CHAPTER 7: ECONOMIC JUSTIFICATION FOR THE PROJECT

7.1.1 This chapter, which reviews the economic justification for the project, refers to the Technical Assessor’s report, and considers the evidence of Professor Bain for the Beauly Denny Landscape Group and the applicants’ response thereto.

THE CASE FOR THE APPLICANTS

7.2.1 The applicants’ case in support of the economic justification of the Beauly-Denny project is summarised in section 2.3 of the Technical Assessor’s report, which we adopt for the purposes of our report.

Cost-benefit analysis of the proposal

7.2.2 The cost-benefit analysis of the Beauly-Denny proposal and other network reinforcements compares network capital and operational costs over time, with and without network reinforcements, using established discounted cash flow (DCF) techniques. Without adequate network transmission capacity, operational costs are incurred from transmission power losses, and the need to restrict lower cost generation and to use more expensive generation. The capital costs of network reinforcements can be compared to the consequent reductions in operational costs. Power flow studies determined the maximum allowable boundary flows, taking the GBSQSS into account, and recognised the random nature of wind generation output. (Technical Assessor’s report, paragraphs 2.3.1-2.3.3)

7.2.3 SKM’s draft report for Ofgem in August 2004 illustrated the significant reductions in constrained energy and transmission losses which would result from the proposed Beauly-Denny reinforcement. The analysis indicated that the proposal would be justified at a level of 1200MW of installed wind capacity in the north of Scotland, assuming a constraint cost for renewables of £70 per MWh. The final proposals in December 2004 assumed a cost of capital of 8.8%. (Technical Assessor’s report, paragraphs 2.3.4-2.3.5)

7.2.4 SKM prepared an updated cost benefit analysis for the applicants in 2006, to reflect increased capital and generation costs, amongst other things. The wholesale price of electricity had doubled between 2004 and 2006; a constraint cost of some £80/MWh was applied; and a cost of capital of 6.25%. The 2006 analysis indicated that a balance between capital and avoided operational costs was reached with about 880MW of installed wind capacity. (Technical Assessor’s report, paragraph 2.3.6)

7.2.5 The applicants’ sensitivity analysis indicated a break even wind capacity of 1,084MW using the renewable energy constraint costs used by Ofgem in 2004 and the same cost of capital. The “low cost case” where constraints and losses are only valued at generation replacement fuel costs (about £30/MWh), based on forecast 2007 and 2008 costs, indicates a break even wind capacity of 1,282MW. (Technical Assessor’s report, paragraphs 2.3.7-2.3.9)
7.2.6 Compared to a “do nothing” option, the Beauly-Denny proposal is estimated to provide savings in constraints costs and losses of almost £1,000m when evaluated through to 2027. (APL 4/6, Table 3)

**Evaluation of alternative reinforcement options**

7.2.7 A comparison of the capital costs and break even wind capacity of alternative reinforcement options showed that the three alternatives involving the uprating of the Beauly-Denny line (i.e. 275kV light construction, dual 275kV, and the proposal) would be significantly better than any of the alternatives. A DCF analysis which considered the costs of constraints remaining following reinforcements until 2027, based on the various installed wind capacity trigger points, found that the proposal would provide the greatest long term benefits, followed by the dual 275kV option, and then by the 275kV light construction option. Sensitivity analysis using a range of constraint and losses costs produces a similar ranking, and confirms that the proposal provides the greatest economic benefits in all of the cases considered. (Technical Assessor’s report, paragraphs 2.3.10-2.3.13)

7.2.8 The truncated Net Present Value (NPV) valuations are equivalent to a situation where all renewable generation is effectively retired in 2027, thereby returning the network to the minimal constraint situation that has applied in the past.

7.2.9 The low cost scenario considers only generation substitution costs, i.e. with no ROC, climate change levy (CCL), etc. incentive whatsoever, and therefore demonstrates the robustness of the proposal against changes in the financial incentive to renewable generation and/or changes in the treatment of constraint payments in the wholesale market.

7.2.10 The sensitivity analysis considered a “high wind” scenario of 2.6GW of new renewables connected north of the north-west boundary by 2020, and a “low wind” scenario with 1.6GW in the same time period. The results indicated that the Beauly-Denny reinforcement provided the greatest economic benefit, and the Beauly-Denny options were about 30% cheaper than the next best alternative reinforcement.

7.2.11 A DCF analysis to consider sequences of investments, which extended the NPV period beyond 2027, showed that the proposal is the most economic first investment and, when followed by the rebuild of Beauly to Blackhillock, represents the most economic sequence of investments. However, if there is uncertainty about the level of wind generation which will ultimately connect to the system, it might be more prudent to reconductor Beauly-Blackhillock as an intermediate step following completion of the Beauly-Denny proposal. (Technical Assessor’s report, paragraphs 2.3.14-2.3.15)

**THE CASE FOR SIR DONALD MILLER**

7.3.1 Sir Donald Miller’s evidence on this matter is summarised within section 3.1 of the Technical Assessor’s report, which we adopt for the purposes of our report.

