RIIO-ED1 RIGs Environment and Innovation Commentary, version 2.0

2015-2016

Electricity North West Limited

Contents

Summary – Information Required

One Commentary document is required per DNO Group. Respondents should ensure that comments are clearly marked to show whether they relate to all the DNOs in the group or to which DNO they relate.

Commentary is required in response to specific questions included in this document. DNO's may include supporting documentation where they consider it necessary to support their comments or where it may aid Ofgem's understanding. Please highlight in this document if additional information is provided.

The purpose of this commentary is to provide the opportunity for DNOs to set out further supporting information related to the data provided in the Environment and Innovation Reporting Pack. It also sets out supporting data submissions that DNOs must provide to us.

Worksheet by worksheet commentary

At a worksheet by worksheet level there is one standard question to address, where appropriate, as follows:

- **Allocation and estimation methodologies**: DNOs should detail estimates, allocations or apportionments used in reaching the numbers submitted in the worksheets.

  This is required for all individual worksheets (i.e. not an aggregate level), where relevant. Not all tables will have used allocation or estimation methods to reach the numbers. Where this is the case simply note "NA".

  Note: this concerns the methodology and assumptions and not about the systems in place to check their accuracy (that is for the NetDAR). This need to be completed for all worksheets, where an allocation or estimation technique was used.

In addition to the standard commentary questions, some questions specific to each worksheet are asked.

E1 – Visual Amenity

Allocation and estimation methodologies: detail any estimations, allocations or apportionments to calculate the numbers submitted.
All projects are set up on our Capital Programme Management (CPM) system. All expenditure is allocated on a percentage basis to a series of investment drivers. Allocations are calculated by Project Managers based on the respective costs of project deliverables. Volumes are also recorded on projects in a way that indicates the driver. Undergrounding for Visual Amenity is identified as a separate driver and specific projects raised for these schemes of work.

Explanation of the increase or decrease in the total length of OHL inside designated areas for reasons other than those recorded in worksheet E1. For example, due to the expansion of an existing, or creation of a new, Designated Area.
There have been no changes to the boundaries of the Designated Areas within our region in 2015-16, however on 23 October 2015, Defra announced the expansion of the Lake District and Yorkshire Dales National Parks by 70 km^2 and 417km^2 respectively; https://www.gov.uk/government/publications/national-parks-extensions-to-the-lake-district-and-yorkshire-dales-parks This will increase the reported length of lines within Designated Areas from 2016-17 onwards. The entirety of both of these increases lies within our operating region. We have agreed with our partners that lines within the newly decimated areas are eligible for consideration within the undergrounding scheme, but that there is no increase in total funding, in line with Ofgem's RIIO-ED1 strategy decision in 2013.

E2 – Environmental Reporting

Allocation and estimation methodologies: detail any estimations, allocations or apportionments to calculate the numbers submitted.
All projects are set up on our Capital Programme Management (CPM) system. All expenditure is allocated on a percentage basis to a series of investment drivers. Allocations are calculated by Project Managers based on the respective costs of project deliverables. Volumes are also recorded on projects in a way that indicates the driver. Environmental investment is identified as a separate driver within the classification system. **Fluid Filled Cables** To calculate the Oil In Service (Cell AH22), the following estimations are used: Single Core 33kV cable = 1,560 litres of oil per km

Three Core 33kV cable = 1,300 litres of oil per km 33kV cable = 1.1835 tanks per km 33kV cable = 173.525 litres of oil per tank Single Core 132kV cable = 4,800 litres of oil per km Three Core 132kV cable = 4,000 litres of oil per km 132kV cable = 1.7605 tanks per km 132kV cable = 337.985 litres of oil per tank In 2015-16, we removed 34km of 33kV oil-filled cable from service, together with 2km of the 132kV equivalent.

DNOs must provide some analysis of any emerging trends in the environmental data and any areas of trade-off in performance.
No significant emerging trends were identified in terms of environmental data. The volume of fluid-filled cable oil lost however continues to show a downward trend as the overall volume of oil in service declines in line with the proactive replacement programme.

Where reported in the Regulatory Year under report, DNOs must provide discussion of the nature of any complaints relating to Noise Pollution and the nature of associated measures undertaken to resolve them.
The noise complaints reported in the year were a mix of complaints including complaints relating to substation noise, on-going works, substation alarms and damage to customer property.

Where reported in the Regulatory Year under report, DNOs must provide details of any Non-Undergrounding Visual Amenity Schemes undertaken.
Investment in this area comprises civil works undertaken at substations where work has been undertaken to improve the aesthetics of the substation. This is usually in the form of additional investment over and above the minimum where requests have been received from neighbouring houses or the local authority to install more expensive fencing rather than the basic steel palin fence. In such cases the additional investment is presented on this table together with a volume. It should be noted that the volumes reported are a count of the number of sites at which such work has been completed rather than a length in km.

Any Undergrounding for Visual Amenity should be identified including details of the activity location, including whether it falls within a Designated Area.
No additional undergrounding for visual amenity outside of the scheme described in table E1 was undertaken in 2015-16.

Where reported in the Regulatory Year under report, DNOs must provide discussion of details of any reportable incidents or prosecutions associated with any of the activities reported in the worksheet.

N/A.

Where reported in the Regulatory Year under report, DNOs must provide discussion of details of any Environmental Management System (EMS) certified under ISO or other recognised accreditation scheme.
Electricity North West is certificated to the ISO 14001 Environmental Management System Standard.

DNOs must provide a brief description of any permitting, licencing, registrations and permissions, etc related to the activities reported in this worksheet that you have purchased or obtained during the Regulatory Year.
N/A.

DNOs must include a description of any SF6 and Oil Pollution Mitigation Schemes undertaken in the Regulatory Year including the cost and benefit implications and how these were assessed.
The oil mitigation schemes – operational sites reported in the year were related to reinforcement at Woolfold Primary substation, replacement of T11 and T12 transformers at Poulton substation and replacement of an LV cable at Caton.

E3 –BCF

Allocation and estimation methodologies: detail any estimations, allocations or apportionments to calculate the numbers submitted.
For the DNO Emissions: Buildings Energy usage - Buildings Electricity calculations, the kWh usage data provided by the business energy suppliers and/or landlords for whole buildings or parts of buildings that we occupy is used. Within this data some estimates for energy usage have been made by where half hourly metering is not installed. For the DNO Emissions: Buildings Energy Usage - Substation Electricity calculations the kWh usage data provided by the business energy suppliers for metered supplies and the estimated consumption figure as submitted in the unmetered MPAN certificate are used. Within the metered data, some estimates for energy usage have been made by where half hourly metering is not installed and all of the umetered supplies are estimates. For the DNO Emissions: Business Transport – Rail calculation, nominal mileages were used for unspecified Zone 1, 2 and 3+ journeys based on typical locations visited by our staff. Zone 1 journeys were taken to be a three miles one-way, Zone 2, six miles one-way and Zone 3, nine miles one-way. For the DNO Emissions: Fugitive Emissions - Gases Other calculation, an estimated leakage rate is taken from Table 8B in Annex 8 of the *2012 Guidelines to Defra/DECC's GHG Conversion Factors for Company Reporting*. To determine which leakage rate applies, the units were compared with the sizing guide in the December 2011 ICF document *Development of the GHG Refrigeration and Air Conditioning Model Final Report*. All units were judged to be "Small Stationary Air

Conditioning" units. The time used by each unit was calculated as 24% of time available in the year based on an assumed usage of eight hours per day, five days per week = 40 hours per week/168 hours in week= 24%. For the DNO Emissions: Losses calculation, the reported figure is a snapshot of received data as of the date of this report and will change as further settlement reconciliation runs are carried out (up to 28 months after each relevant settlement date).

