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Energy A

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Rt Hon Michael Heseltine MP
Secretary of State for the
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15 June 1981

Dear Michael

I wrote to you on 10 April about publication of the Severn Barrage Committee (SBG) Report and promised that I would write more fully after Easter with an assessment of the report and with recommendations on any further work and on whether a period of public consultation should follow the Report's publication.

The SBC conclude that an Inner Barrage, estimated to cost £5.7 billion, and taking 9-12 years to build from the decision to proceed and providing generating capacity of 7.2GW is technically feasible and could be economically attractive if nuclear generation capacity remained limited and that it would be an insurance against a future in which energy costs were unexpectedly high. The Committee acknowledges, however, that there are considerable remaining uncertainties and that the construction of more nuclear plant would on present estimates be a more economically attractive investment.

Although the SBC's work has covered 2½ years, at a cost of £2.3m, it was not able fully to examine the environmental, social and industrial aspects of a Barrage. It has however identified possible impacts, made preliminary judgements and suggested further work on economic and environmental aspects. This would be included in an Acceptability and Preliminary Design Study, taking up to 4 years and costing up to £20m, which the SBC recommends the Government should now put in hand.

A preliminary assessment of the Severn Barrage Report has now been prepared by two working parties under the aegis of the Official Inter-Departmental Committee on the Severn Barrage (ICOSB), covering,

respectively, Economic/Energy Policy and Environmental/Socio-Economic matters. Their papers and a note summarising their main findings are attached.

The working party on economic and energy policy aspects considers that the report does not adequately take into account the risks involved in such a huge construction project. It is a one-off project with a high risk of increase in construction time and cost. As brought out in the working party's study of sensitivities, the introduction of not unreasonable assumptions about slippage and escalation of the kind which have been all too often encountered on large civil projects would result in the costs of the project exceeding the benefits. Since the main advantage of a barrage would be in fossil fuel savings, it needs to be compared not only with investment in nuclear power but also with investment in alternative energy projects, combined heat and power and energy conservation. Investment in these areas could prove more attractive, being less risky and capable of incremental development, building on experience.

The Working Party on Environmental and Socio/Economic Issues indicated that considerable uncertainty remains both over the acceptability of the barrage and the attendant social and environmental costs and benefits, both considered in isolation and in relation to those of other forms of energy supply.

We now have to decide what statement the Government should make on publication of the report. I am strongly in favour of a neutral statement which neither hints at acceptance of the SBC's recommendation for further work nor expresses reservations about their conclusions.

I have received intimations from Taylor Woodrow, associated with GEC, MacAlpines and Balfour Beatty, that they would be interested in promoting the financing and construction of the Barrage. Obviously they, and other firms, will wish to study the SBC Report in detail before deciding whether to pursue this interest. But we should not include in the statement anything which deters the private sector from giving the report serious study and from working up proposals for handling the project if they wish.

I think it is important, too, that the Government should be seen to be encouraging genuine public debate about a project of such magnitude and complexity. Expression of reservations at this stage would suggest that the Government had no real interest in canvassing public reaction.

I recommend a period of six months for public consideration of the report. At the end of that period, the Government could consider the SBC's recommendation of an Acceptability and Preliminary Design Study in the light of public reaction and of any firm proposals which the private sector may have developed for pursuing the project.

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I shall be grateful for the agreement of yourself and colleagues to the enclosed draft Answer to an arranged Parliamentary Question. Copies go to the Prime Minister, the Chancellor of the Duchy of Lancaster, the Secretaries of State for Trade, Industry, Employment, Transport and Wales, the Chief Secretary to the Treasury, the Minister for Agriculture, Fisheries and Food, Robin Ibbs and Sir Robert Armstrong.

Yours ever

David

D A R HOWELL

DRAFT PQ AND ANSWER

TO ASK THE SECRETARY OF STATE FOR ENERGY WHEN HE INTENDS TO PUBLISH THE SEVERN BARRAGE COMMITTEE REPORT

ANSWER
Volume 1 of the Severn Barrage Committee's Report, containing the Committee's main findings and their conclusions and recommendations, is being published today as one of my Department's Energy Papers. Volume 2, which consists of technical material for specialist readers will be published as soon as it is available. I have arranged for a copy of Volume 1 of the Report to be placed in the Library of the House.

The Government welcomes this very thorough Report as a basis for the consultation about the complex issues involved that must now be undertaken. It looks forward to receiving, during the next few months, comments from interested parties on those issues. Decisions, for example, about the further studies recommended in the report, will then be taken in the light of such a public debate.

AN ASSESSMENT OF THE SEVERN BARRAGE REPORT

Introduction

The Interdepartmental Committee on the Severn Barrage set up two working parties to prepare assessments of the Economic/Energy Policy aspects and the Environmental/Socio Economic aspects of the Severn Barrage Report. This note summarises the findings in their papers at Annexes A and B. Although restricted in the depth of their assessment by the time available, the working parties have reached the clear conclusion that the Barrage is not at present economically viable and that, although much more work would be needed fully to assess the environmental costs and benefits of the scheme, these already present serious reservations. The main areas considered are:

1 The Economic appraisal

2 Energy policy implications

3 Environmental and Regional Considerations

4 Industrial implications

5 The Organisation and funding of the Scheme.

1 The Economic Appraisal

The Barrage is a very large, high risk, one-off project. As the Severn Barrage Committee recognise, investment in nuclear capacity would be more economic than the Barrage. In any event there are considerable risks and uncertainties in its construction, risks which the report does not adequately analyse. These include in particular the risks of cost escalation and slippage. Sensitivity studies carried out by the working party show, for example, that an increase of 50% in capital costs and construction period and a 10% reduction in energy output would result in the costs of the barrage exceeding the benefits (discounted at 5%).

2 Energy Policy Implications

The Severn Barrage would add very little firm capacity to the CEGB's system. Its main advantages would be in fossil fuel savings. It therefore needs to be compared with investment in nuclear power and with investment in alternative energy projects, combined heat and power and energy conservation. Investment in these areas could prove more attractive, being less risky and capable of incremental development, building on experience.

3 Environmental and Regional Considerations

The Environmental working party agrees with the Severn Barrage Committee's Conclusions that the environmental, social and industrial acceptability of a Barrage has not yet been established. However they feel that the SBC assessment, even though it is incomplete, has tended to underemphasize the possible repercussions of the scheme. Benefits could be expected from the Barrage in terms of recreation, tourism, agriculture and a reduction in the risk of flooding. However, the potential disbenefits are considerable for example in costs of maintaining water quality, constraints on the growth of

industrial and other developments upstream, and the effect on ports and on commercial fisheries. The SBC have not considered who should be responsible for these costs which could be considerable - for example the cost of controlling pollution in order to maintain present water quality land drainage and sea defence could be between £120m and £230m. The Working Party concludes that at this stage there is no overwhelming reason on environmental or regional grounds, against proceeding with the next stage of studies. However, there are sufficient reservations to make it possible that further research could result in the identification of major impediments.

4 Industrial Implications

The Economic Working Party conclude that investment in the Barrage would be unlikely to yield as much engineering work to the UK as would a similar level of investment in nuclear power. The impact of the barrage on the development of industry in the Severn Area would, as stated above, require further research.

5 Organisation and Funding

There would be very considerable problems in funding the Barrage; the project would almost certainly be unattractive to private investors, and Government would have to provide or guarantee finance at a time when capital is likely to be severely rationed. The CEGB would not wish to be involved in the non-energy aspects of the scheme. A separate authority to construct and subsequently lease the power facilities would be appropriate, but there would be scope for dispute over the sharing of costs and benefits.

