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The Rt Hon John Biffen MP
Chief Secretary
HM Treasury
Treasury Chambers
Parliament Street
LONDON SW1

7/8

7 August 1980

Dear Chief Secretary,

ECONOMIC CASE FOR TORNESS AGR

My officials undertook during our review of the AGR programme earlier this year to circulate a paper about the economic jusitification for proceeding with the construction of Torness.

I now attach a note which sets out briefly the relative costs of building new coal-fired and nuclear capacity in Scotland and the case for building Torness on SSEB's present timetable. This seeks to apply the same general methodology as was used by the Department of Energy in preparing its economic evaluation of Heysham.

I am copying this letter and the enclosure to the other members of E Committee, to Sir Robert Armstrong and to Mr Ibbs.

Yours sincerely,

Approved by the Secretary of State and signed in his absence

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ECONOMIC EVALUATION OF TORNESS
NOTE BY THE SCOTTISH OFFICE

1. The decision to invest in new nuclear generating capacity has to be made in the context of a wide range of considerations, not all of which are necessarily directly related to the economics of electricity generation. This paper deals solely with the economic case for investing in Torness in terms of the cost of electricity generation. The cost of any new power station relates either to the cost of adding to generating capacity, if the new station is needed to provide extra capacity, or, if extra capacity is not needed, to the savings resulting from substituting the output of new plant for that from existing plant. In the first instance, because the requirement for additional generating capacity is determined in the UK by a judgement that security of supply should be maintained over time at a specified minimum level, the investment decision involves selecting plant which adds to capacity at the least cost (capital and operating costs) and timing its introduction to the system so that, in the context of increasing demand, security of supply is maintained. In the second instance economic evaluation involves a continuing review of the cost savings likely to result from replacing some of the output of existing plant with that from new plant in order to ascertain whether, over time, any fuel and other operating savings (ie, through the use of a cheaper fuel or improved efficiency) will be large enough to compensate for the additional capital expenditure involved.

2. The paper deals firstly with the economic case for having a nuclear power station as the next major addition to the Scottish system as compared to the obvious alternative of a new coal-fired plant. It then deals with the economic case for commissioning the Torness AGR in 1986/87 according to SSEB's current timetable, as compared with delaying it until it is required to provide additional capacity, which, on SSEB's present forecasts, would not be until 1992/93.

COMPARATIVE COSTS OF NEW COAL AND NUCLEAR PLANT

3. Table 1 shows the net effective cost of adding nuclear (an AGR) and coal-fired plant to the Scottish generating system with commissioning in 1986/87. The net effective cost reflects the total cost to the system and comprises two main items. The first is the capital cost of the new station, in this case expressed as an annual sum over its life, assuming a real interest rate of 5%, in terms of £/kw/year. In the case of the nuclear station allowance must also be made for the cost of decommissioning at the end of the station's life and this is shown as a separate item on the same basis as capital cost. The second main item is the savings, mainly fuel cost, made on the

generating system as a result of running a new lower cost plant which reduces or even eliminates generation by older equipment with higher fuel cost. This is referred to as system savings, again expressed as an annual sum over the life of the plant. Other operating costs have also to be included and these are shown separately in Table 1. The capital costs less systems savings give the net effective cost of the new station. The station with the lowest net effective cost is the best investment for expanding capacity. If the system savings are greater than the capital cost the net effective cost is negative and the implication would be that there would be a net benefit in investing to replace the output of existing plant with output from the new station.

TABLE 1: NET EFFECTIVE COST OF NUCLEAR AND COAL

	Nuclear	£/kw/year	Coal
Capital charges	81		40
Decommissioning	2		-
Other operating costs	11		10
System savings	-115		-30
Net effective cost	- 21		+20

4. These estimates, made by SSEB, show that the nuclear plant has a considerable running cost advantage over a coal-fired plant and this more than offsets its higher capital costs. In addition the net effective cost of nuclear plant is negative which implies that there would be benefit in building it so that it could substitute for the output of existing plant. These conclusions do, however, rest on a number of assumptions concerning construction costs, plant performance and fuel prices which are listed in the Annex to this paper. It is therefore possible that these assumptions will turn out to be wrong in time, in ways which raise or lower the advantage of nuclear over coal-fired plant. An indication of the extent of the changes which would have to be made to a particular assumption in order for the advantage of nuclear stations over coal-fired stations to be eliminated is given in Table 2.

TABLE 2: SENSITIVITY OF NUCLEAR OVER COAL FIRED PLANT

	Change Required to Eliminate Cost Advantages of Nuclear over a new coal fired plant
Increased cost of construction of nuclear plant	51%
Timing of commissioning of nuclear plant	7 year delay
Output of nuclear plant	36% reduction over life
Coal/oil prices	Around 50% lower than projected over the lives of the stations

5. None of these examples allows for any adverse changes which might affect the coal fired plant, such as commissioning delays, and higher than expected coal prices. Because in each case, a very large change would have to occur in the basic assumption made, it can be concluded that the case in terms of generating costs for a nuclear station, that is for Torness, as the next electricity generating plant to be built in Scotland is robust. This does not preclude the possibility that a combination of adver circumstances might have to be faced, for example, construction delays and higher than anticipated construction costs, but there is some scope for this kind of outcome in the wide range of variation possible for individual assumptions.

