boards' assumption of increases in the real price of coal (4 per cent per annum up to 1985 and 1½ per cent thereafter) are more pessimistic, especially in the early years, than those of the Department of Energy. On the other hand their assumptions on increase in the real price of oil (a rise of 80 per cent by 2000) are more optimistic than the Whitehall view which is expecting at least a doubling over the next 20 years.

3.8 The exact price profile does have some impact on the out-turn but is not of great significance. The important difference is that GEC is still working on a pre-1973 type assumption on the future of oil prices. On this we think that GEC is wrong and the Boards are more nearly right. This difference plays an important part in explaining why the Boards £/kw figure is so much higher than pre-1973 and was such a surprise and shock to GEC.

iii. The rate of interest used to discount future costs to present day values

3.9 The higher the rate of discount the lower the £/kw parameter. The Boards have used a rate of discount of 10 per cent. GEC advocate the use of a higher

rate, in part because of the practice of overseas customer utilities. In the United States, for instance, it would be customary for the utilities to use a commercial rate of interest plus a factor to cover expected tax payments.

3.10 The Boards could well reply that in using 10 per cent they are going much higher than the 5 per cent set down in the White Paper on Nationalised Industries (Cmd 7131). They are using 10 per cent rather than 5 per cent because of the inherent uncertainties in the efficiency of the AGRs and the uncertainties on the future price of fuels. Using 10 per cent rather than 5 per cent is not an ideal way of allowing for uncertainty but it does represent a considerable move towards the rates advocated by GEC.

iv. Whether the fuel saved by the extra efficiency will be i. internal to the station (ie constant station output but less steam needed) or ii. external to the station (ie increased station output and savings made absorbed in the system, down the merit order)

3.11 This assumption and the assumption on future fuel prices are the critical ones in determining the economic parameter (£/kw). The traditional approach (and one which GEC would use) is assumption i. - that the saving is made inside the station. The savings there are small for the value of uranium fuel saved in raising less steam in the AGR is not large. So the extra efficiency of 6 flow does not save much. On assumption ii. the savings are made in fossil fuelled stations (over the life of the AGRs there will still be some fossil stations on base load) and the savings in coal and oil are worth much more than savings in uranium fuel. This puts a much higher premium on the extra efficiency of the 6 flow. Indeed, the £/kw figure under assumption ii. is three times that under assumption i. (£1,200 as against £420).

3.12 In the circumstances of the new AGRs, the CPRS believes that the Boards are right to work on assumption ii. They are also right to work on the assumption of rising fuel costs and the assumption of a 10 per cent rate discount seems reasonable. All in all, we would not support the GEC claim that the Boards' £/kw economic parameter for the two new AGRs of something around £1,000/kw is outrageously high.

3.13 But this judgement is relevant to the conditions of the two new AGRs where it is possible to convert extra output from the turbines into extra electricity input into the grid and hence allow lower inputs from other stations to the grid. It would not necessarily hold for all future stations.

3.14 The steam raising capabilities of the present design AGR nuclear island has such limitations that the likely output from either 6 flow or 4 flow turbines will not be more than the associated generators can convert into electricity. In future stations greater availability of steam and greater output from the turbines could exceed the limit which the present design of generators could carry (680/690 MW). In that case the extra efficiency of the 6 flow could not be fed into the grid to save fuel in other stations. The savings would have to be internal to the new stations, assumption i. would then be appropriate, the £/kw correspondingly much lower, and the choice between 6 flow and 4 flow affected.

3.15 The importance of the 'economic parameter' £/kw can be shown by the following. It is generally agreed that the efficiency advantage of a 6 flow over a 4 flow is somewhere in the region of $1\frac{1}{2}$ - $2\frac{1}{2}$ per cent. On a 660 MW set that means an advantage of between, say, 10 MW to 20 MW which has to be valued by the £/kw and set against the extra capital cost of the larger 6 flow (extra LP turbine, extra condenser and associated equipment, extra spares, larger building to erect and maintain). This extra capital cost is between £6-£9m per set. The effect of taking a £/kw of £1,200 (using the Boards' assumption ii. that the savings will be made elsewhere in the grid) rather than £/kw of £420 (savings internal to the station) is -

6 flow Efficiency Margin	Savings on 660 MW	Economic Parameter		
		£/kw 420	£/kw 1,200	
$1\frac{1}{2}\%$	9.9 MW	£4.2m	£11.9m	} Value of 6 flow fuel savings to be compared to 6 flow extra capital costs (£6/9m).
2%	13.2 MW	£5.5m	£15.8m	
$2\frac{1}{2}\%$	16.5 MW	£6.9m	£19.8m	

It will be seen that on £/kw figures of £420, the 6 flow has a hard time to show a profit over its extra capital costs while it can always do so on £1,200. It must, however, be stressed that the 'profit' is small in relation to other uncertainties: at best £10m per set (£20m per station) compared with a station cost of £600-£700m. Also these benefits accrue during the 25 to 30 years of life of the station and over this period the uncertainties of fuel prices, operating efficiency, unexpected 'outages' are considerable.

The Technical Assessment

3.16 As was said above, the economic assessment (the calculation of the £/kw economic parameter) is undertaken before the tenders are asked for and the resulting £/kw figure is included in the tender conditions. After the tenders are submitted the Boards necessarily spend months checking the technical calculations and efficiency predictions given in the tenders and trying to assess the extent to which the suppliers' estimates of performance can be relied upon.

3.17 In the United Kingdom this work is undertaken largely at the CEGB centre at Barnwood - regarded as one of the most expert of technical assessment groups on turbine technology in the world. The assessment, in the end, has to rely on technical judgements based on past experience rather than on rigid theoretical analysis of the manufacturers' test programmes and computer data.

3.18 The tender specifications for turbines for the two new AGRs included the requirement that the LP rotors should be standard with those that the manufacturers concerned had recently supplied for other United Kingdom power stations. In the case of Parsons that mean commonality with Hunterston, a 6 flow station. On this basis the 6 flow design that they submitted had, they claimed, a $2\frac{1}{2}$ per cent efficiency advantage over their 4 flow, and the Boards broadly agree with this. Parsons have argued, however, that to use Hunterston rotors in a 4 flow configuration produces a drop in efficiency greater than any savings which the Boards would achieve on spare parts from having commonality with Hunterston. Parsons have therefore also offered the Boards an alternative (more efficient) 4 flow with non-Hunterston rotors which would reduce the $2\frac{1}{2}$ per cent efficiency advantage of a Parsons 6 flow over a Parsons 4 flow.

3.19 GEC claim that their (GEC) 6 flow design had only a 1 per cent efficiency advantage over the GEC 4 flow design. Neither generating board believe that the difference could be as small as this but there is disagreement on how GEC should modify their basic 4 flow turbine for 6 flow working.

3.20 In adding the third LP cylinder to go from 4 flow to 6 flow, the CEGB would like GEC to leave the LP cylinder design unaltered and make the necessary modifications in the earlier (HP and LP) stages of the turbine. CEGB believes that the efficiency advantage of a GEC 6 flow over a GEC 4 flow could then be raised to over 2 per cent. But this would be a 'one-off' modification which

GEC would be most reluctant to undertake - arguing that it would be relevant to no other market and doubting whether the efficiency improvement would be as high as CEGB believes. The SSEB shares GEC's doubts about the wisdom of the CEGB proposal.

3.21 These complex arguments about the predicted efficiency advantage of a Parsons 6 flow over a Parsons 4 flow and of a GEC 6 flow over a GEC 4 flow say nothing about the absolute comparisons between the two ranges of product. As was said at the outset of this report, the CPRS has not been given the tender submissions and can only speculate on the possible outcome. Parsons have stressed to us that their (mainly 6 flow) machines have regularly headed the Boards' efficiency lists. On the other hand, GEC 4 flow machines are likely to be significantly better than Parsons 4 flow.

3.22 So the likely contenders are a GEC 4 flow against a Parsons 6 flow. The SSEB has suggested that 1.6 per cent might be the margin between the Parsons 6 flow and GEC 4 flow and that, on the face of it, it seems a reasonable guide to the likely order of difference.

3.23 As we have said above, a $1\frac{1}{2}\%$ per cent efficiency advantage on a 660 MW set valued at a £/kw of £1,200 gives a figure of £11.9m to be compared with an extra capital cost of £6 to £9m per set. On the two sets per station there would be a theoretical advantage of around £5m to £10m to be set against total cost of constructing each station of £600-£700m.

3.24 As has also been said above these calculated advantages would not be insignificant but they do not bulk large in comparison with the many uncertainties affecting the turbine choice. Fuel price movements over the 25 to 30 year life of the station are uncertain as is the performance of the new AGRs.

4. EXPORTS

4.1 Turbine generators are used in a number of industrial applications and are made in a wide range of sizes from 10MW to 1200MW. Large steam turbines for public power generation form only a part, although an important part, of the overall market. There are currently 18 companies of world class capable of manufacturing the range of machines used in large power stations, including formidable competitors in America, Switzerland, Germany and Japan. At present, however, both British manufacturers are well capable of holding their own in technical design.

4.2 In choosing a supplier, an overseas utility will have primarily in mind the tendered price, followed by -

- the quality of the manufacturer's engineering, manufacturing capability, quality control and site organisation
- the reliability of the machine, and the likely cost of repairs and maintenance
- the manufacturer's reputation on delivery dates
- the credit terms on offer.

Manufacturers, and the consultants, both say that quality and reliability will be judged very much against performance of reference plant installed elsewhere, which already has a good period of operation behind it. The credibility of delivery dates will also be enhanced if the manufacturer can point to experience of timely installation of similar machines. In most countries a turbine manufacturer looks to his 'home' utility to accept the development risks on new machines and to give support through procurement which provides 'reference plant' to give background operating and technical data for potential customers.