7.3.2 The costs of wind generation plus back-up costs and transmission reinforcements, less carbon benefits, amount to £56.2/MWh, which is twice the value
of bulk power on the market. Payments to wind generators plus generation support and transmission charges paid by customers, less transmission charges paid by wind generators and carbon benefit, amount to £92.5/MWh, which is some three times the market price of bulk power. The total increase in annual costs of the 6GW renewables target for Scotland even by 2010 would reach £300m, and by 2020 the additional sums in Scotland would amount to some £3500m. (Technical Assessor’s report, paragraphs 3.1.8-3.1.11)

7.3.3 The present system in the UK gives no financial incentive to the owner and operator of the transmission system to minimise his investment. Once Ofgem has approved the investment, he is assured of a satisfactory return on the expenditure. (Technical Assessor’s report, paragraph 3.1.13)

7.3.4 Ofgem’s assessment did not examine alternative schemes to see whether they could offer better value for money or have other planning advantages. Moreover there is a risk that many of the wind generation developments will be delayed or fail to receive planning permission, which would result in premature or stranded investment. The high price of energy in the Ofgem study of £70/MWh (compared with £25/MWh for thermal energy) is not sustainable in the long term, and is far higher than any expected valuation of carbon emissions. (Technical Assessor’s report, paragraphs 3.1.14-3.1.15)

7.3.5 There appear to be several defects in the methodology, which bring forward the date when the expenditure is said to be justified. The proposal would not remove all the constraints on the export of power from wind generators in the north of Scotland, as the capacity of the Scotland/England interconnector (2.2GW) is largely taken up with existing generation. The Ofgem study also discounts the use of some 400MW of hydro capacity north west of Beauly to reduce the amounts of constrained-off wind energy, and under-estimates the potentially significant contribution of Foyers pump storage station which should have been included in the economic assessment. The study ignores the costs of transmission overheads, operation and maintenance, which should be discounted and added to the capital costs of the reinforcement. For these reasons the cost of the Beauly-Denny line could only be justified, if at all, for a substantially larger capacity of wind power than 1,200MW in the north. (Technical Assessor’s report, paragraphs 3.1.16-3.1.17)

TECHNICAL ASSESSOR’S FINDINGS

7.4.1 The Technical Assessor’s findings and conclusions on the economic justification for the proposal are given at paragraphs 4.2.20-4.2.31 of his report, and are summarised below.

Cost benefit analysis

7.4.2 The applicants’ economic case for the proposal is based on capital investment to reduce constraint costs on the MITS as the volume of renewable generation increases in the north of Scotland. The GBSQSS permits investment in projects which can be economically justified (paragraph 4.3), and requires investment to meet operational security criteria provided that the measures are economically justified (paragraph 4.10).
7.4.3 The report by SKM in 2004, which contained an economic appraisal of the project, showed that the proposal would make substantial reductions in constrained energy and transmission losses, compared to the existing network, as installed wind capacity increases. Ofgem concluded that the proposal would become cost effective when around 1200MW of wind generation was connected to the network, and approved the investment, which it designated “baseline investment”, in December 2004.

7.4.4 Sir Donald Miller’s concerns about Ofgem’s methodology are noted, but the Technical Assessor considers that the economic case for the project should be assessed in the context of the current market framework which was established by the Government. The cost of generating renewable energy is relatively high because of Government incentives to encourage renewable energy schemes.

7.4.5 The Technical Assessor attaches significant weight to Ofgem’s approval of the investment in 2004, and finds that the applicants have demonstrated in 2006 that the economic justification for the project remains sound. Even on the basis of SHETL’s lower limit of 5.2GW of renewable energy in their area, with break even figures of 880-1280MW the Technical Assessor is satisfied that the proposal is easily justified on economic grounds.

7.4.6 The economic case is strong because of the high value of constrained energy costs used in the analysis, the spread of wind output during the year and the limitations of the existing transmission network. The economic case remains sound even if low values are used for replacement fuel costs.

**Economic evaluation of alternative reinforcement options**

7.4.7 An economic comparison of the proposal with a number of AC and DC alternatives shows that the three options along the Beauly-Denny corridor have much lower break-even wind capacities, and much more favourable NPV, than other schemes. The proposal and the similar dual 275kV L12 option are also shown to be the best first step reinforcements.

