RIIO-ED1 RIGs Environment and Innovation Commentary, version 2.0

2016-17

Scottish and Southern Electricity Networks

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 (ie 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.
SSEH and SSES Project costs have been allocated on a project by project basis in Harmony. The total expenditure for these projects has been allocated based upon the appropriate activity driver with no apportionment. **<u>2015/16 Restatement</u>** As was detailed in a review of these packs and notified to Ofgem, while the overall costs for Visual Amenity had been captured correctly between E1 and CV20 of the Cost & Volumes packs, there were a couple of anomalies that required rectification for SSES. 1. Cost type split in CV20 should have recorded costs between labour, materials and contractors and this has now been rectified. 2. Within E1, the length of OHL removed and cable installed only included 2 out of the 3 projects that were worked on during the year. These numbers have been corrected. This includes assets at LV, HV and EHV. We had not included the project names from Row D54 onwards, and we have corrected this, including the 3 projects from North Downs, South Downs and Surrey Hills accordingly.

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.
N/A

E2 – Environmental Reporting

Allocation and estimation methodologies: detail any estimations, allocations or apportionments to calculate the numbers submitted.
SSEH and SSES The allocation of these project costs to individual cells in the regulatory reporting table is automated in Harmony for 2016/17. **Data obtained from our Asset Management Systems** The following parameters mandated in the table were extracted from our asset management systems: • Fluid used to top-up cables: • Fluid recovered; • SF_6 Bank; • SF6 Emitted (Please refer section '**E3-BCF**' of this commentary for the '**Restatement of SF_6**' emitted). Fluid recovered is a figure we don't currently capture for fluid-filled cables.. **Data obtained from our Environmental Management Systems** The following parameter mandated in the table was extracted from our environmental management system;

- Environmental Management System (EMS) Certified Activities

Environmental Volume information is derived from actual projects completed during 2016/17.

Data cleansing

As part of our Asset Data Project that was completed during 2015/16 and discussed with Ofgem, there was a movement of asset data which has resulted in variations to a number of 2015/16 data that was provided in Table E2. We have made the necessary adjustments in this submission as well as in the resubmission of our 2015/16 Environment and Innovation packs for SSEH and SSES.
Below is a summary of the data affected.

SSEH

- Fluid filled cable in service: In 2015/16, 80km of fluid filled cables in service was reported which was updated as part of the Asset Data Project to 73km.
- Oil in service in cables: The data cleansing described above for fluid filled cables in service has had an impact on the oil in service in cables reported in 2015/16. The value of oil in service in cables has decreased from the reported value of 38,480litres to 35,090litres.

SSES

- Fluid filled cable in service: In 2015/16, 921.52km of fluid filled cables in service was reported which was updated as part of the Asset Data Project to 1134km.
- Oil in service in cables: The data cleansing described above for fluid filled cables in service has had an impact on the oil in service in cables reported in 2015/16. The value of oil in service in cables has increased from the reported value of 578,699litres to 689,618litres.

DNOs must provide some analysis of any emerging trends in the environmental data and any areas of trade-off in performance.
SSEH and SSES There have been no significant emerging trends identified in environmental data.

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.
SSEH and SSES The noise complaints reported in 2016/17 for both SSEH and SSES included complaints related to substation noise. A total of 4 noise complaints were made in SSEH's and 12 in SSES's licence areas. A total of £0.997m was spent on rectifying a noise issue in Ealing Primary Substation and building a noise enclosure to deal with noise issues at Birdham substation in the SSES licence area.

Where reported in the Regulatory Year under report, DNOs must provide details of any Non-Undergrounding Visual Amenity Schemes undertaken.
N**/A**

Any Undergrounding for Visual Amenity should be identified including details of the activity location, including whether it falls within a Designated Area.
There is no undergrounding within a Designated area reported in E2. Any undergrounding is reported in Table E1.

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.
N/A

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.

SSEH

SF6
There were no SF6 mitigation schemes undertaken by SSEH in 16/17.

Oil Pollution Mitigation Scheme - Operational and non-operational sites
There were no oil pollution mitigation schemes at operational sites and non operational sites in SSEH's area in 2016/17.

SSES

SF6
There were no SF6 mitigation schemes undertaken by SSES in 16/17.

Oil Pollution Mitigation Scheme - Operational Sites
In 16/17, there were 19 oil pollution mitigation schemes at operational sites in SSES' area. The schemes were undertaken to mitigate the risk of discharging insulating oil into the environment at these operational sites.The schemes cost a total of £0.772m.

Contaminated Land Clean up
In 16/17, there were 4 incidents of land contamination in the SSES area. Initial risk assessments were undertaken to determine the extent of the contamination and to ascertain the risk mitigation works and/or clean up works required. The schemes cost a total of £0.011m.

E3 –BCF

Allocation and estimation methodologies: detail any estimations, allocations or apportionments to calculate the numbers submitted.
SSEH and SSES Energy and fuel consumption figures used to calculate the CO_2 emissions submitted for SSEH and SSES have been extracted from a number of sources which include our asset management system PLACAR, and our expenses and travel systems. The only area where we have used estimation principles is in calculating the electrical load for each substation in the SSES and SSEH area which are then used to derive the CO_2 emitted. The estimating principle is described in this narrative under Building energy usage.

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.
SSEH and SSES This narrative details the total Green House Gas emissions produced by Scottish and Southern Electricity Networks (SSEN) in the financial year 2016/17. Scottish and Southern Electricity Networks is our new trading name that replaces our old brand, Scottish and Southern Energy Power Distribution (SSEPD). SSEN is comprised of Scottish Hydro-Electric Power Distribution (SSEH)[1] and Southern Electric Power Distribution (SSES)[2] and one electricity transmission business, Scottish Hydro Electric Transmission plc (SHE Transmission). In turn, SSEN is part of the wider corporate group SSE plc, which includes generation, transmission, supply, retail, telecoms and contracting activities. There are no apportionment of emissions across the corporate group.

BCF process The reporting methodology for BCF must be compliant with the principles of the Greenhouse Gas Protocol.3 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.
SSEH and SSES We have followed Ofgem's classification of carbon sources. We have been developing the capability to report our carbon footprint for several years, leading to more accurate identification of relevant equipment and its associated emissions. This piece of work satisfies the requirements of the Business Carbon Footprint RIGs. All conversion rates are extracted from specific annexes listed in the Defra/DECC Greenhouse Gas (GHG) Conversion Factors for Company Reporting. Please refer to our BCF report and accompanying tables for the data for each respective source.

[1] SHEPD
[2] SEPD
[3] 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.

Building energy usage

All relevant distribution buildings have been identified using the same office/depot/store log provided to Ofgem's property consultants.

Energy usage (both electricity and gas) within shared buildings is allocated using our Corporate Recharge model which is consistent in all submissions to Ofgem[4]. The 'Grid Rolling Average' conversion factor has been used to provide the buildings electricity section. The Gross Calorific Value has been applied consistently for the conversion of gas figures.

	2016/17			2015/16			
Consumption	***Electricity (kWh)***	***Gas (kWh)***	***tCO_{2e}***	***Electricity (kWh)***	***Gas (kWh)***	***tCO_{2e}***	***% Change (tCO_{2e})***
SSEH	2,051	187	880	2,109	181	1,008	-15%
SSES	2,757	445	1,218	2,877	427	1,409	-16%

Substation Energy

Substations have been separated into three categories for energy usage estimations.