4.3 The characteristics of the steam produced in an AGR station is very similar to a conventional fossil fired station so turbine experience from one can be read across to the other. PWR reactors, the nuclear system predominantly in use overseas, provide steam at much lower temperatures and pressures; consequently the turbine design is very different. Turbines in United Kingdom conventional or AGR stations do not therefore provide a reference point for PWR stations abroad.

4.4 Lack of PWRs in the United Kingdom make it difficult to achieve export orders for turbines for installation in PWR nuclear stations abroad: nevertheless both British companies have achieved a few such export orders: Parsons in Korea and Canada (although these were achieved through a link with a local company which has now been broken) and GEC in Korea. The Heysham and Torness AGR stations therefore are relevant for fossil-fuelled stations in the output range from about 500MW to 750MW. Above and below that range, there is no real disagreement about the appropriate number of exhaust flows.

4.5 A complication is that electricity supply is not consistent; some parts of the world - essentially North and South America and some Asian countries - are based on a 60 cycles per second (60c/s) system, the rest using 50 cycles per second (50c/s). At 60c/s turbine blade lengths and rotor diameters are smaller for a given turbine rating because the machines must rotate faster (3,600 rpm instead of 3,000 rpm). The debate on 4 or 6 flow exhaust systems therefore applies at lower output in 60c/s countries.

4.6 The consultants were therefore asked to survey the 50c/s market, and to include 60c/s countries, such as Canada, Korea, and South America where export opportunities existed. Excluded were those countries in which the domestic turbine generator industry is effectively a monopoly supplier, for instance Germany, France and Italy.

4.7 The picture which emerged of this section of the market over the last 5 years is shown in Table I.

TABLE I

Ordering of
500 - 750MW Fossil-Fired Sets 1973-1978

	<u>USA</u>	<u>Commonwealth and ex-Commonwealth Countries</u>		<u>Other Countries Potentially Open to UK Exports</u>		<u>TOTAL</u>
	<u>60c/s</u>	<u>60c/s</u>	<u>50c/s</u>	<u>60c/s</u>	<u>50c/s</u>	
Total Orders	75	0	21	3	7	106
<u>of which:</u>						
GEC	0	0	6	0	0	6
NEI (Parsons)	0	0	1	0	0	1

In the past 5 years British manufacturers made no sales in the biggest market (North America) and have only a precarious foothold elsewhere. The position is perhaps even worse than it looks, since all 6 sales by GEC were for one station in South Africa in 1975 and 1976. The single Parsons sale was to Australia in 1976. The recent pattern of exports for the United Kingdom industry shows the companies attempting to cling, against strong European and Japanese competition, to the old Commonwealth market which they once dominated, and showing little success in breaking into new developing country markets. This failure to develop new outlets in developing countries will be particularly important in coming years, as the more developed countries move towards stations of a larger rating (over 750 MW) and the 'medium' sized power station market is centred more on developing countries. The expected faster growth of the developing country market is shown in Table II (based on our consultants' survey).

TABLE II

500-750MW Fossil Fired	1973-1990	
	Traditional British/ Market	Developing Countries*
	(UK share in brackets)	(UK share in brackets)
<u>Non-Nuclear Orders</u>		
1973/78	21(7)	10(0)
1980/1990	47	96

∕ Australia, Canada, Eire, Hong Kong, India, Malaysia, New Zealand, Pakistan, Singapore, South Africa. (10 countries)

*Argentina, Brazil, Chile, China, Denmark, Egypt, Finland, Greece, Holland, Indonesia, Iran, Korea, Phillipines, Poland, Portugal, Spain, Sweden, Taiwan, Thailand, Turkey, Uruguay, Venezuela. (22 countries).

4.8 The survey indicated that orders in overseas markets were overwhelming for 4 flow machines, and indeed all of the British exports were of the 4 flow type. And the overseas preference for 4 flow machines in fossil stations is almost certain to continue, because -

- what cooling water is available is usually warm and often in short supply.
- there is often relatively cheap local fuel, with smaller weight being given to future rises in price.
- the plant may not be required for base load operation, or the grid system may be such that the station, although on base load is not normally run at maximum output.
- difficulties in raising capital means that the developing countries are worried by high initial capital cost and require a relatively high rate of return.

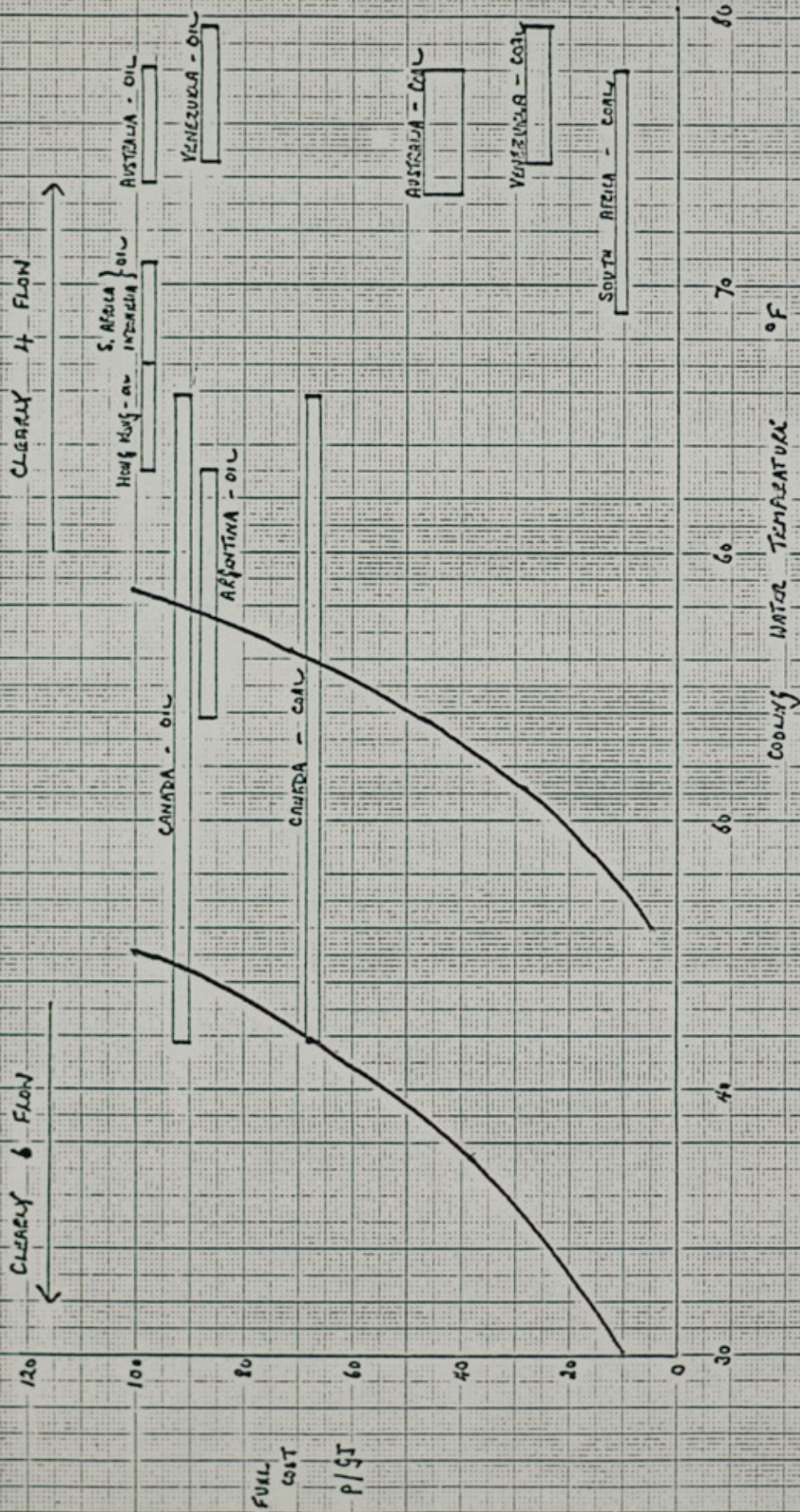
4.9 The consultants were able to represent in a series of graphical diagrams how the choice of 4 or 6 flow turbines depended on variations in various technical parameters. We have attempted to combine these simplistically in Figure I which, although crude, gives we think a fair indication of the world market picture. The diagram shows two boundaries, related to fuel cost and local cooling water temperatures, which define areas where the decision on turbine type is clear. Within the area between the boundaries the choice is finely balanced, and a detailed study to assess overall benefits is required. Figure II shows how British conditions relate to the boundaries.

4.10 The CEGB has pointed out to us a number of exceptions to the usual preference for 4 flow fossil fired stations. Two in Holland and one in Germany, have been ordered with 6 flow exhaust, in locations where cooling water temperatures are probably similar to those around our own coasts. There are contradictory reports about the intentions of the French utility (EdF), but we are not likely to know EdF's preference before firm orders for our new AGRs have been placed. Canadian utilities have opted for 4 flow machines in the past, although local cooling water conditions should perhaps favour a 6 flow solution; however it is possible that calculations there were based on assumed supplies of cheap American coal. Similarly Japan has adopted 4 flow machines, but making this domestic choice they may have had also their export markets in mind.