CASE FOR COMMISSIONING TORNESS IN 1986/87 INSTEAD OF 1992/93

6. The Scottish Electricity Boards, in common with the CEGB, aim to maintain a target planning margin, measured as the amount of installed plant capacity above projected maximum demand required in order to provide security of supply over time. This plannin margin is now 28%, and makes allowance for short term difficulties which might be caused by exceptionally cold weather and the non-availability of plant at times of maximum demand. Until recently the Scottish Boards' demand projections implied that, following the commissioning of the oil/gas fired station at Peterhead, which will now take place over the next two years, this 28% planning margin would be reached by the end of the 1980's, implying the need for a new station to be fully available by that time. As a result of revisions to their demand forecasts the Boards now consider that the need for a new station for capacity reasons could be put back for 6 years. The economic case for building Torness now depends therefore on whether, in the circumstances of lower forecast demand, the increased capital cost of introducing it earlier than is required for capacity reasons is offset by systems savings, and, given the uncertainties in cost and performance projections already referred to, on the scale of any offset. Table 3 shows the capital cost of bringing Torness forward from 1992/93 to 1986/87, taking account of the need for replacing it 6 years earlier at the end of its life, and the systems savings attributable to earlier rather than later commissioning. As in the case of Table 1 these sums have been annuitised at a real interest rate of 5%, but in this case over 6 years and in terms of total costs rather than cost per unit of output.

TABLE 3: COST OF ADVANCING TORNESS FROM 1992/93 TO 1986/87

	Net Cost £m/Year)
Net additional capital charges	98.9
Decommissioning allowance	2.4
Other operating costs	14
System savings	-134
	- 18.7

7. The result of this analysis suggests that the systems savings would exceed the additional capital costs, the cumulative value over the period 1986 to 1992 of the net savings being £112.2 million which is equivalent to a present value in 1980, at a 5% discount rate, of £74.4 million. The decision to undertake earlier commissioning is not without risks nor, on the other hand, can it be solely related to generating economics but should also take into account other considerations such as the desirability of widening fuel mix, given the uncertainties about the availability and cost of fossil fuels in the future, and maintaining a capacity to build nuclear generating stations. On the one hand technology might improve in the intervening period as a result, for example, of further experience with existing AGRs leading to further design improvements which could not be incorporated if construction begins now, or the adoption of alternative reactor systems which might have lower capital costs and the same or superior operating characteristics as the AGR. On the other, discontinuities in ordering would make it extremely difficult to establish settled production programmes for the nuclear industry, and might make it much more expensive to proceed with Torness or any nuclear alternative if there is further delay.

8. For the purposes of this paper it is assumed that no real increase in capital costs occurs over time. SSEB believes however on the basis of recent experience that it would be prudent to assume an annual real increase of 4% in the capital cost of construction. This and a more pessimistic view on fossil fuel prices leads the Board to quote a figure of £400 million as the benefit of advancing the station to 1986. This significantly improves the case for earlier commissioning. As far as other factors are concerned Table 4 looks at the magnitude of (a) improved performance due to additional experience with the AGR and (b) improved technology which would be necessary to eliminate the benefits of advancing Torness.

TABLE 4: SENSITIVITY OF BENEFITS OF ADVANCING TORNESS

	Decrease required to eliminate the benefits
(a) Decrease in availability during the first 6 years 1986-1992	-14%
(b) Reduced capital cost of the 1992 plant	-10%

9. The Scottish Office's conclusion is that there are direct economic benefits to be gained from commissioning Torness on the present timetable, aside from any consideration relating to the case for maintaining a UK capability for constructing AGRs and for widening the possibility of fuelling options available to the Scottish Boards. These benefits are substantial, although fairly modest in relation to the

total capital cost of the project.

10. If demand for electricity remained unchanged from its expected 1980/81 level it is still probable that Torness would be fully utilised over the initial years of its life, and therefore the savings due to building the station earlier than is required for capacity reasons would remain unaffected. If demand grew more rapidly than projected by SSEB, the result would be that Torness would be needed on capacity grounds before 1992.

30 July 1980

ANNEX

ECONOMIC EVALUATION OF TORNESS: ASSUMPTIONS

Capital Costs AGR (Torness)

Capital cost including interest during construction and initial fuel £1,394m (£1,143/kw sent out)

Availability: Rising over the first four years after commissioning to annual average of 68%; lifetime availability of 63% over 25 years.

New Coal Station

Capital cost including interest during construction £748 m

Average availability 66%

Existing Thermal Stations

Average availability 62%

Fuel Prices - March 1980

Coal - £34.5/tonne increasing at 2% pa till 2000, and at 5% pa thereafter in real terms.

Fuel Oil - £97.9/tonne increasing at 3.5% pa in real terms.

Distillate - £174/tonne increasing at 3.5% pa in real terms.

AGR fuel - £4.58/MWH increasing at 1% pa from 1996 onwards in real terms.

Load/Sales Growth

Maximum Demand 1980 6085 MW

Growth averages 2.4% pa to the year 2000

Cost of Capital

Annuities and net present values estimates using an interest rate of 5%.

Derivation of £/kw/year for Torness in Table 1

This figure is derived by annuitising the cost and benefits of the additional plant over the plant life, and dividing then by the capacity, in kilowatts, of the plant. For example, the capital cost of Torness is estimated to be £1394m which, annuitised over 25 years of life at a 5% interest rate, gives an annual capital charge of £98.9m. The sent out capacity of Torness is 1,220,000 KW which gives an annual charge per kilowatt/year of £81.