HV: 6.6kV - 20kV,
EHV: 22kV - 66kV,
132kV (SSES only), as 132kV is Transmission in Scotland

All SSEN substations are registered as unmetered supplies so in calculating the total BCF,

[4] This is externally audited as part of our EU Cross Subsidy Submission, Standard License Condition 44.

substation energy consumed is deducted from the total systems losses to avoid double counting. A best estimate framework for the energy consumption at these sites has been used. Principles and assumptions used in this estimation are detailed below:

Substation Numbers - The number of substations in each category is taken from our plant database (PLACAR). The numbers are split between our licensees to give figures for both SSES and SSEH. Out of area substations are excluded.

Estimating Principles. All substations in SSEN's licensees are registered as unmetered supplies. A best estimate framework for the energy consumption at these sites has been used, as detailed below. Electrical load in a substation is a combination of the following factors:

- Space Heating: Based on multiples of 3kW off-peak heating ON for 4 hours per day, for 4 months of the year (only 4% of HV sites are heated).
- Panel Heaters: Based on multiples of 0.07kW. On for 8 hours per day, for 4 months of year in the South; and 12 hours per day, for 12 months of a year in the North.
- Lighting: Based on multiples of 0.2kW - ON for 10 days during the year.
- Battery-Chargers and Tele-control equipment: Based on multiples of 0.5kW - continuous supply to DC standing loads.
- Mains powered equipment: Based on 0.5kW - continuous supply.
- Transformer Coolers: Based on cooler ratings of individual transformers.
- Flood lighting: Based on 0.3kW, ON for 2.5 days in a year. (Only Designated Sites)
- CCTV Cameras: Based on 0.002kW – continuous supply (Only Designated Sites)
- Infra Red Illumination: Based on 0.014kW, ON for 12 hours per day for 12 months of a year. (Only Designated Sites)
- Digital Video Recorders: Based on 0.125kW – continuous supply (Only Designated Sites)

	2016/17			2015/16				
SSEH	***Number of Sub-stations***	***Total Units (kWh)***	***tCO_{2e}***	***Number of Sub-stations***	***Total Units (kWh)***	***tCO_{2e}***	***% Change (kWh)***	***% Change (tCO_{2e})***
HV	8280	1,942	800	8280	1,942	898	0%	-12%
EHV	594	12,727	5,244	594	12,726	5,882	0%	-12%
Total	**8,874**	**14,669**	**6,045**	**8,874**	**14,669**	**6,780**	0%	-12%

	2016/17			2015/16				
SSES	***Number of Sub-stations***	***Total Units (kWh)***	***tCO_{2e}***	***Number of Sub-stations***	***Total Units (kWh)***	***tCO_{2e}***	***% Change (kWh)***	***% Change (tCO_{2e})***
HV	30926	5,644	2326	30926	5,644	2,609	0%	-12%
EHV	608	8,823	3635	608	8,823	4,078	0%	-12%
132kV	84	2,211	911	84	2,211	1,022	0%	-12%
Total	**31,618**	**16,677**	**6872**	**31,618**	**16,677**	**7,708**	0%	-12%

<u>Data cleansing</u>

Data cleansing has resulted in variations to the number of substations leading to in changes to the total energy consumed at substations (KWh) reported in our 2015/16 Environment and Innovation pack submission for SSEH and SSES. We have made the necessary adjustments in this submission as well as in the resubmission of our 2015/16 Environment and Innovation packs for SSEH and SSES.
The total units of substation energy consumed in SSEH was reported as 11,090kWh and in our 2015/16 packs whilst 15,546kWh as reported for SSES.

Point of clarification from 2015/16 submission

In the 2015/16 Environment and Innovation pack, substation electricity energy consumed (KWh) from unmetered substation sites was not deducted from total system losses leading double counting. In calculating total BCF including losses, the substation electricity energy consumed ought to have been deducted from the total losses figure. The total losses figure reported in 15/16 for SSEH and SSES were 246,941.78tCO_{2e} and 831,868.53 tCO_{2e} respectively. These resulted in the total BCF (including losses) value being overstated for SSEH and SSES. The values reported in the 2015/16 pack were 269,268.25tCO_{2e} and 870,555.90tCO_{2e} for SSEH and SSES respectively.
The necessary adjustments have been made in our 2016/17 submission as well as in our resubmission of the 2015/16 pack. The correct figures for total BCF (including losses)are 263,003.11tCO_{2e} for SSEH and 858,453.47tCO_{2e} for SSES.
Other updates have been made to the BCF template - these are all clarified in the relevant sections of these paragraphs on BCF. The impact of these updates (SF_6 restatement, error in the reporting of Business Transport Air and not excluding substation energy consumed from the total system losses figure) have resulted in the value of the total BCF (excl losses) having to be updated from 22,326.47tCO_{2e} and 38,687.36tCO_{2e} to 22,841.36tCO_{2e} and 34,293.10 tCO_{2e} for SSEH and SSES respectively.

Operational Transport
Road
The volume of fuel (litres) consumed by operational vehicles is captured using fuel cards and is reported separately for SSEH and SSES. We do not report freight separately from passenger operational transport, so all operational travel has been reported under passenger transport. The appropriate conversion factor has been used to convert the volume of fuel consumed into tonnes of CO_2. The volume figures are shown below.

	2016/17					2015/16					
	Petrol (l)	***Diesel (l)***	***Gas Oil (l)***	***LPG (l)***	***tCO_{2e}***	***Petrol (l)***	***Diesel (l)***	***Gas Oil (l)***	***LPG (l)***	***tCO_{2e}***	***% Change (tCO_{2e})***
SSEH	7,492	1,850,381	26,873	0	4,929	13,868	1,952,226	4,954	1,671	5,092	-3%
SSES	29,465	3,203,751	223,793	0	9,095	30,208	3,513,701	64,266	191	9,333	-3%
Total	36,957	5,054,132	250,665	0	14,024	44,076	5,465,926	69,220	1,861	14,424	-3%

Point of clarification from 2015/16 submission
In DPCR5 and 2015/16, contractor's emissions from operational transport (road) was included with Operational Transport Road in cell AD22 in the BCF worksheet. To avoid the risk of double counting, we have simply taken the decision to split the contractor's emissions for operational Road by reporting it correctly in cell AD68 of the BCF worksheet rather than our previous approach of adding it into the value reported in cell AD22 of the BCF worksheet.

Operational Transport
Road
Contractors
The transport spend from SSE Contracting has been converted into miles travelled using SSE's mileage rate of £0.35 per mile. The mileage is then converted into kms which has then been converted into tonnes of CO_2 using the appropriate conversion factor.

The value of fuel costs related to operational transport by contractors in 2016/17 shows a downward trend from 2015/16. This is because there has been a shift away from using SSE Contracting Group as an 'external' contractor in 2016/17, with a number of the core areas being brought into the Networks business where we are able to have overall control. This has led to an overall reduction in fuel consumption in this area, and ultimately tonnes of CO_2.

