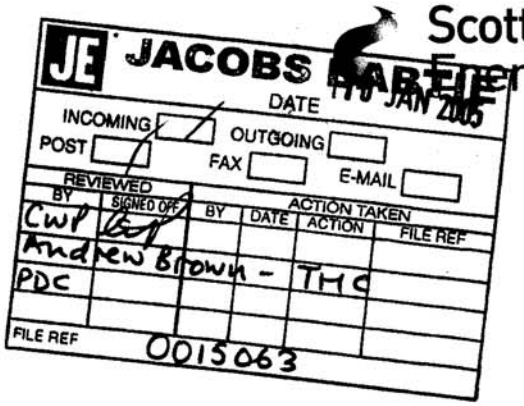
Disclaimer

Appendix 1 - Information Provided by SHETL



Scottish and Southern Energy

Mr Clive Poole
Jacobs Babtie
Fairbairn House
Ashton Lane
Sale
Manchester
M33 6WP

Peter Lodge
Major Projects
Inveralmond House
200 Dunkeld Road
Perth
PH1 3AQ
Tel: 01738 456217

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Dear Clive

Beauly – Denny Report

Further to our discussions, please find below a summary of all information provided by Scottish Hydro Electric Transmission Limited (SHETL) in connection with the above report:

Circuit ratings
The Beauly - Denny line will consist of twin 700 sq.mm AAAC conductors per circuit operating at 90 deg. C. It will have one circuit operating at 400kVand the other at 275kV from the outset.

The seasonal current ratings for these circuits are:

Post Fault Rating	4,050 amps (W)	3,890 amps (S/A)	3,620 amps (S)
Pre Fault Rating	3,400 amps (W)	3,270 amps (S/A)	3,040 amps (S)

If a cable circuit was employed we would want it designed to match the above "pre fault" ratings as a minimum.

Reliability
Due to the strategic nature of these circuits reliability will be a critical factor. The study should cover this and examine fault rates, risks and proven technology. Data on the existing 132kV overhead line circuits is provided below..

Due to the emphasis on reliability, where an underground cable at 275kV or 400kV is required SHETL, and most other major transmission operators, insist on fluid filled rather than XLPE cables due to their proven technology and performance at these high voltages.

Whole Life Costs
These need to be considered due the costs of fault repairs and maintenance. For our 275kV overhead line network the annual maintenance and fault costs are £30 to 40k per 100 circuit km/year.

Installation Costs
The construction costs quoted to date have been based on cost multipliers e.g. a 400kV double circuit cable would cost 14 to 25 times more than an equivalent rated overhead line (the cost ratio for 275kV double circuit would be 12 to 15).

The unit costs will vary for several reasons e.g. length of cable circuit and the terrain.

We would consider that a 500m cable section is nominal and a 300m span length for a overhead would be nominal.

Other costs
The estimates for terminal equipment costs for cable circuits are as follows:
400kV
a) Sealing end terminations and structures (six No.) witinin a fenced sealing end compound - £583,000
b) Ancillary equipment required e.g fluid tanks and link boxes - £ 368,000
c) Sealing end compound, per site - £450,000

275kV
a) Sealing end terminations and structures (six No.) witinin a fenced sealing end compound - £387,000
b) Ancillary equipment required e.g fluid tanks and link boxes - £ 323,000

These are based on two singles per phase for each cable circuit and are based on one termination end.

The cost to design, supply and construct 400kV double circuit tower line (a new design but fundamently based on L12) and then to dismantle existing 132kV line between Beauly - Denny is ca. £750k/km.

This does not allow for any of the necessary "accommodation" works, such as providing access (form tracks & use helicopters), scaffolding, temporary and permanent OHL diversion to allow new build and any damage claims.

The dismantlement of the 132kV would be in the region of £4M.

There is no cost premium for new tower design as we have to re-design the existing L12 to comply with the new standards.

The accommodation works would be in the order of £300k/km and I would expect a similar price for a cable installation as there will be similar issues.

Please be aware that these prices are all estimates as we have not tendered for any construction contracts yet.

Environment
The terms of reference for our environmental consultant is to propose an overhead line route from Beauly to Denny.

However, with respect to undergrounding, it is SHETL`s policy, that where an exceptionally high value is placed on visual amenity an underground installation may be considered.

Network Issues
The technical characteristics of cable and overhead lines are different and these need to be considered with a view to our transmission system. With AC cable installations there is a need to provide reactive compensation depending on the length and size of the cable circuit.

i) Reactive compensation

We have no figures for this at present for the cost of reactive compensation and the associated substations.

ii) With respect to the statistics for the existing overhead line fault rates, we will chase these again.

Fault Rates

National fault rates from Electricity Association from 2001/02 provide the baseline figures of:

For 132kV circuits based on sustained faults and for five years ending March 02 a 132kV overhead line had 0.65 faults per 100 circuit km of line, whereas a cable had 2 faults per 100 circuit km. Transient outages, including DAR, account for an additional 46% of short duration outages nationally for the same 5 year period.