7.4.8 The Technical Assessor finds that the proposal, and the light duty 275kV (L3) and heavy duty 275kV (L12) schemes, offer much better value for money than other AC or DC schemes. The light duty 275kV scheme would have the lowest capital cost (£290m), but if renewable generation grows to the anticipated level the proposal would be the best first step reinforcement. The construction of the heavy duty 275kV line would offer a £10m saving over the proposal, but the proposal would be slightly better in the long term.

7.4.9 In the context of section 9(2)(a) of the Electricity Act 1989, the Technical Assessor considers that the 275kV option is slightly more “efficient” (i.e. cheaper), but that the proposal is slightly more “economic” (i.e. more favourable break-even wind capacity and NPV analysis).
THE CASE FOR THE BEAULY DENNY LANDSCAPE GROUP

Background

Targets for renewables

7.5.1 The 40% target governs the level of wind and other renewables capacity across Scotland as a whole which will be required by 2020. It is equivalent to 17.2TWh of energy, to be supplied by hydro, wind turbines, and other renewable sources, principally biomass. The 40% target has now been replaced by the 6GW target. There is no Scottish Executive target for wind generation in the Highlands. With agreed upgrades to Sloy, in south-west Scotland (Kendoon) and to the Scotland-England interconnector FREDS has estimated that the transmission network could cope with up to 4GW of wind generation in the SPT area alone, which would be sufficient to meet the 40% target. Having regard to the wind capacity which already exists in the SHETL area, it follows that the 40% target could be met, or exceeded, without any further wind development in the Highlands.

Economic incentives for investment in wind farms

7.5.2 The Government creates incentives for windfarm development through the price that developers expect to receive for the energy they generate. Currently this has 3 elements: Renewables Obligation Certificates (ROCs); Climate Change Levy Certificates (CCLs); and the wholesale price of energy.

7.5.3 The Renewables Obligation scheme, which sets electricity supply companies a target for the proportion of their output that must be generated from renewable sources, will end in 2027. Recent values of ROCs have been in the £40-45 per MWh range, but future values are uncertain.

7.5.4 The CCL is a tax on energy use paid by producers in a wide range of industries. Electricity produced from renewable sources is exempt, and can therefore be sold to industrial users at a higher price than electricity from conventional generators. There is no guarantee that the CCL will continue indefinitely; the justification for it will disappear if climate change considerations affect fossil fuel prices directly.

7.5.5 Under the current electricity trading arrangements the wholesale electricity spot prices vary half-hourly throughout the day and throughout the year. Independent windfarm developers are, however, affected by contract prices for their output over extended periods, which reflect the costs of generating electricity by other means, including in particular fossil fuel costs, the intermittent nature of wind turbine output, and any tax or other arrangements affecting conventional generators. The increase in gas and, to a lesser extent, coal prices since 2003 has increased wholesale electricity prices, but it is a matter for speculation whether these relatively high prices will persist, increase, or be reversed in future. The European Emissions Trading Scheme also affects wholesale prices.
Windfarm development

7.5.6 For windfarm development to take place three conditions must be satisfied: the developers must expect it to be profitable; planning consent must be granted; and access to the national grid to transmit electricity must be secured.

7.5.7 The cost of developing windfarms in the Highlands is relatively high, and transmission costs are high because much of Scotland’s electricity is exported. Expected profitability is the excess of the revenue from electricity generated over predicted costs, including the capital cost of constructing the windfarm itself, the capital cost of connecting the windfarm to the grid, annual operation and maintenance costs, and annual grid charges for transmitting electricity. If annualised revenue exceeds annualised cost (i.e. NPV is positive) the project is expected to be profitable. The charges for the use of the grid, which are revised annually, are a significant element in total costs.

7.5.8 THC’s Highland Renewables Strategy confines major windfarm development to three preferred areas, with the result that THC’s own targets for these areas represent an upper bound for the likely level of development.

7.5.9 Faced with a flood of applications to connect, it became clear that the transmission capacity of the grid south from the Highlands was insufficient to cope with more than a fraction of the proposed developments. Therefore the licensees made their offers conditional on Beauly-Denny. The distinction between conditional and unconditional offers is crucial to an understanding of the economic case for the line.

Ofgem’s methodology and analysis

7.5.10 The critique on behalf of BDLG focuses in particular on the analysis carried out by Ofgem (CD L15) supporting its decision to approve the proposal, which led Ofgem to judge that the line would be warranted if wind capacity in the Highlands exceeded 1200MW.