The requisite element of these fuel costs are now correctly shown with main business consumption, where there has been on ongoing efficiency drive regarding numbers of staff and vehicles, where we have been able to keep usage in this area under tight control.

Point of clarification from 2015/16 submission

In 2015/16, the tCO_{2e} value had been entered in the input volume cell B068 of the BCF worksheet instead of kms travelled by contractors so the conversion factor had to be 1. Entering the kms travelled has made it possible to apply the correct Defra conversion factor to derive the tCO_{2e} values. The kms figure for both 2015/16 and 2016/17 are presented in our BCF Table E3. Our 2016/17 submission and resubmitted 2015/16 Environment and Innovation packs have been revised with the updated figures. These changes have been made to ensure that the figures are reported consistently across the whole of RIIO-ED1.

Rail

Any operational rail journeys have been included in the business travel section of the report.

Sea

The use of sea travel is minimal, and considered negligible due to the scale of the emissions.

Air

Emissions for business travel by air are recorded and broken down into SSES or SSEH. Class of travel is not recorded. All flights taken between UK locations have been recorded as domestic, flights from the UK to Europe as Short-Haul International and flights from the UK to non-European destinations as Long Haul International. Internal flights in countries other than the UK have been recorded as domestic flights.

An average fuel consumption rate of 160 l/hr (single squirrel helicopters) and 212 l/hr (for twin squirrel helicopters), and a petrol conversion factor has been used to convert the hours into mass of CO_2 emissions. These figures are shown below:

	2016/17		***2015/16***		
	Miles (l)	***tCO_{2e}***	***Miles (l)***	***tCO_{2e}***	***% Change (tCO_{2e})***
SSEH	33,632	76	59,655	135	-78%
SSES	29,106	66	19,426	44	33%

The hours of helicopter hire have decreased in SSEH compared to the previous year but the increased emissions in SSES's license area is due to an increase in the level of line patrol in 2016/17.

Business Transport

Road

Business transport miles are captured through our expenses department. The distance travelled by both petrol and diesel vehicles are used to calculate the relevant CO_2 emissions.

Rail

Journeys made for business travel by rail are recorded through our travel department. The distance travelled is used to calculate the relevant CO_2 emissions.

Sea

SSEH experienced 3 major weather events in 2016/17 which required the use of sea travel to restore supplies to remote islands. This explains the increase in 2016/17 from the levels in 2015/16.

Air

Emissions for business travel by air are recorded and broken down into SSEH or SSES. Class of travel is not recorded. All flights taken between UK locations have been recorded as domestic, flights from the UK to Europe as Short-Haul International and flights from the UK to non-European destinations as Long Haul International. Internal flights in countries other than the UK have been recorded as domestic flights.

	2016/17					**2015/16**					
	Road (miles)	***Rail (km)***	***Air (km)***	***Sea (km)***	***tCO_{2e}***	***Road (miles)***	***Rail (km)***	***Air (km)***	***Sea (km)***	***tCO_{2e}***	*% Change tCO_{2e}*
SSEH	1,930,944	241,549	833,123	8,963	597	1,993,583	203,763	1,363,054	2,458	810	-36%
SSES	4,327,228	443,834	435,063	0	1,307	4,135,937	226,916	988,666	-	1,392	-6%
Total	6,258,172	685,384	1,268,186	8,963	1,904	6,129,520	430,679	2,351,720	2,458	2,203	-16%

Point of clarification from 2015/16 submission

We have made corrections to the our 2015/16 submission for distance travelled by air for Business Transport both SSEH and SSES. The distance travelled by air was reported as 644,098km for SSEH and 609,079km for SSES in the 2015/16 packs. These have been updated to the correct values, 1,363,054km and 988,666km as presented in the table above for SSEH and SSES respectively. These updates have resulted in the tCO_{2e} values for SSEH and SSES being adjusted from 101.5tCO_{2e} and 105.9tCO_{2e} to 214.8 tCO_{2e} and 165.6 tCO_{2e} for SSEH and SSES respectively.

Fugitive Emissions

SF_6

Emissions of SF_6 are calculated by combining the volume of SF_6 used in routine maintenance and the volume used during fault repair. These figures are extracted from our Asset Management System.

Up until 2015/16, we also included SF_6 emitted through natural leakage in our submission. This is referred to as background emissions. This was calculated using the Engineering Recommendation S38 and a model produced by the ENA. The appropriate conversion factor was used to transform this combined figure of SF_6 lost to tCO_{2e}.

Restatement of SF_6

We reviewed our calculation methodology with Ofgem and it was agreed that the correct calculation methodology for the BCF submission should not include background emissions (i.e. should not assume a percentage leakage rate) but only the volume of SF_6 emitted during asset installation, emissions due to leakage (measured through top-ups) and those due to equipment failure. We can confirm that our calculation methodology for the volume of SF_6 emitted has been revised to include the weight of SF_6 lost through top-Ups due to routine maintenance and fault repair. These figures are extracted from our Asset Management System (PLACAR) and the appropriate conversion factor was used to transform this combined figure of SF_6 lost to tCO_{2e}.

Our 2016/17 submission includes:

- Restatement of historical SF_6 data for the 'E2 - Environmental Reporting' and the 'E3 – BCF' worksheets.
- For the 'E2 - Environmental Reporting' worksheet, 'SF_6 Emitted' we have restated the

data for the historical years 2010/11, 2011/12, 2012/13, 2013/14, 2014/15 and 2015/16.

	2016/17		2015/16		
	SF_6 (kg)	tCO_{2e}	SF_6 (kg)	tCO_{2e}	% Change (tCO_{2e})
SSEH	4	89	6	132	-48%
SSES	132	3016	132	3032	-1%

Fuel combustion
We record the volume of fuel used to provide generation on our distribution networks.

Mobile Generation
Mobile generation is primarily required as backup to ensure continuity of supply when works requiring a network outage are taking place. Diesel fuel is used primarily in SSEH while in SSES, a combination of diesel and gas oil are combusted.

	2016/17				2015/16				
	Mobile Generation				Mobile Generation				
	Diesel (l)	Gas Oil (l)	Petrol (l)	tCO_{2e}	Diesel (l)	Gas Oil (l)	Petrol (l)	tCO_{2e}	% Change (tCO_{2e})
SSEH	1,230,157	20,984	121	3,275	970,747	12,813	45	2,546	22%
SSES	177,942	1,550,007	0	5,062	207,739	1,170,006	8	3,940	22%

Fixed Generation (Diesel)
Our fixed (embedded) generation is primarily required as a backup in the event of network faults. Our 7 fixed sites are located on the islands off the North of Scotland. No fixed generation sites are located in SSES's area.

There has been a 14% increase in fixed diesel used during 2016/17 due to the 3 major weather events experienced in the period.

	2016/17		2015/16		
	Fixed Generation		Fixed Generation		
	Diesel (l)	tCO_{2e}	Diesel (l)	tCO_{2e}	% Change (tCO_{2e})
SSEH	1,494,985	3,904	1,295,178	3,347	14%

Losses
Figures for network losses have a two year lag, but an estimate is produced at the end of the reporting year and converted to tCO_{2e}.