Diagram I

4 AND 6 FLOW TURBINES OF 500MW - 750MW RATING

- DEPENDENCE OF CHOICE ON TECHNICAL PARAMETERS



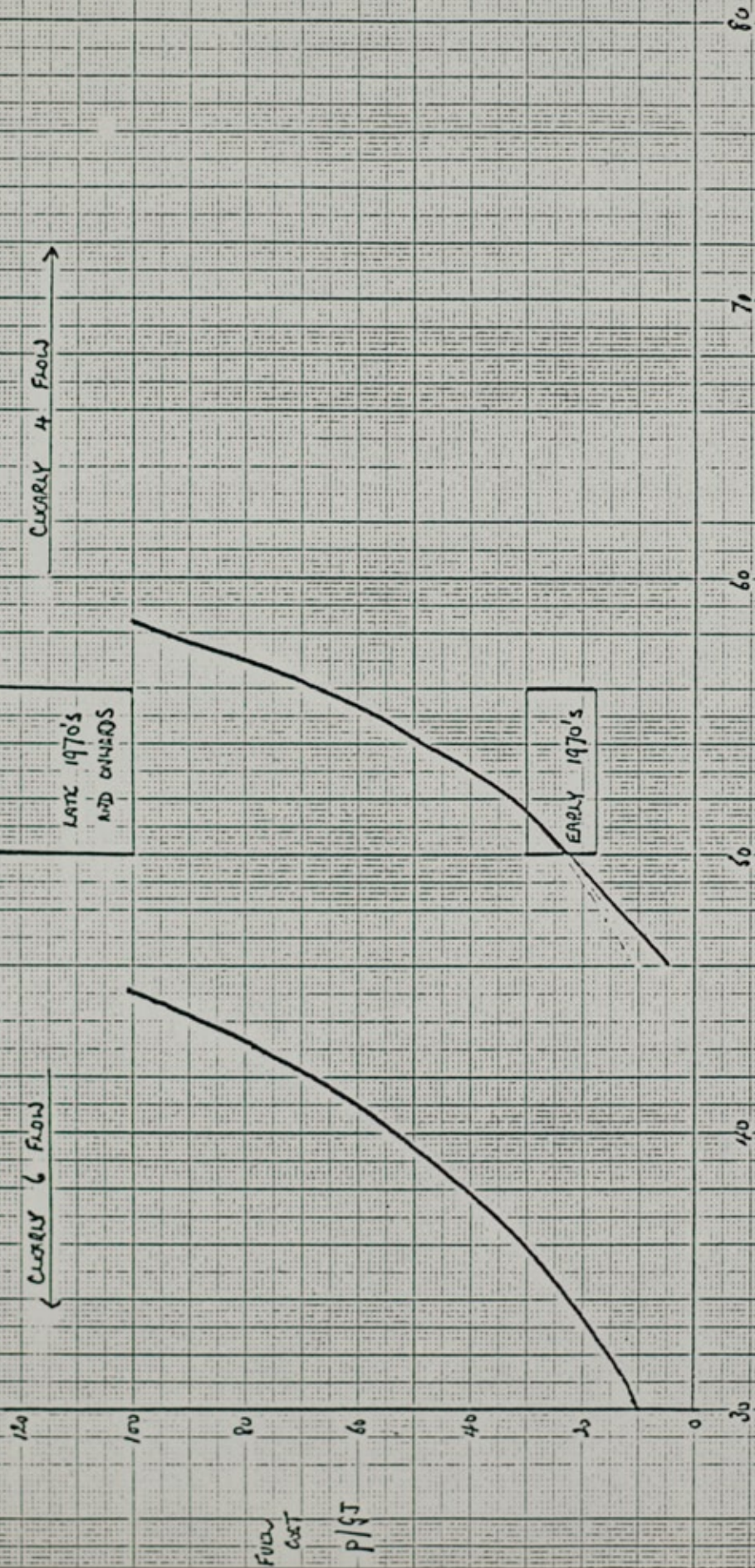
FUEL COST
P/GJ

COOLING WATER TEMPERATURE
°F

DIAGRAM II

CHOICE BETWEEN 4 AND 6 FLOW TURBINES

- CHANGE IN BRITISH CONDITIONS



4.11 It is not unreasonable that with relatively high fuel prices and temperate weather conditions, the outcome of assessments by utilities in Northern latitudes will be different from those elsewhere. Nevertheless in current conditions assessments for new stations in Northern latitudes are unlikely to show a margin heavily in favour of either 4 or 6 flow systems and the choice would be largely determined by elements of judgement.

4.12 In the overseas market to which British manufacturers are likely to have access however there is little doubt that the great majority of their customers will require 4 flow designs in future. Because the conditions in Northern Europe and particularly in Scotland, are clearly so different from those that are likely to obtain in those markets at which British manufacturers will be aiming, we do not think that the choice by the British Boards for their new stations will have any significant impact on other utilities in their own considerations. Indeed we would think it unwise to assume that the CEBG would be regarded in any way as a world trend-setter in this respect. This is also the view of the consultants.

4.13 For similar reasons neither we nor the consultants believe that a choice of a 6 flow system for the two new AGRs would be regarded by overseas purchaser as a vote of no confidence in the technology of the 4 flow machines which GEC is now building for the CEBG and SSEB.

4.14 However, we do believe, along with the consultants, that should the announcement of the choice of turbine for the AGR stations be for a 6 flow and be coupled with a statement that it would represent a standard for future stations, then this could be expected to have a marked effect on overseas confidence in Britain's ability to produce 4 flow machines competitively long term.

4.15 At the stage when the CEBG were attempting to obtain a joint Parsons/GEC tender, for the new AGRs they implied that these new stations would indeed set the pattern for the future. We see no justification for announcing this. From a CEBG point of view there are some obvious advantages in standardisation. How important these are is a matter for debate. We have indicated above that even in the United Kingdom for some future nuclear station the balance might shift back to 4 flow. In view of the commercial implications we believe that no public announcement on standardisation should be made until the issue has been more fully studied.

5. Conclusion

5.1 GEC's turbine design philosophy is built uncompromisingly around the assessment, fully supported by our consultants, that the world market for fossil fuel stations in the 500 to 750MW range will be overwhelmingly for 4 flow machines. This led GEC to design a standard LP module suitable as a four-flow combination in the 500 to 750MW range, and in different combinations across a much wider range (from about 250 to 900MW). Such standardisation brought with it considerable manufacturing advantage.

5.2 In ordering 4 flow turbines for the oil-fired stations at Littlebrook and Peterhead early in the 1970s the Boards appeared to give GEC's design philosophy a clear vote of confidence. Nobody at that time foresaw the massive rise in energy costs which was shortly to occur or the substantial further increases which are now thought likely in future years. This change has played an important part in altering the economic balance between power station capital and operating costs in a way which, in United Kingdom circumstances, brings the more traditional 6 flow design back into contention.

5.3 Because of their different operating environments, overseas customers considering buying from United Kingdom manufacturers are still likely to be interested only in 4 flow designs. At home the particular circumstances at Heysham and Torness - plentiful availability of cooling water, limited availability of steam from the nuclear reactor, and the requirement for reliable baseload capacity - suggest that the 6 flow design may have the edge. But for future AGR stations beyond Heysham and Torness and for non-baseload fossil stations the balance of advantage even in the United Kingdom could revert to being in favour of 4 flow machines.

5.4 The turbine generator industry is in a parlous state. It needs the support of the home utility, both in providing a working base in which to test and demonstrate new developments, and to provide an environment conducive to production continuity and steady design evolution. There is little sign that the Generating Boards give adequate weight to the industrial implications of their procurement policies or accept responsibility for the health of the industry. Understandably their concern is, largely, with their own economic interests.

5.5 The problem has been made worse by the hostility between the two main manufacturers, NEI (Parsons) and GEC. Both companies are in unremitting competition both at home and abroad, and have shown no desire or willingness to co-operate. In these circumstances, it is perhaps not surprising if the Generating Boards have not been unhappy to stand at one remove so that the two companies could clearly be seen as independent tenderers.

5.6 At the outset of the tendering process the CEGB maintained - wrongly we believe - that the 6 flow system would be appropriate for all future base load stations. A decision by the CEGB to settle permanently for the 6 flow system would totally undermine GEC's expert position, and GEC was rightly alarmed. On the other hand, GEC's objections to the CEGB's approach to the particular orders for Heysham and Torness are less justified.

5.7 Against this background, the current dispute can be seen as no more than a further episode in the struggle between the two companies for the limited work available. It is likely that the company which fails to win the order - or a part of it - will be unable to continue manufacturing large scale turbine generators independently for very much longer. Other things being equal, GEC is probably the better placed to survive, with its more advanced design directed as the export market.

5.8 If, following Drax B, both the new AGRs should be given to NEI (Parsons) the wisdom of supporting the weaker company would be called into question. There remains the possibility of splitting the order between the manufacturers. Although it has been the Board's intention that the two stations should be as near as possible identical, the adoption of identical turbine generators is not of fundamental importance; (much more important is the standardisation of the nuclear reactor). Building different turbine generators at each station would clearly add to design costs, by a few million pounds, and it would do nothing towards the aim of rationalising the industry, but it may be preferable to the exit from the industry of the potentially strongest supplier.

29 May 1979

(CONFIDENTIAL)

Sir Kenneth's redraft
of 4 flow/6 flow

cc Dr Atkinson
M. Knapp

→ Summary and Conclusions

1. As the CPRS report on the future of the United Kingdom power plant industry showed, the collapse of the world market for new power station construction and the heavy competition from overseas suppliers has left the United Kingdom power plant industry in a parlous state. With a greatly reduced home market and very little exports it is unlikely that the UK can support two efficient and profitable firms in making turbines and two making boilers. There is an urgent need for mergers, but these are difficult to achieve, especially between the two turbine manufacturers, GEC and NEI (Parsons). The struggle between them for the small amount of United Kingdom home market business from the CEGB and the SSEB is understandably intense. When the order was placed last year for a new coal fired station (Drax B) most of the work went to Parsons, partly on the grounds of the severe unemployment problems in North East England. The placing of the turbine orders for the two new AGRs (say £150m. worth) is a matter of the greatest importance to the two companies. If both these orders also went to Parsons, GEC (which probably is potentially the more viable manufacturer of large turbines) would take a bad knock in this section of their business. It is not surprising therefore that both companies should watch with great care the way the generating boards go about choosing the turbines for the new AGR stations and be particularly sensitive to any signs of what they regard as unfair treatment.