Detailed below are some statistics on our existing double circuit 132kV Errochty - Fort Augustus line (EF1 and EF2). This line runs over the Corrieyairack Pass at high altitude.

The length of line is circa 150km. Fault information starts from 1986 and can be as (with transients included):

Year	Faults		Causes	Damage
	Transient	Sustained		
1986	2		Ice / High winds	None
1987	1		Lightning (1)	None
1988	2		Ice / High winds / lightning (2)	None
1989	1		Ice / High winds	None
1991	1		Ice / High winds	None
1992	6		Ice / High winds	None
1993	4		Ice / High winds	None
1994	6		Ice / High winds / Lightning (2)	None
1995	2	1	Ice / High winds	1 conductor broken
1996	4		Ice / High winds	None
1997	6		Ice / High winds / Lightning (5)	None
1998	2	1	Ice / High winds / Lightning (2)	1 conductor strands broken
1999	5	3	Ice / High winds	1 broken jumper
2001	1		Lightning	Broken OPGW
2003	1		Helicopter hit line	1 broken conductor

The existing line construction is a mixture of vintages from 1935 to 1955 and based on standard designs. To counter clashing problems at the high altitudes interphase spacers were fitted in 2000.

The new line will be designed for the climate and altitude.

Access to the Corrieyairack Pass is very difficult and will be an issue for either an overhead line or underground cable but with the repair times associated with cable it will make this particularly onerous.

System design information

Rating

Transmission system planning bases network capacity for overhead circuits on the 'post fault continuous' circuit rating. This is a 24 hour rating, after which the rating is reduced to the 'pre-fault continuous' rating. This allows fuller network operation through short term post fault management and is an industry standard. It assumes a relatively quick post fault return to service, typical of overheads, but not for cables, which can take a matter of weeks to repair, especially in less accessible terrain and in the winter months.

A cable section has a fixed seasonal rating and will constrain the circuit design flow to its pre-fault continuous rating, reducing the network design capability. In the case of Beauly / Denny, the post fault winter rating is 4,050 amps and the pre-fault winter rating is 3,400 amps.

Flows
Winter studies based on peak demands show line flows in the region of 1,700 amps on both circuits, with all 3 phases of the RETS reinforcement work established and with 6,000 MW of generation connected (forecast to be in place around 2013). Summer flows are expected to be of the same order, given that the reduced generation flows will be offset by the increased north / south flows resulting from the reduced summer loads in the north of Scotland.

The winter circuit flows for the first three RETS phases, complete with conductor winter ratings and post fault circuit flows (contingency required by SSE's licence security standards) are tabled below:

Line Fows in Amps

	RETS 1		RETS 2		RETS 3	
	400 kV	275 kV	400 kV	275 kV	400 kV	275 kV
Intact System	909	903	1299	1260	1732	1680
Post Fault	1083	1155	1732	1680	2237	2099

Circuit Rating	Winter	3400	3400
	Summer	3040	3040

These flows are based on winter peak demands and renewables operating at 60% of plated rating.

We already have over 9,000 MW of generation connections applications either connected, in process, or at the pre feasibility stages, and there is an increasing number of incoming applications over and above this. This is almost all onshore wind (including the Scottish Islands) and we have still to see the marine and off shore wind materialise. This is consistent with government expectations for 2010, and is set to double for 2020.

Losses
Because of the circuit contingency allowance required by security standards (and spare capacity), the circuits run at less than full load.

Post Fault Lost Generation
Another meaningful evaluation factor is the post fault repair time and associated generation constraint costs (generation will be constrained off against a depleted system). Cable repair times are appreciable compared with overhead lines, given fault location, excavation, jointing and re-commissioning. The cost of constrained renewable generation can be high (>£45 / MWHr) and a cable repair could take in the region of 30 days against 2 days for overhead line. A brief analysis shows that the daily constraint cost can be in excess of £1.5M (of £45M for a cable fault repair)

Additional Information
Our national fault returns for transmission lines reflect the improved performance of the higher voltage (more robust) circuits, such as proposed for Beauly / Denny (eg L12 construction). They also show that the majority of overhead line faults are non damage (transients), where the line is successfully re-energised (either by DAR or remote control) following a trip.

Fault Rate / 100 km		Total	Non Damage	Damage
132 kV Overhead Lines	National	0.53	0.35	0.17
	SSE	0.83	0.79	0.05
275 kV Overhead Lines	SSE	0.27	0.27	0.00

Included is a national average for 132 kV as a comparitor. This is not readily available for 275 kV.

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Summary

The selection of the circuit conductor size allows for increased power flows beyond RETS 3. RETS 3 is based on 3,000 MW of renewable generation within SHETL's licence area, and we are already dealing with around 9,000 MW of connection applications.

Furthermore, this current activity is mainly onshore wind and we have still to see the marine and offshore wind materialise. The chosen conductor size allows for future generation beyond 3,000 MW and avoids the need for a rebuild, thus avoiding cost duplication and unnecessary environmental impact.

I trust you agree that this is a true reflection of the information provided to date and wish you all the best for the New Year

Yours sincerely

Peter Lodge
Transmission Reinforcement Manager