SP TRANSMISSION

RIIO T1 Business Plan

Section 6 Operating Costs

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Contents

CONTENTS 1

EXECUTIVE SUMMARY 2

1. INTRODUCTION 3

2. ACTIVITIES, COST APPROACH, KEY CHANGES AND STAKEHOLDER ENGAGEMENT 4

2.1 Key activities: 4
2.2 Cost - Bottom up approach 4
2.3 Changes from TPCR 4 to RIIO- T1 5
2.4 Stakeholder engagement 5

3. OVERVIEW OF CURRENT AND FUTURE I&M COSTS 6

3.1 Inspection, Maintenance and Faults 6
3.2 Maintenance and Faults 6
3.3 Vegetation Management (Tree cutting) 7
3.2 Offshore and New Technology 7
3.4 Tower Painting 7

4. INSPECTION COSTS AND VOLUME DETAIL 8

4.1 Inspections 8

5. MAINTENANCE COSTS AND VOLUME DETAIL 10

5.1 Switchgear 10
5.2 Changes in OHL Maintenance costs (from TPCR4 to RIIO-T1) 12

6. SUMMARY: TOTAL DIRECT COSTS 16

7. INDIRECT COSTS 17

APPENDICES 20

Executive Summary

The SPT RIIO-T1 OPEX submission has been developed to provide the optimum level of funding required to ensure the long term stewardship of our 132kV, 275kV and 400kV transmission network; which is expanding, becoming more complex and increasingly ageing requiring more interventions as the asset base ages.

The submission of £67.8m of OPEX has been developed to ensure:

- We effectively manage a £3.74bn asset base during the period 2013 to 2021.
- Policy compliance.
- We satisfy our Legislative & Statutory obligations.

This submission "blueprint" has also been developed in line with our Stakeholder input which defines:

- *Stakeholders fully support our plans to ensure full policy compliance*
- *The HSE have reinforced their requirements that full policy compliance is the minimum expectation for Maintenance & Inspections.*
- *Our staff and trade unions expect a safe working environment for our people where equipment is maintained to policy and they have a safe working environment.*

The submission has been developed in conjunction with our 'Best View' Load and Non Load investment plan, which totals £1,94bn. The OPEX submission of £67.8m ensures the management of these additional assets commissioned during the period 2013-2021, and reflects the renewal of high cost poor performing assets.

We also require to ensure we have key condition information and data, upon which the future investment plans for RIIO- T2 will be based, and is part of our ongoing holistic approach to asset management.

1. Introduction

SP Transmission's 400kV, 275kV and 132kV transmission network is a key UK strategic asset, which has historically facilitated the bulk transfer of power from thermal generating stations to large urban load centres. The increase in renewable energy and the assets required to facilitate the generation connections and transfer capacity necessitates additional and more complex assets which will incur ongoing inspection and maintenance regime.

Further to this our asset replacement programme for RIIO- T1 seeks to reduce the large volume of ageing, unsupportable assets as outline in our Non-Load narrative.

This document details the OPEX strategy for managing all our 400kV – 132kV network assets going forward into RIIO- T1. It sets out:

1. An overview of our total asset base volume, the key activities, our approach to costing and the main cost changes from TPCR4.
2. An overview of current and future costs and the key cost movements.
3. The volume and mix of assets forecast to support our submission which
    a. Quantifies the volume, additional substations and asset movements associated with our Load and Non Load investment plans.
    b. Details the volumes and type of assets associated with the new technology that will require maintenance and inspections during RIIO T1.
4. Detailed volume and cost tables associated with inspections and maintenance, vegetation management and tower painting.
5. The strategy and provision of costs for condition information for substations, overhead lines and cables.
6. A summary of the total costs which represent our submission.
7. An index of appendices which details strategies, asset management policies and maintenance frequencies which satisfy our Legislative & Statutory obligations.

ScottishPower EnergyNetworks (SPEN) manages all physical assets utilising an Integrated Management System which combines the requirements of the Asset Management System specification (PAS55), the Quality Management System international standard (ISO9001), the Occupational Health & Safety Management System international standard (ISO18001) and the Environmental Management System international standard (ISO14001).