BCF reporting boundary and apportionment factor DNOs that are part of a larger corporate group must provide a brief introduction outlining the structure of the group, detailing which organisations are considered within the reporting boundary for the purpose of BCF reporting. Any apportionment of emissions across a corporate group to the DNO business units must be explained and, where the method for apportionment differs from the method proposed in the worksheet guidance, justified.
N/A – we are not part of a larger Group.

BCF process The reporting methodology for BCF must be compliant with the principles of the Greenhouse Gas Protocol.[1] Accounting approaches, inventory boundary and calculation methodology must be applied consistently over time. Where any processes are improved with time, DNOs should provide an explanation and assessment of the potential impact of the changes.
N/A.

[1] Greenhouse gas protocol

Commentary required for each category of BCF

For **each** category of BCF in the worksheet (ie Business Energy Usage, Operation Transport etc) DNOs must, where applicable, provide a description of the following information, ideally at the same level of granularity as the Defra conversion factors:

- the methodology used to calculate the values, outlining and explaining any specific assumptions or deviations from the Greenhouse Gas Protocol
- the data source and collection process
- the source of the emission conversion factor (this shall be Defra unless there is a compelling case for using another conversion factor. Justification should be included for any deviation from Defra factors.)
- the Scope of the emissions ie, Scope 1, 2 or 3
- whether the emissions have been measured or estimated and, if estimated the assumptions used and a description of the degree of estimation
- any decisions to exclude any sources of emissions, including any fugitive emissions which have not been calculated or estimated
- any tools used in the calculation
- where multiple conversion factors are required to calculate BCF (eg, due to use of both diesel and petrol vehicles), DNOs should describe their methodology in commentary
- where multiple units are required for calculation of volumes in a given BCF category (eg, a mixture of mileage and fuel volume for transport), DNOs should describe their methodology in commentary, including the relevant physical units, eg miles.

DNOs may provide any other relevant information here on BCF, such as commentary on the change in BCF, and should ensure the baseline year for reference in any description of targets or changes in BCF is the Regulatory Year 2014-15. DNOs should make clear any differences in the commentary that relate to DNO and contractor emissions.

DNO Emissions: Buildings Energy usage - Buildings Electricity

The buildings-electricity energy usage figure is calculated using the kWh usage data provided by the business energy suppliers and/or landlords for whole buildings or parts of buildings that we occupy.

To convert the usage into tCO_2e the Defra/DECC's *UK Government Conversion Factors for Company Reporting 2014 Version 1.2* Scope 2 Electricity Generated conversion factor of 0.49426 $kgCO_2e$ per kWh was used for the consumption in April and May 2015 and the *UK Government Conversion Factors for Company Reporting 2015 Version 2* conversion factor of 0.46219 for consumption from June 2015 to March 2016.

The kWh total is multiplied by the conversion factor to give the $kgCO_2e$ number and then divided by 1,000 to provide the tCO_2e number.

For 2015-16 the calculation is as follows:

- Consumption April and May 2015 = 1,187,005.00 kWh x 0.49426 / 1,000 = 586.69 tCO_2e
- Consumption June 2015 to March 2016 = 5,845,049.00 kWh x 0.46219 / 1,000 = 2,701.52 tCO_2e

This gives a total of 3,288.21 tCO_2e. To ensure this figure was the 2016 entry in table E3 a scalar of 0.00046760332 (cell AY14) was used:

- Total consumption 2015-16 = 7,032,053.00 kWh (cell BO14) x

0.00046760332 = 3,288.21 (cell AD14)

DNO Emissions: Buildings Energy Usage - Substation Electricity

The substation electricity usage data is calculated from kWh usage data provided by the business energy suppliers for metered supplies and the estimated consumption figure as submitted in the unmetered MPAN certificate.

To convert the usage into tCO_2e the Defra/DECC's *UK Government Conversion Factors for Company Reporting 2014 Version 1.2* Scope 2 Electricity Generated conversion factor of 0.49426 $kgCO_2e$ per kWh was used for the consumption in April and May 2015 and the *UK Government Conversion Factors for Company Reporting 2015 Version 2* conversion factor of 0.46219 for consumption from June 2015 to March 2016.

The kWh total is multiplied by the conversion factor to give the $kgCO_2e$ number and then divided by 1,000 to provide the tCO_2e number.

For 2015-16 the calculation is as follows:

- Consumption April and May 2015 = 2,319,712.00 kWh x 0.49426 / 1,000 = 1,146.54 tCO_2e
- Consumption June 2015 to March 2016 = 11,694,326.00 kWh x 0.46219 / 1,000 = 5,405.00 tCO_2e

This gives a total of 6,551.54 tCO_2e. To ensure this figure was the 2016 entry in table E3 a scalar of 0.00046749844 (cell AY16) was used:

- Total consumption 2015-16 = 14,014,039 kWh (cell BO16) x 0.00046749844 = 6,551.54 (cell AD16)

DNO Emissions: Operational Transport - Road

The operational transport figure is calculated from fuel litres purchased data provided by the business fuel card suppliers. All the operational vehicles that we own have diesel engines.

To convert the usage into tCO_2e the Defra/DECC's *UK Government Conversion Factors for Company Reporting 2015 Version 2* Scope 1 conversion factor for Diesel (average biofuel blend) of 2.5839 $kgCO_2e$ per litre is used.

For 2015-16 the calculation is as follows:

Consumption = 1,306,457.47 litres x 2.5839 / 1,000 = 3,375.76 tCO_2e

To ensure this figure was the 2016 entry in table E3 a scalar of 0.0025839 (cell AY22) was used:

- Total consumption 2015-16 = 1,306,457.47 litres (cell BO22) x = 0.0025839 = 3,375.76 (cell AD22).

DNO Emissions: Business Transport – Road

The business transport figure for road travel is calculated from the mileage claimed back through the corporate expenses system.

To convert the usage into tCO_2e the following conversion factors from the

Defra/DECC's *UK Government Conversion Factors for Company Reporting 2015 Version 2* Scope 1 Passenger Vehicle tab were used:

- Small petrol cars: 0.255226 $kgCO_2e$ per mile
- Medium petrol cars: 0.320758 $kgCO_2e$ per mile
- Large petrol cars: 0.467901 $kgCO_2e$ per mile
- Small diesel cars: 0.231214 $kgCO_2e$ per mile
- Medium diesel cars: 0.282617 $kgCO_2e$ per mile
- Large diesel cars: 0.362424 $kgCO_2e$ per mile

For 2015-16 the calculation is as follows:

- Small petrol car: 271,877.00 miles x 0.255226 / 1,000 = 69.39 tCO_2e
- Medium petrol car: 377,218.00 miles x 0.320758 / 1,000 = 121.00 tCO_2e
- Large petrol car: 63,493 miles x 0.467901 / 1,000 = 29.71 tCO_2e
- Small diesel car: 348,608 miles x 0.231214 / 1,000 = 80.60 tCO_2e
- Medium diesel car: 1,869,222 miles x 0.282617 / 1,000 = 528.27 tCO_2e
- Large diesel car: 1,002,549 miles x 0.362424 / 1,000 = 363.35 tCO_2e

This gives a total of 1192.32 tCO2e. To ensure this figure was the 2016 entry in table E3 a scalar of 0.00030316043 (cell AY31) was used:

- Total consumption 2015-16 = 3,932,967 miles (cell BO31) x 0.00030316043 = 1192.32 (cell AD31).

DNO Emissions: Business Transport – Rail

The business transport figure for rail is calculated using details provided by our travel supplier of rail journeys undertaken by our employees. The journey details are split into those travelled on national rail and London Underground and then the mileages for each journey calculated using the distances between stations published on the Network Rail website. The mileages are then converted into kilometres for calculating the tCO_2e.

For London Underground journeys, nominal mileages were used for unspecified Zone 1, 2 and 3+ journeys based on typical locations visited by our staff. Zone 1 journeys were taken to be three miles one-way, Zone 2, six miles one-way and Zone 3, nine miles one-way.

Excluded from the rail journey calculations are any journeys booked by employees directly and claimed back through the corporate expenses system as these are minimal and the details not specific enough to make a valid calculation.