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2. Last November Sir Arnold Weinstock came to see the then Prime Minister to explain his unhappiness at the apparent desire of the generating boards to standardise on 6 flow turbine generator designs for the two new nuclear power stations at Heysham and Torness. GEC can manufacture and have submitted a tender for a 6 flow design but their basic and preferred system has only 4 exhaust flows at this level of power output (660MW). According to Sir Arnold no overseas utility was likely to consider 6 flow turbines for 660 MW sets and the boards, by their actions, were about to damage the export prospects of the turbine manufacturing industry and GEC in particular. He challenged the boards' methodology for evaluating 6 flow versus 4 flow claiming, in fact, that they had revised their methodology to achieve the result they preferred.

3. The CPRS was asked to report on the two issues raised by Sir Arnold: (i) the methodology used by the UK generating boards to assess competing turbine designs; and (ii) the export prospects for 4 and 6 flow machines.

Methodology of choice between 6 flow and 4 flow turbines

4. Assessment of tenders for these huge turbines is a complex and technically difficult operation. It would not have been sensible, nor was it necessary to fulfil our remit to look at methodology, for the CPRS to try to second-guess the boards and make our own detailed analysis of the tenders as submitted by the manufacturers. For that we have made a more general examination of the characteristics of 4 and 6 flow machines

and of the arguments on the methodology of choice put forward by the parties involved.

5. 4 flow machines have a lower overall efficiency than 6 flow machines in converting steam energy into electrical energy, but they are cheaper to manufacture and install (smaller and mechanically somewhat less complex). The methodological argument is therefore one of the worth of the fuel savings compared to the extra capital cost of the larger more efficient machines.

6. The first step then is to get from the tenders (i) the difference in cost and (ii) the likely differences in efficiency. In estimating likely differences in efficiency a considerable degree of judgement is required, based on previous design and operating experience. The uncertainties are large in relation to the theoretical differences in efficiency; they include the performance of the AGR nuclear island (i. e. its ability to produce the amount of steam for which it is rated), and the operating problems of large turbines (blade and rotor) failures which have sometimes led to long periods of breakdown.

7. Originally the CEGB seemed so certain that the 6 flow solution was preferable that they asked only for tenders for 6 flow machines. It took pressure from GEC to make them agree to both 4 flow and 6 flow tenders. GEC was left naturally worried lest the CEGB's mind was already made up, and this worry was confirmed when they saw the methodology that the CEGB proposed to use for comparing increased efficiency with increased capital costs.

8. It is true that the CEGB appear to have had, from the start an instinctive preference for 6 flow machines at Torness and Heysham but this is understandable. These are base load stations on coastal sites with plenty of cold sea water available for cooling - important elements in efficiency differences and economic comparisons. Also the GEC 4 flow machines are new designs for which there is as yet no operating experience.

9. The methodology used by the generating boards for the new AGRs is indeed different from that commonly used in the industry and different from that used on some previous occasions by the boards themselves. It results in figures much more favourable to 6 flow machines than any previously seen ^{was} and understandably worrying to GEC. Nevertheless for the reasons described in detail in this report, the CPRS believes that for the two stations in question the boards' approach is logical and defensible.

Exports

10. The second part of the CPRS's remit was to examine Sir Arnold Weinstock's contention that if the generating boards chose 6 flow machines for the two new AGRs it would badly damage the export prospects of the UK power plant manufacturing industry. A consortium of UK engineering consultants has confirmed to us GEC's contention that only 4 flow machines have realistic export prospects in this range of power output.

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11. GEC's 4 flow turbine is more advanced than is Parsons' 4 flow model and might be expected to outmatch Parsons' version fairly consistently in overseas competition. But GEC cannot claim more than a precarious foothold in the export market and Parsons have not sold a machine of this size overseas for more than two years.

12. The consultants who advised us did not believe that the Heysham and Torness decisions would have any direct influence on an overseas customer in his choice of supplier, providing the UK decision were not expressed as a vote of no confidence in the losing tenderer. Further, since GEC should have examples of their 4 flow design in operation, in the UK and in South Africa, long before the new Heysham and Torness stations are complete, they cannot claim they need this order as a demonstration to overseas customers of the GEC turbine technology. Though, of course, the greater the number of home orders a manufacturer can show the more appeal he will have to an overseas customer and the keener will be the price he can offer.

13. The UK generating boards do not at present take much account of the export market, but Sir Arnold's accusation that the boards are being wildly unreasonable in their approach at Torness and Heysham cannot be sustained.

Conclusions

14. In the view of the CPRS there is no substantial technical case for the Government to get involved in the ordering process, nor are there overwhelming export arguments in favour of intervention.

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15. The Government accepted the conclusions of the CPRS report that in the long run there is no place for two independent turbine generator manufacturers in the UK and that a merger is desirable.

16. At this relatively late stage it would not be easy to use the Heysham and Torness orders to realise this objective. The opportunity to submit a joint design was offered to the manufacturers and spurned.

17. If both AGR turbine orders go to one company, the other is unlikely to be able to continue in the business of large turbine generator manufacture for much longer. GEC is probably the better placed to survive. But if, following Drax B, it should be the boards' preference to give both AGR orders to NEI (Parsons), the wisdom of again supporting the weaker company will be called into question.

18. As soon as the results of the boards' analysis of the tenders are available, the Government will need to take account of the industrial implications of allocating the orders according to the boards' preferences, and of the cost of alternative ways of distributing the work.

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I. INTRODUCTION

1.1 Two new nuclear power stations, based on the advanced gas cooled reactor (AGR), are to be constructed as the next stage in the expansion of British nuclear generating capacity. One station will be built by the Central Electricity Generating Board (CEGB) at Heysham in Lancashire and the other by the South of Scotland Electricity Board (SSEB) at Torness, a coastal site in Caithness. The two Generating Boards are co-operating in the design and planning of these stations.

1.2 Each station will contain two 660MW turbine generator sets. The work represents some £150m. of business for the industry which faces a serious shortage of orders.

1.3 Following the CPRS report on the Future of the Power Plant Manufacturing Industry (1976), the policy has been to try to rationalise the industry by the formation of a unified turbine generator manufacturing capability (similarly for the boilermaking industry). So the two generator manufacturers, GEC and C A Parsons (now part of Northern Engineering Industries (NEI))^{were asked} to submit a joint tender for the turbine generators at Heysham and Torness. The manufacturers declined to do so. The Generating Boards then had no option but to ask for independent tenders from the two manufacturers.

1.4 The Boards judged initially that it was only worth considering designs of turbine generator with six exhaust flows, and the tender specifications were framed accordingly. However, GEC protested that

their own design was conceived and optimised around four exhaust flows and the tender basis would put them at a competitive disadvantage. Following these representations the Boards revised their tender conditions to cover both four and six flow designs.

1.5 Nevertheless GEC remained convinced that the Boards were wedded to a six exhaust solution, and that other designs would not be assessed impartially. Their suspicions were reinforced by the very high value which the Boards said they would put on marginal advantages of efficiency of 6 flow over 4 flow (8 times any previous figure). As a result Sir Arnold Weinstock wrote to the then Prime Minister, and subsequently met him, to express GEC's concern at the attitude of the Boards and to ask the Government to make an independent judgement, taking into account not only the Boards' own preferences but also the impact of their decision on the ability of the manufacturing industry to export - GEC contended that overseas utilities are only interested in 4 flow designs.

1.6 The CPRS was therefore asked to assess:

- (i) the method which CEGB and SSEB intended to employ to compare the two systems; and
- (ii) the export prospects of four and six flow exhaust designs.

1.7 The CPRS was not asked (nor would it be competent) to undertake an independent assessment of the tenders. Neither the Boards nor NEI (Parsons) were prepared to divulge details of the tenders to the CPRS and we are not therefore aware, for instance, of the prices at which the

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manufacturers have offered their machines. The Boards are completing a detailed analysis of the tenders. We cannot predict the results of this analysis, or the final preferences of the Boards.

1.8 In our study on methodology we have talked to representatives of the Generating Boards and the manufacturers, who have also provided us with a good deal of written information. We were greatly assisted by Dr L Rotherham, formerly head of research for the electricity supply industry and Vice-Chancellor of the University of Bath. Advice was also received from a number of other expert sources.

1.9 On the exports side of our remit, the four main British firms of consultants in this area, Kennedy and Donkin, Merz and McLellan, Preece Cardew and Ryder, and Ewbank and Partners, have acted in concert to provide us with a review of recent activity in the export market for machines of the class under consideration and to provide some indications of the likely future markets.

1.10 Although it is known publicly that that the CPRS has been examining the problem, we would recommend against publication of this report.

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2. TECHNICAL BACKGROUND

2.1 A turbine is a device for converting energy in a gas or fluid into mechanical rotational energy. In steam turbines the heat energy contained in the steam is converted to mechanical energy by allowing the the steam to expand through a series of turbine wheels attached to a central rotor.

2.2 In large steam turbines, it is not feasible that the steam should undergo its complete expansion within one cylinder. Normally the bigger turbines consist of a high pressure (HP) cylinder, an intermediate pressure (IP) cylinder, and, because the volume of steam is by then so large, two, three or possibly more low pressure (LP) cylinders all on one rotor shaft. For the size of generating set being considered for the two AGR stations (660MW) an HP, IP and either two or three LP cylinders represent the normal configuration. Because the LP cylinders are fed from the centre, with steam expanding outward towards the two ends, machines with two LP cylinders are said to have 4 flow exhaust systems, and those with three LP cylinders a 6 flow exhaust system.

