Scottish and Southern Energy
Power Distribution

SHE Transmission

Transmission Losses Report 2013/14

(October 2014)

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Summary

As part of its statutory and Transmission Licence obligations, SHE Transmission has an obligation to publish an annual Transmission Losses report for the previous relevant year on or before 31 October 2014 and for each subsequent year, unless the Authority directs otherwise, in accordance with the requirements of the Special Condition 2K.4 of our licence conditions.

Transmission energy losses in year 2013/14 in SHE Transmission area were 0.38TWh as measured by the System Operator, National Grid, while power losses at peak GB Transmission System demand were 0.08GW. There was an increase in transmission energy losses from 0.27TWh in the previous year. The transmission power losses in SHE Transmission area at peak GB Transmission System demand were 0.073GW as modelled by SHE Transmission in power system simulation software PSS/E using the actual generation and demand background at peak. The power losses would have been 0.078GW without the reinforcement projects completed in the year, giving a net benefit of 6.6% despite the overall increase in losses.

As a Transmission Owner (TO) we endeavour to minimise transmission losses on our network through consideration of losses in our investment planning processes. Losses in the transmission network are dependent on power transfers through the network. This in turn depends on the balance between generation output and demand. In 2013/14 there was 2.24GW of renewable generation and 1.42GW demand in SHE Transmission area at peak GB Transmission System demand. The consequence of intermittent renewable generation is that losses can vary significantly depending on generation output and demand which are managed by the System Operator. With the significant increase in renewable generation connected to the north of Scotland and significant electricity demand being in Central Scotland and England, an increase in losses would be expected due to the long distance journey of north to south power flows.

This report presents SHE Transmission's update on transmission losses taking into account the connected renewable generation and the reinforcement projects completed in the year 2013/14.

Developments – 2013/14

The following developments on the transmission network took place in the year 2013/14.

Reinforcement Projects

Beauly – Denny

The following components of the Beauly – Denny reinforcement project were completed during the year 2013/14: -

- Beauly – Fort Augustus 400kV circuit and Beauly – Fasnakyle – Fort Augustus 275kV circuit replacing the Beauly – Fasnaklye – Fort Augustus 132kV double circuit overhead line.
- Installation of 1x240MVA, 275/132kV supergrid transformer SGT1 and 1x240MVA, 400/132kV supergrid transformer SGT3 at Fort Augustus substation
- Installation of 2x1200MVA, 400/275kV supergrid transformers at Beauly substation
- Installation of 1x120MVA, 275/33kV supergrid transformer at Fasnakyle substation

- Installation of 150MVAr Static Var Compensator (SVC), 2x45MVAr capacitors and 2x90MVAr reactors at Beauly substation
- Installation of 2x60MVAr reactors at Fort Augustus substation

Asset Replacement Projects

Several overhead line (OHL) re-conductoring and transformer replacement projects were in progress but not completed during 2013/14 and were therefore not ready for assessment of their impact on the transmission losses in the current reporting year.

Equipment Specifications

Transformer specifications for wind farm substations were standardised with transformer impedance of 18% on 100MVA instead of the usual 25% specified for grid transformers. This was aimed at improving voltage regulation and may result in the reduction of transmission losses.

New Technologies

ACCC overhead conductor

The trial project on the Peterhead – St. Fergus 132kV OHL was completed in the year. It is planned to be transferred to business-as-usual in 2014/15 year, where its potential use would be considered as part of the investment option assessment for new projects.

Multi-terminal test environment for HVDC systems

The above project is still in design stage. It is expected that the project would allow detailed study of the interaction between new HVDC and existing AC networks to optimise DC and AC network performance which could lead to the reduction of transmission losses. The assessment of the potential impact on losses will be made in future reporting years.

132kV Crossarm Trial

The trial project on the Craigiebuckler – Kintore 132kV OHL is still ongoing. It is planned for completion in the year 2014/15 when its potential use in an overhead line upgrade from one voltage level to another would be evaluated.

Generation

397MW of embedded and directly connected renewable generation was connected to SHE Transmission network in 2013/14.

Transmission Losses

National Grid determined that the transmission energy losses within SHE Transmission area for the year 2013/14 were 0.38TWh and transmission power losses at peak GB Transmission System demand were 0.08GW.

Transmission power losses at peak GB Transmission System demand were 0.073GW as estimated from the PSS/E model with actual generation and demand background at 2013/14 peak GB Transmission System demand.

Impact of Reinforcement Projects on Losses

Although the main driver behind the major transmission reinforcement projects is to create additional capacity to accommodate the rapid growth of renewable generation development, in some

instances there is a positive impact on transmission losses with a reduction in the losses as compared to the status without the reinforcement projects. For the current reporting year, there was a 6.6% net benefit in transmission power losses as a result of the reinforcement projects. The power losses at peak GB Transmission System demand would have been 0.078GW without the reinforcement projects completed in the year.