To convert the usage into tCO_2e the following conversion factors from the Defra/DECC's *UK Government Conversion Factors for Company Reporting 2015 Version 2* Scope 3 Business Travel – Land tab were used:

- National Rail: 0.045057182 $kgCO_2e$ per kilometre
- London Underground: 0.05631 $kgCO_2e$ per kilometre

For 2015-16 the calculation is as follows:

- National Rail: 642,134 km x 0.045057182 / 1,000 = 28.93 tCO2e
- London Underground: 3,582 km x 0.05631 / 1,000 = 0.20 tCO2e

This gives a total of 29.13 tCO2e. To ensure this figure was the 2016 entry in table E3 a scalar of 0.00004511788 (cell AY32) was used:

Total consumption 2015-16 = 645,716.00 km (cell BO32) x 0.00004511788 = 29.13 (cell AD32).

DNO Emissions: Business Transport – Air

The business transport figure for air travel is calculated using details provided by our travel supplier of air journeys undertaken by our employees. The journey details are split into domestic, short haul international and long haul international and the kilometres travelled for each journey calculated using the air journey distance calculator on the www.webflyer.com website.

To convert the usage into tCO_2e the following conversion factors from the Defra/DECC's *UK Government Conversion Factors for Company Reporting 2015 Version 2* Scope 3 Business Travel – Air tab were used:
used:

- Domestic, Average Passenger With RF 0.29795 $kgCO_2e$ per kilometre
- Short Haul, Economy Class With RF 0.16634 $kgCO_2e$ per kilometre
- Long Haul, Business Class With RF 0.4401 $kgCO_2e$ per kilometre

The kilometre travelled totals are then multiplied by the conversion factors to give the $kgCO_2e$ number and then divided by 1,000 to provide the tCO_2e number.

For 2015-16 the calculation is as follows:

- Domestic Average Passenger: 97,586 km x 0.29795 / 1,000 = 29.08 tCO_2e
- Short Haul International Economy Class: 360,023 km x 0.16634 / 1,000 = 59.89 tCO_2e
- Long Haul International Business Class: 224,893 km x 0.4401 / 1,000 = 98.98 tCO_2e

This gives a total of 187.94 tCO_2e. To ensure this figure was the 2016 entry in table E3 a scalar of 0.00027536532 (cell AY34) was used:

- Total consumption 2015-16 = 682,502.00 km (cell BO34) x 0.00027536532= 187.94 (cell AD34)

DNO Emissions: Fugitive Emissions - SF_6

The amount of sulphur hexafluoride (SF_6) emitted is calculated using the actual mass of SF_6 used when topping up or replacing distribution network apparatus with low gas or gas loss. The top-up amounts are the actual amounts recorded by the engineers on-site when topping up. The loss amounts for apparatus that has been replaced as a result of gas loss are the amounts of gas held by those units.

To convert the usage into tCO_2e the Defra/DECC's *UK Government Conversion Factors for Company Reporting 2015 Version 2* Scope 1 conversion factor for SF_6 of 22,800 tCO_2e per tonne was used.

The amount of gas emitted is then multiplied by the conversion factor to give the tCO_2e number.

For 2015-16 the calculation is as follows:

0.014627 tonnes x 22,800 = 333.50 tCO_2e

To ensure this figure was the 2016 entry in table E3 a scalar of 22.80 (cell AY40) was used:

- Total emissions 2015-16 = 14.627 kg (cell BO40) x 22.80 = 333.50 (cell AD40).

DNO Emissions: Fugitive Emissions - Gases Other

The "gases other" figure is calculated using data held on the capacity and type of HFC gases contained in air conditioning units in use within our occupied offices.

An estimated leakage rate is taken from Table 8B in Annex 8 of the *2012 Guidelines to Defra/DECC's GHG Conversion Factors for Company Reporting*. To determine which leakage rate applies the units were compared with the sizing guide in the December 2011 ICF document *Development of the GHG Refrigeration and Air Conditioning Model Final Report*. All units were judged to be "Small Stationary Air Conditioning" units.

The time used by each unit was calculated as 24% of time available in the year based on an assumed usage of eight hours per day, five days per week = 40 hours per week/168 hours in week= 24%.

To convert the usage into tCO_2e the following conversion factors from Defra/DECC's *UK Government Conversion Factors for Company Reporting 2015 Version 2* Scope 1 Refrigerant and Others tab were used:

- HCFC-22/R22 Chlorodifluoromethane 1,810 tCO_2e per tonne
- R407C 1,774 tCO_2e per tonne
- R410A 2,088 tCO_2e per tonne

The capacity for each HFC type is multiplied by the time used percentage, the annual leak rate and the global warming potential conversion factor to provide the tCO_2e number.

For 2015-16 the calculation is as follows:

- R22: 0.17265 tonnes charging capacity x 24% usage x 3% leakage rate x 1,810 = 2.25 tCO_2e.
- R407C: 0.1708 tonnes charging capacity x 24% usage x 3% leakage x 1,774 = 2.18 tCO_2e.
- R410A: 0.93837 tonnes charging capacity x 24% usage x 3% leakage x 2,088 = 14.10 tCO_2e.

This gives a total of 18.54 tCO_2e. To ensure this figure was the 2016 entry in table E3 a scalar of 2.00886239877 (cell AY41) was used:

- Total emissions 2015-16 = 9.23 kg (cell BO41) x 2.00886239877 = 18.54 (cell AD41).

DNO Emissions: Fuel Combustion – Diesel

The fuel combustion - diesel figure is calculated from fuel litres purchased data provided by the business plant card supplier.

To convert the usage into tCO_2e the Defra/DECC's *UK Government Conversion Factors for Company Reporting 2015 Version 2* Scope 1 conversion factor for

Diesel (average biofuel blend) of 2.5839 kgCO_2e per litre is used.

The litreage total is multiplied by the conversion factor to give the kgCO_2e number and then divided by 1,000 to provide the tCO_2e number.

For 2015-16 the calculation is as follows:

Consumption: 48,015.98 litres x 2.5839 / 1,000 = 124.07 tCO_2e

To ensure this figure was the 2016 entry in table E3 a scalar of 0.0025839 (cell AY47) was used:

- Total consumption 2015-16 = 48,015.98 litres (cell BO47) x = 0.0025839 = 124.07 (cell AD47).

DNO Emissions: Fuel Combustion – Other

The Fuels Other figure is calculated from fuel litres purchased data provided by the business fuel and fuel card suppliers.

To convert the usage into tCO_2e the following conversion factors from the Defra/DECC's *UK Government Conversion Factors for Company Reporting 2015 Version 2* Scope 1 Fuels tab were used:

- Petrol: (average biofuel blend) 2.1944 kgCO_2e per litre
- Gas Oil: 2.90884 kgCO_2e per litre

The litreage total is multiplied by the conversion factor to give the kgCO_2e number and then divided by 1,000 to provide the tCO_2e number.

For 2015-16 the calculation is as follows:

- Petrol consumption: 8,502.68 litres (average biofuel petrol) x 2.1944 / 1,000 = 18.66 tCO_2e.
- Gas oil consumption: 220,151.00 litres x 2.90884 / 1,000 = 640.38 tCO_2e

This gives a total of 659.04 tCO_2e. To ensure this figure was the 2016 entry in table E3 a scalar of 0.00284297167 (cell AY49) was used:

- Total consumption 2015-16 = 242,509.34 litres (cell BO49) x 0.00284297167 = 689.45 (cell AD49).

DNO Emissions: Losses

Losses occur in all electricity networks, and for GB distribution companies typically represent 5-10% of energy distributed to end customers. Losses are usually divided into two categories: technical and non-technical. Technical losses can be further divided into fixed losses (e.g. transformer iron losses) and variable losses which are dependent on power flows in circuits, both of which have a direct carbon impact. Non-technical losses include unregistered or illegal connections, theft, meter inaccuracies, meter settlement errors and other settlement data issues.

