Scottish and Southern Energy
Power Distribution

SHE Transmission

Transmission Losses Report 2014/15

(October 2015)

Transmission Losses Report 2014/15

Introduction

SHE Transmission has a licence obligation to publish an annual Transmission Losses report for the previous relevant year on or before 31 October in accordance with the requirements of Special Condition 2K.4 of our licence conditions. Special Condition 2K.4 requirements for the report include:

- 2K.4(a): The level of Transmission Losses measured as the difference between the units of electricity metered on entry to the transmission system and the units of electricity metered on leaving the system.
- 2K.4(b): Progress report on the implementation of Transmission Losses strategy and an estimate of the contribution to minimise Transmission Losses that has occurred as a result.
- 2K.4(c): Any changes or revisions of the Transmission Losses Strategy
- 2K.5: Description of any calculations used to estimate Transmission Losses on the transmission system.

As laid out in our Transmission Losses Strategy published in December 2013 the actual transmission losses throughout the year are monitored by the System Operator, National Grid. We only estimate losses for a system snapshot at the time of peak demand. For the reporting year 2014/15 the difference between the units of electricity metered on entry to our system and the units of electricity metered on leaving the system was 0.67TWh and the losses at peak GB Transmission System demand were 0.17GW as determined by National Grid.

What are losses?

Losses occur from heating when power flows through the conductors and transformers of the transmission system. Any increase in these flows across the transmission system results in an increase in losses. Losses also occur due to the magnetisation of overhead line conductors and iron core in transformers.

We estimate losses at peak as follows:

$$Losses\ at\ peak\ (MW) = A - B$$

Where

$$A = Total\ generation\ at\ peak\ (MW)$$

$$B = Peak\ Demand + Export\ (MW)$$

This report presents SHE Transmission's update on transmission losses taking into account the connected low carbon generation and the reinforcement projects completed in the year 2014/15.

Transmission Losses for 2014/15

National Grid determined that the difference between the units of electricity metered on entry to SHE Transmission system and the units of electricity metered on leaving the system was 0.67TWh and the losses at peak GB Transmission System demand were 0.17GW for the year 2014/15. This was a 76% increase in the difference in units compared to 0.38TWh in 2013/14. There was also a 112.5% increase in losses at peak from 0.08GW in 2013/14 as shown in Figure 1 below.

Transmission Losses Report 2014/15

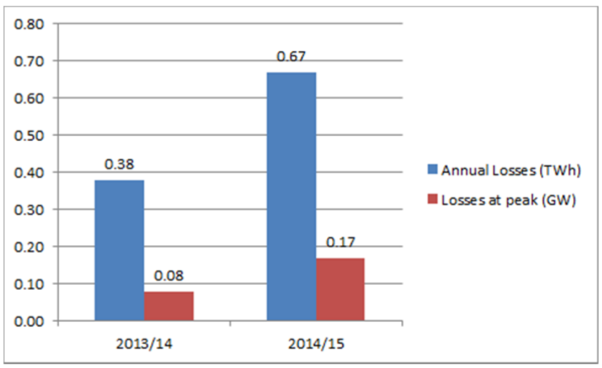

Figure 1: SHE Transmission Losses for 2013/14 and 2014/15

Transmission losses are very sensitive to changes in geographic generation patterns. The laws of physics that relate to electrical losses mean that, in general, the further electricity has to travel from its source of generation to where it is used the greater the losses will be.

Despite only having a 5% increase in generation output at peak GB Transmission System demand from 2.32GW in 2013/14 to 2.43GW in 2014/15 for the whole SHE Transmission network, there was a 107% increase in generation output from 0.69GW to 1.43GW from our most remote areas in the north-west region (Zones T1 and T5 shown in Figure 2 below) of the SHE Transmission network in 2014/15 as compared to 2013/14. This increase in generation in the north-west region increased boundary flows across the B1 boundary by 181% at peak GB Transmission System demand from 0.32GW to 0.9GW. This is the underlying reason for the large increase in losses compared to last year.

Boundary circuits unavailability due to outages from the ongoing reinforcement projects during the year have also contributed to the increase in losses. The outages on critical Main Interconnected Transmission System (MITS) circuits across the B1 boundary like the Beauly – Denny 400/275kV circuits and the Beauly – Blackhillock – Kintore 275kV circuits resulted in increased power flows into the remaining 275kV circuits, as well as increasing power flows through the 132kV system thereby increasing losses.

There was also a 115% increase in generation output within the south-east region (Zone T4) of the SHE Transmission network from 0.27GW to 0.58GW, thereby increasing power flows through the transmission network.