Structure of Ofgem’s analysis

7.5.11 Ofgem’s analysis takes account only of the financial considerations as they apply to the grid. It is not an economic evaluation of the proposed project. The key elements in Ofgem’s analysis are:

- a technical evaluation of the energy likely to be constrained-off the system if the project is not carried out, for different levels of wind turbine capacity;
- an estimate of the compensation payments associated with constrained-off energy and of savings due to the reduction in transmission losses;
- comparison of the discounted value of these payments and savings, for different levels of wind turbine capacity, with the capital cost of the project;
- a forecast of the likely level of new generation.
Constrained energy volume and loss analysis

7.5.12 SKM’s estimates (CD L16) take account of the limited capacity of the grid, the existing pattern of demand load and supply from hydro stations in the north of Scotland, and the variability (seasonal and other) of wind generation. The boundary capabilities are determined partly by the physical characteristics of the grid lines and associated substations, but also by the security standards which apply to the GB transmission network. As wind capacity increases the rise in the proportion of potential energy which is “lost” as result of the existing grid constraint means that increasing wind capacity beyond some cut-off point will be worthwhile only if the grid is reinforced.

7.5.13 SKM’s figures take no account of “the possible mitigation of constraints by making use of the pumped storage facility at Foyers”. (see Chapter 5 of this volume and below)

Cost constraint valuation

7.5.14 In its evaluation of the constraint costs that would arise if Beauly-Denny is not carried out Ofgem assumed that the present ROC regime would continue until 2027, after which it would fall away and be replaced by a scheme which funds the social cost of carbon (estimated at £7/MWh). The constraint costs were estimated as £65-75/MWh (£25-30/MWh as the estimated cost of replacement generation and £40-45/MWh as the value of the ROC plus an allowance for some benefit from CCL exemption up to 2027) and £32-37/MWh thereafter (energy value plus social cost of carbon).

7.5.15 The fuel costs and power price projections used by SKM were based very heavily on the experience of 2005 and 2006, when gas and power prices were very high by historical standards. Effectively these high prices were extrapolated forward for a period of 20-40 years, which is an unsound approach.

New generation forecast

7.5.16 Ofgem first considered whether the underlying economics of windfarms at the present time were conducive to further development, and then used SKM’s central forecast as a guide to the amount that was likely to take place. Ofgem concluded that the financial incentives were sufficient to encourage the development of more windfarms (CD L15, paragraph 3.11). Ofgem noted that SKM’s central forecast of wind capacity north of Beauly was greater than its own estimate of the break even level (1200MW) and accordingly approved Beauly-Denny as a baseline investment.

Critique of Ofgem’s analysis

Constrained energy volumes

7.5.17 Ofgem’s analysis is based on the implicit assumption that the GB-wide security standards will continue to apply. (see Chapter 5 of this report)
7.5.18 The GBSQSS (CD L11) contradicts the applicants’ statement that intertripping should not be relied upon. Operational measures can be applied if economically justified, and paragraph 4.10 refers to balancing services (which would include hydro and pumped storage). Operational intertripping is recommended for the purposes of planning and investment. Paragraph 12 of Annex E to the White Paper (CD L06) notes the potential for the system to be “over-engineered” in some instances. Paragraphs 20 and 21 of Annex E, which refer to intertripping, highlight the hidden “non-firm” capacity of the system. Use of operational intertripping allows the use of the whole capacity of the system.

Constraint costs: critique

7.5.19 Ofgem is incorrect to treat all the energy constrained off the system as giving rise to constraint costs at the levels assumed in its analysis, because:

- compensation payments arise only when the transmission licensee has made unconditional offers of connection to the grid, whereas for much of the expected growth in wind capacity only conditional offers have been made;
- SKM and Ofgem have wrongly assumed that all the energy constrained off will be renewable, and therefore eligible for ROCs. If large scale hydro was constrained off, no compensation for ROCs would be payable. Moreover, since reservoirs act as a storage device, energy not generated today is not usually lost, but can be generated tomorrow;
- the Government’s proposals for the ROCs scheme post 2015 would reduce the ROCs for onshore windfarms, thereby affecting the level of any constraint payments;
- there is a significant possibility that wind turbines will not be replaced at the end of their useful lives, in which case constraint costs will diminish sharply after about 2030.

Natural hydro generation

7.5.20 There are two problems with the treatment of hydro by SKM and Ofgem. Firstly, the Ofgem analysis is focused on the compensation payments due from the grid to constrained off generators. If the generator is not eligible for ROCs, no compensation in respect of ROCs will be payable. Assuming that NGC constrains off the least expensive generators first, a significant proportion of the generation constrained off will not attract ROCs. Secondly, water retained in the reservoirs of large schemes can be used at a later time, and only if the reservoir becomes over-full is it lost for ever. This means that in general the loss of profit to the generator will only be the difference between the electricity price at the time it is constrained off and the price at the later time when the generator is operated. Thus the compensation payable to hydro generators constrained-off the system is likely to be small.