Losses are measured as the difference between energy entering (generation) and energy exiting the network (demand), as recorded under the Balancing and Settlement Code (BSC) arrangements. Reported losses therefore do not distinguish between technical and non-technical losses.

The reported figure is a snapshot of received data as of the date of this report and will change as further settlement reconciliation runs are carried out (up to 28 months after each relevant settlement date).

To convert the usage into tCO_2e the Defra/DECC's *UK Government Conversion Factors for Company Reporting 2015 Version 2* Scope 2 Electricity Generated conversion factor of 0.46219 $kgCO_2e$ per kWh is used. This factor is contained on the UK Electricity tab of the conversion factors.

The kWh total is multiplied by the conversion factor to give the $kgCO_2e$ number and then divided by 1,000 to provide the tCO_2e number

For 2015-16 the calculation is as follows:

- Reported losses = 1,445,254,010 kWh x 0.46219 / 1000 = 667,981.95 tCO_2e

To ensure this figure was the 2016 entry in table E3 a scalar of 0.00046219 (cell AY55) was used:

- Total consumption 2015-16 = 1,445,254,010 kWh (cell BO55) x 0.00046219 = 667,981.95 (cell AD55).

Contractors
When reporting BCF emissions due to contractors in the second half of the worksheet please:

- Explain, and justify, the exclusion of any contractors and any thresholds used for exclusion.
- Provide an indication of what proportion of contractors have been excluded. This figure could be calculated based on contract value.

Please provide a description of contractors' certified schemes for BCF where a breakdown of the calculation for their submitted values is not provided in the worksheet.

If a DNO's accredited contractor is unable to provide a breakdown of the calculation and has entered a dummy volume unit of '1' in the worksheet please provide details of the applicable accredited certification scheme which applies to the reported values.

For the BCF emissions due to contractors, only Operational Transport – Road and fuels other have been calculated.

The fuel usage figure from contractors includes the usage by the larger framework contractors only and excludes any usage by smaller, low volume sub-contractors where the collation of data is impractical. The proportion of BCF emissions attributable to the excluded contractors is estimated as less than 10%.

Contractor Emissions: Operational Transport – Road

The contractor operational transport figure is calculated using road fuel litres used data provided by contractors in relation to their fleet usage on our behalf.

To convert the usage into tCO_2e the Defra/DECC's UK Government Conversion Factors for Company Reporting 2015 Version 2 Scope 1 conversion factor for

Diesel (average biofuel blend) of 2.5839 kgCO_2e per litre is used.

For 2015-16 the calculation is as follows:

Consumption = 1,564,733.36 litres x 2.5839 / 1,000 = 4,043.11 tCO_2e

To ensure this figure was the 2016 entry in table E3 a scalar of 0.0025839 (cell AY68) was used:

- Total consumption 2015-16 = 1,564,733.36 litres (cell BO68) x = 0.0025839 = 4,043.11 (cell AD68).

Contractor Emissions: Fuel Combustion – Other

The Fuels Other figure is calculated from fuel litres used data provided by contractors in relation to their generator and plant usage on our behalf.

To convert the usage into tCO_2e the following conversion factors from the Defra/DECC's UK Government Conversion Factors for Company Reporting 2015 Version 2 Scope 1 Fuels tab were used:

- Petrol: (average biofuel blend) 2.1944 kgCO_2e per litre
- Gas Oil: 2.90884 kgCO_2e per litre
- LPG: 1.50938 kgCO_2e per litre

The total is multiplied by the conversion factors to give the kgCO_2e number and then divided by 1,000 to provide the tCO_2e number.

For 2015-16 the calculation is as follows:

- Petrol consumption = 8,057.97 litres (average biofuel petrol) x 2.1944 / 1,000 = 17.68 tCO_2e
- Gas oil consumption: 1,127,777.65 litres x 2.90884 / 1,000 = 3,280.52 tCO_2e
- LPG consumption = 896.00 litres x 1.50938 / 1000 = 1.35 tCO_2e.

This gives a total of 3,299.56 tCO_2e. To ensure this figure was the 2016 entry in table E3 a scalar of 0.00290267244 (cell AY95) was used:

Total consumption 2015-16 = 1,136,731.62 litres (cell BO95) x 0.00290267244= 3,299.56 (cell AD95).

Building energy usage Natural gas, Diesel and other fuels are all categorised as fuel combustion and must be converted to tCO_2e on either a Gross Calorific Value (Gross CV) or Net Calorific Value (Net CV) basis. The chosen approach should be explained, including whether it has been adapted over time. Substation Electricity must be captured under Buildings Energy Usage. Please explain the basis on which energy supplied has been assessed.
We only use electricity as our energy source for buildings and substations. The Buildings - Electricity energy usage figure is calculated using the kWh usage data provided by the business energy suppliers and/or landlords for whole buildings or parts of buildings that we occupy. The substation electricity usage data is calculated from kWh usage data provided by the business energy suppliers for metered supplies and the estimated consumption figure as submitted in the unmetered MPAN certificate.

E4 – Losses Snapshot

Allocation and estimation methodologies: detail any estimations, allocations or apportionments to calculate the numbers submitted.
For all initiatives it is assumed that there were no losses saving in the first year (2015-16) and the full losses saving in the following years. **Opportunistic Installation with 300mm^2 HV Cable** We purchase HV cable in the following standard sizes; 95mm^2, 185mm^2 and 300mm^2. Our corporate Capital Programme Management system (CPM) does not record the size of cable installed. Therefore, the volumes of 300mm^2 HV cable (km) installed is calculated to be the aggregate volume from the appropriate CV table apportioned in the ratio of 300mm^2 HV cable purchased: total HV cable purchased. The unit cost of the baseline solution is taken to be our Target Unit cost for the activity in 2015-16 price base. The unit cost of this activity is calculated as the our Target Unit cost for the activity in 2015-16 price base plus the marginal (average) cost of purchasing 300mm^2 HV cable over 185mm^2 HV cable. The unit (1km) losses benefit was calculated as the losses saved by replacing a 185mm^2 HV cable with 300mm^2 HV cable. The peak current was assumed to be the thermal rating of the 185mm^2 cable. A typical (for ENWL) load factor of 0.53 was assumed across the network leading to a calculated loss load factor of approximately 0.3. **Opportunistic installation with 300mm^2 LV cable** We purchase LV cable in the following standard sizes; 95mm^2, 185mm^2 and 300mm^2. Our corporate Capital Programme Management system (CPM) does not record the size of cable installed. Therefore, the volumes of 300mm^2 LV cable (km) installed is calculated to be the aggregate volume from the appropriate CV

table apportioned in the ratio of 300mm^2 LV cable purchased: total LV cable purchased.

The unit cost of the baseline solution is taken to be our Target Unit cost for the activity in 2015-16 price base.

The unit cost of this activity is calculated as the our Target Unit cost for the activity in 2015-16 price base plus the marginal (average) cost of purchasing 300mm^2 HV cable over 185mm^2 LV cable.

The unit (1km) losses benefit was calculated as the losses saved by replacing a 185mm^2 LV cable with 300mm^2 LV cable. The peak current was assumed to be the thermal rating of the 185mm^2 cable. A typical (for ENWL) load factor of 0.53 was assumed across the network leading to a calculated loss load factor of approximately 0.3.

Proactive replacement of 1000kVA & 800kVA ground mounted transformers

The volume of 1000kVA and 800kVA ground mounted transformers replaced proactively (Equipment to manage losses) is reported in CV21. The volume split between the 1000kVA and the 800kVA units is established by inspection of our ellipse asset register.