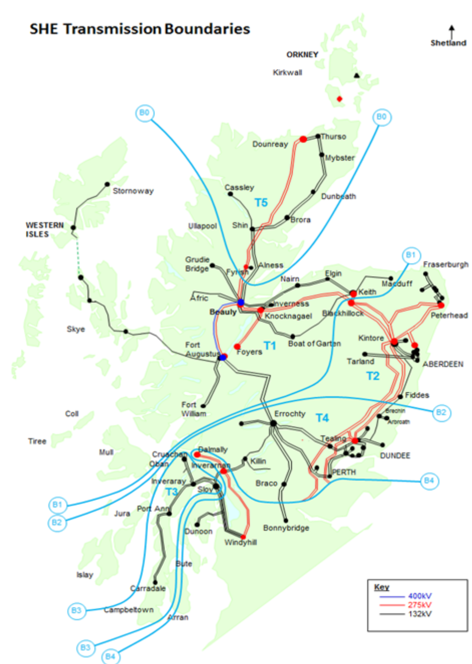

Figure 2: SHE Transmission System Boundaries

How we are minimising losses

The main driver behind our investment in the transmission system continues to be the creation of additional transmission capacity to accommodate the increase in low carbon generation development in the north of Scotland.

We are still using the whole lifetime costs in our investment decisions and the procurement of materials and equipment include capitalized loss values for efficient and economic designs. Transmission losses shall continue to be considered as part of other investment factors such as technical and design feasibility, stakeholder impact and efficiency during investment appraisal and when undertaking cost benefit analysis on reinforcement projects. The same approach will also be applied to the recently established Network Options Assessment (NOA).

New and alternative technologies that were successful during trials are planned to be considered for business as usual.

Some of the developments we are undertaking as part of the implementation of our Transmission Losses Strategy are detailed below.

Reinforcement Projects

In 2014/15, there was partial completion of overhead line (OHL) reinforcement works within Beauly – Denny 400/275kV OHL project, Beauly – Mossford 132kV OHL project and Beauly – Blackhillock – Kintore 275kV OHL project.

We also installed 275/132kV supergrid transformers at Fort Augustus and Tummel Bridge substations, quadrature booster transformers at Tummel Bridge to help to minimise losses through the shifting of power flows away from the 132kV network to the 275kV network.

Asset Replacement Projects

Grid transformers were replaced at Thurso, Strichen and Macduff Grid Supply Point (GSP) substations in year 2014/15. However, several OHL reinforcement projects were still in progress during the year and therefore their impact on the transmission losses was not considered in the current reporting year.

Material and Equipment Specifications

In 2014/15 we initiated a technical approval process to adopt the use of a new type of high temperature conductor for our generation connection projects after a successful trial installation. This is aimed at increasing OHL capacity without the need to rebuild existing OHLs or build new OHLs thereby reducing whole lifetime costs. The proposed conductor is Aluminium Carbon Core Conductor (ACCC) Monte Carlo conductor which has almost twice the rating of similar sized conductors of other types like ACSR Bear and AAAC Rowan. This would help to reduce the need to construct additional OHLs for the same transfer capability requirement on generation connection projects, with potential to reduce losses from conductor heating as well.

New Technologies

ACCC overhead conductor

The Aluminium Carbon Core Conductor (ACCC) trial project on the Peterhead – St. Fergus 132kV OHL was completed in 2013/14. A technical approval process has been initiated to transfer the ACCC conductor type to business-as-usual for consideration as part of the investment option assessment for new projects.

Multi-terminal test environment for HVDC systems

The design phase for the project is planned to be completed in 2015/16 and therefore its 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 has been completed. The insulated crossarms installed have been integrated as part of the transmission network. The successful completion of the trial crossarms shows that this technology may be a viable option for future reinforcement projects requiring voltage upgrade.

Impact of Our Work on Losses

The ongoing reinforcement projects in our investment plan have had an overall positive secondary effect on transmission losses so far. Despite the significant increase in low carbon generation connected to the system and subsequent increase in losses, there were net reductions in losses at peak when the system was studied with and without the reinforcement projects in 2013/14 and 2014/15. We also estimate that the trend will continue in 2015/16. The estimated impact of our reinforcement projects on transmission losses is shown in Figure 3 below.

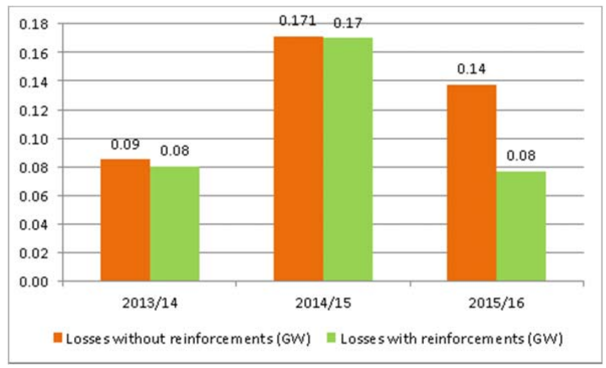

Figure 3: Impact of Reinforcement Projects on Transmission Losses at Peak

While we endeavour to minimise losses in our system through use of appropriate technology and upgrading parts of our 132kV system to 275kV, the rapidly increasing power exports through the system could result in losses remaining flat or increasing slightly over time.

How our strategy is changing

We are proposing a revision to our Transmission Losses Strategy, as published in December 2013, to include the joint Transmission Owners' methodology for calculating transmission losses.

Issue Revision (no 1.0 – October 2015)