INTER-DEPARTMENTAL COMMITTEE ON THE SEVERN BARRAGE:
WORKING PARTY ON ECONOMIC AND ENERGY POLICY ASPECTS

ASSESSMENT OF THE SBC REPORT

Introduction

1 This note represents a preliminary assessment of the economic appraisal carried out by the Severn Barrage Committee (SBC). In the time available, it has not been possible to do more than outline the major issues raised and to indicate some of the problems involved. Four major areas are considered:

1 The economic appraisal
2 Energy policy implications
3 Industrial implications
4 Organisation and funding

I THE ECONOMIC APPRAISAL

2 The Report considers three alternative schemes, the most attractive being an Inner Barrage costing £5.7bn (December 1980 prices) over 9-12 years with an installed capacity of 7.2 GW. However, because of the cyclical nature of the tides, a load factor of only about 20% is obtained and firm capacity contribution is only about 15% of rated output (1 GW). Thus the main benefits from building a Barrage derive from fuel savings in marginal power stations and not from reduced investment in new generating capacity. The Inner Barrage would generate some 13 Twh a year, 6% of present electricity demand.

3 The Committee have examined the project by reference to three background scenarios:

I: Higher Demand and Slightly Restricted Nuclear Growth

i) electricity demand growth 1.8% pa;
ii) nuclear planting up to a maximum of 3 GW pa after 2000;
iii) price of coal 34p/therm in 2000 rising to 40p/therm in 2030 (December 1980 prices).

II: Higher Demand - Low Nuclear

i) nuclear planting is restricted to 1 GW pa from 1990
ii) all other assumptions as in Case I.

III: Low Demand - Nuclear Unrestricted

i) electricity demand growth 1.2% pa to 2000; 0.8% pa after 2000
ii) nuclear planting unrestricted after 2000 (but with a 28% planning margin and a fixed retirement rate).
iii) coal price as in Case I.

4 These scenarios do not, of course, encompass the full range of possible outcomes. For instance electricity demand could grow at a lower rate than 1.2% pa to 2000; the planning margin could be reduced.

Comparison with nuclear

5 Any assessment of the economic case for the Barrage needs to include a comparison of the project with alternative investment in electricity supply. Since the main benefit of the Barrage would be to reduce the system's fuel consumption, and most importantly coal, it is not helpful to make comparisons with new coal-fired plant, gas turbine plant, or refurbished coal stations, as such investments would be mainly justified on capacity grounds. It is best judged against investment in nuclear capacity, the major benefit of which is also the displacement of fossil fuel. The Report makes this comparison, and in all the Scenarios considered nuclear is the clear economic choice (although it must be pointed out that the costs of nuclear power - which in the Report are based on assumptions used in the 1979 Energy Projections - are themselves subject to considerable uncertainty).

6 A constraint on nuclear planting is, in fact, crucial to the Committee's analysis. If nuclear capacity could be constructed, it would always be preferred to the Barrage, as the SBC point out.

The benefit/cost ratios for 4 GW of nuclear generation (costing about the same to build as the Barrage) would - on the assumptions set out in Annex 5 of the Report - be from 1.55 to 2.3 (Figure 22; page 36). By contrast, the B/C ratios for the Inner Barrage range from 0.95 to 1.4.

Cost assumptions

7 Whilst the estimates in the Report are based on a carefully thought out method of construction, there are many uncertainties about the construction of a Barrage of this size. The Report itself does not offer any detailed treatment of risk and sensitivity (paragraphs 125-132). The effect on B/C ratios of variations in key parameters - for example, capital costs, delays, output, availability - is not analysed.

A Basic Costings:

8 In general, a conservative approach has been taken to Barrage construction, relying where possible on established technology. Construction costs of £5.7 bn include a 25% contingency primarily to cover post tender cost increases including increases due to design change and escalation in construction timescale. However, no project of the scale of the Barrage has been attempted in the UK before, and the risks of things going wrong must be high (for example, serious slippage in the planned timetable; and shortfalls in energy output, resulting from possible changes in tidal range and the risk of silting). It must seriously be questioned whether a contingency allowance of this size is adequate.

9 Cost escalation and slippage in construction time could render the Inner Barrage uneconomic in a number of ways, for example:

i) higher capital costs due to delays and labour troubles;
ii) deferred income from sales of electricity;
iii) large increases in interest during construction

10 This project would appear to be highly vulnerable to cost-escalation and to a rather lesser degree to slippage. It is an

extremely large, one-off project quite beyond previous UK experience. It would create substantial employment for no more than about 9-12 years. The work force would have incentives to delay completion of the project through low productivity and strikes. Unscheduled expenditure such as completion bonuses might be necessary to keep the project moving.

11 Estimates of possible escalation and slippage are not easy to make. There is no comparable civil engineering project construction under UK conditions with which the Inner Barrage can be directly compared and comparisons are further hindered as a result of the differing bases on which contracts are drawn up. However, the cost of the Thames Tidal Barrier rose by 40% in real terms between 1973 and 1979; the cost of the main civil works for the project now has an estimated escalation to completion of 200%, three-quarters of this being due to industrial relations problems. Slippage on the Humber Bridge resulted in a doubling in the originally estimated construction time. Generally, experience on large sites in the UK shows that high cost increases and considerable slippage are all too common.

12 The Department of Energy have prepared the following sensitivities the 25% contingency allowance is included in Tables 1 and 2, and excluded in Table 3:

B/C ratios for the Inner Barrage

Table 1: (inc 25% contingency)	central estimates	cost escalation		construction time		energy shortfall
		+50%	+100%	18 yrs (+50%)	24yrs (+100%)	-10%
Scenario I	1.1	0.7	0.5	0.9	0.8	1.0
Scenario II	1.4	0.9	0.7	1.2	1.0	1.3
Scenario III	0.95	0.6	0.5	0.8	0.7	0.9

Table 2 (including 25% contingency)

cost escalation	+50%				+100%			
construction time	18 yrs (+50%)		24 yrs (+100%)		18 yrs (+50%)		24 yrs (+100%)	
energy shortfall	0	10%	0	10%	0	10%	0	10%
Scenario I	0.6	0.6	0.5	0.5	0.5	0.4	0.4	0.4
Scenario II	0.8	0.7	0.7	0.6	0.6	0.5	0.5	0.5
Scenario III	0.5	0.5	0.4	0.4	0.4	0.4	0.3	0.3

Table 3 (excluding 25% contingency)

cost escalation	+50%				+100%			
construction time	18 yrs (+50%)		24 yrs (+100%)		18 yrs (+50%)		24 yrs (+100%)	
energy shortfall	0	10%	0	10%	0	10%	0	10%
Scenario I	0.8	0.7	0.6	0.6	0.6	0.5	0.5	0.4
Scenario II	1.0	0.9	0.8	0.7	0.7	0.7	0.6	0.6
Scenario III	0.7	0.6	0.5	0.5	0.5	0.5	0.4	0.4

13 The crucial dependence of the economics of the Barrage on capital costs and construction period is clear. Even when the contingency allowance is removed, a 50% increase in these parameters - hardly unlikely in the light of experience on other large UK construction sites - reduces the B/C ratios to well below 1.0 in Scenarios I and II and to just 1.0 in Scenario II. Any further deterioration in performance, or any shortfall in energy output

further reduces the return so that in all cases costs exceed benefits (at 5% discount).

14 Environmental costs are being examined separately. It should not be forgotten, however, that costs associated with environmental impacts have not been included in the calculation of B/C ratios in the Report. The interdepartmental Working Party on environmental and socio-economic impacts consider that these costs could be considerable. The SBC estimate that they could be equivalent to 5-10% of the construction cost of the Barrage, or a reduction in the B/C ratio of up to 0.07. However, using SBC's own estimates of cost, we have estimated that the B/C ratio could be reduced by up to about 10%, or around double that suggested in the Report.

B Value of energy contribution

15 The main role of a Severn Barrage would be to displace fuel consumed by the CEGB system, although there would also be a modest contribution to capacity requirements. As the Report makes clear, the value of the electricity generated is critically dependent on the price of fossil fuels and the amount and cost of nuclear power during the period 1995-2015.