2. Activities, Cost Approach, Key Changes and Stakeholder Engagement

2.1 Key activities:

During RIIO T1, SPT will have increased through our investment programme our asset base to over 6000 main assets which will represent:

- 157 Substation sites
- 2 HV/DC convertor stations
- 4074km of overhead line
- 475 circuit breakers
- 294 transformers
- 789km of cables

The key operational activities associated with our assets are:

- Asset Inspection – Legislative and Statutory hazard inspection compliance which includes condition information.
- Maintenance – Condition Based maintenance (CBA), Reliability Centred Maintenance (RCM) and Time Based Maintenance (TBM). In addition condition information critical to non load asset replacement.
- Offshore HV/DC links – Inspection, maintenance, control & operation of our convertor stations and submarine cables.
- Tower Painting – tower painting to ensure the long life of our tower assets
- Vegetation Management – public safety associated with ESQCR
- Fault Repair – Safety risks, mal-operations and system security.

2.2 Cost - Bottom up approach

The FBPQ table for direct costs for engineering opex (Table 2.1) is built up on a volume x unit cost basis, and we will explain how the costs develop through this section, in addition how the costs are changing from TPCR4 and through RIIO T1.

The volumes are based on our 'Best View' plan which is detailed in Table 4.15 and reflect the Load and Non Load investment.

Unit costs reflect the true cost of inspecting and maintaining our assets, which are subject to more rigorous legal / safety requirements and more onerous maintenance scopes as the asset bases age.

2.3 Changes from TPCR 4 to RIIO- T1

There are significant changes from TPCR4 to RIIO-T1 and in addition through the duration of the new price review:

- Increased costs due to aging, poor performing and unsupportable equipment, e.g. air blast and bulk oil circuit breakers. These costs are framed within the context of our replacement programme for new equipment in our capital business plan, of which the new assets attract lower costs for maintenance once commissioned.
- Increased asset base requiring inspection & maintenance due to additional new substations and additional new overhead lines routes and circuits mainly associated with the connection of renewable generation.
- New maintenance costs due to the application of new technologies to increase network capacity, e.g. HVDC convertors and series and shunt compensation.
- Changes in legislation which materially affects the approach to maintenance, and therefore increases the cost, e.g. confined space and working at heights regulations.

2.4 Stakeholder engagement

In addition stakeholder engagement has been a key element in the build up of our plans.

Stakeholder Input

- *Stakeholders fully support our plans to ensure full policy compliance for inspections & maintenance.*
- *The HSE have reinforced their requirements that full policy compliance is the minimum expectation for Maintenance & Inspections.*
- *Our staff and trade unions expect a safe working environment for our people where equipment is maintained to policy and they have a safe working environment.*

3. Overview of Current and Future I&M Costs

Inspection, Maintenance and Faults costs will increase from **£6.1m** in TPCR4 2011, to **£10.1m** per annum by 2021.

The following table compares the cost movements from 2011 until the end of the price review period 2021.

Activity	TPCR4 (2011)	End RIIO-T1(2021)
Inspection Maintenance and Faults	£3.9m	£5.1
Vegetation Management (Trees)	£0.5m	£0.6m
HC DC Link and new technology	£0m	£2.8m
Tower painting	£1.7m	£1.6m
Totals pa	**£6.1m**	**£10.1m**

The cost movements are detailed in the following section 3.1 to 3.5.

3.1 Inspection, Maintenance and Faults

Inspection costs have increased from **£0.34m** to **£0.45m** predominantly due to:

1. OHLs and substation asset additions
2. Inspecting and condition assessing an ageing asset base

3.2 Maintenance and Faults

Maintenance cost and faults costs have increased from **£3.6m** to **£4.6m** due to:

1. The number of circuit breakers added for renewable energy connections which will increase the asset base, and subsequently increase the maintenance costs associated with sf6 circuit breakers.
2. Asset replacement of ageing switchgear will reduce the volume of high maintenance switchgear, however the scope change and cost of replacement parts will increase the unit costs for maintenance and fault costs of these remaining assets. Added to that new legislative compliance, for example working in heights and confined spaces has currently increased costs.
3. Increased costs for enhanced mid life maintenance of existing ageing SF6 circuit breakers.

4. Cable (including faults) and maintenance costs will increase from £0.5m to £0.8m in line with our strategy to collect condition based information on oil and xlpe cables.
5. Substation transformer asset volumes will increase in RIIO- T1, however the new units will have longer frequencies and less intrusive maintenance regimes, therefore the costs will be maintained at a stable level.