	2016/17		2015/16			
	MWh	tCO_{2e}	MWh	tCO_{2e}	% Change (MWh)	% Change (tCO2e)
SSEH	531,232	218,894	519,617	240,162	2%	-10%
SSES	1,794,175	739,290	1,783,164	824,160	1%	-11%

Point of clarification from 2015/16 submission
All SSEN substations are registered as unmetered supplies so in calculating the total BCF, substation energy consumed is deducted from the total systems losses leading double counting.
In calculating the total BCF for 2015/16, substation energy consumed was deducted from total systems losses, however, our BCF template shows the total losses including substation energy consumed. These have been updated to the correct values 519,617MWh and 1,783,164MWh as presented in the table above for SSEH and SSES respectively.

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.

BCF emissions due to contractors are reported under operational transport and is related to fuel used in vehicles for business activities. The source of the emissions is vehicles owned by others i.e. non SSEN vehicles. The SSEN's contractor mileage rate of £0.35/mile is applied to convert transport spend into miles travelled. This is then converted into tonnes of CO_2 using the appropriate conversion factor under scope 3. Contractor coverage makes up 0.2% of total BCF.

Building energy usage Natural gas, Diesel and other fuels are all categorised as fuel combustion and must be converted to tCO2e 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.
SSEH and SSES Please refer to the paragraph on Building energy usage under the section titled "Commentary required for each category of BCF"

E4 – Losses Snapshot

Allocation and estimation methodologies: detail any estimations, allocations or apportionments to calculate the numbers submitted.
SSEH and SSES The numbers submitted are based on the Ofgem CBA and were calculated as part of the analysis. The CBAs were calculated as part of our update to our Losses Strategy https://www.SSEN.co.uk/lossesstrategy/ For the non technical losses it is necessary to estimate the number of MWhs that will now be correctly metered and billed following resolution by our Revenue Protection (RP) Teams. The RP team have identified the number of properties / MPANS that they have rectified during the period. The number of MWhs was estimated using the "average consumption" per property type derived from the SHEPD or SEPD CDCM model as appropriate.

Programme/Project Title Please provide a brief summary and rationale for each of the activities in column C which you have reported against.
SSEH and SSES **LV and HV Cable** The analysis was completed based on the justification to install cables that are larger than the load requirements. The increased conductor size reduces losses and over the lifetime of the asset. Completing a CBA over the lifetime of the cable allows an assessment to be drawn as to whether or not the higher capital cost breaks even over the predicted lifetime of the asset. It was not possible to accurately record the number of instances where a cable had been upgraded and hence an estimate, based on % of installed cable, was used in both the CBA and the E4 submission. **EHV and 132kV Transformers** Analysis has been conducted to consider three types of transformer: Super Low Loss; Low Loss; and Minimum Standard.

- 33kV Transformer (GM);
- 66kV Transformer; and
- 132kV Transformer (SSES only).

The minimum standard is a transformer that simply meets the requirements of the EU Eco Directive Tier 1. There are numerous ways to improve the efficiency from advanced core materials to lower winding resistances. Completing a CBA over the lifetime of the project allows an assessment to be drawn as to whether or not the higher capital cost breaks even over the predicted lifetime of the asset.

LV Transformers – GMT
We considered the benefits of prioritising our asset replacement programme to focus on pre 1960s transformers before more modern assets. Transformers installed before this date had significantly higher losses due to the quality of the steel used in the core and hence a losses benefit can be achieved if these units are targeted for replacement.

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

SSEH and SSES

The 'Other' reference in column E relates to Connections for the transformer measures.

The final reference to 'Other' relates to our work within our Revenue Protection team to recovery DUOS under Non Technical Losses.

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

SSEH & SSES

HV and LV Cable
The baseline scenario used was to model the cable size to meet the load requirements only e.g. what we would have installed in previous price control periods. This was used to make a comparison with the increased conductor size and hence make a break even assessment.

EHV and 132kV Transformers
The minimum standard is a transformer that simply meets the requirements of the EU Eco Directive Tier 1. This has been used as the baseline scenario with all calculations of energy or financial savings calculated over and above this value. This was completed in the same manner for 33kV, 66kV and 132kV transformers.

LV Transformers – GMT; we considered the benefits of prioritising our asset replacement programme to focus on pre 1960s transformers before more modern assets. Transformers installed before 1960 tend to have been manufactured using less efficient materials than their modern counterparts. The baseline scenario is effectively a do nothing approach e.g. do not prioritise assets based on losses benefits.

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.
SSEH and SSES We have not made any alterations to the CBAs which was used in the 2015/16 submission and hence we have included the same CBAs in the 2016/17 submission. ED_SSE - RRP - 2016-16 RRP Returns\Societal benefits Asset Replacement 33kV transformers Southern.xlsx ED_SSE - RRP - 2016-16 RRP Returns\Societal benefits Asset Replacement 66kV transformers Southern.xlsx ED_SSE - RRP - 2016-16 RRP Returns\Societal benefits Asset Replacement 132kV transformers Southern.xlsx ED_SSE - RRP - 2016-16 RRP Returns\Societal benefits Asset Replacement 33kV transformers Hydro.xlsx ED_SSE - RRP - 2016-16 RRP Returns\Societal benefits Connections 33kV transformers Southern.xlsx ED_SSE - RRP - 2016-16 RRP Returns\Societal benefits Connections 132kV transformers Southern.xlsx ED_SSE - RRP - 2016-16 RRP Returns\Societal benefits Connections 33kV transformers Hydro.xlsx ED_SSE - RRP - 2016-16 RRP Returns\Societal benefits General Reinforcement 33kV transformers Southern.xlsx ED_SSE - RRP - 2016-16 RRP Returns\Societal benefits General Reinforcement 132kV transformers Southern.xlsx As per 2015/16 we have not included a CBA for the LV Transformers – GMT; this activity is a prioritisation of our asset replacement programme and hence there is not a baseline to make comparison with from a financial perspective. There is no CBA provided for our Non Technical Losses work on DUOS recovery – as there is no clear baseline scenario to evaluate the benefit of the scenario. Do nothing is not an option in this case and the activity is not optional.

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.
SSEH and SSES There have been no changes to the CBAs which we submitted in 2015/16. E4 SHEPD Losses Snapshot: LV Transformers- GMT has changed from 14 to 1. This was a typo in the original submission. No CBA exists here, only the E4 report.

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.
SSEH and SSES There have been no changes to the CBAs submitted in 2015/16. The links provided are the same as those submitted as part of the 2015/16 submission. Where relevant, refer to the filepaths provided in the section titled "**Use of the RIIO-ED1 CBA Tool"** for access to each of the programme / project titles in column C of the worksheet which have been split between Asset Replacement, General reinforcement and Connections.

E5 – Smart Metering

Allocation and estimation methodologies: detail any estimations, allocations or apportionments to calculate the numbers submitted.
SSEH and SSES <u>Smart Meter Communication Licensee Costs (pass through)</u> Values submitted relate to actual costs incurred as invoiced by the Digital Communication Company (DCC). <u>Smart Meter Information Technology Costs (pass through)</u> The values submitted relate to actual expenditure incurred by both our smart meter programme and our smart meter lifecycle team.

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.
No benefits have been delivered in this regulatory year. The national smart metering system being delivered by the DCC will not be available until regulatory year 2017/ 2018.