2.3 Essentially the amount of energy which may be extracted from a given steam input will depend upon the extent to which the steam is allowed to expand within the turbine. Although internal mechanical design will have an effect, broadly speaking, the larger the exhaust area of the turbine the greater should be its efficiency in converting steam heat energy into mechanical, and hence electrical, energy.

6 flow systems (and LP cylinders) have more exhaust area (room for

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expansion) than 4 flow and hence have, in principle, higher efficiency.

2.4 But there is an important complication. The steam leaving the last row of turbine blades passes to a condenser, where it is converted back to water. The vacuum existing in the condenser has a significant influence on efficiency. The greater the vacuum the more heat energy is converted into mechanical energy, but another effect acts in the opposite direction: the better the vacuum the greater the velocity with which the steam leaves the last stage blades (the so-called "leaving loss"). In general the power available for electricity generation increases as the condenser vacuum is increased, until the velocity of the steam leaving the last row of turbine blades approaches the local speed of sound, at which point no further conversion of heat energy into mechanical energy occurs although the leaving loss continues to increase. Maximum power therefore occurs just below the local speed of sound. The larger the exhaust area the higher the vacuum pressure needed for this condition to be reached.

2.5 If a 6 flow machine is to maintain an appreciable efficiency margin over the 4 flow alternative, a good vacuum in the condenser is therefore essential. The vacuum obtainable is dependent upon the temperature of the cooling water available to operate the condenser. Vacua needed by 6 flow machines can be obtained when plenty of cool water is available from rivers and seas in high latitudes. Where power stations are sited inland and away from rivers so that air cooled condenser towers must be used for cooling the condenser water, or where stations

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are in tropical or sub-tropical climatic zones, it is rare that the right vacuum can be provided economically within the condenser to make 6 flow machines a sensible proposition.

2.6 At present then, for 660 MW operating where plenty of cool water is available, a 6 flow machine should give a higher overall efficiency than a 4 flow. ^{in future} But this may not always be so. There is considerable extra capital cost associated with the third LP cylinder, with its water condenser and associated equipment, and with the extra space required to house them. Turbine manufacturers would like to get the exhaust flow area at present obtainable in 660 MW sets only from 3 LP cylinders from a 2 LP system by having larger LP stages with larger turbine blades - though the mechanical and metallurgical problems are severe.

2.7 Brown-Boveri (Switzerland), KWU (Germany), Mitsubishi and Hitachi (Japan) are all working towards 40" blade turbines. In the United Kingdom both GEC and Parsons have development work underway but for some time to come their commercial sets will be based on the Parsons 36" and GEC 37.2". The Parsons 36" blade LP stage is more of a gradual evolution from past practice - derivatives of those installed in Drax A in 1966 - they are flexible in being adaptable to 6 flow or 4 flow machines at the customer's choice. GEC's 37.2" blade LP stages are stronger, more highly rated and more recent in design than Parsons. They are also more of a break with the past. Prior to the 1969 merger

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of AEI and English Electric into GEC the two companies had independent turbine designs. After 1969 GEC appointed a new designer and developed a new range of machines based on standard LP modules where one module would be used in 300 MW sets, two in 600 MW sets, and three in 900MW. Stations incorporating the new design and technology are under construction for the CEGB, the SSEB, in Northern Ireland, and in South Africa, but there is, as yet, no operating experience with them. It will be seen, however, that GEC approached the 600 MW set with a two LP stages (4 flow) system in mind.

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3. ASSESSMENT OF ALTERNATIVE DESIGNS

3.1 If adequate cold water is available, there is no doubt that ^{with present turbine blade lengths,} a 6 flow machine will offer a greater overall efficiency than a 4 flow design. But this extra efficiency is obtained at the price of an additional capital cost. The problem is one of computing a worth for the extra efficiency to compare with the extra capital required.

3.2 The evaluation of the efficiency margin is carried out in two stages:

(i) An Economic Assessment

The calculation of the worth in present day terms of a unit of extra station efficiency.

(ii) A Technical Assessment

The calculation of the actual efficiency margin to be expected in operation between tendered designs.

3.3 Normally the economic assessment is carried out by the customer before he seeks tenders. The result of his assessment, expressed in £ per marginal kilowatt (£/kw) is given in the tender specifications (it is called "the economic parameter"). The higher the £/kw economic parameter the higher the premium put upon the greater efficiency of 6 flow as compared to 4 flow. When the Boards asked GEC and Parsons to tender for the new AGRs the "economic parameter" they set down was so very much higher than anything seen before (e. g. as compared with the parameter for the Littlebrook oil fired station in 1972/73) that GEC were understandably worried. In what follows we shall describe why the generating boards' £/kw figure is so much higher than GEC's own expectations and calculations.

Calculation of the £/kw

3.4 The £/kw calculation depends on a series of assumptions:

(i) the manner in which the new station is expected to be used - base load, peak lopping or some combination of the two;

(ii) the expected price of power station fuel over the life of the station;

(iii) the rate of interest used to discount future costs to present day values;

(iv) whether the fuel saved by extra-efficiency will be internal to the station (i. e. station output constant but lower steam raising requirements) or whether the fuel saved will be external to the station (i. e. the extra efficiency will mean a larger output from the new station and a lower output from another station - ideally from the least efficient station in the system).

3.5 The difference of approach between the Boards and GEC on these four sets of assumptions are as follows:

(i) The use of the new stations

3.5 AGR nuclear stations have very low running costs (i. e. use little fuel) but are expensive to build (£6/700m.). They should therefore be used as intensively as possible, i. e. on base load. Both the Boards and GEC assume that this will be the case with the two new AGRs.

(ii) The expected price of fuel over the life of the station

3.6 GEC have assumed only small real increases in fuel price over the life of the stations. The Boards, in common with most international and UK opinion, have assumed considerable real increases. The Boards' assumption of increases in the real price of coal (4 per cent per annum up to 1985 and $1\frac{1}{2}$ per cent thereafter) are more pessimistic, especially in the early years, than those of the Department of Energy. On the other hand their assumptions on increases in the real price of oil (a rise of 80 per cent by 2000) are more optimistic than the Whitehall view which is at least expecting a doubling over the next 20 years.

3.7 The exact price profile does have some impact on the out-turn but is not of great significance. The important difference is that GEC are still working on a pre-1973 type assumption on the future of oil prices. On this we think that GEC is wrong and the Boards are more nearly right. This difference plays an important part in explaining why the Boards £/kw figure is so much higher than pre-1973 and was such a surprise and shock to GEC.

(iii) The rate of interest used to discount future costs to present day values

3.8 The higher the rate of discount the lower the £/kw parameter. The Boards have used a rate of discount of 10 per cent. GEC advocate the use of a higher rate, in part because of the practice of overseas customer utilities. In the United States, for instance, it would be customary for the utilities to use a commercial rate of interest plus a factor to cover expected tax payments.

3.9 The Boards could well reply that in using 10 per cent they are going much higher than the 5 per cent set down in the White Paper on Nationalised Industries (Cmnd 7131). They are using 10 per cent rather than 5 per cent because of the inherent uncertainties in the efficiency of the AGRs and the uncertainties on the future price of fuels. Using 10 per cent rather than 5 per cent is not an ideal way of allowing for uncertainty but it does represent a considerable move towards the rates advocated by GEC.

- (iv) Whether the fuel saved by the extra efficiency will be internal to the station (i. e. constant station output but less steam needed) or external to the station (i. e. increased station output and savings made absorbed in the system, down the merit order)

3.10 This assumption and the assumption on future fuel prices are the critical ones in determining the economic parameter (£/kw). The traditional approach (and one which GEC would use) is assumption (i) - that the saving is made inside the station. The savings there are quite small for the value of uranium fuel saved in raising less steam in the AGR is not large. So the extra efficiency of 6 flow does not save much. On assumption (ii) the savings are made in fossil fueled stations (over the life of the AGRs there will still be some fossil stations on base load) and the savings in coal and oil are worth much more than savings in uranium fuel. This puts a much higher premium on the extra efficiency of the 6 flow. Indeed, the £/kw figure under assumption (ii) is three times that under assumption (i) (£1,200 as against £420).

3.11 In the circumstances of the new AGRs, the CPRS believes that the Boards are right to work on assumption (ii). They are also right to work

on the assumption of rising fuel costs and the assumption of a 10 per cent rate discount seems reasonable. All in all, we would not support the GEC claim that the Boards' £/kw economic parameter for the two new AGRs of something around £1,000/kw is outrageously high.

3.121 But this judgement is relevant to the conditions of the two new AGRs where it is possible to convert extra output from the turbines into extra electricity input into the grid and hence allow lower inputs from other stations to the grid. It would not necessarily hold for all future stations.

3.13 The steam raising capabilities of the present design AGR nuclear island has such limitations that the likely output from either 6 flow or 4 flow turbines will not be more than the generators can convert into electricity. In future stations greater availability of steam and greater output from the turbines could exceed the limit which the present design of generators could carry (680/690MW). In that case the extra efficiency of the 6 flow could not be fed into the grid to save fuel in other stations. The savings would be internal to the new stations and assumption (i) would then be appropriate, the £/kw correspondingly much lower, and the choice between 6 flow and 4 flow affected.

