- Who will be allocated the losses? It would appear the existing wind farm will as the existing wind farm allocation will become boundary meter – new wind farm. So the additional private cable losses will be attributed/payable by the existing wind farm. Are they aware of this and confirmed they are agreeable?

**Allocation of Losses and agreement by the jointly owned company - *Burnfoot Wind Farm Limited***

EDF Renewables has a development department that has consulted with the 2 parties that jointly, and equally own, the existing wind farm via a joint company, that is called – *Burnfoot Wind Farm Limited*. These 2 parties are EDF and an investment bank. Both these companies will jointly, and equally, own the new additional extension that is called Burnfoot East WF. Therefore the two companies are sharing the development and future running costs of the original, and new, WFs as a joint venture.

EDF Renewables has calculated the new losses resulting from adding the new Burnfoot East WF generation to the original Rhodders WF connection via the 6.5km Private Cable and presented these to our internal development department. The increase in losses are very low and they have determined that the losses will not significantly affect *Burnfoot Wind Farm Limited,* and agreed this with partner investor.

The very small increase in losses in the common 6.5km long private cable shall effectively allocated to *Burnfoot Wind Farm Limited* as they own the actual Private Cable as part of the original development. *Burnfoot Wind Farm Limited* is effectively accepting the increase in losses in return for a significant increase in generation through this privately owned asset.

The plan put forward is to add a new Tariff meter at the Rhodders Substation connection point for measuring the new generation/consumption attributable to the Burnfoot East WF. This new development will be considered a standalone WF by the *Burnfoot Wind Farm Limited*, who have sold the future generation via a Corporate Power Purchase Agreement.

- The losses calculation only calculate the I2R losses, so does not take account of the capacitive losses – is that correct? Would the losses be material at 33kV, I suspect they would and they would be continuous not load related?

**With respect to the 33kV cable capacitive current losses**

It is correct the original calculations did not include the capacitive current effects. This was due to the very small effect they have on the overall system and an effort to present all information in a plane simple format to all parties concerned.

In operation the 33kV cable charging currents shown as capacitive current losses due to the very small charging current will be negligible compared to the reactive energy the wind farm will generate or absorb as part of its normal operation. At 23MW the combined WF could be required to provide grid support of 7.1 MVar of reactive import or export current. This will equate to 125Amps of reactive current. The few tens of amps of capacitive charging current will simply be absorbed into the daily running figure required by the grid.



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For completeness EDFR present the effects of the Cable capacitances and how they increase losses, as below.

It should be noted that capacitive current absorbed by a cable is a distributed current and so not all the current flows through the total length of a particular cable. However EDFR have assumed worst case and that all the distributed current actually flows through entire length of the actual cable under consideration. Therefore actual losses will be less than calculated losses.

The original Rhodders wind farm has a total cable length of 2670m forming the actual turbine array. This consumes 2.93Amps of capacitive current that would flow through the resistance of the cables in that Wind Farm. The currents will then flow through the private cable from Alva substation to Rhodders Substation. Existing tariff meter is mounted at Alva so measures all grid connected currents.

The 6500m of cable from Alva Substation to Rhodders substation consumes 14.24 Amps of Capacitive current that would flow through the resistance of that cable, again EDFR have assumed it all flows through the lumped resistance of this cable not the distributed resistance the real cable will present.

Adding the worst case capacitive current into the original loses calculations for Rhodders wind farm fractionally increases the total cable losses *(compared to originally submitted calculations)* by the following amounts;

2.00 kW at 100% of generation (= 12.3MW) that is 13.13kW total losses become 15.16kW

1.57kW at 75% of generation (= 9.22MW) that is 7.38kW total losses become 8.95kW

1.08kW at 50% of generation (= 6.15MW) that is 3.28kW total losses become 4.36kW

0.57kW at 25% of generation (= 3.08MW) that is 0.82kW total losses become 1.39kW

0.08kW at 00% of generation or 0 (Zero) MW that is 0.00kW total losses become 0.08kW

The new Burnfoot East extension to the Rhodders substation will only add approximately 2.9km of turbine array. This adds 3.5Amps of Capacitive current that has to flow through the common Private Cable (owned by *Burnfoot Wind Farm Limited* ) down up from Alva substation to Rhodders substation thus fractionally increasing losses in this very low resistance cable.

Adding Burnfoot East capacitive current into the revised calculations, for the combined Rhodders WF and Burnfoot East WF, fractionally increases the loss figures as shown below

4.60kW at 100% of generation (= 23.1MW) – that is 46.3kW total losses become 50.91kW

3.34kW at 75% of generation (= 17.3MW) – that is 26.05kW total losses become 29.53kW

2.36kW at 50% of generation (= 11.55MW) – that is 1.58kW total losses become 13.94kW

1.24kW at 25% of generation (= 5.77MW) – that is 2.89 kW total losses become 4.13kW

0.03kW at 00% of generation or 0 (Zero) MW that is 0.08 kW total losses become 0.11kW.


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The new tariff meter will be installed at the Rhodders Substation. It will measure generation and losses for the new 2800m of cable and the associated new wind turbines that will be installed at the Burnfoot East WF.

The new meter reading will have its readings deducted from the Alva tariff meter readings to provide the individual generation for Rhodders WF, which will include losses in the Private Cable owned by *Burnfoot Wind Farm Limited* and individually for the new Burnfoot East WF.


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