16 The actual mix of fuels displaced depends upon the assumed plant mix in the next century, and particularly upon the nuclear component. In scenarios I and III, which each contain a much higher nuclear component, more than 50% of the fuel displaced is nuclear. However as fossil fuel is assumed to be considerably more expensive than nuclear fuel, and as most of the fuel saved in the early years of the Barrage's operation is fossil, the economic case for the Barrage is sensitive to fossil fuel price (particularly coal) and much less sensitive to nuclear fuel price.

17 We have considered the effect on the economics of the Barrage if even more modest nuclear planting were assumed than in Scenario II of the SBC Report with a low rate of growth of electricity demand

(say 1% pa). The answer is already implicit in Scenario II of the Report. Scenario II contains a combination of demand and nuclear construction such that the inner, preferred, barrage always displaces fossil fuel. In this case the estimated benefit/cost ratio is 1.4, although for additional nuclear plant it is 2.3. With demand growth at 1% pa it will still be fossil fuel that is displaced so long as nuclear planting in addition to the present AGR programme does not significantly exceed 8 GW in 2000, 15 GW in 2010 and 20 GW in 2030. This represents a very modest nuclear programme indeed, and signficantly more nuclear plant would reduce the fossil fuel saved and hence the B/C ratio.

18 The return from the project is dependent on the fuel price assumptions made: coal is assumed to be 34p/therm in 2000 rising to about 40p/therm in 2030, this being the projection of coal costs on the international market. The figure for 2000 is not out of line with the Byatt provisional central estimate for imported coal at European ports. Comparable projections to the year 2030 have not been made.

19 There are considerable uncertainties about future fuel prices. The Report presents (fig 24, p.40) some sensitivities for Scenario I; the Department of Energy have provided estimates of sensitivities for the other cases:

p/therm in (2000: (2030:	SBC central 34 39.3	SBC low 29.7 33.0	CEGB estimates 26 40	SBC high 45.9 52.1
B/C ratios:				
Scenario I	1.1	1.0	1.0	1.2
Scenario II	1.4	1.2	1.3	1.75
Scenario III	0.95	0.8	0.8	1.0

20 It will be seen that the SBC's low case (with prices some 15% lower than central estimates) results in a reduction of the B/C ratios by 0.1-0.2. CEGB central estimates for UK coal prices are quoted by the SBC as 26 p/therm in 2000 (a figure in line with that given by the Board in evidence to the Select Committee on Energy) rising to about 40p/therm by 2030. Such a profile lowers the central B/C ratios by about 0.1. Were UK prices to rise at a rather slower rate beyond 2000 than the Board estimate, then the ratios would be reduced further.

21 Generally, higher coal price assumptions improve the economics of the Barrage; but - as the SBC themselves point out - the economics of nuclear plant and other coal-saving projects are also similarly improved.

22 The effect of the Barrage on CEGB system operation is not quantified in the Report. The Barrage would have an output which varies from zero to a few GW's and back over a few hours. This increases the need to cycle other plant, with increased wear and tear, and reduced efficiency. Preliminary estimates made by CEGB suggest that the consequent reduction in benefit would be about 5-6%. (There is a certain amount of flexibility available in controlling the output of the Barrage which could offset these disbenefits to some extent, though it is not clear by how much).

23 The SBC made some limited studies of the interaction of tidal power with pumped storage. Their tentative conclusion was that the presence of various levels of pumped storage in the electricity supply system would make very little difference to the total benefits obtainable from a Barrage.

24 In summary, as the SBC recognise, investment in nuclear capacity would be more economic than investment in the Barrage. In any event there are considerable risks and uncertainties in constructing the Barrage, risks which the Report does not adequately consider. Sensitivity studies show how crucially dependent is the return

from the project on the capital cost and construction period assumptions, assumptions which - on the basis of UK experience with large construction sites - seem unlikely to be met. The effect of lower than estimated coal prices would be further to reduce the case for the Barrage.

2 ENERGY POLICY IMPLICATIONS

25 The main potential advantage to be gained from the Barrage on energy policy grounds is a fuel saving of 5-8 mtce a year. The Barrage would also further diversify the sources of electricity supply. Against this, however, would have to be set the fact that a Barrage adds very little firm capacity to the CEGB's system (1 GW in the case of the Inner Barrage). It would also be a very expensive and high risk way of insuring against unforeseen circumstances, such as a shortfall in coal supply or nuclear capacity.

26 The Barrage is an "alternative energy" project which may be seen as desirable on grounds of diversifying sources of supply. But it needs also to be viewed in relation to the possibility of investment in other non-conventional energy programmes. At a time of low or no economic growth, the Barrage competes for scarce funds. Apart from the comparison with nuclear (where capital rationing considerations also apply), chp and conservation schemes are other possible projects with which the Barrage needs to be compared. Although comparisons are difficult to make, it is the case that comparable investment in CHP, energy conservation, wind power etc appears a great deal less risky, and is capable of incremental development, building on experience. By contrast, the Barrage is an all-or-nothing scheme.

i) chp: the Marshall Report indicated that a district heating scheme, either purpose built or using an existing station, and providing 1 GW of heat and generating capacity, would cost (at today's prices) some £1000m (three-quarters of which is needed for heat distribution) and would permit the saving of up to 0.8 mtce a year.

ii) energy conservation: EcS calculate that the total cost of insulating and draught-proofing all as yet untreated buildings in the UK would be around £3.5 billion (1980 prices) and that this would result in fuel savings of around 9 mtce (on the assumption that there is no change in internal temperatures), and would reduce the need for generating capacity. Thus, even with Government insulation grants (which may not be necessary in practice), this would seem prima facie to be a cheaper way of achieving the energy savings possible with a Severn Barrage.

3 INDUSTRIAL IMPLICATIONS

27 The SBC Report indicates that the Inner Barrage would require some 160 hydro-electric turbines amounting to about 7200 MW of electrical capacity. These together with switchgear and transmission equipment probably comprise the central element of the manufacturing workload arising from the Barrage, though other equipments such as cranes, construction equipment, gate valves, would also be required.

28 In relation to competitors overseas the UK has no strong indigenous manufacturers in the hydro-electric turbine sector, especially for low-head machines, and this could vitiate the presumed benefits of the Barrage as regards manufacturing work. Whilst licences could be taken (France, Switzerland) and UK capability expanded it appears questionable whether market prospects, once the Severn contract was complete, would justify the necessary UK investment. In these circumstances it may be no more than realistic to suppose that a substantial proportion of the Barrage work would, in practice, find its way to overseas suppliers. Participation in the Barrage at any level would naturally strengthen the UK hydro-electric turbine sector. But in overall terms it is difficult to conceive that 7200 MW of tidal power from the Severn Barrage would, if the choice had to be made, yield as much electrical and mechanical engineering work to the UK as would the equivalent capacity of, say, nuclear power.

29 The Barrage would, of course, create substantial employment during the construction phase, but most of this would disappear on completion.

4 ORGANISATION AND FUNDING

30 The SBC Report does not discuss who would construct and operate the Barrage; nor how its construction would be funded.

31 There appear to be four main possibilities: construction and control by electricity utility, private enterprise, separate authority, or mixed enterprise. However, since the Barrage is for the generation of electricity on a massive scale, the CEGB would need to be closely associated with the project from its inception.

The role of the CEGB:

31 i) construction: The CEGB have shown no interest in building the Barrage: their interest lies in the production of electricity, and nuclear construction is in any case expected to place a great burden on their finances from the mid-1980's onwards;

ii) operation: the Board would need to be closely associated with the operation of the Barrage. Responsibility for power operation would ensure that their generating system was run optimally taking account of the Barrage contribution. Responsibility for the whole scheme, however, with its wider social implications, goes beyond the CEGB's competence; and in any event the Board is already regarded by many as being too big. Ownership of the Barrage by a separate authority, however, would leave the question of what the CEGB should pay for tidal power. The CEGB would wish to maximize the return on its plant, and minimize 'leasing charges'. It would not be interested in meeting any social costs which might result from the existence of the Barrage. Provision for arbitration would not remove the seeds of conflict.