3.14 The importance of the 'economic parameter' £/kw can be shown by the following. It is generally agreed that the efficiency advantage of a 6 flow over a 4 flow is somewhere in the region of $1\frac{1}{2}$ - $2\frac{1}{2}$ per cent. On a 660MW set that means an advantage of between, say, 10MW to 20MW which has to be valued by the £/kw and set against the extra capital cost of the

larger 6 flow (extra LP turbine, extra condenser and associated equipment, extra spares, larger building to erect and maintain). This extra capital cost is between £6-£9m. per set. The effect of taking a £/kw of £1,200 (using the Boards' assumption (ii) that the savings will be made elsewhere in the grid) rather than £/kw of £420 (savings internal to the station) is -

<u>6 flow Efficiency Margin</u>	<u>Savings on 660MW</u>	<u>Economic Parameter</u>		
		<u>£/kw</u> 420	<u>£/kw</u> 1,200	
1½%	9.9 MW	£4.2m.	£11.9m.) Value of 6 flow fuel savings to be compared to 6 flow extra capital costs (£6/9m.)
2%	13.2 MW	£5.5m.	£15.8m.	
2½%	16.5 MW	£6.9m.	£19.8m.	

It will be seen that on £/kw figures of £420, the 6 flow has a hard time to show a profit over its extra capital costs while it can always do so on £1,200. It must, however, be stressed that the 'profit' is small in relation to other uncertainties. At best £10m. per set (£20m. per station) compared with a station cost of £600-£700m. The benefits accrue only over the 25 to 30 years of life of the station and the uncertainties of fuel prices, operating efficiency, unexpected 'outages' are considerable.

The Technical Assessment

3.15 As was said above, the economic assessment (the calculation of the £/kw economic parameter) is undertaken before the tenders are asked for and the resulting £/kw figure is included in the tender conditions. After

the tenders are submitted the Boards necessarily spend months checking the technical calculations and efficiency predictions given in the tenders and assessing the extent to which the suppliers' estimates of performance can be relied upon.

3.16 This work is undertaken largely at the CEGB centre at Barnwood - regarded as one of the most expert of technical assessment groups on turbine technology in the world. The assessment, in the end, has to rely on technical judgements based on past experience rather than on rigid theoretical analysis of the manufacturers' test programmes and computer data.

3.17 The tender specifications for turbines for the two new AGRs included the requirement that the LP rotors should be standard with those that the manufacturers concerned had recently supplied for UK power stations. In the case of Parsons that meant commonality with Hunterston, a 6 flow station. On this basis the 6 flow design that they submitted had, they claimed, a $2\frac{1}{2}$ per cent efficiency advantage over their 4 flow, and the Boards broadly agree with this. Parsons have argued, however, that to use Hunterston rotors in a 4 flow configuration produces a drop in efficiency greater than any savings which the Boards would achieve on spare parts from having commonality with Hunterston. Parsons have therefore also offered the Boards an alternative (more efficient) 4 flow with non-Hunterston rotors which would reduce the $2\frac{1}{2}$ per cent efficiency advantage of a Parsons 6 flow over a Parsons 4 flow.

3.18 GEC claim that their (GEC) 6 flow design has only a 1 per cent efficiency advantage over a GEC 4 flow design. Neither generating board believes that the difference could be as small as this but that apart there is disagreement on how GEC should modify their basic 4 flow turbine for 6 flow working.

3.19 In adding the third LP cylinder to go from 4 flow to 6 flow, the CEGB would like GEC to leave the LP cylinder design unaltered and make the necessary modifications in the earlier (HP and IP) stages of the turbine. CEGB believes that the efficiency advantage of a GEC 6 flow over a GEC 4 flow could^{then} be raised to over 2 per cent. But this would be a 'one-off' modification which GEC would be most reluctant to undertake - arguing that it would be relevant to no other market and doubting whether the efficiency improvement would be as high as CEGB believes. The SSEB shares GEC's doubts about the wisdom of the CEGB proposal.

3.20 These complex arguments about the predicted efficient advantage of a Parsons 6 flow over a Parsons 4 flow and of a GEC 6 flow over a GEC 4 flow say nothing about the absolute comparisons between the two ranges of product. As was said at the outset of this report, the CPRS has not been given the tender submissions and can only speculate on the possible outcome. Parsons have stressed to us that their (mainly 6 flow) machines have regularly headed the Boards' efficiency lists. On the other hand, GEC 4 flow machines are likely to be sufficiently better than Parsons 4 flow.

3.21 So the likely contenders are a GEC 4 flow against a Parsons 6 flow (though it is possible that the GEC 6 flow may not be far behind the Parsons

6 flow). The SSEB has suggested that 1.6 per cent might be the margin between the Parsons 6 flow and GEC 4 flow and that, on the face of it, it seems a reasonable guide to the likely order of difference.

3.22 As we have said above, a $1\frac{1}{2}$ per cent efficiency advantage on a 660MW set valued at a £/kw of £1,200 gives a figure of £11.9m. to be compared with an extra capital cost of £6m. to £9m. per set. On the two sets per station there would be a theoretical advantage of around £5m. to £10m. to be set against total cost of constructing each station of £600-£700m.

3.23 These calculated advantages would not be insignificant but they do not bulk large in comparison with the many uncertainties affecting the turbine choice. Fuel price movements over the 25 to 30 year life of the station are increasing uncertain as is the performance of the new AGRs.

4. EXPORTS

4.1 Turbine generators are used in a number of industrial applications and are made in a wide range of sizes from 10MW to 1200MW. Large steam turbines for public power generation form only a part, although an important part, of the overall market. There are currently 18 companies of world class capable of manufacturing the range of machines used in power stations, including formidable competitors in America, Switzerland, Germany and Japan. At present, however, both British manufacturers are well capable of holding their own in technical design.

4.2 In choosing a supplier, an overseas utility will have primarily in mind, first the tendered price followed by

- the quality of the manufacturer's engineering, manufacturing capability quality control and site organisation
- the reliability of the machine, and the likely cost of repairs and maintenance
- the manufacturer's reputation on delivery dates
- the credit terms on offer.

Manufacturers, and the consultants, both say that quality and reliability will be judged very much against performance of reference plant installed elsewhere, which already has a good period of operation behind it. The creditibility of delivery dates will also be enhanced if the manufacturer can point to experience of timely installation of similar machines. In most countries a turbine manufacturer looks to his 'home' utility to accept the development risks on new machines and to give support through procurement which provides 'reference plant' giving background operating and technical data for potential customers.

4.3 The characteristics of the steam produced in an AGR station is very similar to a conventional fossil fired station so turbine experience from one can be read across to the other. PWR reactors, the nuclear system predominantly in use overseas, provide steam at much lower temperatures and pressures; consequently the turbine design is very different. Turbines in UK conventional or AGR stations do not therefore provide a reference point for PWR stations abroad.

4.4 Lack of PWRs in the UK make it difficult to achieve export orders for turbines for installation in PWR nuclear stations abroad: nevertheless both British companies have achieved a few such export orders: Parsons in Korea and Canada (although these were achieved through a link with a local company which has now been broken) and GEC in Korea. The Heysham and Torness AGR stations are relevant for fossil-fuelled stations in the output range from about 500MW to 750MW. Above and below that range, there is no real disagreement about the appropriate number of exhaust flows.

4.5 A complication is that electricity supply is not consistent; some parts of the world - essentially North and South America and some Asian countries - are based on a 60 cycles per second (60c/s) system, the rest using 50 cycles per second (50c/s). At 60c/s turbine blade lengths and rotor diameters are smaller for a given turbine rating because the machines must rotate faster (3,600rpm instead of 3,000rpm). The debate on 4 or 6 flow exhaust systems therefore applies at lower output in 60c/s countries.

4.6 The consultants were therefore asked to survey the 50c/s market, and to include 60c/s countries, such as Canada, Korea, and South America where export opportunities existed. Excluded were those countries in which the domestic turbine generator industry is effectively a monopoly supplier, for instance Germany, France and Italy.

4.7. The picture which emerged of this section of the market over the last 5 years is shown in Table I.

Ordering of TABLE I
500 - 750MW Fossil-Fired Sets 1973-1978

	<u>USA</u>		<u>Commonwealth and ex-Commonwealth Countries</u>		<u>Other Countries Potentially Open to UK Exports</u>		<u>TOTAL</u>
	<u>60c/s</u>	<u>60c/s</u>	<u>50c/s</u>	<u>60c/s</u>	<u>50c/s</u>		
Total Orders	75	0	21	3	7	106	
<u>of which:</u>							
GEC	0	0	6	0	0	6	
NEI(Parsons)	0	0	1	0	0	1	

In the past 5 years British manufacturers made no sales in the biggest market (North America) and have only a precarious foothold elsewhere. The position is perhaps even worse than it looks, since all 6 sales by GEC were for one station in South Africa in 1975 and 1976. The single Parsons sale was to Australia in 1976. The recent pattern of exports for the UK industry shows the companies attempting to cling, against strong European and Japanese competition, to the old Commonwealth market which they once dominated, and showing little success in breaking into new developing markets. This failure to develop new outlets will be particularly important in coming years, as the more developed countries move towards stations of a larger rating, and the 'medium' sized power station market is centred more on developing countries. The expected faster growth of the developing country market is shown in Table II (based on our consultants' survey).

TABLE II

<u>500-750MW Fossil Fired</u>	<u>1973-1990</u>	
	<u>Traditional British¹ Market</u>	<u>Developing Countries*</u>
	(UK share in brackets)	(UK share in brackets)
<u>Non-Nuclear Orders</u>		
1973/78	21(7)	10(0)
1980/1990	47	96

¹ Australia, Canada, Eire, Hong Kong, India, Malaysia, New Zealand, Pakistan, Singapore, South Africa. (10 countries)

* Argentina, Brazil, Chile, China, Denmark, Egypt, Finland, Greece, Holland, Indonesia, Iran, Korea, Phillipines, Poland, Portugal, Spain, Sweden, Taiwan, Thailand, Turkey, Uruguay, Venezuela. (22 countries).