The outlook for ROCs

7.5.21 Ofgem’s assumption about the value to be attached to ROCs has been overtaken by events. The DTI/National Audit Office report on renewable energy noted that the level of ROCs was excessive for onshore windfarms, and the
Government’s 2006 Energy Review proposed that the RO be adapted through a “banding” system to provide greater support to emerging technologies and less for established technologies. The Government has announced its intention to freeze the buy-out price (in money terms) at the 2015/16 level; to increase the RO beyond the 15.4% set for 2015/16 only if warranted by actual renewable generation; and to limit it to 20%. The “banding” proposal is likely to result in a substantial reduction in ROCs income for new onshore wind farms in the north of Scotland after 2010.

7.5.22 There is also considerable uncertainty over the future of the CCL and the effect on energy prices of any carbon emissions trading scheme or carbon tax. The combined effect of ROCs, CCL and the emissions trading scheme (ETS) on the level of compensation paid is expected to decline from about £35/MWh in 2012 when new windfarms may come onstream if Beauly-Denny goes ahead to about £25-30/MWh in 2020 and about £25/MWh in 2027, thereafter falling to £10/MWh when the ROCs scheme is terminated. Windfarms which are in operation in 2010 will be “grandfathered” and will continue to receive ROCs at the current level, but it will be in NGC’s interest to ensure that wind generators constrained-off the system are those that are entitled to the lower levels of compensation.

Non-renewal of wind turbines

7.5.23 Ofgem’s analysis assumes implicitly that wind turbines will continue in operation over the 40 year life of Beauly-Denny, i.e. that the turbines will be replaced at the end of their 20 year lives. However in the absence of substantial support arrangements windfarms would not be economic today, and it cannot be assumed that they will be replaced in the absence of these arrangements. There is a significant risk that windfarms will be a temporary phenomenon, in which case the grid connection between Beauly and Denny will be left with considerable excess capacity. Subsidies have already been cut in Spain; are to be reduced in Germany; and have been abandoned in California.

The Foyers pumped storage facility

7.5.24 Foyers provides important system support services. It maintains a spinning reserve, and can supply significant power at 15 seconds’ notice, which helps to balance supply and demand in the grid as a whole. However, if the grid capacity between Beauly and Denny is full it will be impossible for Foyers to operate in this way. With substantial wind capacity north of Beauly this is likely to be a relatively frequent occurrence. BDLG considers that considerably more than 100MW of additional mitigation may be available from Foyers if its existing role in the system is not treated as a non-negotiable asset. Most of the time Foyers could be used to absorb 300MW when the wind is blowing at the most favourable level.

Effect on Ofgem’s break-even level

7.5.25 If hydro schemes were not run when grid capacity was fully utilised by wind farms, the break-even level would be raised by about 300-350MW, at very little cost in terms of compensation payments, to 1500-1550MW. Taking account of proposed changes to the ROCs regime and other changes in support arrangements would raise the break-even level by about 150MW. The use of Foyers would add at least
100MW. Overall, taking account of the variables referred to above would raise the level of wind capacity required to justify Beauly-Denny from the 1200MW in Ofgem’s analysis to a minimum of 1750MW.

7.5.26 Taking advantage of the flexibility incorporated in the GBSQSS adds over 500MW to the north-west boundary condition. (see Chapter 5 of this volume)

7.5.27 If an allowance of 50MW is made for the increase in boundary condition conceded by Mr Punton, an additional 50MW for growth in local demand, and conservative figures of 250MW for the effect of hydro north of Errochty and 300MW for Foyers, and 500MW for operational intertripping, a break even level of 2,500MW is produced, using Ofgem’s methodology.

The forecast level of new generation

7.5.28 SKM’s central estimate of 1500MW of onshore wind generation capacity north of Beauly, which Ofgem relied on in its analysis, is not now supported by the evidence. Adding all operational windfarms in THC area, together with schemes not determined or under appeal or at scoping stage (assuming the 35% success rate noted in the BWEA Annual Report, 2005), gives an estimated total of under 1100MW. However, approval rates are likely to fluctuate from year to year, and some proposals that do not conform with THC’s strategy will be dropped.

7.5.29 From THC’s total of 4000MW of installed capacity in 2020, the following can be deducted: 500MW of hydro, because it could be shut down without substantial constraint costs; 1000MW of offshore wind, because it is speculative and would connect to the grid east of SHETL’s north-west boundary; and 400MW of wave and tide, because it is too speculative. This leaves a target (i.e. not a prediction) of 2100MW which leaves a margin of 400MW compared to the break-even point for the investment of 2500MW. Hence the investment cannot be economically justified.