Private enterprise

33 The Inner Barrage alone would require some £5.7bn over a period of 9-12 years before any return. It is difficult to see how a consortium could be set up able and willing to raise such a large sum on such a speculative undertaking with such a long pay-back. (There are lessons to be learnt from the Gas-Gathering Pipeline here). Cast-iron guarantees of return would be required, almost certainly Government-backed, and probably taking the form of long-term contracts for electricity sales which the esi could be expected to resist.

34 The Barrage would not therefore appear to be a promising venture for private capital. A 'mixed enterprise' project is open to similar difficulties.

Separate authority

35 The SBC seem to have assumed that a separate authority would be required. This would presumably be Government-funded. Even if the CEGB had a place on the authority, and contributed to the costs of main Barrage construction (in addition to the generating plant elements) this would be during a period of net esi borrowing from the Government. A separate authority, established with appropriat powers, would be best placed to cope with the environmental and wider social consequences of the Barrage. It would however need to agree with the CEGB over sharing the eventual benefits from power generation, and would be in a relatively weak negotiating position even if the CEGB - as the sole or dominant customer - were statutorily obliged to take the output.

36 To sum up:

i) it seems likely that the Government would, because of the size of the project, be the ultimate risk-takers;

ii) if the CEGB built and ran the whole project this would avoid problems of arm's length sales. But there are severe disadvantages to this (and CEGB would certainly want some guarantee on compensation for social costs);

iii) an authority to construct and subsequently lease the power facilities would appear the more appropriate body, but there would be scope for disagreement over the sharing of costs and benefits;

iv) private investors are unlikely to find the scheme attractive.

V CONCLUSIONS

37 i) Returns from investment in nuclear plant appear a good deal more attractive than those from the Barrage, as the Report recognises.

ii) The Barrage is a very large, high risk, one-off project; it would be a major national investment but one without clear-cut economic benefits, or any obvious successor project to which its lessons could be profitably applied;

iii) The SBC Report does not give an adequate analysis of risk and uncertainty - in particular, risks of cost escalation and slippage reduce the economic case for the Barrage still further;

iv) investment in energy conservation, chp and other energy schemes could prove to be more attractive;

v) there would be very considerable problems associated with funding the Barrage; the project would almost certainly be unattractive to private investors, and Government would have to provide or guarantee finance at a time when capital is likely to be severely rationed;

vi) industrial benefits appear unattractive when compared with other forms of energy investment.

Department of Energy
30 April 1981

IDWP/SD

INTER DEPARTMENTAL COMMITTEE ON THE SEVERN BARRAGE WORKING PARTY ON ENVIRONMENTAL AND SOCIO-ECONOMIC ISSUES

PRELIMINARY ANALYSIS OF ENVIRONMENTAL AND SOCIO ECONOMIC IMPACTS OF THE PROPOSED SEVERN BARRAGE

CONTENTS

INTER DEPARTMENTAL COMMITTEE ON THE SEVERN BARRAGE: NOTE OF THE ENVIRONMENTAL AND SOCIO-ECONOMIC IMPACTS OF THE PROPOSED BARRAGE SCHEME

A. INTRODUCTION

1. Although a decision on whether or not to proceed with the next Acceptability study stage of a Barrage in the Severn Estuary is likely to be made primarily on the basis of the economic viability (in terms of power generation only) of the scheme it is essential to know also at this stage whether there are any major environmental or socio-economic impacts from the scheme that would prove to be a crucial impediment.

2. Volume 1 of the Pre Feasibility study report states (para 11) that 'the environmental changes so far predicted either raise questions for which solutions have been identified or are such as not to rule out further consideration of a barrage'.

3. It states further (in paras 13 and 14) that 'the social and industrial impacts of a barrage, including the effects on employment, on the future developments of industry around the estuary, on land resources, on local communities (especially during construction) and on existing amenities, would all need careful consideration. From this enumeration of the effects of a barrage it is clear that its environmental, social and industrial acceptability has not yet been established. This must therefore be a major objective of any future work'.

4. Although, therefore, no crucial environmental or socio-economic impediment has been identified in the work of the Pre Feasibility Study to date, considerable uncertainty remains. It is essential to distinguish between the acceptability of the Barrage and the purely financial costs of the potential disbenefits and the financial benefits. The Pre Feasibility Study has not addressed the former and has touched on the latter in only a few instances. The Working Party on Environmental and Socio-economic Impacts, established by the Inter Departmental Committee on the Severn Barrage, has carried out a very rapid assessment of the findings in volume 1 of the Pre Feasibility Study Report. The purpose of this, within the group's overall terms of reference, was to establish whether there are any identifiable major impediments on environmental or socio economic grounds.

5. It should be noted that the Pre Feasibility Report does not include in the calculation of its cost/benefit ratios any environmental or socio economic benefits or disbenefits other than the 'indirect' costs associated with improvement to water quality after the Barrage is built and changes to land drainage and sea defences. These two together are estimated to be £100M-£210M. The Report states that 'many of the impacts of a barrage on the natural environment are intrinsically unquantifiable in financial terms'. It then goes on to comment on possible indirect benefits on recreation and industry that may offset indirect costs but it is not possible to quantify the scale of these.

6. The complexity of the potential environmental and socio-economic impacts of the Barrage is recognized in the Pre Feasibility Study Report, but the various kinds of impact are analysed separately, and interactions (eg. between water quality and the standards applied to industrial discharges) are not sufficiently brought out. Wider planning issues are only referred to very briefly. The long timescale of any Barrage development makes prediction hazardous, because social and economic characteristics of the region affected are likely to change in any event. Hence the environmental and socio economic analyses in the Report - and in the present commentary - must be regarded as preliminary, to be extended if an Acceptability Study is undertaken.

7. This note therefore:

i. analyses each area of potential impact in turn, drawing attention to any major interactions;

ii. makes an overall assessment;

iii. outlines further work that would be needed in order to identify more fully the nature and extent of impacts and the further research that would be needed in any Acceptability study.

B. THE POTENTIAL ENVIRONMENTAL AND SOCIO ECONOMIC IMPACTS OF THE BARRAGE SCHEME:

ASSESSMENT OF THE PRE FEASIBILITY STUDY FINDINGS

8. The analysis below describes, for each of eleven areas of potential impact identified so far, the main findings in Volume 1 of the report. It then assesses these and identifies, in general terms, further uncertainties and work that would be required in order more accurately to specify the nature and extent of the environmental and socio economic impacts of the proposed barrage scheme.

B.1. PORTS AND SHIPPING

IMPACTS - THE PRE FEASIBILITY STUDY FINDINGS

9. The report concludes that the heights of the tides at the port entrances, as a result of the Barrage, would be critical for continued port access and equally that the future navigability of the estuary will depend on changes in the siltation regime. The proposed Inner Barrage (the preferred scheme) is estimated to effect only a small change on maximum water levels, and there may be an improvement in overall accessibility due to the higher low water levels.

10. In addition the report acknowledges that the requirement for ships to pass through locks in the Barrage to gain access to ports that would be upstream of even the Inner Barrage is a key factor both in the initial capital costs for the estimated two locks and also the running costs, including dredging and costs to shipping companies in delay times. (The existence of ship locks is also a determining factor in the feasibility and economic viability of a road across the Barrage itself).

11. There are a number of other issues, such as the cost and practicability of schemes to maintain the present standard of port access, changes in port traffic due to different access patterns imposed by the Barrage, and new patterns of sedimentation with concomitant effects on the need for dredging or navigation aids, and all are recognised in the Report as being subject to considerable uncertainty.