4.8 The survey indicated that orders were overwhelming for 4 flow machines, and indeed all of the British exports were of the 4 flow type. And the overseas preference for 4 flow machines in fossil stations is almost certain to continue, because

- what cooling water is available is usually warm and often in short supply

- there is ^{often} relatively cheap ^{local} fuel, with smaller weight being given to future rises in price

- the plant may not be required for base load operation, or the grid system

may be such that the station, although on base load is not normally run at maximum output

- difficulties in raising capital means that the developing countries are worried by high initial capital cost and require a relatively high rate of return.

4.9 The consultants were able to represent in a series of graphical diagrams how the choice of 4 or 6 flow turbines depended on variations in various technical parameters. We have attempted to combine these simplistically in Figure I which, although crude, gives we think a fair indication of the world market picture. The diagram shows two boundaries, related to fuel cost and local cooling water temperatures, which define areas where the decision on turbine type is clear. Conditions within the area between the boundaries the choice is more even, and a detailed study to assess overall benefits is required. Figure II shows how British conditions relate to the boundaries.

4.10 The CEBG has pointed out to us a number of exceptions to the usual preference for 4 flow fossil fired stations. Two in Holland and one in Germany, have been ordered with 6 flow exhaust, in location where cooling water temperatures are probably similar to those around our own coasts. There are contradictory reports about the intentions of the French utility (EdF), but it is unlikely that we shall know EdF's preference before ^{for our new AGRs} firm orders have been placed. Canadian utilities have opted for 4 flow machines in the past, although local cooling water conditions should perhaps favour a 6 flow solution; however it is possible that calculations there were based on assumed supplies of cheap American coal. Similarly Japan has adopted 4 flow machines, but making this domestic choice they may also have had their export markets in ^{mind.}

It is not unreasonable that with relatively high fuel prices and temperate weather conditions, the outcome of assessments by utilities in Northern latitudes will be different from those elsewhere. Nevertheless in current conditions assessments for new stations in ^{Northern latitudes} are unlikely to show a margin heavily in favour of either 4 or 6 flow systems and the choice would be largely determined by elements of judgement.

4.11 In the market to which British manufacturers are likely to have access however there is little doubt that the great majority of their customers will require 4 flow designs in future.)

Because the conditions in Northern Europe and particularly in Scotland, are clearly so different from those that are likely to obtain in these markets

DIAGRAM I

4 AND 6 FLOW TURBINES OF 500MW - 750MW RATING - DEPENDENCE OF CHOICE ON TECHNICAL PARAMETERS

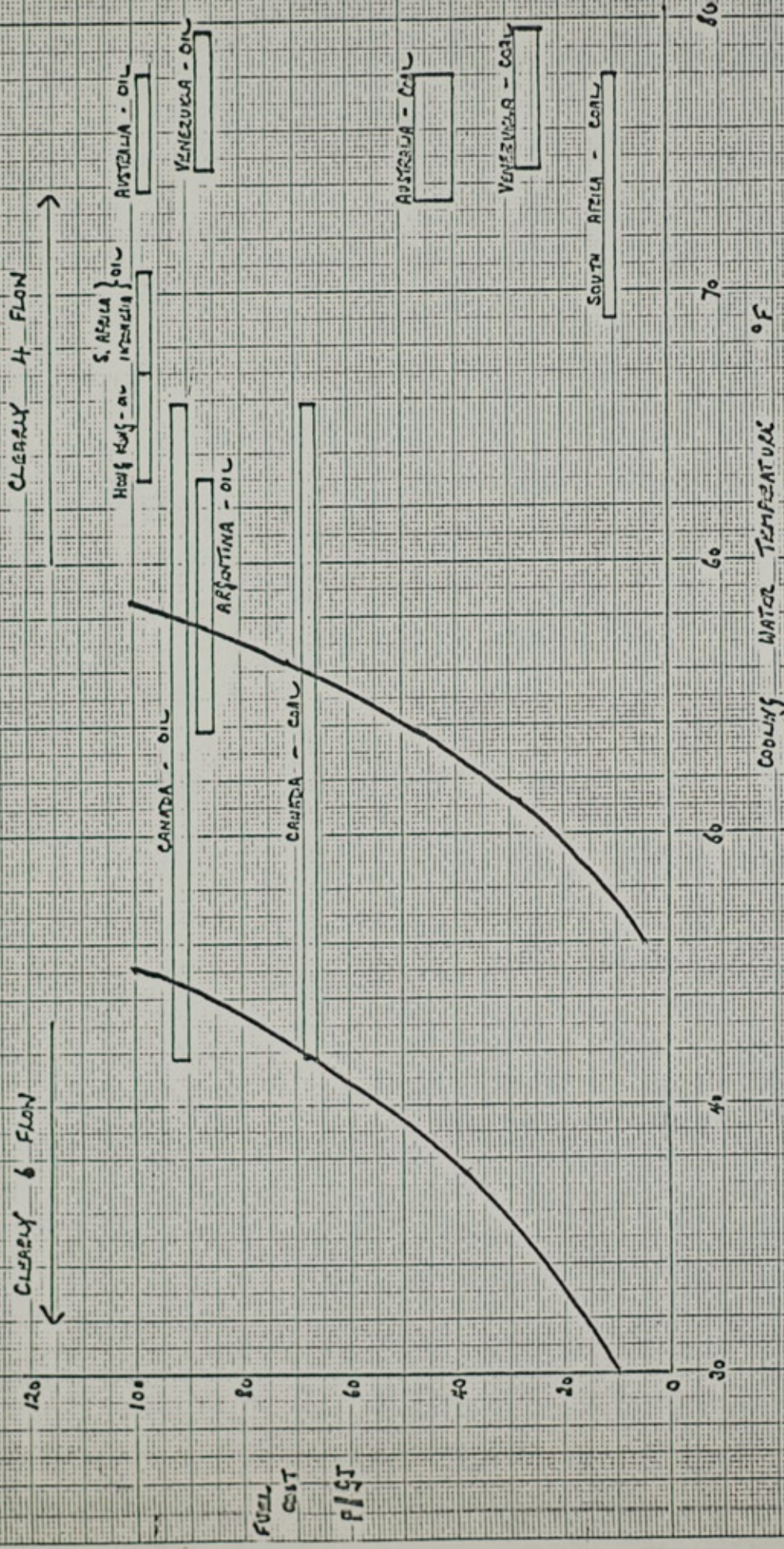


DIAGRAM II

CHANGE IN BRITISH CONDITIONS
-
CUBIC BETWEEN 4 AND 6 FLOW TURBINES

120

100

80

60

40

20

0

30

40

50

60

70

80

← CLEARLY 6 FLOW

CLEARLY 4 FLOW →

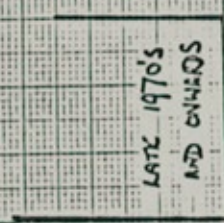
LATE 1970'S
AND ONWARDS

EARLY 1970'S

FLOW
COST

P/£

COOLING WATER TEMPERATURE OF



at which British manufacturers will be aiming, we do not think that the choice by the British Boards for their new stations will have any significant impact on other utilities in their own considerations. Indeed we would think it unwise to assume that the CEGB would be regarded in any way as a world trend-setter in this respect. This is also the view of the consultants.

4.12 For similar reasons neither we nor the consultants believe that a choice now of a 6 flow system would be regarded by overseas purchaser as a vote of no confidence in technology of the 4 flow machines which GEC is now building for the CEGB and SSEB.

4.13 However, we do believe, along with the consultants, that should the announcement of the choice of turbine for the AGR stations be for a 6 flow and be coupled with a statement that it would represent a standard for future stations, then for obvious commercial reasons this could be expected to have a marked effect on overseas confidence in Britain's ability to produce 4 flow machines competitively long term. This would put in doubt the future of the company not chosen.

4.14 The earlier stance of the CEGB, when attempting to obtain a joint Parsons/GEC tender, was that these new stations would indeed set the pattern for the future. We see no justification for this; From a CEGB point of view there are some obvious advantages in standardisation (how important these are is a matter for debate). But that does not mean that they have to announce a determination to standardise.

We believe that, in view of the commercial implications no public announcement of this kind should be made until the issue has been more fully studied.

5. REVIEW

5.1 GEC's turbine design philosophy is built uncompromisingly around the assessment, fully supported by our consultants, that the world market for fossil fuel stations in the 500 to 750MW range will be overwhelmingly for 4 flow machines. This led GEC to design a standard L.P. module suitable as a four-flow combination in the 500 to 750MW range, and in different combinations across a much wider range (from about 250 to 700MW). Such standardisation brought with it considerable manufacturing advantage.

5.2 In ordering 4 flow turbines for the oil-fired stations at Littlebrook and Peterhead early in the 1970s the Boards appeared to give GEC's design philosophy a clear vote of confidence. Nobody at that time foresaw the massive rise in energy costs which was shortly to occur or the substantial further increases which are now thought likely in future years. This change has played an important part in altering the economic balance between power station capital and operating costs in a way which, in UK circumstances, brings the more traditional 6 flow design back into contention.

5.3 But because of their different operating environments overseas, customers considering buying from UK manufacturers are still likely to be only interested in 4 flow designs. At home the particular circumstances at Heysham and Torness - plentiful availability of cooling water, limited availability of steam from the nuclear reactor, and the requirement for reliable baseload capacity - suggest that the 6 flow design may have a marginal advantage.

5.4 For future AGR stations beyond Heysham and Torness and for non-baseload fossil stations the balance of advantage even in the UK could revert to being in favour of 4 flow machines again.