The impact of the reinforcement projects on transmission losses in our transmission network was determined by the comparison between network status with and without the reinforcement projects with the same generation and demand background.

The Beauly – Denny reinforcement project had a major impact on transmission losses in the wake of the renewable generation connected in the year. The voltage upgrade from 132kV to 400/275kV of the OHL section between Beauly and Fort Augustus via Fasnakyle helped to reduce losses arising from conductor heating. The higher voltages help to reduce the current passing through the overhead line thereby minimising transmission losses. The conductors for the new OHL also have less AC resistance (0.04Ω/km) compared to the conductors of the replaced OHL (0.1586Ω/km). This also helps to reduce the transmission losses.

The installation of an SVC, reactors and capacitors onto the transmission network under the Beauly – Denny project also helps to manage voltage profiles under various loading conditions thereby helping to reduce transmission losses.

Strategy Implementation

Implementation Progress

SHE Transmission continues to take account of transmission losses in all investment planning studies. The whole lifetime costs of options are considered in investment option assessment as well as in the procurement of transformers, static VAR compensators, conductors and cables. The impact of losses is also considered when undertaking cost-benefit analysis on network reinforcement and expansion. Losses cannot however be considered in isolation but are taken into account in investment option assessments with other factors such as stakeholder impact, efficiency, technical and design feasibility.

Strategy Revision

There are no changes or revisions to our strategy as reported in December 2013.

Future Developments – 2014/15

Reinforcement Projects

The impact of the future reinforcement projects on transmission losses was estimated by the comparison between losses with and without the new development project in the local area of the project. The ‘Gone Green’ scenario generation and demand background for 2014/15 with the ETYS13 Year 2 (2014/15) network topology was the basis of the forecast studies.

The following components of the major reinforcement projects are expected to be completed during the year 2014/15: -

Beauly – Denny

- Installation of 1x240MVA, 275/132kV supergrid transformer SGT3 at Fort Augustus substation
- Installation of 1x120MVA, 275/33kV supergrid transformer at Fasnakyle substation
- Installation of 2x240MVA, 275/132kV supergrid transformers at Tummel Bridge substation
- It is estimated that the losses at peak demand around Beauly – Fort Augustus area would reduce by 57% from 8.53MW to 3.71MW upon completion of scope of works.

Keith – Macduff 132kV Reinforcement

- Transformer upgrade from 1x45MVA to 1x90MVA unit at Macduff 132/33kV Grid Supply Point (GSP) substation.
- Installation of a second 1x90MVA, 132/33kV grid transformer at Macduff GSP substation
- Installation of a second 132kV circuit from Keith to Macduff GSP substation.
- It is estimated that the losses at peak demand around Keith/ Macduff area would reduce by 4% from 4.22MW to 4.07MW upon completion of scope of works.

Burghmuir 132/33kV GSP Substation

- Transformer upgrade from 2x60MVA to 2x90MVA units.
- It is estimated that the losses at peak demand at Burghmuir GSP would reduce by 5% from 1.0MW to 0.95MW upon completion of scope of works.

Strichen 132/33kV GSP Substation

- Transformer upgrade from 2x45MVA to 2x90MVA units.
- It is estimated that the losses at peak demand at Strichen GSP would reduce by 20% from 0.05MW to 0.04MW upon completion of scope of works.

Generation

SHE Transmission expects to connect 413MW of renewable generation to the electricity network in year 2014/15.

Impact of Reinforcement Projects on Transmission Losses

It is estimated from the ETYS13 Year 2 (2014/15) PSS/E model that our transmission power losses at peak GB Transmission System demand would be 0.147GW with 'Gone Green' scenario generation and demand background, subject to the completion of the planned reinforcement projects. If the aforementioned reinforcement projects were not implemented, the transmission power losses would be 0.153GW as shown in figure 1 below.

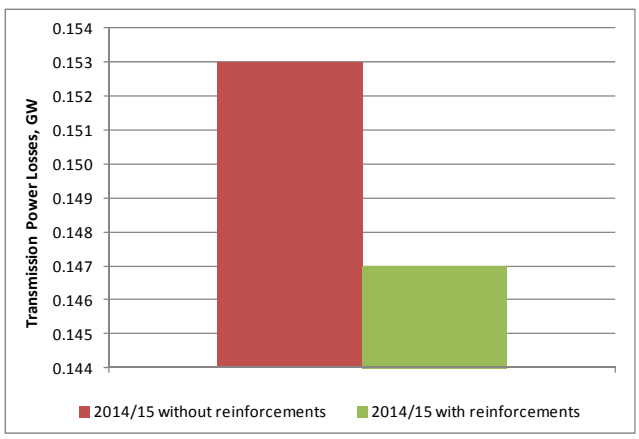

Figure 1: Impact of Reinforcement Projects on Transmission Losses at Peak Demand with 'Gone Green' scenario

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