ASSESSMENT OF THE PRE FEASIBILITY STUDY FINDINGS

12. While the Report infers that none of the barrage schemes would involve complete exclusion of vessels from the ports, the Pre-Feasibility Study raises more questions about port access than it answers. The introduction of any physical barrier in the sea approaches to a maritime port must be a matter of potential concern, particularly where, as in this case, major ports such as Bristol (4.6m tonnes annually and the largest local authority port in England and Wales), Cardiff (1.9m tonnes annually) Newport (2.2m tonnes annually) and Sharpness/ Gloucester will be impounded above an Inner Barrage. There appears at least a risk of the barrage having some harmful effect on the ports and port related industries.

13. An assessment of the overall effect of a Barrage will depend on the outcome of the further studies which the Report acknowledges are necessary into the post-barrage water levels and siltation prospects. These studies will need to pay particular attention to the effects on the larger ships which, while small in numbers, account for a very significant part of the ports' total trade and revenues.

14. The studies also need to be put in the context of future traffic forecasts and likely trends in ship sizes and cargo handling technology relevant to the barrage's 20 year construction timescale (and possibly beyond), and the extent to which the barrage might constrain potential further development of the impounded ports and divert traffic to other ports. The assessments would need to consider the position both during construction and after construction of the barrage on the following issues:

i.	Siltation:	further studies into the uncertainties of predicted sediment movement. The extent and cost of potential dredging requirements to be identified for each port (including those impounded and those immediately outside the barrage). Assessment of compensation costs in the event of siltation causing closure of any of the impounded ports. Assessment of potential benefits if projected changes in the sediment regime result in lower maintenance dredging requirements.
ii.	Water levels:	the prediction of water levels to ± 0.2m is potentially critical for the largest ships. The extent and cost of potential remedial works to be identified for each port. Further examination needed of scope for using barrage turbines to pump up the impounded water level. Assessment of disbenefits to each port of the drop from the existing high water levels in the estuary and of the benefits of higher minimum water levels.
iii.	Economic effects:	quantification of with-and-without-barrage traffic forecasts; quantification of costs arising from possible modification of trade to ports and consequent effects on viability of port operations; constraints imposed on industries served by the ports and situated in the vicinity of existing port facilities and their hinterlands. An assessment would be needed of the impounded ports' competitive positions as a result of the additional costs of locking through the barrage and new dredging, buoying and pilotage needs.
iv.	Lock sizes:	further study is needed into suitability of lock sizes, eg to examine whether separate provision is needed for small vessels and recreational craft for which locks of 370m x 50m x 30m would be uneconomic in operation.

v. Conflicts of Interest: assessment of requirements to avoid conflict between commercial shipping and recreation, conservation and other commercial water activities.

B.2. LAND DRAINAGE AND SEA DEFENCES

IMPACTS - THE PRE FEASIBILITY STUDY FINDINGS

15. The report states that the Barrage would reduce high tide levels and keep out surge tides. However its presence would also concentrate wave attack, over longer periods than at present, on a more limited range of shoreline. For this reason improvement of sea defences may be needed - at a cost of up to £10m (the report does not state the extent of running costs as well as capital costs).

16. The report indicates that the Barrage could produce a benefit from reduced risk of flooding in the area but would in any event enable corrective action to be taken more easily than at present.

17. The report shows that there are approximately 80,000 ha of low lying land around the estuary. The majority of rivers drain into the Severn estuary by gravity through outfalls at heights in excess of 5m OD. The report notes that some of the main drains are fitted with barriers to exclude tides and sediments and that some depend upon pumping.

18. An ebb-generation Barrage scheme would reduce the duration when discharge can occur for land drains at or below 5m OD and lower lying drains would need substantial pumping at a capital cost of £14-19m. (The report states that an outer Barrage scheme would require more major works.)

19. The report concludes that necessary engineering works are feasible for any of these consequences.

ASSESSMENT OF THE PRE FEASIBILITY STUDY FINDINGS

20. The report does not state to whom capital and annual running costs would be attributable.

21. It is true to say that the engineering problems of drainage are reasonably well understood and should not require much further research before necessary solutions could be devised. However the related effects on salinity, siltation in drainage channels and aspects of water quality that could affect the use of improved land for agriculture need also to be taken into account and incorporated into the further studies in any Acceptability stage.

B.3. AGRICULTURE

IMPACTS - THE PRE FEASIBILITY STUDY FINDINGS

22. The report states that there would be benefit to agriculture in the area as a result of the proposed Barrage in that essential land drainage schemes would lower the water tables (nevertheless destroying wetlands thus posing a conflict with nature conservation).

23. In some low lying areas there would need to be measures to prevent saline intrusion but the Report suggests that the costs of this at £1m (annually?) would be negligible.

24. The Second stage of a Barrage, the report states, would offer more scope for land improvement but with even greater disbenefits to nature conservation.

ASSESSMENT OF THE PRE FEASIBILITY STUDY FINDINGS

25. The very limited attention given in the Report to the balance of land demand for agriculture as against nature conservation, visual amenity and pressures for land use change makes it very difficult to assess the findings. On the whole it would be agreed that the Barrage would be of benefit to agriculture, viewed in isolation. Possible disbenefits, or additional costs, could arise from the increased salinity in the estuary and associated rivers and drains with consequent costs for drainage.

B.4. FISHERIES

IMPACTS - THE PRE FEASIBILITY STUDY FINDINGS

26. The report acknowledges that the estuary is important for a number of types of fish, notably for commercial fishing of salmon. (The estuary and rivers up stream are also important for salmon angling.)

27. The salmon fisheries are of national importance, providing 35% of the England and Wales catch. The report estimates the annual value of the salmon angling and commercial fisheries to be £6m annually and that of eel fishing (of local importance) to be £0.4m annually.

28. The report also notes the nature conservation interest of other fish in the estuary such as shad and lamprey.

29. The report's conclusions on the effect of the barrage are very tentative. Thetraditional commercial salmon fisheries however are likely to be adversely affected by changes in tidal fluctuations. The report states that work of several years duration would be needed, particularly in order to predict accurately whether salmon and eel would pass through the turbines and sluices without damage or without destroying the traditional patterns of use of the Severn estuary and its rivers for migration.

30. The report suggests some solutions, such as fish passes, but their success cannot be predicted. It also notes the need to keep water quality at an adequate level for salmon.

ASSESSMENT OF THE PRE FEASIBILITY STUDY FINDINGS

31. Even though the report is tentative in its conclusions it needs to be stressed that the impact on fish in the estuary and its associated rivers is very uncertain indeed. With the present state of knowledge the effect on salmon fisheries in particular cannot be predicted and it is by no means certain that any of the procedures outlined in the report will be effective. All that can be said at this stage is that a flood generation scheme would create a greater barrier to fish migration than the ebb generation scheme favoured in the Pre Feasibility Study Report.

B.5. WATER QUALITY

IMPACTS - THE PRE FEASIBILITY STUDY FINDINGS

32. The Pre Feasibility study has included a number of studies, using numerical models, to analyse the existing water quality of the estuary and make predictions about changes in water quality as a result of a Barrage.

33. It acknowledges the interdependence of water quality and other environmental characteristics such as the aquatic ecosystem, water based recreation and industry (only briefly).

34. It concludes that the degree of contamination from industrial-based polluting loads is small in the estuary compared to its size - except close to outfalls. There are nevertheless high concentrations of heavy metals, for example, in aquatic animals which are not used for human consumption. (This has an effect on aquatic ecosystems generally.)

35. Upstream of the Barrage, in what the report terms as sub-estuaries, there are already some rivers which have a low dissolved oxygen content (which can prejudice the passage of migratory fish.) A Barrage would probably reduce this further. Generally waters there would be less saline, except at "low water" when reaches near the mouths of the sub estuary would become more saline.

36. Downstream water pollutants are presently dispersed by strong currents and this effect would be reduced by a Barrage. The report states that this would be partially counteracted by dilution because of increased water levels behind the Barrage. There will also be reductions in salinity and turbidity (which would encourage the growth of algae) as a result of a Barrage.

37. The report observes that the future level of water quality is a policy decision not a pre-defined standard. Water quality levels near to the present standard could be maintained by reducing pollutant loads by not more than 50%. The estimated cost of water treatment works is £120-£200m capital with £12-£24m annual running costs.