The total cost of installing both 1000kVA and 800kVA is taken as the reported total costs (from CPM) of those projects reported in CV21 that have an associated output. The average cost of purchasing 1000kVA (6.6kV, 11kV, unit type, cable connected) is calculated together with the average cost of purchasing 800kVA (6.6kV, 11kV, unit type, cable connected) units leading to calculation of an average marginal cost difference between 1000kVA and 800kVA units. The unit costs of 1000kVA and 800kVA units is calculated by solving the following equations:

Total Cost to Deliver 1000/800kVA Units = (No. 1000kVA units x Installed Cost 1000kVA Unit) + (No. 800kVA Units x Installed Cost 800kVA Unit) --- (1)

Installed Cost 1000kVA Unit = Differential Cost + Installed Cost 800kVA unit --- (2)

The losses calculation is based on transformer resistance values. The peak current was assumed to be the thermal rating of the of the transformer type. A typical (for ENWL) load factor of 0.6 was assumed for urban areas of the network leading to a calculated loss load factor of approximately 0.38.

Opportunistic installation of primary transformers (33kV/HV)

Two primary transformers were delivered in 2015-16. These were replaced under the asset replacement driver and reported in CV7.

There was no price differential between the old ENWL standard primary transformers and the new Eco-Standard primary transformers. For the purpose of the CBA calculation the unit cost of installation of the Old units (baseline scenario) and the Eco-Standard units (option 1) was taken as the our Target Unit cost.

The losses calculations are based on transformer resistance values. The peak current was assumed to be half (because primary transformers are installed as pairs for resilience) the thermal rating of the of the transformer type. A typical (for ENWL) load factor of 0.53 was assumed across the network leading to a calculated loss load factor of approximately 0.3.

Opportunistic replacement of pre-1970 200kVA pole mounted transformers

We purchase pole mounted HV/LV transformers in the following standard sizes;

- 25kVA – single phase
- 50kVA – single phase
- 100kVA – single phase
- 25kVA – three phase
- 50kVA – three phase
- 100kVA – three phase
- 200kVA – three phase

The volumes of 200kVA transformers installed are calculated to be the aggregate volume from the appropriate CV table apportioned in the ratio of 200kVA transformers released from store: total pole mounted transformers released from store.

Estimated unit costs for the baseline scenario and the losses initiative scenario are taken from our Capital Programme Management (CPM) system. Example projects and costs were developed for the replacement of a standard and Eco 200kVA pole mounted transformer on an existing 'H' pole.

The losses calculations are based on transformer resistance values. The peak current was assumed to be the thermal rating of the of the transformer type. A typical (for ENWL) load factor of 0.53 was assumed across the network leading to a calculated loss load factor of approximately 0.3.

Theft of Electricity

The costs associated with Relevant Theft of Electricity activities are taken directly from table I5. These costs include the costs of investigating all reported or suspected instances of Relevant Theft of Electricity. Many of these are not ultimately found to be cases of Relevant Theft of Electricity, and therefore have no losses benefit associated with them, but costs are included to reflect the full cost of operating a Relevant Theft of Electricity activity.

The income associated with Relevant Theft of Electricity activities is also taken directly from table I5. This income represents all income received during 2015-16 and will include some payments received from instances of theft identified in prior years (for example where a customer agrees to a payment plan and pays the debt over several years). We make no adjustment in our CBA to reflect the lag in receiving income.

The net of costs and associated income are reported within the losses snapshot table. As income was slightly higher than costs during 2015-16 we report a negative value for this year.

We estimate the losses benefit associated with identifying and remedying instances of Relevant Theft of Electricity as follows:

- For sites where we have billed the customer for the value of electricity for 12 months of theft (our usual approach), we quantify losses based on the invoiced amount of electricity used. We assume that this full losses benefit is achieved in the year that we identify the theft, reflecting the fact that the full 12 months has been invoiced. We assume this whether or not the customer has yet paid anything against the invoice; this reflects the benefit associated with there being no ongoing theft.

- For sites where we have billed the customer for the value of electricity for less than 12 months of theft (for example if the customer has not lived in the property for a year), we quantify losses benefit in year 1 based on the invoiced amount of electricity used. For subsequent years we increase the losses benefit to a full 12 month effect – reflecting the full amount of electricity that will no longer be being stolen. We assume this whether or not the customer has yet paid anything against the invoice; this reflects the benefit associated with there being no ongoing theft.

- For sites where we have identified theft but have not raised an invoice, for example where we have no reasonable expectation of recovering the costs, where the values involved are very small (for example where a customer has only just moved into a property) or where all lost units will be recovered via a supplier (following registration of a new MPAN) we assume a losses benefit of 10kWh per day for domestic properties and 30kWh a day for commercial properties. We assume that none of this losses benefit is achieved in the year that we identify the theft, with 100% of the benefit achieved from year 2 onwards.

These losses benefits reflect the fact that electricity is no longer being stolen – either the theft has ceased or the units are being entered into settlements.

In all cases we assume that the losses benefits persist on an ongoing basis, ie that the customer continues to use electricity at the rate we assumed, that the customer does not revert to stealing electricity and that the site is not disconnected.

Programme/Project Title

Please provide a brief summary and rationale for each of the activities in column C which you have reported against.

There are two elements to the Losses Snapshot submission; technical and non-technical losses. The losses Snapshot Table E4 has been completed based on the losses reduction initiatives detailed in our Losses Strategy (April 2015).

For Technical Losses the activities are as follows:

- Opportunistic installation with $300mm^2$ HV cable.
- Opportunistic installation with $300mm^2$ LV cable.
- Proactive replacement of 1000kVA ground mounted transformers.
- Proactive replacement of 800kVA ground mounted transformers.
- Opportunistic installation of primary transformers (33kV/HV).
- Opportunistic replacement of pre-1970 200kVA pole mounted transformers.

For Non-Technical Losses the activity is the identifying and remedying instances of Relevant Theft of Electricity.

Primary driver of activity

If, in column E, you have selected 'Other' as the primary driver of the activity, please provide further explanation.

In Column E the following other drivers have been identified for the various programmes/projects. These reflect the opportunistic nature of these initiatives:

Opportunistic use of 300mm^2 HV cable:

- Diversions
- Quality of Supply
- Overhead Clearances
- WSC
- Visual Amenity
- Faults
- DRS
- Connections
- Other Asset Movements

Opportunistic use of 300mm^2 LV cable:

- Diversions
- Quality of Supply
- Overhead Clearances
- WSC
- Visual Amenity
- Faults
- DRS
- Connections
- Other Asset Movements

Opportunistic replacement of pre-1970 200kVA pole mounted transformers:

- Diversions
- Quality of Supply
- Overhead Clearances
- WSC
- Visual Amenity
- Environmental
- Faults
- DRS
- Connections
- Other Asset Movements

For Relevant Theft of Electricity, none of the other column E primary drivers apply.

Baseline Scenario Please provide a brief description of the 'Baseline Scenario' inputted in column K for each activity.

Opportunistic use of 300mm^2 HV cable: baseline scenario is the continued installation of 185mm^2 HV cable which produce higher losses.

Opportunistic use of 300mm^2 LV cable: baseline scenario is the continued installation of 185mm^2 LV cable which produce higher losses.

Proactive replacement of Pre-1990 1000kVA transformers with Eco Standard Units: baseline scenario is to retain pre-1990 transformers which produce higher losses.

Proactive replacement of Pre-1990 800kVA transformers with Eco Standard Units: baseline scenario is to retain pre-1990 transformers which produce higher losses.

Opportunistic Primary Transformer Replacement with Eco Standard Units: baseline scenario is to replace with pre-2015 ENWL specification units which produce higher losses.

Opportunistic 200kVA PMT replacement with Eco Standard Units: baseline scenario is to replace with pre-2015 ENWL specification units which produce higher losses.

Relevant Theft of Electricity: baseline scenario is to not carry out any relevant Theft of Electricity activity.

Use of the RIIO-ED1 CBA Tool

DNOs should use the latest version of the RIIO-ED1 CBA Tool for each of the activities reported in column C. Where the RIIO-ED1 CBA Tool cannot be used to justify an activity, DNOs should explain why and provide evidence for how they have derived the equivalent figures for the worksheet. The most up-to-date CBA for each activity reported in the Regulatory Year under report must be submitted.

