

**National Grid Electricity Plc
Special Condition 2K.4 – Transmission Losses Report
Reporting Period 1 April 2016 to 31 March 2017**

Introduction

National Grid Electricity Transmission (NGET) has a licence obligation that, “On or before 31 October 2014 and for each subsequent year, unless the Authority directs otherwise, the licensee must publish an annual Transmission Losses report for the previous Relevant Year prepared in accordance with the provisions of this condition to be published on, and be readily accessible from its website, and to include in reasonable detail:

- (a) the level of Transmission Losses from the licensee’s Transmission System, measured as the difference between the units of electricity metered on entry to the licensee’s Transmission System and the units of electricity metered on leaving that system;
- (b) a progress report on the implementation of the licensee’s strategy under paragraph 2K.2, including the licensee’s estimate of the contribution to minimise Transmission Losses on the licensee’s Transmission System that has occurred as a result; and
- (c) any changes or revisions the licensee has made to the strategy in accordance with paragraph 2K.2 of this condition.

There is also the requirement, as part of SC2K.5 to include “a description of any calculations the licensee has used to estimate Transmission Losses on the licensee’s Transmissions System.”

2K.4 (a) Transmission Losses for this reporting period

Transmission Losses have been calculated for the 2016/17 financial year for the England & Wales system. The calculation is based on the latest applicable settlement metering currently available for generation, demand and French / Moyle Interconnector BMUs, together with operational metering for the boundaries between the Scottish Hydro Electric and Scottish Power systems and the Scottish Power and England and Wales systems.

Overall the losses arising from the GB transmission system are calculated by taking the difference between the sum of infeed to and the sum of the offtakes from the transmission system. This is carried out using data from the Elexon SAA-IO14 data feed. At a GB level the Total Generation (sum of positive metered active power) and Total Demand (sum of negative metered active power) values can be used.

Table 1 shows last year’s losses and the Table 2 shows historical losses for comparison purposes in order to see changes based on the losses strategy and changes to load and non-load related activities.

Table 1 – 2016/17 losses from the England & Wales transmission system

Period – 1 Apr 2016 to 31 Mar 2017		
	Loss (TWh)	Loss %
England and Wales (NGET)	4.13	1.53

Table 2. Historical losses from the England & Wales Transmission System

Losses (TWh)	2007/08	2008/09	2009/10	2010/11	2011/12	2012/13	2013/14	2014/15	2015/16	2016/17
E/W	5.15	4.92	5.36	4.22	5.23	4.93	4.45	4.60	4.61	4.13
Losses (%)	2007/08	2008/09	2009/10	2010/11	2011/12	2012/13	2013/14	2014/15	2015/16	2016/17
E/W	1.62	1.59	1.77	1.40	1.80	1.67	1.57	1.65	1.70	1.53

It is not possible to quantify the exact causes for the decrease in losses from 2015/16 to 2016/17 (1.7% to 1.53%). It can be seen from data from previous years that losses will vary from year to year due to various factors, the effect of which cannot be easily quantified. Transmission losses can be affected by various factors including the volume of electricity transmitted and the amount of resistive equipment electricity travels through from generation to load point. This is affected by the location of generation and the distribution of demand across the system causing varying levels of flow on the network throughout the year. Operational measures are also taken to manage system compliance and security which may affect transmission losses.

Operational measures which affect transmission losses could, amongst others, include the use of Quad Boosters and Series Reactors to divert power away from overloaded lines under particular circumstances or use of Voltage Control Circuits (switching out of certain circuits) to manage high Volts on the system. In 2015 – 16, National Grid experienced a further increased need to undertake operational measures to mitigate voltage increases on the system by using Voltage Control Circuits which can have the impact of increasing transmission losses.

Reactive compensation equipment (MSC, reactors, SVC) all have resistive losses associated with their operation. However, they will also compensate for reactive power travelling on the OHLs from far sources, they also have the effect of reducing losses by providing reactive power locally. It is not certain whether the total effect will be positive or negative because this can vary depending on system and contracted background.

