Metering Dispensation Rules for Lincs Offshore Windfarm

Supporting document for BSCP32/4.1 as submitted on 27 March 2013

This note establishes and documents the correction formulae for estimating the active and reactive energy export/import for Lincs offshore windfarm based on the readings from the main offshore settlement meters.

Operational Arrangement

The 132/33kV Lincs offshore substation has three intended running arrangements.

Normal Running Arrangement

Under the normal operation scenario, the 132/33kV Lincs offshore substation has a running arrangement as illustrated in Figure 1, where the red circle represents the circuit breaker inside is open. In the diagram PPS represents Power Park String of Lincs offshore windfarm. PPS1-4 forms BM Unit 1 and PPS5-6 forms BM Unit 2 from Lincs offshore windfarm. M1, M2, M3 and M4 represent four main settlement meters located at the LV sides of GT1 and GT2, respectively. Both reactors will be permanently switched in to compensate for the two exporting cables. The 132kV and 33kV busbar section circuit breakers (BS1 and BS2) will remain open to limit the fault current.

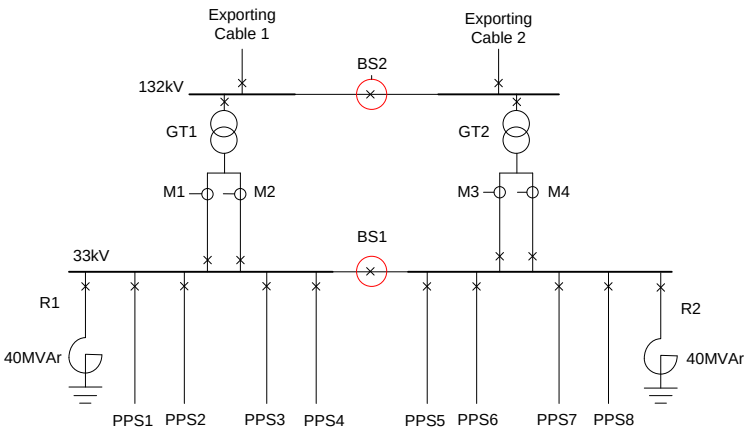

Figure 1 Normal running arrangement of 33/132kV Lincs offshore substation

Constrained Running Arrangement 1a and 1b

When the exporting cable 2 is out of service, the Lincs offshore substation will have the running arrangement 1a as illustrated in Figure 2. Under this arrangement the shunt reactor R2 will be switched out of service to avoid the over-compensation for the remaining exporting cable.

Similarly for the running arrangement 1b, the shunt reactor R1 will also be switched out of service when the exporting cable 1 is out of service.

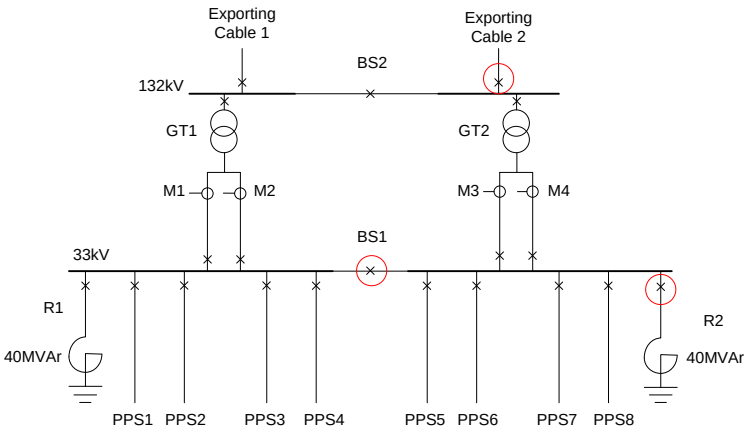

Figure 2 Constrained running arrangement 1a when one exporting cable is out of service

<u>Constrained Running Arrangement 2a and 2b</u>

When the GT2 is out of service, the Lincs offshore substation will have the running arrangement 2a as illustrated in Figure 3. Under this arrangement the busbar section circuit breakers BS1 and BS2 will close and the power flows from Lincs offshore windfarm and reactors will go through the remaining GT.

