

**PRECOGNITION**

**by**

**Simon Allen**

**On Behalf Of**

**STIRLING BEFORE PYLONS &  
FRIENDS OF THE OCHILS**

**in relation to**

**THE STIRLING LOCAL SESSION OF THE  
BEAULY - DENNY PUBLIC INQUIRY**

**19<sup>th</sup> October 2007**

**Undergrounding**

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## 1. Introduction

- 1.1 I am Simon Allen, a Chartered Accountant and Management Consultant with over 20 years experience of consulting in the electricity industry with PricewaterhouseCoopers (where I was European Head of Utilities in the Corporate Finance division), ICF International (where I was Head of European Operations) and now as an independent consultant.
- 1.2 My work within the UK electricity industry began in 1988 and included 3 years on the restructuring and privatisation of the 12 Area Boards in England & Wales and the National Grid Company. In 1995/6 I worked on secondment as Head of Due Diligence at Nuclear Electric leading up to its integration with Scottish Nuclear and privatisation as British Energy.
- 1.3 I have also spent several years working in Europe and in recent years have advised the European Commission on the potential for undergrounding high voltage electricity transmission networks in Europe and the standard costs associated with the construction of 380kV transmission assets across Europe.
- 1.4 I have appeared as a witness at the Strategic Session and Inverness Local Session on behalf of the Eilean Aigas Estate.

## 2. Reasons for Undergrounding

- 2.1 The section of proposed line between the substations at Braco and Denny passes through Allan Water, the moorland area of Sherrifmuir, the western edge and scarp southern slope of the Ochil Hills, to the east of the Wallace Monument, across the River Forth and close to the settlements of Fallin and Cowie. It then crosses the M9 motorway and passes close to the settlement of Plean.
- 2.2 The reasons for undergrounding sections of the line between Braco and Denny were outlined in the Statement of Case submitted by Stirling Before Pylons and Friends of the Ochils in January 2007. The section of this line in the Stirling area crosses a number of sensitive areas including Sherriffmuir, the Ochil Hills AGLV and the National Wallace Monument. It is believed that the presence of an overhead line will have a significant detrimental effect on the landscape throughout this area.
- 2.3 This point was highlighted by MSP Keith Brown at the Scottish Parliament Members' Business Debate on 19<sup>th</sup> September 2007 (motion S3M-97) on the Beauldy Denny Public Inquiry (Document StBP/2/24). He described the area as "a landscape experience that is unique in Scotland" and stated "My constituency is not the only scenic stretch of the route—far from it—but Ochil is scenic and historic. The Wallace monument, which is no less than a symbol of Scotland's nationhood, looks out on to a landscape that will, if the proposal succeeds, be bisected by concrete and steel. Those of us who are familiar with Scottish history will recognise the significance of the battle of Sheriffmuir. I worry that, 300

years on, we may as a country take a decision that would run huge electricity pylons right through the middle of that battlefield”.

- 2.4 The proposed overhead line also passes very close to the settlement of Fallin and other villages. According to Keith Brown “The eastern villages of Stirling are often forgotten about in this context but have regularly been seen as a dumping ground for pylons and various other public utilities, to the detriment of their people”. The Applicants’ current proposed route would appear to endorse this view.
- 2.5 “Major adverse” visual impacts for some properties were identified by the Applicants in the Environmental Statement which disclosed that 3 properties would be within 100metres (m) of the line, 23 within 200m and a further 333 within 600m (as shown in the extract from table 17.4 in the Environmental Statement below). It should also be pointed out that the application for the overhead line relates to a “corridor” and as such more properties could be affected if the corridor is moved by the contractor for technical reasons.

Route Section	Number of Properties				Notes
	0 – 100m	100 – 200m	200 – 300m	300 – 600m	
Braco to Cambushinnie Wood	0	0	2	0	Isolated residential properties
Cambushinnie Wood to Bridge of Allan	0	3	4	25	Isolated residential properties and some properties within Kinbuck Village (19 properties)
Bridge of Allan to Denny	3	20	28	274*	Isolated residential properties and properties within the town of Fallin.
<b>Total</b>	<b>3</b>	<b>23</b>	<b>34</b>	<b>299*</b>	

- 2.6 Since the publication of the Environment Statement, the Applicants have produced APL 5/17 which is an updated assessment of the number properties within 600m of the line. The position regarding properties in the Stirling area is shown below:

Location	0-100m	100-200m	200-300m	300-600m
Braco to Cambushinnie Wood	0	0	0	2
Cambushinnie Wood to SHETL/SPT Boundary	0	2	4	31
SHETL/SPT Boundary to Denny	2	32	49	430
<b>Total</b>	<b>2</b>	<b>34</b>	<b>53</b>	<b>463</b>

- 2.7 In preparing these statistics, the Applicants’ consultant WSP Environmental acknowledged that when measuring the number of properties within 200-300m of the line, they excluded the Halls of Residence at Stirling University (which houses approximately 200 students) and that there may be more properties

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affected in Fallin within the 300-600m range. These would appear to be major omissions in the study carried out by the consultant.