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

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.

SSEH and SSES

General E6 Assumptions for All Technologies

1) Costs represent the cost of the technology only i.e. it doesn't include associated costs in the CBA such as reinforcement costs.
2) MVA released represents the MVA released by the technology only i.e. it doesn't include associated MVA released by reinforcement as shown in the CBA.
3) Estimated gross avoided costs are the gross costs avoided by the technology plus the actual cost of implementing the technology. It doesn't

include NPV costs e.g. for ANM

SSEH
Hybrid Generator
This is a generator that runs on both diesel and battery power.

CO_{2e} calculation = Number of litres used x 2.67614. This figure has been taken from DECC carbon calculation factors for 100% mineral oil.
It is assumed that the maintenance costs of the hybrid generator are half that of the diesel generator obtained by internal stakeholder engagement.
Standard generator diesel use per hour is estimated at 6 litres for a 30kVA generator running at 75% load.

2016/17 Update
Hybrid generator fuel savings now calculated through battery usage i.e. 2.5 kWhrs per litre of fuel used. Figure has been taken from hybrid generator close down report. Two hybrid generators have been removed from service due to reliability issues and so are showing as disposals in 2017 of the E7 reporting template.

Live Line Tree Harvesting
This is where tree felling occurs by a specialised machine working adjacent to a live line.

<u>Conventional Harvesting under outage with generation</u>
CIs & CMLs: These are halved in value as it is a planned outage. This means both CI and CMLs are halved in value when calculating CI and CML costs.
Two disconnections occur: Customers are disconnected from their main supply onto temporary / back-up generation and then disconnected again when put back onto their main supply. This means CIs are doubled.
Staff costs: These include staff, senior authorised personnel and standby staff. They are calculated by using estimated daily costs multiplied by the number of days they are required for.

Generation costs: Estimated generator equipment costs based on size/type of generator and number of days used for.

CI and CML Generator trip costs: Generators are estimated to trip at least once in 55 days for a period of 4 hours before supply is restored. This counts as an unplanned outage, therefore full CI and CML costs are incurred. These CI and CML costs are calculated by assuming the generator will trip for a 4 hour period before power is restored, multiplied by the percentage likelihood of the generator tripping. Generator trip percentages are calculated by dividing the number of days the outage occurred by 55 (the number of days before a generator is likely to trip). The 4 hour figure was obtained from internal stakeholder engagement. CI/CMLs are then multiplied by 4 hours to find a total number and then multiplied by the percentage likelihood of the generator tripping. Generators trip percentages are found by dividing the number of days the outage occurred by 55 (the number of days before a generator is likely to trip).
Staff generator trip costs are incurred as staff are required to attend faulty generators. This is calculated by multiplying £500 (average staff costs to attend and fix faulty generators) by the percentage likelihood that the generator will trip.

<u>Live Line Harvesting</u>
Live Line Harvester Costs: Based on costs incurred by SSEN and costs to rent the harvester from the contractor.

Potential system security benefits: Under the conventional harvesting method, there is increased potential for CIs and CMLs in the event that a fault develops on a nearby circuit, which would usually have the ability to be back-fed from the circuit that is out for harvesting purposes.
Manual tree felling work relies on a planned shutdown over several weeks. Other customers are therefore at risk if a fault develops and their supply can no longer be back-fed. This risk has been quantified by taking the total CIs and CMLs if a fault was to occur on an affected circuit and multiplying it by 5%. 5% is a conservative estimate. Live line harvesting removes this risk.

All calculations are presented in the CBA workings tabs.

2016/17 Update: Changes have been made to the method used to calculate CO_{2e} from diesel usage as the 2015/16 method was incorrect. Both years are now showing correct CO_2 emissions for diesel usage.

Pole Pinning
This is where poles reaching end of life are pinned to extend their lives

Cost of replacing one pole: This is taken from the RIIO-ED1 2016 unit cost sheet. The values vary slightly for SSEH and SSES and have therefore been separated in the CBA.

PP Tractor/Beaver Cost per month: This is the cost involved in hiring the pole pinning beaver tail machine. The annual hire cost of the machine has been split up into 12 to derive a monthly figure

Pole pinning cost per pole: This is the cost involved for pinning a single pole i.e. labour costs, pole pinning material costs.

Number of poles pinned: The number of poles that were pinned in any given month.
Total pole pinning cost: Total costs of pinning poles for any given month. This is also the method investment used in the asset deferment table (see CBA).

Replacement cost avoided: This is the cost that would have been spent had the poles been replaced rather than pinned. This is also the base investment figure that is used in the asset deferment table.
Method NPV: The NPV costs involved in pole pinning based on the assumption that one pole, once pinned, does not need to be replaced for 14 years. This is calculated using the asset deferment benefits table.

NPV Saving: The actual saving of replacing a pole based on a pole's life being extended 14 years before it needs to be replaced. It is the base investment minus the method NPV.

All calculations are demonstrated in the CBA.

2016/17 Update
Pole pinning has been stopped. However, costs were incurred as it took time to take the machine off hire.

<u>Forestry Mulcher</u>
This is a specialised machine that is designed to clear small trees and shrubs underneath OHL.

Hand felling assumptions: Assumptions must be made in order to calculate and compare the forestry mulcher costs against the traditional hand felling methods.
Hand felling labour costs are estimated at an average of £225 per day.
Hand felling costs also include the hiring of a chipper machine at £225 per week and vehicle hire estimated at £1,171 per month.
Chainsaw fuel costs are estimated at £15 per day.
Chipper fuel costs are estimated at £22.80 per day.
Number of days work estimated by tree cutting manager.
Forestry mulcher assumptions: Labour & vehicle hire costs are the same as hand felling costs.
Cost of the Mulchers has been incurred via NIA project. 10% of project costs have been included here to reflect costs.
Mulcher fuel costs are estimated to be £103 per day (higher cost estimate).
All costs have been obtained from consulting the tree cutting manager who has access to costs.

Western Isles (WI) Active Network Management (ANM)
ANM frees up additional capacity on the network by constraining generation under specific conditions.

CBA Narrative

Option Baseline: Do nothing. It is unlikely that this scenario would ever occur as it would mean generators would be constrained beyond acceptable levels. It also shows a lack of commitment to customers for developing the network and prevents new connections from occurring. For these reasons, this option was not chosen.

In this scenario, the network capacity is at its maximum and so there is no available capacity.

Option 2: There is strong demand for generators to connect renewable generation on the island. Previously this has not been an issue as there was sufficient network capacity to connect new generators. However, as the network is at its limit in terms of its capacity, the cost to connect and time to connect has increased considerably.
For example, a generator requesting a new connection would be quoted approximately 20m in 2016. This is because a sub-sea cable reinforcement would be necessary in order to increase capacity, and will take approximately 3 years to complete.

In this scenario, generators can't operate until 2020, once the subsea cable reinforcement is complete. The £20m reinforcement releases an additional 9MVA of capacity, once works have completed (approximately 3 years).
MWhrs of renewable generation have been calculated by using actual generation export values from WI ANM generators. This takes account of the generator being constrained for 0.09%, over the one year period it was operational.