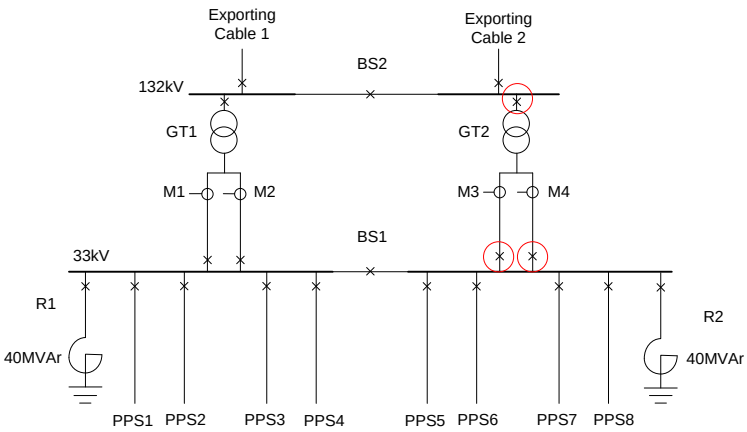

Figure 3 Constrained running arrangement 2a when the GT1 is out of service

Similarly for the running arrangement 2b, both busbar section circuit breakers BS1 and BS2 will close in order to export power through the remaining GT from Lincs offshore windfarm when the GT1 is out of service.

Technical Specifications of Shunt Reactors

Each shunt reactor is rated at 40MVAr at nominal voltage and the factory acceptance test indicated that the guaranteed loss at rated current and 75°C is 105kW.

Proposed Metering Dispensation Rules

<u>Normal Running Arrangement</u>

For active power, we propose using the following formulas to correct the aggregated volume from the two main settlement meters corresponding to each BMU in order to compensate the active power loss from the two shunt reactors:

BMU1 [MWh/hh] = Aggregation of {M1, M2} [MWh/hh] + 0.0525 [MWh/hh]

BMU2 [MWh/hh] = Aggregation of {M3, M4} [MWh/hh] + 0.0525 [MWh/hh]

<u>Constrained Running Arrangement 1a</u>

For active power, we propose using the following formulas to correct the aggregated volume from the two main settlement meters corresponding to each BMU in order to compensate the active power loss from the shunt reactor:

BMU1 [MWh/hh] = Aggregation of {M1, M2} [MWh/hh] + 0.0525 [MWh]

BMU2 [MWh/hh] = Aggregation of {M3, M4} [MWh/hh]

<u>Constrained Running Arrangement 1b</u>

For active power, we propose using the following formulas to correct the aggregated volume from the two main settlement meters corresponding to each BMU in order to compensate the active power loss from the reactor:

BMU1 [MWh/hh] = Aggregation of {M1, M2} [MWh/hh]

BMU2 [MWh/hh] = Aggregation of {M3, M4} [MWh/hh] + 0.0525 [MWh/hh]

<u>Constrained Running Arrangement 2a</u>

For active power, we propose using the following formulas to correct the aggregated volume from the two main settlement meters corresponding to each BMU in order to compensate the active power loss from the two shunt reactors:

BMU1 [MWh/hh] = Aggregation of {M1, M2} [MWh/hh] + 0.105 [MWh/hh]

BMU2 [MWh/hh] = Aggregation of {M3, M4} [MWh/hh]

<u>Constrained Running Arrangement 2b</u>

For active power, we propose using the following formulas to correct the aggregated volume from the two main settlement meters corresponding to each BMU in order to compensate the active power loss from the two shunt reactors:

BMU1 [MWh/hh] = Aggregation of {M1, M2} [MWh/hh]

BMU2 [MWh/hh] = Aggregation of {M3, M4} [MWh/hh] + 0.105 [MWh/hh]

For reactive power, we are currently discussing with National Grid on proposed formulae to determine the reactive energy measured quantities for the LINCS BM Units under different configurations.