National Grid's approach for the management of transmission losses remains unchanged from that outlined in the December 2013 published strategy document (as required by Special Condition 2K paragraph 2 of the Transmission Licence) and the subsequent update in October 2014 (SpC 2K, paragraph 4).

In addition to ongoing network investment and to ensure effective and innovative future development of the network, National Grid is investigating new Aluminium Conductor Steel Reinforced (ACSR) conductor types to install on the network which could provide benefits including increased capacity, reduced noise and reduced resistance. These conductors may be considered for use on the network in due course following R&D activities and Type Registration.

As more generation is connected at the periphery of the network, the losses are expected to increase. Load losses do not linearly change with circuit loading being proportional to the square of the current carried. A particularly heavily loaded circuit in one year contributing significantly to the total losses may be less loaded the next year and have a much smaller proportion of the total losses. Local reactive support for voltage management avoids the transmission of reactive power over distances that would otherwise increase system losses.

2K.4 (b) Progress on implementation of Transmission Losses Strategy for this reporting period

Information shown in this section is in the context of National Grid operating the full GB system but only owning and being responsible for the assets of the England and Wales transmission system.

National Grid's approach for the management of transmission losses remains unchanged from that outlined in the December 2013 published strategy document. Utilisation of National Grid's Whole Life Value framework assists the selection of economically justified investments based on a broad range of investment criteria, including consideration of transmission losses. Where the Whole Life Value framework identifies that the cost of transmission losses are material to the investment decision and that sufficient certainty of future year-round transmission flows make the analysis worthwhile, then further detailed transmission loss assessments will be undertaken that quantify year-round transmission losses.

National Grid has been considering transmission losses in equipment specifications and procurement processes in line with this strategy prior to its launch, so non-load related investments delivered can be attributed to this strategy.

Transmission network developments that have passed or shall pass through the optioneering phase after National Grid's transmission losses strategy release in December 2013 present the greatest opportunity for the consideration of transmission losses to influence the chosen investment solution. All schemes where optioneering has taken place since December 2013 (load and non-load) have been assessed under National Grid's Whole Life Value framework. Of these investment decisions, optioneering has identified that losses could be material to the investment decision in some instances.

In alignment with the Whole Life Value assessment, transmission losses have been considered for different transmission solutions. Studies concluded that under peak system conditions, investment solutions that employed a new circuit would experience up to a 25% reduction in losses on local transmission circuits, justifying a clear losses benefit from investment for system peak conditions.

As a result of the 2015 Network Development Policy (the economic decision making process for undertaking load related investment on the Transmission Network) as published in the Network Option Assessment, the following schemes are being progressed by National Grid Transmission Owner which were identified as reducing losses on the system in the Transmission Strategy.

The reconductoring works completed between Harker, Hutton and Quernmore Tee have increased transfer capability across B7 boundary and also reduced transmission losses due to the less resistive conductor type used. The same is also true for the reconductoring works completed on the Trawsfynydd-Treuddyn circuit.

2K.5 Calculations used to estimate Transmission Losses

The calculations outlined below show how we estimate the overall Transmission Losses, taking into consideration the collection of metered information detailing the power flow onto and off of the Electricity System

$$BoundaryLosses(TWh) = \frac{\left(\frac{ConstrainedFlow}{100}\right)^2 \times kmWT \times R\% / km}{\frac{CCTWT}{CapWT}}$$

$$Annual\ MWhLosses = \frac{\left(\frac{(LoadLoss_{Old} - LoadLoss_{New})}{\Delta} + (NoLoadLoss_{Old} - NoLoadLoss_{New})\right) \times \frac{50}{52} \times 8760h}{1000}$$

$$\Delta = \frac{1}{(RMS\ average\ transformer\ loading)^2}$$

$$TotalLosses(TWh) = \left(\sum BoundaryLosses\ per\ boundary\right) + Load\ Related\ Losses + Fixed\ Losses$$