Option 3: Instead of going ahead with the traditional reinforcement proposed above, we have implemented single generator ANM on the WI. ANM allows us to offer generators requesting a connection to be given a constrained connection instead. ANM has freed up an additional 9MVA of constrained capacity on the WI network without the need for expensive reinforcement. This capacity has already been taken up by a single generator. It is forecast that more generators will want to connect to the WI network throughout the RIIO-ED1 period. A full ANM scheme will be implemented when the next request for generation occurs. This is forecast to occur in 2019. However, this will only release an additional 9MVA of capacity. Any more generators requesting connections after this point will then trigger the £20m reinforcement to be implemented. It is forecast that this will be triggered in 2022 and will not be available until RIIO-ED2.

In this scenario ANM is in place, which allows increased capacity on the network of 18MVA over RIIO-ED1. Around 9MVA of capacity has already been taken up and another 9MVA of capacity is forecast to be taken up in 2019 alongside the completion of a full ANM scheme. The £20m reinforcement will then be triggered by demand for new connections in 2022. This will be completed during RIIO-ED2 and release an additional 9MVA of capacity.
At some point within the next 16 years the subsea cables connecting WI to mainland Scotland are forecast to be replaced. It is assumed that the new cables will be of higher capacity to allow more firm connections of generation to connect to the network. Once this occurs, the benefits of ANM will have to be reassessed as it may not be necessary if enough capacity is made available via subsea cables.

Orkney ANM
ANM frees up additional capacity on the network by constraining generation under specific conditions

CBA Narrative

Orkney ANM: Only one scenario has been considered by the CBA as it has been operational pre RIIO-ED1. Costs have been recorded against each year where they were incurred. Reinforcement avoided occurred pre RIIO-ED1 and so benefits have not been counted again here. The main benefit derived is from reduced emissions as a result of renewable generation being connected via ANM.

No new capacity has been freed up due to deploying ANM in RIIO-ED1 on Orkney.

E6 Template
Costs: Only costs for the ANM solution have been inserted here.
Only the MVA released by ANM has been included. Total MVA released is 0MVA.
Estimated Gross Avoided costs: There are no avoided costs as traditional reinforcement would have occurred pre RIIO-ED1.

SSES

Pole Pinning
As per SSEH above.

Bidoyng
This technology locates LV underground cable faults

BD3 calculated data: BD3 CIs and CMLs occur where Bidoyng fuses are available and a fault has been located using Kelvatec's location services.

It is assumed that rogue circuits (circuits prone to faulting), where Bidoyng equipment is located, will have an average of 4 faults on them per year.

If a cable problem is located before it faults and causes a fuse operation then the maximum number of CIs and CMLs are saved i.e. CI and CMLs multiplied by 4 (the average number of times the circuit would have faulted because of the fault). The more fuse operations that occur, the less CIs and CMLs savings occur. Once 4 fuse operations have occurred no more CI and CML savings can be gained (as it is assumed 4 is the number of times a circuit will fault).

Calculation details below:

0 fuse operations =Number of CIs and CMLs multiplied by 4
1 fuse operation = Number of CIs and CMLs multiplied by 3
2 fuse operations = Number of CIs and CMLs multiplied by 2
3 fuse operations = Number of CIs and CMLs multiplied by 1
4 or more fuse operations = Number of CIs and CMLs multiplied by 0

CMLs: It is assumed that one fault will cause an outage of 181.3 minutes. This is based on average fault restoration times for cable faults.

CIs: It is assumed that one fault will cause an interruption for all customers on that particular circuit.

CBA Data
Number of CIs: This is the total number of customers multiplied by the CI fine of £10.75 (April to August) or £10.77 (September to March) and then multiplied again by the number of fuse operations.

Number of CMLs: This is the number of customers multiplied by £47.13. This is the average cost of a 3 hour outage i.e. 181.3*0.26. The resulting figure is multiplied again by the number of fuse operations to obtain a final figure.

Additional costs: These include Planned Supply Interruption (PSI) costs, backfeed costs and excavation costs.

PSI costs: These are planned supply interruption costs. It is estimated that an average cost of £995.96 will be incurred as a result of planned interruptions being necessary due to specific faults on specific circuits. This is an average figure taken from the Bidoyng business case, which takes into account average PSI costs.

Backfeed costs: These are average costs incurred as a result of backfeeding. It is estimated that an average cost of £1991.93 will be incurred if backfeeding is required. This figure has been derived from the Bidoyng business case, which takes into account average costs of backfeeding. Backfeeding savings only occur on BD3 faults i.e. faults that are transient in nature and are cleared by the automatic replacement of fuses due to Bidoyng technology. This is because it removes the need for backfeeding.

Excavation costs: Bidoyng creates an average estimated saving of £1250 in terms of reduced excavation costs. This is because it can pinpoint underground faults more effectively, reducing the need for multiple excavations.

Total costs: This is a summation of all costs stated above.

BD1 calculated data: BD1 costs vary from BD3 costs as there are no fuse units available to prevent multiple faults from occurring. However, the Bidoyng technology can prevent faults from occurring by locating pre fault 'signatures' or warning signs before an actual fault occurs. This is why we have CI and CML savings.

CBA Data

Number of CIs: This is the total number of customers that could be affected by an LV fault. It is calculated by taking the total number of customers on each feeder and dividing it by 3 to find the average number of customers per phase. As the fault is likely to occur on one of the phases not all customers lose supply. If faults occur on more than one phase these additional affected customers are added to obtain a final figure of how many customers could have been interrupted.
The number of customers is multiplied by £10.75 or £10.77 (depending on the month) to obtain a customer interruption figure.

Number of CMLs: This is the number of customer's that have been interrupted as calculated previously, multiplied by 180 to find the total CML cost. 180 minutes is the average amount of time customers are expected to be off supply due to an LV cable fault.

Total out of hours cost: This is the cost associated for attending faults out of working hours. It has been derived from the Bidoyng business case which calculates an average out of hours cost per fault.

BD1 & BD3 costs are then added to get total costs used in the CBA.

Total Bidoyng contract spend: This is the amount of money spent on the Bidoyng contract specifically for fault location and fuse replacement services.
Bidoyng incentive spend: It is estimated that a total of £130,000 will be spent for 2016/17. This is the total amount of additional money that Kelvatec, the Bidoyng contractors, are awarded on top of the normal contract due to accurately locating faults (refer to workings template tab in CBA).

Total Bidoyng spend is the addition of these two spends.

16/17 Update: Bidoyng has performed better in 2016/17 compared with as a result of more CIs and CMLs being avoided.

Isle Of Wight (IoW) Active Network Management (ANM)
ANM frees up additional capacity on the network by constraining generation under specific conditions

CBA Narrative

Option Baseline: Do nothing. It is unlikely that this scenario would ever occur as it would mean generators be constrained on the Isle of Wight (IoW) beyond acceptable levels. Given the network capacity is at its maximum, there is no benefit in terms of constrained volume avoided. It also shows a lack of commitment to customers for developing the network. For these reasons, this option was not chosen.

Option 2 ANM: In this scenario, ANM is in place, which allows increased capacity on the network of 45MVA. This has allowed an 8.46MVA generator to connect early while a reinforcement scheme awaits completion. Completion is due to finish in 2017/18. Once completed the generator will switch to an inter trip scheme, leaving 45MVA of capacity that can be taken up by new generators wanting to connect.