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5.5 It is obviously convenient to the Generating Boards if they can vary their stance to reflect the balance of advantage at any given time. If the industry was thriving and underpinned by a healthy export load, then the disadvantages of such a policy might not be too severe;

5.6 But the industry is in a parlous state. It needs the support of the home utility, both in providing a working base in which to test and demonstrate new developments, and to provide an environment conducive to production continuity and steady design evolution.

5.7 There is little sign that the Generating Boards give adequate weight to the industrial implications of their procurement policies or accept responsibility for the health of the industry. Their concern is, largely, with their own economic interests.

5.8 The problem has been made worse by the hostility between the two main manufacturers, NEI (Parsons) and GEC. Both companies are in unremitting competition both at home and abroad, and have shown no desire or willingness to co-operate. In these circumstances, it is perhaps not surprising if the Generating Boards have been willing to stand at one remove so that the two companies could clearly be seen as independent tenderers.

5.9 At the outset of the tendering process the CEGB maintained - wrongly we believe - that the 6 flow system would be appropriate for all future base load stations. A decision by the CEGB to settle permanently for the 6 flow system would totally undermine GEC's position, and GEC was rightly alarmed. On the other

other hand, their objections to the CEEB's approach to the particular orders for Heysham and Torness are less justified.

5.10 Against this background, the current dispute can be seen as no more than a further episode in the struggle between the two companies for the limited work available. GEC have chosen the technical battleground as one giving them the strongest cards.

5.11 It is likely that the company which fails to win the order - or a part of it - will be unable to continue manufacturing large scale turbine generators independently for very much longer. Other things being equal, GEC is probably the better placed to survive, with its more advanced design appropriate for the export market. But if, following Drax B, both the new AGRs should be given to NEI (Parsons) the wisdom of supporting the weaker company would be called into question.

5.12 It is too late to attempt further to use these orders as a vehicle for restructuring the industry; the construction timetable for these two critically important stations cannot be jeopardised in this way.

5.13 There remains the possibility of splitting the order between the manufacturers. Although it has been the Board's intention that the two stations should be as near as possible identical. The adoption ^{of} identical turbine generators is not of fundamental importance; (much more important is the standardisation of the nuclear reactor). Building different turbine generators at each station would clearly add to design costs, by a few million pounds, and it would do nothing towards the aim of rationalising the industry, but it may be preferable to running the risk of the exit from the industry of the potentially strongest supplier.

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To: PRIME MINISTER
From: SIR KENNETH BERRILL

The Choice between 4 and 6 Flow Turbine Generator designs
for the new AGR Power Stations at Heysham and Torness

1. You will hardly need reminding of the problems of the power plant manufacturing industry. The collapse of the domestic power station ordering programme and the severe contraction of export prospects following the oil shock of 1973 put the manufacturing industry under serious threat. An over-sized and divided industry faced major problems in competing technically against American, European and Japanese manufacturers. This was the background against which the CPRS report was written in 1976.
2. In order to provide work for the manufacturers the building of Drax B power station was brought forward; the turbine generator work for Drax B was given to Parsons. But it proved impossible to implement the Government's declared policy of rationalising the industry and creating a single turbine generator manufacturer (and a single boilermaker).
3. The two new AGR stations at Heysham and Torness represent the next tranche of home orders. Although the generating boards (CEGB and SSEB) asked GEC and Parsons to submit a joint tender for the turbine generator work, the two manufacturers could not agree and the order was put out to competitive tender. Both companies are desperately keen to win the order (worth some £150m.). It was not surprising therefore that GEC should voice dismay when it appeared the generating boards might be favouring Parsons' designs rather than their's.
4. When last November Sir Arnold Weinstock came to see you to explain his unhappiness he criticised the generating boards for apparently wishing to standardise on turbine designs with 6 exhaust flows. Although GEC can

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manufacture and have submitted a tender for a 6 flow design their basic, and preferred, system has only 4 exhaust flows at this level of power output (660 MW). According to Sir Arnold no overseas utility was likely to consider 6 flow turbines for this size of set and the boards, by their actions, were about to damage the export prospects of the turbine manufacturing industry and GEC in particular.

5. Following the meeting with Sir Arnold you asked the CPRS to look into the methodology used by the UK generating boards to assess competing turbine designs and into the export prospects for 4 and 6 flow machines.

6. The purpose of this note is -

to appraise you briefly of our preliminary findings;

and to suggest that Ministers will wish to decide whether or not to become involved in the placement of the AGR orders before the boards' preferences become public knowledge.

7. A fuller account of our work is in preparation. In the meantime the generating boards have been making their detailed assessment of the tenders received from the manufacturers. Their assessment is likely to be complete in April.

Preliminary Findings

8. Assessment of tenders for these huge turbines is a complex and technically difficult operation. It would not have been feasible or sensible of us to try to second guess the boards and make our own detailed analysis of the tenders as submitted by the manufacturers. In any case neither the boards nor NEI (Parsons) were prepared to divulge details of the tenders. We have, however, been able to make a more general examination of the characteristics of 4 and 6 flow machines and of the arguments put forward by the parties involved.

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9. 4 flow machines have a lower overall efficiency than 6 flow machines in converting steam energy into electrical energy, but they are smaller and mechanically somewhat less complex. The argument is therefore one of the worth of the fuel savings compared to the extra capital cost of the larger more efficient machines.

10. The theory of turbine behaviour is a highly developed science. But it has become clear to us that in assessing rival machines a considerable degree of technical judgement is required, based on previous design and operating experience.

11. The CEGB's approach is logical and defensible, though they appear to have exercised their technical judgement fairly consistently in favour of the 6 flow solution. (Indeed, it was only after pressure from GEC that the CEGB agreed to consider 4 flow designs at all.)

12. The SSEB originally appeared to look on the 4 flow system more favourably than the CEGB but subsequently have shown themselves reluctant to break ranks with the CEGB.

13. We think the boards' assessment will show an overall advantage to the 6 flow system in the particular circumstances of the new AGRs at Heysham and Torness. One of the crucial factors is the availability of large volumes of relatively cold water for cooling at UK coastal sites. But the advantage of the 6 flow system is likely to be very small in real terms.

14. But there are other factors not directly acknowledged in the boards' assessment which will have a much more important influence on the performance of the stations than 6 flow -v- 4 flow. The performance of the AGR nuclear system is itself uncertain. And in the past large turbine generators have suffered operating problems (blade failures, and so on) which have led to long periods of breakdown. Such unreliability is unpredictable in advance, but the GEC 4 flow machines are new designs for

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which there is as yet no operating experience, so that intuitively the boards may be favouring the tried-and-tested Parsons' 6 flow machines - especially as there are so many other uncertainties associated with the AGR nuclear technology.

15. As to the export situation, a consortium of UK engineering consultants has confirmed to us GEC's contention that only 4 flow machines have realistic export prospects in this range of power output.

16. GEC's 4 flow turbine is more advanced than is Parsons' 4 flow model and might be expected to outmatch Parsons' version fairly consistently in overseas competition. But GEC cannot claim more than a precarious foothold in the export market and Parsons have not sold a machine of this size overseas for more than two years.

17. The consultants did not believe that the Heysham and Torness decisions would have any direct influence on an overseas customer in his choice of supplier, providing the UK decision were not expressed as a vote of no confidence in the losing tenderer. Further, since GEC should have examples of their 4 flow designs in operation, in the UK and in South Africa, long before the new Heysham and Torness stations are complete, they cannot claim they need this order, or part of it, as a demonstration to overseas customers of the GEC turbine technology.

18. The UK generating boards do not at present take much account of the export market, but Sir Arnold's accusation that the boards are being wildly unreasonable in their approach at Torness and Heysham cannot be sustained.

Conclusion

19. From our review of the technical background there is no substantial technical case for the Government to get involved in the ordering process, nor are there overwhelming export arguments in favour of intervention.

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20. The Government accepted the conclusions of the CPRS report that in the long run there is no place for two independent turbine generator manufacturers in the UK and that a merger is desirable.

21. Of the two companies GEC is probably the better placed to survive. But if following the Drax B order to Parsons it should be the boards' preference to give both AGR orders to Parsons, the wisdom of supporting the weaker company will be called into question.

22. It will be immensely more difficult for Government to weigh these issues dispassionately if the boards' preferences are already public knowledge. So I attach a draft letter which you may care to send to the Secretary of State for Energy, in which it is suggested that he should formally ask the Electricity Council to communicate the results of the tender assessment to the Government before indicating its preferences to the manufacturers.

23. I am sending a copy of this minute to Sir John Hunt.

KR
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9 March 1979

Att

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DRAFT LETTER TO THE SECRETARY OF STATE FOR ENERGY

The Choice of Turbine Generator Design for the new AGR
Power Stations at Heysham and Torness

You will recall the representations Sir Arnold Weinstock made to me towards the end of last year about the choice of turbine generator for the two new AGR power stations, and my request to the CPRS for an assessment of the relative merits of 4 and 6 flow turbine designs and their export prospects.

The CPRS is still preparing its report but its preliminary advice is that the technical argument between GEC and the generating boards gives no substantial cause for the Government to become involved nor are there overwhelming export arguments which might make the Government wish to intervene.

However, as we agreed when we discussed the CPRS power plant report, there are not going to be enough home and overseas orders to support two UK companies long term. The Drax B order went to Parsons to keep them going, short term. The allocation of the two AGR orders will have similar important industrial and employment consequences.

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I am sure you will agree that before the preference of the generating boards becomes public knowledge, Ministers should have the opportunity to consider the implications. This might be achieved if the Chairman of the Electricity Council communicated the results of the tender assessment by the generating boards in the first instance to the Government rather than to the manufacturers. Officials from the interested Departments, together with the CPRS, could then prepare a paper on it for discussion in EY.

I am sending a copy of this letter to the Secretaries of State for Industry, Trade and Scotland, and to Sir John Hunt.

END

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February 2010