- 2.8 Studies conducted globally over the past 30 years have demonstrated a correlation between radiation emitted from overhead power lines and the proliferation of carcinogenic illnesses such as leukaemia and evidence to the Inquiry on behalf of objectors has been presented by Professors Henshaw and O'Carroll. As pointed out, for 400kV overhead lines, the magnetic field is not negligible until some 150-200 metres away from the line and in the case of Beaully to Denny the line is likely to be heavily loaded and unbalanced in that one circuit is carrying 275kV and the other 400kV. Underground cables, on the other hand, have been shown to mitigate against potential health impacts because the electric field is eliminated and although underground cables can produce higher magnetic fields directly above them than an overhead line these fall rapidly such that 10 metres either side of the cable the magnetic field is negligible.
- 2.9 Following the Stakeholder Advisory Group (SAGE) report in April 2007, a UK Parliamentary cross party inquiry into childhood leukaemia and EMFs reported in July 2007. The Committee backed the moratorium recommended by SAGE on the building of new homes and schools within 60 metres of EHV power lines and the banning of new EHV OHLs within 60 metres of new homes and schools. However, they also recommended the government consider the case for extending the ban to 200 metres for EHV OHLs. As there are 36 properties within 200 metres of the line between Braco and Denny, the Reporters are asked to give weight to the Committee's recommendations and not accept the current proposal for the overhead line.
- 2.10 In addition to the health risk, residents along the route from Braco to Denny face deterioration in their real estate values. As noted [Inquiry Document EA 70], recent studies in England and Scotland have shown that where a pylon was constructed close to a residential property (i.e. within 150m), this resulted in a 20% loss in market value. Should the development of the proposed line affect property values in the Stirling area in a similar negative manner, then given that a house is typically a family's principal asset, the consequences for some sections of the local community would be significant.

### **3. Undergrounding in the Stirling area is feasible**

- 3.1 In late 2006, the Applicants asked PB Power with CCI and MTLA to undertake a case study [Inquiry Document APL5/16] of undergrounding specific sections of the line. This report was published in January 2007 and three cable routes in the Stirling area were examined. Two of these were to the east of Stirling: Case Study 3 – Lower Taylorton to Logie and Case Study 4 Lower Taylorton to Cocksburn Wood. One route to the west of Stirling was also examined - Case Study 5 Glen Burn to Touch Road. It was stated in APL 5/16 that these studies were not specific proposals from SHETL; they were case studies intended to demonstrate the salient points associated with underground cable installations

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through different environments typical of Scotland. On the basis of this report, there is no evidence to suggest that an underground section of cable could not be laid in the Stirling area, although the engineering challenges of installing cables up the Ochils escarpment would suggest that this route examined as Case Study 4 is unrealistic.

- 3.2 Case Study 5 covered a distance of approximately 5km between (and including) the Rivers Teith and Forth. This was considered technically feasible. Scottish Natural Heritage have since proposed an alternative underground routing to the west of Stirling from south of Strathallan (Milfour Moor) to Gartur and also from Gartur to Denny, which is being examined by the Applicants' consultants. Further comments on this will be provided in an addendum (or rebuttal) once the report has been released and reviewed.

#### **4. The incremental cost of undergrounding**

- 4.1 The additional costs of undergrounding will depend on the length of route and the engineering challenges that need to be addressed, but have been estimated by the Applicants' consultants in APL 5/16 at £33 - £74 million more than an overhead line. Further comments on this will be provided in an addendum (or rebuttal) once the most recent underground report prepared by the Applicants has been reviewed.

#### **5. The impact of higher capital costs on electricity consumers**

- 5.1 The higher costs associated with the undergrounding of any sections of the line between Beaully and Denny will need to be agreed with Ofgem. On the assumption that were Scottish Ministers to support partial undergrounding of the line, they would then be accepted by Ofgem, the incremental costs would be recovered through transmission use of system charges.
- 5.2 Transmission charges vary geographically reflecting the fact that transmission costs rise the further energy has to be transported from where it is produced to where it used. The effect of higher costs being passed through to business and domestic consumers will therefore vary and it will be down to suppliers and generators to decide the most appropriate way of passing on their respective costs. In the absence of this information, financial modelling and sensitivity analysis is considered to provide a useful benchmark.
- 5.3 One method of looking at the impact of future developments in the transmission system is to carry out sensitivity analysis using National Grid's DCLF Investment Cost Related Pricing (ICRP) Model. This model has been used by National Grid since 2004 to calculate Transmission Use of System (TNUoS) tariffs. The model calculates the marginal costs of investment in the transmission system which would be required as a consequence of an increase in demand or generation at each connection point (or node) on the transmission system, based

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on a study of peak conditions on the transmission system. It uses MWkm to calculate marginal costs of investment, which are estimated in terms of increases in units of km of the transmission system for a 1MW injection to the system. In simulating the way transmission charges are set in Great Britain (GB), ICRP splits Transmission Network Use of System Revenue between generation (27%) and demand (73%), uses 21 generation zones and 14 demand zones across GB and applies locational security costs.