38. The report predicts that in the saltwater/freshwater interface lying 5 and 30km seaward there will be changes on account of reductions in the longtitudinal dispersion of pollutants and in oxygen transfer efficiency (ie absorption of oxygen from the air). The report states that this could have the effect of doubling levels of heavy metals such as cadmium and nickel but leaving other substances such as ammonia, coliform bacteria and inorganic nitrogen relatively unchanged.

ASSESSMENT OF THE PRE FEASIBILITY STUDY FINDINGS

39. The assessment of the current and predicted characteristics of the main and sub estuaries suffers from over-generalisation. More detailed analysis is required of the separate and interacting effects of changes in concentrations of pollutants, turbidity and salinity on all forms of aquatic life, whether eaten by man or not.

40. An additional constraint, only briefly referred to in the report, is the need for compliance with EEC regulations and nationally accepted standards for bathing resorts. For example, the effect of the Barrage on Weston Super Mare, as an identified EEC bathing resort, will have to be considered and may be detrimental.

41. The predicted changes in salinity and the heavier concentrations of certain pollutants are of fundamental importance and would need further careful and detailed analysis. This will be very important in terms of the conditions in the sub estuaries and the effect on fisheries in these areas would need to be taken into account.

42. The report does not sufficiently deal with the effects of water quality on industry. The costs to industry of reducing their pollution load by up to 50% as stated in the report, in order to achieve present water quality objectives would need evaluation and might be substantial. An important point to establish is

whether any such costs will fall to the Water Authorities and industry or whether they will be absorbed into the total costs of the Barrage.

43. Overall, water quality predictions in the Pre Feasibility Study appear to be based on the existing development situation in the area (in its widest sense). Future development has not been taken into account and may be very significantly constrained; for example, ICI and RTZ both own considerable tracts of lands in the Avonmouth area. In the draft Avon Structure Plan this area is scheduled for heavy industrial use. Similarly scheduled housing development on either side of the estuary does not appear to have been considered - for example 6,000-7,000 additional houses are proposed for the North Bristol Area in the draft Structure Plan, and sewage from this area is likely to be directed to Avonmouth. The potential increase in recreation (water based) as a result of the Barrage may also be a determinant of water quality standards.

44. All these factors, not explicitly dealt with in the Report, would have to be taken into account. The report does not take into account the reduction in feasibility and increased costs of progressive upgrading of treatment works to accommodate future development in the area; no account has been taken of future changes in land use, population or industrial development and consequential pollution.

45. The predictions of dispersion of pollutants have to be treated with caution because they are based on extrapolations beyond the range for which the relationships used have been validated. The predictions also assume that most pollutants will come from a point source (as opposed to run off from land) and will therefore be potentially controllable.

B.6. LANDSCAPE

IMPACTS - THE PRE FEASIBILITY STUDY FINDINGS

46. The Pre Feasibility Study gives too narrow an interpretation of the term 'natural environment' in only referring briefly to visual landscape impacts under the general heading of amenity. The main cause of deterioration in visual aspects is cited as being the existence of the land fall sites. The Report does not deal explicitly with landscape change as a result of other aspects of the Barrage and its effect on land around the estuary.

ASSESSMENT OF THE PRE FEASIBILITY STUDY FINDINGS

47. The findings in the report do not therefore give an adequate analysis of the landscape impacts of the proposed scheme. These impacts are likely to be far reaching and would occur not only in the immediate vicinity of the Barrage itself. Further work will be needed to look explicitly at the visual impacts of the Scheme. It would need to focus particularly upon the visual impacts caused by:

i. the barrage itself, the effects of which could be mitigated by the incorporation of aesthetic standards as an integral part of the overall engineering design;

ii. the associated structures including transmission lines along the barrage itself and from landfalls to the National Grid, and on-site construction including new roads and caisson fabrication sites;

iii. the probable need to seek sources of rock and fill - there may be substantial concern if this led to increased pressure

for quarrying, particularly in the Mendips Area of Outstanding Natural Beauty or in other environmentally sensitive areas;

iv. the resultant land drainage works which could give rise to changes in vegetation and the loss of local landscape features possibly with a significant cumulative effect, and from improved sea defence structures;

v. the changes in water levels which will affect the exposure and composition of beaches and shoreline vegetation;

vi. the fact that visual amenity, as expressed for example in Areas of Outstanding Natural Beauty (AONB) depends upon the maintenance of the existing ecological balance to preserve the current landscape quality.

vii. any public road built across the barrage particularly if high level bridges over the locks and road lighting were necessary.

B.7. NATURE CONSERVATION

IMPACTS - THE PRE FEASIBILITY STUDY FINDINGS

48. A great deal of recognition is given in the Report to the fact that parts of the Severn Estuary are of both national and international biological importance. It is also apparent that any of the alternative barrage schemes will have significant effects upon nature conservation interests in the Severn Estuary area through alterations in tidal height, water quality and sedimentation patterns. Specific implications include the submergence of feeding grounds used by internationally significant populations of shorebirds, the loss of important geological exposures and indirectly, the drainage of species - rich wetlands (including the Somerset Levels). The range and scale of effects is reflected in the list in the Report of further Studies considered necessary in any subsequent Acceptability Study.

49. The Pre Feasibility Study report concludes that expert opinion is divided on the extent of adverse damage to birdlife. On the one hand, reduction in the areas of intertidal banks and reduced salinity in the basin could lead to a decrease in the numbers of wading birds and Shelduck while, on the other, the variety and total numbers of birds could be increased through increases in bottom-feeding and suspension feeding organisms.

ASSESSMENT OF THE PRE FEASIBILITY STUDY FINDINGS

50. It is clear that there will be strong primary and secondary effects upon the ecology of the estuary from any of the Barrage schemes and that this will not be restricted solely to birdlife as suggested in the Summary of the Pre Feasibility study report. There may also be significant effects from secondary developments, for example industry and water based recreation.

51. The nature conservation interest is likely to generate substantial controversy. For example there are additional areas of potential conflict from increased agricultural acreage in the existing Somerset Levels (brought about by changes in water levels from land drainage). It would also be necessary to assess the extent to which it is possible to recreate habitats elsewhere and to also evaluate the knock on effects on other estuaries such as the Dee, Morecombe Bay, the Wash and Solway.

B.8. RECREATION AND TOURISM

IMPACTS - THE PRE FEASIBILITY STUDY FINDINGS

52. The Pre Feasibility Study concludes that the lower tidal range and reduced currents arising from a barrage scheme would make the estuary "much more attractive" for water based recreation. Opportunities in the area for recreation and boating, now small because of the large tidal currents and lack of marinas, could be "markedly enhanced" within the basin, perhaps utilising some of the facilities provided for barrage construction.

53. On the tourism side, the Pre Feasibility Study recognises that there could be a significant impact on the tourist attractions of the estuary, particularly since the much reduced tidal range would affect the character and extent of beaches in resort towns. There could however be a boost for tourism in that the barrage itself might prove a major attraction and at this stage, it is probably reasonable to agree with the Study findings that there will be both positive and negative effects on tourism.

ASSESSMENT OF THE PRE FEASIBILITY FINDINGS

54. These findings are apparently based on a rapid recreation study undertaken for the Department of the Energy by consultants who estimate a benefit at net present value of £8-£17m depending on the level of additional investment in recreational facilities (a day visitor centre at the barrage being a prime example.) It has not been possible to consider in depth the consultants report and the assumptions on which it is based at this stage. Only general cautious support can be given at present to the conclusion that there will be greater opportunities for water based recreation.

55. The scale and nature of these recreation and tourism imputs will require further study which should include qualitative as well as economic/quantitative assessments since substantial investments in recreation provision could create disbenefits for the natural environment which the report implicitly recognises in suggesting the need for careful zoning of leisure uses (including on-shore facilities), but does not explicitly state as needing detailed study. The possible disbenefits in reduced sizes of beaches in Weston Super Mare (and for the outer Barrage) Minehead and the need for locking arrangements to enable ocean going yachts to gain access to harbours will all have to be studied further.