Economic assessment of wind farms – the treatment of grid costs

The double counting issue

7.5.30 Ofgem has overlooked the fact that NGC is not committed to making compensation payments in respect of any windfarms other than those to which it is already contracted on an unconditional basis. Where connection contracts are conditional on Beauly-Denny no compensation payments will be due if it does not go ahead, and those generators would be the first to be constrained off. Ofgem’s methodology treats compensation as payable in all circumstances. The actual level of unconditionally contracted capacity, which would give rise to compensation payments if it was constrained off the system, falls far short of the 1200MW which Ofgem found to be the critical level.

7.5.31 The problem arises because of the separation of the assessment of the economic viability of proposed windfarms from the assessment of the economic viability of the reinforcement to the grid infrastructure that is required to deliver the product of the windfarms to their markets. If one is conditional on the other, any proper economic assessment must view the two projects together.
7.5.32 If the windfarm development is contingent on grid reinforcement the procedure employed results in double counting of the value of ROCs and CCL exemptions. The attributed value of ROCs and exemption from the CCL is included in the revenue that developers take into account, and the same value is included again in the calculations undertaken by Ofgem to decide whether or not capital expenditure on grid reinforcement is worthwhile. To justify the windfarm development the projected income has to be credited with revenue from the ROCs and CCL exemptions, and taking them into account again in valuing constraint costs involves double counting.

Conditional and unconditional contracts

7.5.33 It is likely that some of the “contracted” generation will not obtain planning consent, and the total capacity to which NGC is committed to make compensation payments if the generator is constrained off the grid probably falls short of 800MW. Since April 2004 (ES, Volume 2, chapter 3, figure 3.3) there has been a very large increase in the conditional category.

Indicative business case analysis

7.5.34 To assess the economic viability of investment in windfarms and Beauly-Denny together, the analysis for BDLG has considered the likely revenues from generation and likely costs that would be incurred for varying levels of wind capacity dependent on Beauly-Denny going ahead, assuming that 800MW with unconditional contracts will be constructed. The issue is whether further windfarm development is justified if that development entails the capital expenditure involved in Beauly-Denny.

7.5.35 The business case analysis for BDLG shows that, ignoring the costs of Beauly-Denny, the present value of the net revenue from additional windfarms north of Beauly appears to make them viable up to a total windfarm capacity of around 3000MW. However, when the capital cost of Beauly-Denny is added, no matter how much windfarm development takes place the revenues are insufficient to meet the total cost. For example, an additional 1200MW of wind capacity (taking the total to 2000MW) would produce net revenue estimated at £950m, compared with a capital cost for windfarms estimated at £780m. This leaves a surplus of only £170m, in comparison to the capital cost of Beauly-Denny estimated at £332m.

7.5.36 These calculations are only indicative, but the assumptions made are regarded as middle of the road. It is accepted that energy prices have never remained static, and that a higher price in the long term would change net revenue and thereby the business case analysis. However, the conclusion is that on a proper assessment that avoids the double counting inherent in Ofgem’s methodology and makes realistic assumptions about future revenues and costs, the economic case for Beauly-Denny has not been made. The cost-benefit analyses by Ofgem and the applicants have neither taken account of the effects of the Scotland-England interconnector in limiting transmission through the Beauly-Denny line nor, alternatively the cost of future upgrades.
THE APPLICANTS’ RESPONSE TO THE EVIDENCE OF THE BEAULY DENNY LANDSCAPE GROUP AND SIR DONALD MILLER

7.6.1 The cost-benefit analysis does not support the contention that the reinforcement is over-engineered, which is the main concern if there is a possibility that the load factor is too high. This has been accepted by Ofgem, which has not expressed any concern that the project is over-engineered. The proposed reinforcement would facilitate competition in generation even during periods of high loadings from the windfarms, thereby avoiding access to the market being restricted.

7.6.2 The suggestion on behalf of BDLG that the trigger point for reinforcement is 2500MW is not based on any technical analysis provided to the inquiry from a suitably qualified system planning engineer.

7.6.3 The contention that the cost-benefit analysis is flawed because it did not take account of the cost of the upgrades to the interconnector, ignores the expectation that conventional plant will close in the foreseeable future and within the same timeframe as renewables connecting in greater volumes onto the system. The upgrades to the interconnector that have been approved have been independent of whether Beauly-Denny proceeds. There are no plans for a third interconnector.

7.6.4 By removing its “spinning reserve” role of Foyers, the associated reservoir storage is equivalent to only 16% of its total storage, and is insignificant when compared with the variations in wind farm generation output at higher installed capacity levels.

7.6.5 Suppliers, and not generators, have an obligation to source a certain percentage of their electricity supply from eligible renewable sources. These generators are then issued with ROCs for their qualifying output. If suppliers do not have sufficient ROCs they make an equivalent payment at the “buy-out price” into a dedicated buy-out fund, which is administered by Ofgem and redistributed to suppliers (not generators) according to how many ROCs they have presented.