N/A. We have used v4 of the RIIO-ED1 CBA tool, issued by Ofgem on 17 January 2014 for these analyses. We have updated the input and static values as appropriate.

Changes to CBAs If, following an update to the CBA used to originally justify the activity in column C, the updated CBA shows: • a negative net benefit for an activity, but the DNO decides it is in the best interests of consumers to continue the activity, or • a substantively different NPV from that used to justify an activity that has already begun. the DNO should include an explanation of what has changed and why the DNO is continuing the activity. For example, where the carbon price used in the RIIO-ED1 CBA Tool has changed from that used to inform the decision such that the activity no longer has a positive NPV.
N/A. Despite the changes to the input values in the relevant CBAs, all our losses initiatives continue to show a positive NPV.

Cost benefit analysis additional information Please include a reference to the file name and location of any additional relevant evidence submitted to support the costs and benefits inputted into this worksheet. This should include the most recent CBA for each activity reported in column C in the Regulatory Year under report.
• Install 300sqmm HV Cable versus 185sqmm HV CV1 CV2 V2.xlsx • Install 300sqmm HV Cable versus 185sqmm HV CV1 CV3 V2.xlsx • Install 300sqmm HV Cable versus 185sqmm HV CV1 CV7 V2.xlsx • Install 300sqmm HV Cable versus 185sqmm HV Other CV2 V2.xlsx • Install 300sqmm LV Cable versus 185sqmm LV CV1 CV2 V2.xlsx • Install 300sqmm LV Cable versus 185sqmm LV CV7 V2.xlsx • Install 300sqmm LV Cable versus 185sqmm LV Other V2.xlsx • Opportunistic 200kVA PMT Replacement CV7 V2.xlsx • Opportunistic 200kVA PMT Replacement Other V2.xlsx • Proactive 800kVA GMT Replacement CV21 V2.xlsx • Proactive 1000kVA GMT Replacement CV21 V2.xlsx • Programme 23MVA Replacement CV7 V2.xlsx • Relevant theft v no activity Cv21 CBA vfinal.xlsx

E5 – Smart Metering

Allocation and estimation methodologies: detail any estimations, allocations or apportionments to calculate the numbers submitted.

N/A.

Actions to deliver benefits
Detail what activities have been undertaken in the relevant regulatory year to produce benefits of smart metering where efficient and maximise benefits overall to consumers. At a minimum this should include:

- A description of what the expenditure reported under Smart Meter Information Technology Costs is being used to procure and how it expects this to deliver benefits for consumers.
- A description of the benefits expected from the non-elective data procured as part of the Smart Meter Communication Licensee Costs. The DNO should set out how it has used this data.
- A description of the Elective Communication Services being procured, how it has used these services, and a description of the benefits the DNO expects to achieve.

The £1.68m IT costs incurred in 2015-16 covered the procurement, implementation and commissioning of the gateway infrastructure connecting our IT systems to the Data and Communications Company's (DCC) central systems as part of the Smart Meter Implementation Programme and required by the Smart Energy Code. Connection to DCC's central systems facilitates access to smart meter data, generated from alerts and service requests, which in the longer term will enable a network operator to manage its network more effectively and cost efficiently for its customers.

The £0.68m Communication Licensee Costs are those costs payable by us to the Data and Communications Company (DCC), as required by the Smart Energy Code and defined by DCC's published charging methodology statement. DCC's systems and our gateway are being built and are expected to go-live in autumn 2016, so at the moment no smart meter data is being transferred from smart meters to us.

Calculation of benefits
Explain how the benefits have been calculated, including all assumptions used and details of the counterfactual scenario against which the benefits are calculated.

N/A. The Smart Meter programme has not yet rolled out to the extent that benefits are identifiable.

Use of the RIIO-ED1 CBA Tool
DNOs should use the latest version of the RIIO-ED1 CBA Tool for each solution reported in the worksheet in the Regulatory Year under report. Where the RIIO-ED1 CBA Tool cannot be used to justify a solution, DNOs should explain why and provide evidence for how they have derived the equivalent figures for the worksheet. The most up-to-date CBA for each activity reported in the Regulatory Year under report which are used to complete the worksheet must be submitted.

N/A.

Cost benefit analysis additional information
Please include a reference to the file name and location of any additional relevant evidence submitted to support the costs and benefits inputted into this worksheet. This should include the most recent CBA for each solution reported in the Regulatory Year under report.

N/A.

E6 – Innovative Solutions

Allocation and estimation methodologies: detail any estimations, allocations or apportionments to calculate the numbers submitted.

Capacity to Customers

The actual connections costs were the total of the connection cost for an n-0 solution paid by the customer for schemes connected at EHV.. The benefits were calculated by assuming EHV reinforcement of £300 per metre for cable and £200k for a primary switchboard change. It was also assumed that the customer would pay 100% of the additional costs as the increased security is wholly for their benefit.

Transformer Regeneration

This solution was based on the baseline scenario of replacing or refurbishing all Grid and 33kV transformers which had a HI of 5 and refurbishing those with a HI of 4. The regeneration solution is to replace transformers at HI5 with a criticality of 2-4 and refurbish those at HI5 (criticality 1) and HI4 (criticality 2-4). The costs used in the CBAs were derived from the CV7 and CV9 tables from the Cost & Volumes pack.

Fault Support Centre

The CBA was based on the number of LV ways fitted with reclosing devices during 2015-16 and the number of times the devices operated prior to the fault being located and repaired. It was assumed that faults occurred linearly throughout the week and therefore costs for the baseline case included premium time working. Each callout to replace a fuse was costed at three hours and it was assumed that customers would be without supply for 90 minutes.

Repairs were assumed to commence immediately a fault became permanent. It was assumed that the installation of reclosing devices removed the requirement for fuse replacement and as supplies were restored within three minutes the Customer Interruptions and Customer Minutes Lost were reduced. The input from the Fault Support Centre allowed faults to be located prior to becoming permanent and it was assumed that all faults were repaired during normal working hours. The cost of setting up the FSC was included in year 1 of the CBA.

Connect and Manage PV Clusters

The volumes used for this CBA were based on the numbers of customers added to the feed in tariff database during 2015-16. For the baseline scenario, it was assumed that there would be a requirement to purchase a tool for LV system analysis and that clusters of PV would consist of 24 properties covering 5% of the total. The remaining 95% would have on average 1.5 properties per application. Planning time was allocated at 12 hours per scheme for larger schemes and one hour for the small schemes. Solutions for the larger schemes were split between LV cable overlay (5%), transformer change (5%) and altering transformer taps (40%). It was assumed that for 50% of the larger schemes and all of the smaller schemes that the PV demand was approved.

For the Connect and Manage scenario, it was assumed that 2% of the applications would lead to LV system monitoring being installed resulting in 2% of the total number requiring further planning of which 25% required a cable overlay, 10% required a transformer change and 65% required the tap position altering.

In the CBA calculations the feed in tariff number for PV provided by Ofgem (9761) was used. This number differs from the PV installed number in table E7 (7162) which was installations Electricity North West had been informed of.

General
For each of the solutions please explain:

- In detail what the solution is, linking to external documents where necessary.
- How this is being used, and how it is delivering benefits.
- What the volume unit is and what you have counted as a single unit.
- How each of the impacts have been calculated, including what assumptions have been relied upon.

Introduction

The first year of the RIIO-ED1 period has been a crucial period for us in both preparing for and actually deploying a number of Innovative solutions. Many of these solutions will come into active use in future years and our activities during 2015-16 have been limited to transitioning them into BAU via a number of new and amended policy updates, completion of associated procurement exercises to allow us to purchase key products and services as well as internal training on how to carry out the range of activities associated with the deployment of the innovative solutions.