B.9. ROAD ACCESS TO AND ACROSS THE BARRAGE

IMPACTS - THE PRE FEASIBILITY STUDY FINDINGS

56. The report deals very briefly with the opportunity for a road crossing on the Barrage, and casts doubts upon the economic viability of a dual carriageway at a cost of £58m (and £26-£52m to connect this to the main M4, M5 road network). It also admits that further study would be needed on the usefulness of such a road, given current travel patterns in the area and concludes that in the event of the capacity of the Severn Bridge being fully used a crossing further upstream would be the most likely location.

ASSESSMENT OF THE PRE FEASIBILITY STUDY FINDINGS

57. Consideration, which the Highways sides of the WO and DTp have given seperately to the question of additional cross severn road capacity, has tended to confirm the assessment that crossing on the line of the Barrage would be unlikely to solve any longer term future problems on the Severn Bridge.

58. The Pre Feasibility Study findings on road access generally tend to underplay the effects of a barrage on the local road network and changes that might be needed on these in the adjacent Welsh and SW areas. The report does not comment upon:

a. the impact of additional traffic with or without a public road across the barrage in the medium and long term arising from 'planned' (or unplanned) activities and developments stemming from the Barrage, and this would include recreation, sightseeing etc;

b. the implications of construction traffic for the local road network (included in this, as well as movement of materials, might be the traffic impact of the workforce, and of local development activity associated with it);

c. the viability of a public road in the light of possible operational difficulties in poor weather.

B.10. BARRAGE CONSTRUCTION

IMPACTS - THE PRE FEASIBILITY STUDY FINDINGS

59. The Report considers three types of impact:

a. On-site effects, ie the implications of caisson construction and placement

It envisages that part of the barrage which did not consist of a rock and sand embankment and the two locks would consist of caissons, large pre-formed concrete structures, which could be floated into place. Some caissons would house the turbines and associated electrical equipment and others would house the sluice gates.

60. The report suggests that three 60ha sites (for the caisson construction yards) would be needed on the banks of the Bristol Channel, two for turbine caissons and one for sluice caissons. It sets out the characteristics of suitable sites for construction yards, which may be summarised as:

a. easy access to deep water for the towing of caissons to the barrage;

b. within reach of a suitable labour force;

c. good access for materials;

d. level foreshore for construction of the basins and the stockpiling of materials.

61. Possible sites for these yards are suggested at Aberthaw, Bideford, Port Talbot/Margam, Portishead, and possibly Milford Haven.

62. At present turbines and generators of the size and type required are not made in Great Britain, but the report suggests that the machinery might be constructed in UK engineering plant under licence. (The ICOSB Working Party on Economic and Energy Policy Aspects does not agree with this suggestion).

63. Similarly, it is presumed that the sluice gates could be manufactured at plant away from the barrage sites and brought by sea to the caisson yard for final assembly.

b. Off-site effects, ie the sources and transportation of infill materials

64. The report discusses two sorts of materials for embankment construction. Firstly, rock would be needed for an initial mound, though in deep water blank caissons could be used to help make the mound at reduced costs. The source of this rock is not identified in the report, but it is stated that the cost advantage of sea transport over land transport would point towards quarries near the coast. This might imply foreign sources.

65. Secondly, sand would be needed for the main infill material. This could be obtained by dredging near to the barrage site. Alternatives may be local mine waste or china clay waste, though the extra cost of transport would put them at a price disadvantage even though there are ample supplies in the region.

c. Economic effects, ie the manpower requirements

66. The report gives the employment implications of barrage construction. During the construction period this would be:

a. 12,000 jobs in civil engineering at the caisson yards and barrage site;

b. 4,000 jobs in off-site fabrication of turbines, sluices, and other electrical and mechanical engineering items;

c. 5,000 other jobs in quarrying, steel, cement and transport;

d. in addition, some 5-6,000 further jobs from the multiplier effect, though there may be some overlap with c. above.

67. Subsequent operation and maintenance of the barrage might be expected to provide some 500 permanent jobs. Similarly, the experience gained in turbine construction might help electrical engineering contractors to win other orders afterwards.

68. According to the report the labour requirements could be met from the South Wales urban areas with some training. The need for labour camps and imported labour could be minimal.

69. The caisson and turbine construction requirements are known and some possible sites have been suggested. The infill materials requirements are known although the study has not examined in detail the possible sources and their transport implications. The report states that the manpower requirements can be met locally with some retraining.

ASSESSMENT OF THE PRE FEASIBILITY STUDY FINDINGS

70. Before the construction of the barrage is approved, more analysis of the planning and land-use implications is needed than was carried out in the Pre Feasibility Study.

71. Firstly, regarding caisson construction, difficult decisions need to be made about the location of caisson yards and what their infrastructure requirements would be. The structure plans of the area did not take into consideration the possibility of these construction yards. The use of Portishead would be a departure from the draft Avon structure plan and its green belt proposals. Further thought would have to be given to the transport of men and materials to the yards. Additionally,

although the report assumes that the barrage components will be brought in to the yards by sea it is unrealistic to expect no operations adjacent to the proposed landfalls. Further thought needs to be given to the adequacy of the existing transport infrastructure here.

72. In addition, the report suggests that blank caissons might be used as part of the embankment. The implications of this suggestion are not pursued. In particular, it is not stated whether more construction yards would be needed.

73. Secondly, the report appears to have been rather sanguine about the availability of infill materials. Four types of material would be needed, rock, sand, infill material and minestone, rather than the two mentioned in the report. Most rock quarried in the UK is too small for the embankment; supplies could be obtained from South Wales and the Mendips instead of from abroad, but the Mendips is an environmentally sensitive area. A decision would have to be reached on whether to use dredged sand for infill or the more costly but unsightly china clay sand. Minestone, which would form a protective layer over the sand. is available in ample quantities locally but it has usually been dumped in inaccessible places requiring transport infrastructure. The effect of construction and fill on pollution and fish life need to be considered.

74. A related problem passed over by the report is the provision of materials to make concrete. The bulk moving of cement and aggregates in the area would pose transport problems.

75. Thirdly, on the employment aspects the report is sometimes sweeping in its analysis. It is assumed that most workers would be recruited from the Welsh urban areas. However, some of the workforce may be required on the English side and some skilled and supervisory workers may have to be brought to the area. This might imply the need for workcamps, which though minimal in terms of the size of the whole project, could still have significant local planning implications. Permanent housing may also have to be provided. Further thought would have to be given to the training requirements. In addition, it would have to be ascertained whether reliance on the resident workforce, as the report suggests, would cause labour shortages.

B.11. REGIONAL PLANNING ISSUES

IMPACTS - THE PRE FEASIBILITY STUDY REPORT FINDINGS

76. A major feature of these regional planning issues is the complexity and interaction of the impacts. For example, a deterioration in water quality caused by reduced tidal flow could require standards which increase the costs of effluent disposal for commercial and industrial activities extending throughout the river catchment areas draining to the estuary. Many of the individual impacts have been examined separately in this note and attention, in this section, is therefore focussed on the possible ways these impacts could separately and together affect the economy of the region surrounding the estuary.

77. Four potential impacts upon the regional economy are identified in the report. These can arise from:

a. effluent disposal;

b. constraints on cooling water;

c. reduced high tide levels;

d. labour shortages.

78. Effluent disposal problems for industry within the Severn catchment area could arise from the reduced tidal flow within the estuary. This might impose two possible extra costs for industrialists:

- higher standards of effluent treatment might be necessary at industrial plant;

- raised water levels above the barrage might lead to some minor extra cost in pumping industrial effluent.

79. The availability of cooling water in the Severn Estuary has led to it being suggested as a location for major industrial development where the supply of such water is a critical consideration. However, the discussion of power station cooling in the report implies that only sites surrounded by the second part of the staged scheme would be adversely affected.