E6 Template: IoW ANM
Costs: Only costs for the ANM solution have been inserted here.
Only the MVA released by ANM has been included. Total MVA released is 45MVA.
The CBA will be updated each time capacity is filled by generators.

Estimated Gross Avoided costs: There are no avoided costs as traditional reinforcement have not been avoided yet. It is expected that significant savings will be made when more generators connect as ANM will be able to avoid the cost of traditional reinforcement on the IoW.

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.

SSEH

Hybrid Generator

1) The hybrid generator (HG) technology is offered as a solution for off-grid power supply requirements in remote locations and can be used to provide power for residential, construction, telecom towers and disaster relief applications. It is a temporary mobile generator and not utilised full time.

The HG is a combination of a diesel generator (DG) and a power-electronic converter with integrated battery storage. In conventional generator-only applications, the diesel generator must "load follow" and therefore operates at off-optimal conditions for the vast majority of time – the battery system alleviates this requirement.

Other benefits include low/no noise through noise insulation and operation in battery-only mode, less carbon emissions through operation of the DG at optimal conditions and use of battery, generally more efficient operation of the DG and reduced cost of ownership since the engine has to run less often.

Close down report located here:
ED_SSE - RRP - 2016-16 RRP\2011_14 Hybrid Generator LTI Close down report

2) Two hybrid generators are currently in use. The main benefit of the hybrid generator is that it reduces the amount of money spent on diesel by running in battery mode. This also reduces CO_2 output. Maintenance costs are also less than diesel generators.

3) The volume unit is the number of hybrid generators. One generator equates to one unit.

4) Litres of fuel saved by the hybrid generator was calculated through battery usage i.e. kWhrs converted into litres of fuel used. Figure has been taken from hybrid generator close down report.
CO_{2e} Is calculated by using DCF carbon calculation figures for 100% diesel mineral oil.

Live Line Tree Harvester

1) Tree harvesting adjacent to our overhead network presents increasing challenges to SSEN, particularly in our SSEH licence area. Volumes of timber available to be harvested by third parties will continue to rise over the next 20

years and we have increased ESQCR obligations to gain enhanced (falling distance) clearances over the next 25 years.

Current guidance and practice on tree felling within falling distance of the network is to either provide an outage or to fell or dismantle the trees using manual techniques.

Outages has obvious disadvantages:

- significant CI/CML consequences;
- hazards associated with switching and provision of generation;
- reduction in network security;
- time constraints on shutdowns could result in failure to complete works; and,
- machinery breakdown might result in further outages being required.

The use of manual methods adjacent to a live line for large numbers of trees also has significant drawbacks:

- unacceptable exposure to hazard to operatives over long periods from working at height, chainsaws, falling trees and electricity; and,
- drain on highly trained resources needed to carry out programmed maintenance work

The objective of the project was to fully investigate the scope of the issue, evaluate potential methods and machinery that could be employed and to develop safe systems of work to carry out mechanised harvesting adjacent to a live network.

The close down report is located here:
ED_SSE - RRP - 2016-16 RRP Returns\Live Line Harvesting Closedown Report

2) Currently one live line harvester is in operation, which is under contract. Plans are in place to procure our own harvester due to the success of this technology. It has only been used in the SSEH and Scottish Hydro Electric Transmission plc (SHET) regions (SHET use is not reported here). The harvester works by felling trees adjacent to live lines. It produces benefits as it is a far less costly method of harvesting vs conventional hand felling harvesting methods. It is also far more efficient. Benefits come from reduced CIs and CMLs, improved security of supply (also CI and CML benefits) and lower generation costs. Unquantifiable safety benefits also exist, as hand felling of trees for long periods of time are risky.

3) There are various units that have been used e.g. £s related to CI and CMLs, litres for amount of diesel used, etc.

4) Assumptions and how they have been calculated are mentioned in the first box.

2016/17 update: new live line harvester was purchased in July, costing £440,000. This is why costs are so much higher this year in 2016/17.

Forestry Mulcher

1) The forestry mulcher is a machine designed to remove small shrubs and woody species underneath OHL. More details can be found in the close down report:

Forestry Mulcher closedown report location

2) The mulcher is currently being used in the northern SHEPD network where there is a higher proportion of vegetation where use of the mulcher is applicable. The mulcher can’t cut vegetation too large or mature and so its prime purpose is for controlling new growth. It is estimated to be 3.8 to 3.4 times more productive than hand felling. This means more spans can be cut per £ spent, improving unit costs.

3) Units are the number of Bushfighter machines that are in use i.e. 2. These 2 machines were moved into BaU in 16/17 after successfully proving their benefit as part of an NIA project.

4) Assumptions have been detailed in the first box.

SSEH and SSES
Pole Pinning

1) Poles reaching their end of life or those that are significantly deteriorating to the point where they need to be replaced, can instead be pinned. Pole pinning involves using a specialised pole pinning machine that drives a pin through the base of a deteriorating pole. The pin provides the pole with additional strength. It is estimated that pinned poles will have their lifetime extended by 14 years, providing significant financial benefits.

2) Unfortunately pole pinning failed to deliver positive financial benefits and the technology has been stopped by SSEN. This is because not enough poles were being pinned to cover the cost of the equipment hire. Field staff reported problems such as poles being too rotten to pin. It has also been discovered that pole pinning has a negative effect on asset health indices, so it was decided to stop pursuing use of this technology.

3) The volume unit is the number of poles pinned and one pinned pole counts as a single unit.

4) Assumptions and how they have been calculated are mentioned in the first box.

ANM

1) The solution deployed is Active Network Management (ANM), where generators that may otherwise have been unable to connect to the distribution network due to excessive reinforcement costs or timescales, can connect through a flexible connection. The system constitutes Information Communication Technology (ICT) architecture that monitors, in real time, the pre-identified network constraint points and ensures that no generators connected through it can breach the networks operational limits. If those limits are threatened then the system sends control signals to the most appropriate generator to reduce their export until the network limits are no longer threatened, then the generators are released back to a safe operating state. The key governing principles are described in the ENA produced ANM Good Practice Guide, which can be found at the following link.
http://www.energynetworks.org/assets/files/news/publications/1500205_ENA_AN

M_report_AW_online.pdf
The report was created by the ENA ANM Working Group where the relevant subject matter experts meet to share learning and to tackle industry wide issues affecting the wider roll out of ANM.

SSEN have been working on ANM for a number of years, as can be seen through the work completed and charted for the Orkney ANM at the following link https://www.SSEN.co.uk/OrkneySmartGrid/ . Through this work SSEN has built up an in-depth understanding of ANM that has allowed us to roll out ANM into Business as Usual so that more of our customers can experience the benefits that ANM can bring.

SSEN have also recognised the need to support the rollout of this kind of innovation and have implemented business structural change to setup a team, the Active Solutions Team, whose sole responsibility is the rollout out of the more involved proven innovations, like ANM. Through setting up this team SSEN aim to better rollout innovations quicker so that our customers can start realising the benefits sooner.