3.3 Vegetation Management (Tree cutting)

Vegetation Management cost will increase from **£0.5m** in 2011 to **£0.6m** in 2021. This is a well developed efficient programme. We expect that cost during RIIO T1 will rise in line with the additional OHL assets connected.

3.2 Offshore and New Technology

Off shore and new technology costs have increased from **£0m** to **£2.81m** mainly due to new technology added to increase network capacity which include; HVDC Link, Series Voltage compensation and MSCDN (Mechanically Switched Capacitor with Damping Network).

3.4 Tower Painting

Direct opex costs will reduce from £1.7m in TPCR4 to £1.6m in RIIO T1. We currently expect to peak over the next two years (£3.3m) as per our detailed plans and discussions with Ofgem. The decrease in activity is due to the high level of major steelwork refurbishment during the RIIO period and the tower painting activity associated with this programme.

In summary this leads to an overall increase in costs pa from £6.1m TPCR4 (2011) to £10.1m at the end of RIIO-T1.

4. Inspection Costs and Volume Detail

4.1 Inspections

This section describes the changes in inspection costs from TPCR4 to RIIO-T1 due to:

- Changes in the volume of activity
- Changes in the cost of an activity
- Changes in the scope of works or the policy applied

Volume: Inspections

The volume of substations and OHLs requiring inspections will change over the RIIO-T1 period. The volume of substations and OHL's will increase as the network expands mainly due to the connection of new equipment associated with renewable generation connections.

Costs & Volumes p.a.	2013 end of TPCR4 including the roll over		2021 end of RIIO T1	
Activity	**Volume**	**Cost (£m)**	**Volume**	**Cost (£m)**
OHL inspections	10354	0.2	12078	0.27
Substation Inspections	1495	0.15	1868	0.17
Total	11849	0.35	13946	0.45

Scope / Policy: Inspections

Our inspection policy for switchgear is to visually inspect monthly to check for safety & security, with a condition report produced every 10 years. Monthly inspection costs have increased over TPCR4 due to the volume of substations and data attributed to condition information.

Our inspection policy for OHL currently includes statutory foot patrols and helicopter statutory and condition patrols.

During RIIO-T1 we plan to climb and inspect towers in order to gauge the condition of metalwork and fittings which is not captured in the helicopter and foot patrols. The earlier year of the price review will see a more frequent inspection regime due to the current age and condition of our assets. At the end of the price review, and upon the completion of our investment plans, we will have a prioritised inspection regime for assets not part of the investment programme. We expect that in RIIO T2 we will move to a 10 year condition based climbing inspection policy.

The following table shows the impact of this policy on tower inspection volumes.

Volumes p.a.	2014	2021
Activity	**Volume**	**Volume**
Climbing Patrols (Towers)	690	380

Summary: Inspections
We have shown that the costs for substations and OHL's inspections have changed mainly due to the volume increase. These costs are shown in the summary table below.

Costs £m	2013	2021
Activity p.a.	**Cost (£m)**	**Cost (£m)**
OHL inspections	0.2	0.27
Substation Inspections	0.15	0.17
Total	**0.35**	**0.45**

5. Maintenance Costs and Volume Detail

5.1 Switchgear

This section describes the changes in maintenance costs from TPCR4 to RIO-T1 caused by:

- Changes in the volume of activity.
- Changes in the scope of works or the policy applied.

Volume: Switchgear
The volume of circuit breakers requiring maintenance will change over the RIIO-T1 period is shown in the table below as is mainly associated with the following factors:

1. The volume of Gas Circuit breakers will increase as the network expands due to the installation of new equipment associated with renewable generation connections.
2. The replacement of bulk oil and air blast circuit breakers with modern SF6 breakers will change this mix of circuit breakers on the network and is demonstrated below.
3. The connection of HVDC link and other new technologies associated with the new system architecture and operational duties during the price review period.