80. Reduced high tide levels behind the barrage could have adverse effects on the region's industry if it prevented port access for large ships. Although these vessels constitute a minority of the ships using the Severn ports, their cargoes could be economically important to the region's industry. The report indicates that this need not be an insurmountable problem as ome compensatory works to increase the size of ships able to pass through the Barrage and use the ports may be possible.

81. Finally, labour shortages and a consequent increase in the cost of local labour might be another regional problem arising out of a reliance upon local workers for barrage construction. However the Report claims that the number of new jobs created would not be excessive in comparison with the existing resident workforce in the area. Moreover it suggests that the multiplier effect of barrage construction could give a permanent boost to local service industries.

ASSESSMENT OF THE PRE FEASIBILITY STUDY FINDINGS

82. Although the report recognises the risk of some adverse impacts upon the regional economy, it suggests that these likely consequences are relatively slight and that there is no non-energy reason to oppose barrage construction. However this view is premature without further research into the regional planning implications of the Barrage. In regional terms, whilst local employment would improve during the construction period, there would be deleterious effects on the region overall, with the potential effects on the ports giving rise to some concern .

83. For present purposes, the conclusion must be that the Barrage could have impacts on the regional economy. There is, however, insufficient evidence on the likely scale and nature of these impacts to indicate that, either separately or in combination, they would be serious enough to rule out the construction of a Barrage. Further work to assess the nature of these impacts is necessary.

84. Firstly, it would be necessary to clarify whether the effects of a Barrage on the regional economy would be sufficiently severe as to be a strong argument against its construction. Secondly, assessment of those impacts and possible economic opportunities offered by the Barrage and its consequences would be necessary to ensure that the Barrage, if approved, was constructed with the minimum disadvantage to the surrounding area.

C. SUMMARY OF ASSESSMENT AND CONCLUSIONS

85. In very general terms this assessment would concur with the views expressed in Volume 1 of the Pre Feasibility Study Report ie. 'the various impacts and

their causes are to a large extent inter related and many complex issues are involved. The answers to these questions require relatively long term studies or information not yet available ..... there are therefore a number of remaining uncertainties. Thus the conclusions reached on environmental impacts are inevitably less certain than those reached on technical feasibility and economic acceptability. Also it is not possible or indeed desirable to quantify some impacts on economic terms.'

86. Because of this uncertainty it is optimistic to state that no major impediment exists on environmental or socio economic grounds. The above analysis has demonstrated, albeit it briefly and in very general terms, that the impacts and associated costs could be considerable. The Severn Barrage Committee has estimated them at £400m or 10% of the Barrage costs - but this is not based on any convincingly robust evidence.

87. Some of the Benefits from a barrage scheme could be expected to accrue from:

i. increased opportunities for water based recreation;

ii. increased tourism generally with the barrage as a possible attraction;

iii. land improvement;

iv. reduced risk of flooding;

v. possible benefits in terms of employment in barrage construction.

88. Some of the Disbenefits from a barrage scheme could be expected to accrue from:

i. costs of maintaining water quality and constraints on industrial and other development upstream;

ii. deleterious effects on the landscape;

iii. loss of sites important in terms of nature conservation and scientific interest;

iv. the effect on commercial fisheries and amateur angling;

v. land demand for barrage construction sites;

vi. increased traffic associated with barrage construction;

vii. the effect on ports in the estuary and on industry in the area dependent upon them.

89. Obviously this summary oversimplifies the complex pattern of costs and benefits that would be involved. Nevertheless it serves to show that the potential disbenefits are considerable, but some of them can be removed at a cost, and the uncertainties on wider regional issues could compound them. No single factor or combination of factors can be shown at this stage to be an overwhelming reason for not proceeding, on environmental or socio economic grounds, with the next stage. There are so many remaining uncertainties that the Working Party can do no more than express a cautious view that further study could lead to the identification of major impediments on such grounds.

FURTHER WORK FOR THE WORKING PARTY

90. The Working Party is in the process of drawing up a more definitive list of the potential impacts from the proposed Barrage scheme, including an assessment of their nature and extent and costs where determinable. This process will also highlight the existence or otherwise of data that is needed to identify fully the potential impacts but even then it may be that imponderables will remain. The results of this analysis will be used to inform Departments and Ministers of the relevant issues and will act as checklist against which to evaluate comments received from interested parties should a public consultation period be allowed. It is estimated that a resource input of 30 man weeks is required for this work (much of which is directed towards ensuring that interactions between different impacts, thus involving wide consultation, are taken fully into account).

91. The next stage of work if required will be a full assessment of the research that would be needed in any acceptability study in order to reduce to acceptable levels the uncertainty about the nature and cost of impacts. This involves:

i. the specification of further research studies, including:-

- the nature of the analysis required;
- data available;
- need for and form of surveys and models;
- the form of results;
- the identification of resources required and duration of study;

ii. the identification of sources of funding of further research;

iii. the identification of lead organisations to manage the research and the overall programme;

iv. the identification of likely contractors;

It should be stressed that further research should only be initiated in any Acceptability study where it is clear that:

(a) the problem is likely to be important;

(b) existing knowledge is inadequate;

(c) there is a good chance of collecting and analysing data that will really aid decision making.

92. This second stage would most probably lead to revisions of the preliminary analysis. Resource estimates for this element of the work are very difficult to make. It may be that the Volume 2 and supporting material, when available fully to the working party, will reduce the size of the task.

93. To specify the total programme of research is estimated at this stage to require in excess of 150 man weeks work. It is preferable not to start this work until at least a preliminary decision has been made about the economic feasibility of the barrage scheme. If a period of consultation of six months were allowed from

the publication of Volume 2 and a preliminary decision made soon after, the specification of research and its associated costing would be able to be completed within six calender months (in parallel with the Department of Energy's formal evaluation of external opinions). The results of that work would then be included into a final brief for Ministerial decision on the Acceptability Study.

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With the Compliments of

the

Secretary of State

TIDAL POWER FROM THE SEVERN ESTUARY
VOLUME 1

FIFTH AND FINAL DRAFT - ERRATA

PLATE 3 : A SEVERN BARRAGE SCHEME OF 1849

Amend first sentence of description to read:

The illustration shows a proposal based on an earlier idea by Thomas Telford for a barrage to be constructed near the site of the present Severn Bridge.

para 65

Add a sentance to the end:

These figures were derived assuming that at any time only 90% of the turbines would be working.

Fig. 24

The benefit/cost ratios for the high coal cost case were incorrectly given. Also, a footnote has been added. A corrected copy of page 40 is attached.

Annex 5 - footnote g

The numbers given have been corrected and the text changed as follows:

(g) For comparison, actual fuel costs in pence/therm in 1979/80 expressed in December 1980 money values were:

Coal (internationally traded)	15.7
Fuel Oil	19.7
Distillate Oil	31.2
Nuclear Fuel (AGR)	7.3

Annex 9 - amended definition

Water Table is the level below which all fissures and pores in the ground are filled with water.

A number of minor typographical errors and editorial points have been corrected.

ETSU.

15th April 1981

FIG 24: SENSITIVITY OF TIDAL ECONOMICS TO COAL PRICE ASSUMPTIONS IN SCENARIO I

	Coal Price Assumption p/therm		Benefit/Cost Ratio	
	Year 2000	Year 2030	Inner Barrage	Outer Barrage
High	45.9	52.1	1.20	1.05
Reference	34.3	39.3	1.10	0.90
Low	29.7	33.0	1.00	0.85

The use of different coal costs leads to a small change in the plant mix, which slightly reduces the effect on the benefit/cost ratio of the change in coal cost.

Coal prices are in pence/therm for internationally traded coal, shown in December 1980 money values.

Benefit/cost ratio rounded to nearest 0.05.

FIG 25: COMPOSITION OF FUEL SAVINGS OVER THE FIRST 30 YEARS FOR AN INNER BARRAGE