- 5.4 The model uses circuit expansion factors to reflect the differences in costs between overhead lines and underground cables at the various transmission voltages (i.e. 132kV, 275kV and 400kV). The circuit expansion factor that is used for 400kV cables (2007/08) is 22.69. A reference node is then used as a basis point to calculate the zonal marginal km, which is then converted into costs and hence a zonal generation and demand tariff by multiplying it by the expansion constraint and the locational security factor. The zonal differences are calculated based upon how much the profile of power flow through the system changes on average for an additional MW of demand at each node on the zone. The remainder of revenue to be recovered is then added uniformly across the GB transmission system.
- 5.5 On average, according to Ofgem, (*Transmission Price Control Review: Final Proposal* December 2006) transmission charges currently make up about 3% of a domestic consumer's bill and according to Energywatch, the average electricity bill in the UK is £383, so transmission charges make up around £11 of the average bill. Average domestic electricity consumption is 3,300kWh (according to the Department for Business, Enterprise and Regulatory Reform –“BERR” formerly DTI) and this equates to an average unit price of 11.6p/kWh. The price of electricity does vary around the country and on the tariff and method of payment. According to BERR statistics, the average annual domestic electricity bill in Edinburgh in 2007 is 11.2p/kWh for customers paying by direct debit and 13p/kWh for prepayment customers. These are around 5% higher than the UK average.
- 5.6 This model has been obtained under licence by consultants ICF International and has been run at my request to calculate the impact on consumer bills of the investment in the Beaulieu to Denny line. Ofgem has already agreed to £332M of capital investment for the Beaulieu to Denny overhead line) and the model estimates that this will increase the average domestic electricity bill by 40p/year. The model has then been run under 4 further scenarios for different lengths of overhead line and cable:
- 215km OHL and 5km cable;
  - 210km OHL and 10km cable;
  - 200km OHL and 20km cable;
  - 175km OHL and 45km cable.

- 5.7 Using this model under the assumptions noted above, the following increases to the average price of electricity in p/kWh and the revised average GB domestic consumer electricity bill are shown in the table below.

OHL length (km)	Cable length (km)	Impact on price p/kWh	Revised average GB electricity bill	Annual incremental cost of cabling
220	0	0.01835	£383.40	-
215	5	0.02086	£383.48	8p
210	10	0.02337	£383.57	17p
200	20	0.06828	£385.05	£1.65
175	45	0.20777	£389.65	£6.25

- 5.8 On the basis of the above modelling runs, the impact of cabling a section of up to 20km of overhead line between Braco and Denny would result in an additional increase of only £1.65/year (approximately 40p/quarter). The cabling of around 45km of the Beauly to Denny line would have an incremental impact of around 0.2p/kWh, which represents an increase of £6.25p/year (1.6%) in the electricity price.
- 5.9 In considering whether this small incremental cost is justifiable, it should be borne in mind that the National Audit Office has estimated (Feb 2005 report into Renewable Energy) that the total public support for renewable energy in the UK between 2003 and 2006 has been £700 million per annum and will reach up to £1 billion per annum by 2010.
- 5.10 Additionally, when considering the small annual incremental cost, reference is given to the evidence of Prof Nick Hanley, Professor of Environmental Economics at the University of Stirling. His study [Inquiry Document StBP/2/23] on the non-market economic impacts of the proposed Beauly-Denny line, as it passes through the Ochils and Stirling show that more than 80% of local residents sampled were prepared to pay £50 per year to have the line go underground. The mean willingness to pay (a measure of the economic cost of the over-ground transmission line in terms of loss of economic well-being to people in the study area) was in fact much higher at £179 per household per year. The actual cost they would have to pay though, would be much less.

## 6. Conclusion

- 6.1 There are a number of adverse impacts with the Applicants' proposed overhead line route between Braco and Denny, particularly the section of line from Sherriffmuir to Fallin.

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- 6.2 Work carried by consultants concludes that it is technically feasible to lay cables. The costs of undergrounding the section of line will depend on several factors principally the length of cable route, the technical complexities of the selected route and the number of cables per phase that are considered necessary.
- 6.3 If Scottish Ministers recommend partial undergrounding, the incremental costs of underground cables would need to be agreed with Ofgem but will ultimately be borne by electricity consumers. Transmission charges, though, make up only a very small proportion of the electricity bill and the costs will be borne by consumers across Great Britain. The impact on consumer electricity bills from undergrounding a section of the line in the Stirling area will therefore be marginal and a scenic and historic landscape will be preserved from the adverse visual effects of 50 metre high pylons and associated power lines.