7.6.6 BDLG assume a very low and stable electricity wholesale price over the period 2012 to 2028. At a wholesale price of £22/MWh, no new build generation of any type would be economic. There appears to be little to suggest that, over the medium to long term, prices will fall on a sustained basis to below the cost of new entry. Wholesale UK electricity prices are closely linked to the price of gas, which in turn is linked to the price of oil. While fossil fuel resources will remain relatively abundant, the geopolitics of their distribution is complex, with a generally upward impact on prices that is likely to be intensified in the future.

7.6.7 In any case, the dispute on the cost of wholesale electricity and renewables generation is of limited relevance. It is submitted that there is sufficient volume of contracted generation to justify the project at 1200MW, which is the trigger identified in the 2004 SKM report, and accepted by Ofgem.

7.6.8 FREDS has revised the 2020 electricity demand figure in Scotland to 49.5TWh, which means the renewables target for 2020 is over 6.5GW, and the
contribution of wind requires to increase by almost 4GW. (see Chapter 5 of this volume)

7.6.9 The global market for wind power has been expanding faster than any other source of renewable energy, and wind energy worldwide has had an annual growth rate of 23% over the last 15 years. The total installed capacity globally has increased from around 4,800MW in 1995 to 59,000MW by the end of 2005. Given the rapid technological and cost advances associated with an emerging technology, which had an international market turnover in 2006 of more than €13 billion, it appears implausible that wind technology will be a “temporary phenomenon”.

7.6.10 On the issue of “double counting”, from a regulatory perspective the applicants must start from the premise that the generators require to be connected. The conditional contract does not remove that obligation, but to protect the security of the system it is conditional on the reinforcement being put in place. Once it is accepted that they have to be connected at some point, the only issue then is when it is economic to do so. The cost-benefit analysis reflects the obligation on the applicants to carry out the works that are necessary to enable the connections to be made.

7.6.11 Where it can be argued that double counting has occurred, it only applies to the constrained energy of the renewable generation production, i.e. about 11% for the reference “1200MW” case. The significant reductions in transmission losses that would result from the proposed network reinforcement, together with benefits such as increased overall network security, will all work to reduce the significance of any double counting issues.

7.6.12 BDLGs assume a low energy value of £22/MWh, compared to the lifetime costs for generation, which will increase with lower load factor operation. Taking the higher “marginal” cost into BDLG’s “business case analysis” indicates that annual revenue for 1200MW wind generation would increase by about £55m, and £455m should be added to the revenue stream.

7.6.13 In response to Sir Donald Miller’s point about transmission overheads, operation and maintenance, SHETL advises that annual operational costs allowed by Ofgem equate to only about £500,000, i.e. around 0.2% of the cost of this £350m project.

REPORTERS’ FINDINGS AND RELATED CONCLUSIONS

Technical Assessor’s report

7.7.1 The economic case for the project is based on capital investment to reduce constraint costs on the transmission system as the volume of renewable generation increases. Ofgem has already approved the capital investment for the project, based on a break even wind capacity of 1200MW (Technical Assessor’s report, paragraph 5.2.2). The more recent appraisal on behalf of the applicants in 2006 indicates an even more favourable break even wind capacity of 880MW.
7.7.2 We accept the Technical Assessor's overall conclusion that the necessary investment for the project is easily justified, using the Ofgem methodology, in view of the growth in renewable generation anticipated in the north of Scotland (a potential 7.7GW of renewable generation in SHETL's area), even taking SHETL's lower limit of 5.2GW in their area. We also note that the relevant technical standard (GBSQSS) makes provision for reinforcement projects which can be economically justified. (Technical Assessor's report, paragraph 5.1.4)

7.7.3 We agree with his conclusion that the applicants have demonstrated that reinforcement options along the Beauly-Denny corridor are much more economic than other AC or DC schemes. Although the scheme with the lowest cost of the viable options would be a light duty L3 275kV overhead line, the current proposal would be the best scheme in the long term providing the growth in renewable energy increases to the levels expected. We note that the economic case for the proposal and the heavy duty L12 275kV line are very similar, but given that the latter alternative would offer only a marginal saving of £10m (i.e. less that 3%) on an expenditure of £350m and would be an inferior choice in the longer term, we can see little economic advantage in pursuing that option (Technical Assessor's report, paragraph 5.1.5). (see Chapter 6 of this volume)

**Objection by Sir Donald Miller**

7.7.4 The main thrust of Sir Donald Miller's evidence which is reported above amounts to a general economic critique of the Government's policy in support of wind generation, and of Ofgem's role in approving associated investment, rather than an appraisal of the specific merits or otherwise of the Beauly-Denny grid reinforcement proposal which is before the Scottish Ministers. He also highlights the high costs for renewable energy relative to the wholesale price, which is illustrated in APL 4/9. However, this is due to arrangements which the Government has put in place (notably the RO) to incentivise the development of renewable energy schemes (Technical Assessor's report, paragraph 4.2.23). Although Ofgem did not consider alternative schemes, the principal options were evaluated in APL 4/6 by examining the associated constraints and transmission losses.