Whilst there has been much work in preparing the ground for deployment of these future solutions, this commentary and associated CBAs contains only details of innovative solutions which have incurred expenditure and been deployed in 2015-16, and where this expenditure was undertaken as part of normal business (ie not innovation funded projects).

The commentary below details all of the innovative solutions that were deployed in 2015-16 and which can be traced back to IFI, LCNF Tier1 or LCNF Tier2 projects. However, while several of these are presented as separate projects they are eventually brought together in combination to form a new and innovative solution. The commentary below summarises these interactions. Owing to this combination of several projects into combined solutions and to avoid double counting of the associated costs and benefits, a CBA has only been prepared for the combined solution.

Innovative Solutions

There are four Innovative Solutions which form part of our business as usual activities during 2015-16. These are listed below together with the project on which the Innovative Solution depends. These projects are shown in brackets alongside the innovative solutions:

- Capacity to Customers
- Transformer Regeneration (Combined Online Transformer Monitoring)
- Fault Support Centre (Bidoyng Smart Fuse)
- Connect and Manage of PV Clusters (LV Smart Joint)

Capacity to Customers (now known as managed connections)

<u>What the solution is</u>

Managed connections provide customers wishing to connect to the network with a lower cost connection and reduced waiting times versus traditional network reinforcement based connection arrangements. It utilises advances in network automation and communications alongside innovative commercial terms. It is a form of active network management (ANM) solution which may seek to disconnect managed customers from the network for agreed periods only in the event of a relevant network fault.

<u>How the solution is being used</u>

Managed connections are now the standard connection offer provided to all generation customers connecting to the EHV network. Managed connections afford customers a lower cost connection and as such have become the default connection offer provided to all DG customers.

To support decision making by customers, information on the potential 'curtailment factor' (ie the typical period of time that a customer could expect to be at risk of disconnection) is provided alongside the connection offer.

Customers may choose to reject the managed connection offer and instead opt for a more traditional connection arrangement without the managed elements.

<u>How the solution is delivering benefits</u>

Managed connections are providing a number of benefits.

Economic benefits flow to connection customers from lower reinforcement costs and reduced time to connect. Environmental benefits accrue as a result of the connection of low carbon generation such as solar/wind farms.

Fault Support Centre

<u>What the solution is</u>

The Fault Support Centre is an enhanced low voltage network fault management solution which makes use of the increased penetration of intelligent devices such as the Bidoyng coupled with an innovative commercial partnership with a third party provider. The FSC provides a real-time operational management of Low Voltage networks to allow for the proactive management of faults. The data obtained can be further used to target areas of the network which would benefit from asset replacement.

<u>How the solution is being used</u>

The solution is being used as the business-as-usual method by which all transient faults are managed within ENWL. In the event that a transient fault is detected, a bidoyng smart fuse (or suitable alternative such as the weezap) is fitted to the suspect LV network. Our third party service provider (Kelvatek) is informed of the event and information is passed across that allows real-time monitoring of the associated network.

Kelvatek will continue to monitor the affected networks until they have determined the location of the fault and issued an instruction to our field teams to investigate or it can be reasonably shown that the transient fault is no longer active. In such cases the equipment will be recovered and redeployed elsewhere.

How the solution is delivering benefits

The Fault Support Centre allows for the proactive management of LV transient faults. It is clear from our own customer engagement that these types of fault are amongst the biggest cause of customer dissatisfaction. The ability to repair these faults before they have chance to progress into a permanent fault will significantly reduce the number of associated faults and reduce customer disruption accordingly.

Further benefits flow from the reduced CIs and CMLs and associated fault costs that the proactive management of faults delivers.

Bidoyng (smart fuse) (facilitates Fault Support Centre)

What the solution is

The Bidoyng is an innovative replacement for the standard low voltage fuse. It provides for a multi-shot re-close feature as opposed to the single shot available from the standard fuse. This means that customer supplies can be automatically restored in the event of a transient fault. This reduces the number of customer interruptions and customer minutes lost, reduces the cost associated with managing our response to a loss of supply and LV fault and improves customer satisfaction outcomes.

In addition, the Bidoyng provides increased network visibility via its ability to measure and transmit via SCADA key network parameters and make this available in near real-time.

How the solution is being used

The Bidoyng is used to reduce the customer impacts of faults, support increased understanding of the impact of the connection of Low Carbon Technologies and improve the management of network faults.

The Bidoyng smart fuse is acting as an enabler for a number of innovative solutions and applications. In particular, the Bidoyng is a key tool in the management of Low Voltage transient faults. These faults are intermittent in nature and are often difficult to find and repair. The Bidoyng is used to both minimise the customer disruption associated with a fault (ie by automatic restoration of supplies) and to help engineers to locate the fault thus allowing proactive repair of the fault.

How the solution is delivering benefits

The Bidoyng smart fuse is a key enabling technology. It is being used as the main technology deployed on faulty parts of the LV network as part of the Fault Support Centre. In addition, it generates information on the performance of the network to support the application of the Connect & Manage approach to domestic PV clusters connected to the LV network.

Connect & Manage of PV Cluster on LV networks

What the solution is

As a result of the learning outcomes of the LCNF Tier 1 Project – Low Voltage Network Solutions (LVNS), we have been able to successfully implement a streamlined approach to the connection of domestic scale PV systems to the low voltage (LV) network. These systems are often connected in clusters and can give rise to associated network voltage and thermal issues.

Traditionally, a network operator would require detailed and time consuming network assessments to be performed in advance of allowing the connection to proceed. These assessments are aimed at understanding if the connection could give rise to any of the aforementioned problems. However, as a result of the research that was undertaken as part of the LVNS project and the sophisticated network modelling that underpinned, we have been able to adopt an alternative approach.

We have successfully shown that up to a certain threshold (ie percentage of customers with PV systems) it is acceptable to allow the connections to proceed. Once the threshold is met however we will install network monitors to assess using actual recorded data if the network requires any further assessments.

How the solution is being used

The solution is being actively used across our region. We use this to avoid the often costly and time consuming network assessments that can accompany generation connections. We have established a business process supported by internal policy that provides for a continued monitoring of the PV volumes. Specific actions are triggered when these volumes are exceeded and follow up actions are performed as appropriate.

How the solution is delivering benefits

The solution delivers benefits to customers in the form of avoided waiting times associated with the connection of PV systems to the LV network. We have also been able to avoid expensive and resource intensive network connection studies, thus reducing internal costs and freeing up resources to concentrate on other parts of our connection services.

Another significant innovation which we have now transitioned across to BAU is the regeneration of transformers to avoid the need to replace with new. During 2015-16, our activities have been limited to the preparation and mobilisation of the various teams that will be used to deliver this programme which will commence during 2016-17. We have included the details of this innovation within this commentary but have omitted it from table E6.

Transformer Regeneration

What the solution is

The condition of the oil in the transformer main tank is a good proxy for the general condition of the transformer as a whole. It has been shown from recent research that transformer oil regeneration (a process whereby transformer oil is cleaned through an on-site process) can result in an improvement in the overall condition of the transformer thus can extend the expected life of the transformer when used in combination with enhanced condition monitoring.

<u>How the solution is being used</u>

Transformer regeneration is being used as an alternative to traditional transformer replacement during RIIO-ED1 thus reducing the cost of asset replacement.

In 2015-16 our activities have been limited to preparation and establishing delivery capabilities for this solution. As such there are no physical outputs in this reporting period.

<u>How the solution is delivering benefits</u>

The financial benefits from this project are derived from the potential transformer life extension and deferment of asset replacement costs. Other benefits include quality of supply benefits which are limited to improved understanding of the risk of failure of older transformers and a better insight into the oil ageing process.

The Environmental benefits result from extending the life of transformer and its oil therefore reducing the requirements for disposal and recycling of used oil and scrap transformers.

Combined online transformer monitoring (facilitates Transformer Regeneration)

<u>What the solution is</u>

As transformer life is extended through the use of techniques such as transformer oil regeneration, network operators must be certain that the life extended units will continue to operate both safely and reliably. To support this, a real-time condition monitoring system has been developed which provides us with enhanced information on each refurbished transformer via an on-line information dashboard.