2) Customer's benefit from ANM as they are able to connect much sooner and at a far cheaper cost compared to traditional reinforcement. ANM defers this reinforcement cost creating NPV benefits, while allowing more generators to connect.

3) The volume unit on this is £s in terms of reinforcement deferred.

4) Reinforcement costs has been calculated by system planners based on the size of the subsea cable that is necessary for the Isle of Wight network to ensure additional capacity is available for new connections as soon as possible.

The amount of time reinforcement is deferred for is calculated by system planners and is based upon how much additional capacity ANM can free up and predicted generator connection demand.

Currently, 9MVA has been released on WI by ANM. After this, an expensive reinforcement scheme will be necessary to free up additional capacity.

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.

SSEH and SSES
RIIO-ED1 CBA tool used for all technologies

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.

SSEH and SSES
Negative monetary benefit occurred only for pole pinning. This technology has been stopped.

SSEH
Please note that New ANM data has been added to SSEH during 2016 as well as 2017, which was not reported in 2015/16. This includes data from the Western Isles ANM scheme and the Orkney ANM scheme. Although Orkney ANM was pre RIIO-ED1 it is still incurring operational costs and creating carbon benefits and so it has been included. The reinforcement avoided savings have not been included as this was pre RIIO.

Orkney ANM is showing negative monetary benefits as the original reinforcement avoided benefits were claimed pre RIIO-ED1. However, Orkney ANM is enabling large quantities of CO_2 to be avoided by connecting renewable generators. In the Ofgem CBA, this is reflected by a positive NPV due to societal benefits.

SSES
IoW ANM gross avoided costs have changed from -£2.3m to +0.6m. This is because it was previously thought that ANM prevented traditional reinforcement. System planners have confirmed that ANM allowed for the early connection of a generator while it awaited a reinforcement scheme to be completed. Once this scheme is complete the generator will move onto an inter-trip connection. ANM has therefore not prevented traditional reinforcement in this case, it has allowed for early connection of generation while reinforcement was being completed. It is expected that ANM will eventually make significant reinforcement savings, but this will only occur once more generators connect to the network via ANM.

Costs of ANM scheme for IoW have also changed from 0.9m to 0.6m for 2015/16 reporting year. This is because cost estimates were previously used and now have been updated to show actual costs taken from finance system.

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.

SSEH

Hybrid Generator

Option 1 (Baseline):
Comparisons were made against the total running time of the hybrid generator.
The amount of diesel used, was similar to that used by a standard diesel generator. This was estimated to be 6 litres an hour for a generator of the same size (30kVA) running at 75% load. These figures were verified by consulting with internal company experts and well known web sites.
CO_2 used: Multiply litres used by 2.67614 (taken from DCF carbon calculation

spreadsheet for 100% diesel mineral oil).
Maintenance Cost: This was assumed to be twice that of the hybrid generator (confirmed by internal company experts who use the generator).

Option 2
Total running time was estimated by using the hybrid generator on specific jobs over a one month period.
Diesel used: The amount of diesel that the hybrid generator used over a one month period.
CO_2 used: Multiply litres used by 2.67614 (taken from DCF carbon calculation spreadsheet for 100% diesel mineral oil).
Maintenance costs: Costs spent on maintaining the hybrid generator.

Live Line Tree Cutter

Refer to first box

Pole Pinning

Refer to first box

Forestry Mulcher

This is simply the traditional cost of hand felling vs the cost of mulching per span. Assumptions are detailed in the first box.

WI ANM

Benefit of ANM is an NPV cost reduction that must be viewed in the CBA. Traditional reinforcement (Option 2) will have an NPV cost of -£11.53m over 16 years vs ANM forecast scenario (Option 3), which has an NPV cost of -£0.77m over 16 years. This represents an NPV cost saving of £10.67m over 16 years. 16 years is chosen as it is expected that one or more of the subsea cables will be replaced within this time period. Once replacement has occurred and assuming the replacement cable has higher capacity, the benefits of ANM will reduce as more firm connections can be made.
NPV calculations are demonstrated in the CBA and assumptions explained in previous boxes.

SEPD

Pole Pinning

Refer to first box

Bidoyng

Refer to first box

ANM

Benefits of ANM calculated by ANM costs vs traditional reinforcement costs. In this case no traditional reinforcement costs have been avoided and so no benefits are shown.

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.

SSEH

Hybrid Generator

Link to reporting document where hybrid generator benefits are calculated:
ED_SSE - RRP - 2016-16 RRP Returns\Hybrid generator close down report

CBA Location:
ED_SSE - RRP - 2016-16 RRP Returns\SSEH CBA RIIO ED1_v4 - Bi Directional Hybrid Generator v2

Live Line Tree Cutter

CBA Location:
ED_SSE - RRP - 2016-16 RRP Returns\SSEH CBA RIIO ED1_v4 - Live Line Tree Cutting V3

Pole Pinning

CBA Location:
ED_SSE - RRP - 2016-16 RRP Returns\SSES CBA RIIO ED1_v4 - Pole Pinning V2

Forestry Mulcher

Link to original benefits tracker:
Bushfighter Benefits Tracker SHEPD v2

CBA Location:
SSES CBA RIIO ED1_v4 - Forestry Mulcher

Close-down Report:
NIA_SSEPD_0018_CL_2550

Orkney ANM

CBA Location:
Orkney ANM Benefits 2016.17

Western Isles ANM

CBA Location:
Western Isles ANM Benefits 2016.17

SEPD

Pole Pinning

CBA Location:
SES CBA RIIO ED1_v4 - Pole Pinning 2016.17

Bidoyng

Link to original BD1 and BD3 data:
BD1 information for reporting v1.0 & BD3 information for reporting v1.0

CBA Location:
SSES CBA RIIO ED1_v4 - Bidoyng V2

ANM

RIIO-ED1Isle of Wight Development Plan with reinforcement costs location:
RIIO-ED1_SSEPD_BP2_Mar14_sp16_LI_sepd_Fawley-IOW_132kV_Circuit_Reinforcement_MPGP633

CBA Location:
Isle of Wight ANM Benefits 2016.17 v2

E7 – LCTs

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

Where we are notified that a connection has been made, under connect and notify and not all of the information has been provided by the installer. On these occasion we have determined the KW's based on other details provided

We have used CR5 of the connections pack to calculate the number of DG connections that are not G83, consistent with last year. Using the CR5 pack provides a great level of detail. These are financially closed projects. Other projects that may have been connected in the year but have not been financially closed will report 2017-2018.

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.

Heat Pumps – Work was carried out to facilitate the recording of this information during 2016-2017, however this was later in the reporting year and is incomplete. This will be reported next year.

We have used the FITs register to provide the figures for G83 DG making the assumption anything under 11kW falls under G83.

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.

SSEH and SSES

As detailed in our RIIO ED1 submission, our predictions were based on an assessment of likely economic uptake and assumption that tariffs to incentivise uptake (eg FITs, Green Deal etc) would continue to incentivise significant uptake of LCT.

However, there were a number of changes introduced to the FIT scheme last year which have resulted in lower uptake on the scheme. This has meant that the number of new installations has decreased.

We expect that the new lower takeup across all categories of LCT will continue over the next Regulatory Year with equivalent volumes continuing at an equivalent level going forward with little growth or reduction.