7.7.5 It should be borne in mind that the public inquiry, and this report, concern the application to Scottish Ministers under section 37 of the Electricity Act to install the proposed high voltage transmission line between Beauly and Denny, and not Ofgem's decision in 2004 to approve the expenditure for the project. Moreover, our recommendations to the Scottish Ministers will be made in the context of extant Government policy, and the current market framework which has been put in place by Government. The decision on this section 37 application cannot reasonably be predicated on some possible future change in Government policy, or different market framework or system of support, which may be desired by the objectors.

7.7.6 Sir Donald's concerns about the methodology and assumptions employed in the Ofgem study are considered below.
Objection by Beauly Denny Landscape Group

7.7.7 BDLG’s evidence on targets for renewables in general and windfarms in particular (referred to above) is addressed in Chapter 5 of this volume, which considers the technical justification for the project. For the reasons given in Chapter 5 and below we do not accept BDLG’s contentions that the project would only become viable at a break-even level of 1750MW (or even 2500MW), and that the expansion of wind generation in the north of Scotland will be restricted by the capacity of the Scotland-England interconnector.

7.7.8 We can understand the attractiveness of the suggestion that Foyers pumped storage scheme could be used in harness with wind generation. However the potential role of Foyers has been studied in some detail by SKM who found that its contribution would be equivalent to only a 100MW reduction in wind generation capacity, which would not affect the economic justification of the project to a material extent. Similarly, the limited water storage available restricts the extent to which hydro could be employed to match available network capacity. (see Chapter 5 of this volume)

7.7.9 We acknowledge that the rapid expansion of renewable energy in general, and specifically wind generation, has been underpinned by a system of strong economic incentives. We also note that the Renewables Obligation is due to end in 2027, and the 2006 Energy White Paper proposed a banding system to shift support towards emerging technologies.

7.7.10 However, the growth of wind power as an energy source is a worldwide trend, with installed capacity having increased more than 12 fold within a 10 year period to 2005. Having regard to the increasingly demanding targets which are being set by the UK and Scottish Governments, and the increasing efficiency of wind turbines, there is little evidence to support the BDLG’s case that wind generation is likely to be a temporary phenomenon and that wind turbines may not be replaced at the end of their useful lives.

7.7.11 In any case, we note that the cost-benefit analysis of this project assessed the NPV up to 2027, which is the end date of the Renewables Obligation, and found that the proposal offered the greatest economic benefit even in the “low wind” scenario with 1.6GW of new renewables connected north of the north west boundary by 2020 (APL4/6, 4.5.2).

7.7.12 Professor Bain for BDLG, and Sir Donald Miller, suggest that the Ofgem analysis has overstated the likely constraint costs, which would have the result of bringing forward the break-even point and exaggerating the economic benefits of the proposal. In response the applicants contend that wholesale electricity prices are unlikely to fall to below the cost of new entry, and expect the generally upward trend to be intensified in the future. We note that the sensitivity analysis for the applicants found that even where constraints and losses are valued at only £30/MWh the scheme would still break even at 1,282MW. We conclude on this point that the proposal appears to be economically robust even if low constraint costs were assumed.
7.7.13 We consider that the concern about possible “double counting” in the cost-benefit analysis is over-stated. Under the terms of their transmission licence the applicants are obliged to implement the measures that are required to enable generators to connect, in accordance with the requirement of section 9(2)(b) of the Electricity Act 1989 to facilitate competition in the supply and generation of electricity. Conditional contracts merely affect the timing of that connection. Even if “double counting” affected around 11% of the constrained energy for the 1200MW case, the proposal would still be economically justified. Moreover, the importance of “double counting” would be lessened by the reduction in transmission losses and the increase in network security.

7.7.14 We note Sir Donald Miller’s point that transmission overheads, operation and maintenance costs should have been included in the cost-benefit calculations, but given that annual operational costs would be only about £500,000, we do not consider that their inclusion would have had a significant effect on the outcome.

7.7.15 We appreciate BDLG’s argument that the economic viability of windfarms and that of the grid reinforcement should be assessed together. However in practice this would be most difficult to achieve, not least because of all the variables influencing the expansion of wind generation. We are content that the approach employed by Ofgem, which estimates the capital investment to reduce constraint costs on the network as renewable generation increases in the north of Scotland, is a sound basis to evaluate the economic justification for the project.