<u>How the solution is being used</u>

Transformer monitoring will be fitted to all transformers which are to have their oil regenerated in RIIO-ED1 for a period of time as to confirm via observable data that both the initial condition of the transformer is improved and that this improved condition is maintained thereafter. The solution is being used as part of the main project to extend the life of a large number of Grid & Primary transformers. The technology is fitted to targeted transformers for a short period prior to the commencement of the regeneration process and continues for a defined period thereafter.

<u>How the solution is delivering benefits</u>

The condition monitoring provides us with confirmation that the transformer regeneration process has been successful in improving the condition of the transformer oil and thus the main tank. The combined online transformer monitoring is a key enabling technology for the refurbishment of large volumes of

Grid & Primary transformers via the Transformer Regeneration Innovative Solution.

Use of the RIIO-ED1 CBA Tool DNOs should use the latest version of the RIIO-ED1 CBA Tool for each solution reported in the Regulatory Year under report. Where the RIIO-ED1 CBA Tool cannot be used to justify a solution, DNOs should explain why and provide evidence for how they have derived the equivalent figures for the worksheet. The most up-to-date CBA for each solution reported in the Regulatory Year under report which are used to complete the worksheet must be submitted.
Updated CBA analyses continue to show positive NPVs for the Innovative solutions discussed.

Changes to CBAs If, following an update to the CBA used to originally justify the activity in column C, the updated CBA shows a negative net benefit for an activity, but the DNO decides it is in the best interests of consumers to continue the activity, the DNO should include an explanation of what has changed and why the DNO is continuing the activity.
N/A.

Calculation of benefits Explain how the benefits have been calculated, including all assumptions used and details of the counterfactual scenario against which the benefits are calculated.
Capacity to Customers The actual connections costs were the total of the connection cost for an n-0 solution paid by the customer for schemes connected at EHV. The benefits were calculated by assuming EHV reinforcement of £300 per metre for cable and £200k for a primary switchboard change. It was also assumed that the customer would pay 100% of the additional costs as the increased security is wholly for their benefit. **Transformer Regeneration** This solution was based on the baseline scenario of replacing or refurbishing all Grid and 33kV transformers which had a HI of 5 and refurbishing those with a HI of 4. The regeneration solution is to replace transformers at HI5 with a criticality of 2-4 and refurbish those at HI5 (criticality 1) and HI4 (criticality 2-4). The costs used in the CBAs were derived from the CV7 and CV9 tables from the Cost & Volumes pack. **Fault Support Centre** The CBA was based on the number of LV ways fitted with reclosing devices during 2015-16 and the number of times the devices operated prior to the fault being located and repaired. It was assumed that faults occurred linearly throughout the week and therefore costs for the baseline case included premium time working. Each callout to replace a fuse was costed at three hours and it was assumed that

customers would be without supply for 90 minutes.

Repairs were assumed to commence immediately a fault became permanent. It was assumed that the installation of reclosing devices removed the requirement for fuse replacement and as supplies were restored within three minutes the Customer Interruptions and Customer Minutes Lost were reduced. The input from the Fault Support Centre allowed faults to be located prior to becoming permanent and it was assumed that all faults were repaired during normal working hours. The cost of setting up the FSC was included in year 1 of the CBA.

Connect and Manage PV Clusters

The volumes used for this CBA were based on the numbers of customers added to the feed in tariff database during 2015-16. For the baseline scenario, it was assumed that there would be a requirement to purchase a tool for LV system analysis and that clusters of PV would consist of 24 properties covering 5% of the total. The remaining 95% would have on average 1.5 properties per application. Planning time was allocated at 12 hours per scheme for larger schemes and one hour for the small schemes. Solutions for the larger schemes were split between LV cable overlay (5%), transformer change (5%) and altering transformer taps (40%). It was assumed that for 50% of the larger schemes and all of the smaller schemes that the PV demand was approved.

For the Connect and Manage scenario, it was assumed that 2% of the applications would lead to LV system monitoring being installed resulting in 2% of the total number requiring further planning of which 25% required a cable overlay, 10% required a transformer change and 65% required the tap position altering.

Cost benefit analysis additional information
Please include a reference to the file name and location of any additional relevant evidence submitted to support the costs and benefits inputted into this worksheet. This should include the most recent CBA for each solution reported in the Regulatory Year under report.

C2C CBA RIIO ED1_v5.xlsx
LV fault management CBA RIIO ED1_v4.xlsx
PV CBA RIIO ED1_v4.xlsx

E7 – LCTs

Allocation and estimation methodologies: detail any estimations, allocations or apportionments to calculate the numbers submitted.

All EV fast charge (above 16A/3.7kW draw-down) was calculated taken using 7kW as the draw down.

LCT – Processes used to report data
(i) Please explain processes used to calculate or estimate the number and size of each type of LCT.
(ii) If any assumptions have been made in calculating or estimating either of these values, these must be noted and explained.

Secondary Network

The number of secondary network Low Carbon Technologies installed was provided by our internal Data Management and Connections teams. From this the following volumes were identified:

PV Band 1.1 (Domestic CHP and all microgeneration up to 1.5kW) = 216

PV Band 1.2 (Domestic CHP and all microgeneration from 1.5kW single phase to 16A per phase, including 1 phase and 3 phase installations) = 6,946

EV Slow Charge (up to 16A/3.7kW draw-down) = 258

EV Fast Charge (above 16A/3.7kW draw-down) = 306 (2 x 20A, 124 x 30A, 176 x 32A, 2 x 40A, 2 x 64A)

DG (non G83) = 187

The figures for the maximum export allowed were calculated as follows:

EV slow charge = 258 x 3.7kW / 1000 = 0.9546 MW

EV fast charge = 306 x 7kW / 1000 = 2.142 MW (note all fast charge taken as 7kW draw down)

DG (non G83) = 74,986.12 kW /1000 = 74.99 MW

Primary Network

The number of primary network Low Carbon Technologies installed was as follows:

1 x Onshore Wind @ 10.737 MW
4 x PV @ 14.801 MW

LCT - Uptake
Please explain how the level of LCT uptake experienced compares to the forecast in your RIIO-ED1 Business Plan and the DECC low carbon scenarios. This must also include any expectation of changes in the trajectory for each LCT over the next Regulatory Year in comparison to actuals to date.

The volume of LCT uptake on the secondary network was 29% below the forecast volumes for 2015-16. The key difference was in the installation of heat pumps with none connected in the year compared to a forecast of 1,254. EV connections were also below expectation. PV connection was broadly in line with plan and non G83 above the expected level. The volume of LCT uptake on the primary network was in line with forecast although more PVs were connected than anticipated.

		RIIO-ED1 2016	
		Plan	Actual
Secondary network			
Heat Pumps	Number	1,254	
EV slow charge	Number	650	258
EV fast charge	Number	547	306
PVs (G83)	Number	8,641	7,162
Other DG (G83)	Number		
DG (non G83)	Number	0	187
Total		**11,092**	**7,913**
primary network			
Heat Pumps	Number	-	
EV slow charge	Number	-	
EV fast charge	Number	-	
PVs (G83)	Number	3	
Other DG (G83)	Number		
DG (non G83)	Number	2	5
Total		**4**	**5**
Secondary network			
Heat Pumps		21.19	
EV slow charge	MW	0.62	0.95
EV fast charge	MW	0.66	2.14
PVs (G83)	MW	41.83	26.02
Other DG (G83)	MW		
DG (non G83)	MW	1.60	74.99
Total		**65.90**	**104.11**
primary network			
Heat Pumps	MW	-	
EV slow charge	MW	-	
EV fast charge	MW	-	
PVs (G83)	MW	11.01	
Other DG (G83)	MW		
DG (non G83)	MW	8.21	25.54
Total		**19.22**	**25.54**