Total Volumes	2014	2015	2016	2017	2018	2019	2020	2021
SF6 CB	265	289	316	366	329	332	332	363
Bulk Oil	107	100	100	100	100	97	97	69
Air Blast	65	65	57	57	46	46	46	43
New Technology	2	2	2	3	3	3	3	3

Scope / Policy: Switchgear
Our maintenance policy for switchgear remains to carry out a 3 year minor maintenance and a 6/9 year major maintenance dependent on the individual asset. The scope & associated cost of this work has changed significantly over the past few years as we have responded to drivers to improve safe working practices, and to react to the deteriorating condition & performance of some of the older plant items.

Unit Cost	TPCR4	RIIO-T1	Reason for change
Air Blast CB : Major	£8425	£36149	Substantial parts cost now required at each maintenance (£20,000). Full scaffolding required round all blast heads (£9000) for both safety, and detailed scope of work. Time (labour costs) have increased to address issues associated with poor breaker timing and contact performance, and to dismantle / reassemble equipment in accordance with current H&S legislation (e.g. confined space issues in air receivers).
Oil CB : Major	£4333	£7323	The content and scope of the work included specialised parts has prolonged maintenance outage times. In addition confined space regulations have added a further member of staff to the working team for safety reasons
Oil CB : Minor	£462	£937	Working at height regulations mean that a mobile platform is required to complete the testing at additional cost.
SF6 CB	£457	£800	Working at height regulations mean that a mobile platform is required to complete the testing at additional cost.
Isolator & Earth Switches	£364	£778	Working at height regulations means that a mobile platform is required to complete the mechanical maintenance.

Summary: Switchgear

The above analysis has shown that the costs for switchgear maintenance costs have changed from TPCR4 to the costs shown in RIIO-T1 as shown below, and are contained in row 66 of Table 2.1. We expect by the end of the price review period that costs reduce due to the replacement of oil and air blast circuit breakers. However this is offset by the additional 98 sf6 circuit breakers installed during the RIIO period.

Costs £m p.a.	2011	2014	2015	2016	2017	2018	2019	2020	2021
Switchgear	1.5	0.21	0.20	0.20	0.20	0.20	0.20	0.20	0.20

5.2 Changes in OHL Maintenance costs (from TPCR4 to RIIO-T1)

This section describes the changes in maintenance costs from TPCR4 to RIIO-T1 caused by the following factors:

- Changes in the volume of activity, and
- Costs associated with managing and ageing asset.

OHL maintenance includes:

1. Maintenance costs (Cormon)
2. Tower Painting
3. Tree Vegetation management

Costs £m p.a.	2011	2014	2015	2016	2017	2018	2019	2020	2021
OHL Maintenance £m	0.1	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
Tower Painting £m	1.7	1.61	1.61	1.61	1.61	1.61	1.61	1.61	1.61
Vegetation Management £m	0.5	0.52	0.52	0.52	0.52	0.54	0.56	0.57	0.57

Volume: OHL

The volume of OHL requiring maintenance will change over the RIIO-T1 primarily due to generation connections:

Volumes p.a.	2011	2014	2015	2016	2017	2018	2019	2020	2021
400 & 275kV Conductor	2245	2283	2283	2417	2417	2417	2417	2417	2417
132kV Conductor	1509	1585	1607	1658	1658	1658	1658	1658	1658

Overhead Lines Maintenance

The volume of OHL requiring maintenance will change over the RIIO-T1 primarily due to generation connections. Our main activity for OHL maintenance is Cormon testing, which given the age of the remaining asset base will require an enhanced role in managing the condition of the remaining conductor. This data will supplement our knowledge for future investment in addition to the risk mitigation associated with the aged asset.

Cormon is a non-intrusive conductor internal condition monitoring tool with the ability to determine the condition of the galvanised steel core. The Cormon test gear was developed in the 1990s by the Electricity Association and National Grid.

The method involves inducing electrical currents into the conductor and measuring the resultant feedback. The results can be displayed graphically or in tabulated format. The results are best utilised when compared to a previous set of results over the same span indicating a rate of deterioration rather than an expiry date. The most onerous part of the process is the removal of spacers and spacer dampers (on the 275 and 400kV system only) and obviously needs an extended outage to carry out the work. However five spans can be monitored in the time it takes to remove a section of conductor. Cormon is recognised as being the only non-intrusive technique on the market.

Our policy for Cormon is based on a rolling 5 year programme.

Costs £m p.a.	2014	2015	2016	2017	2018	2019	2020	2021
Maintenance	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2

Volume and costs movements from TPCR4: Tower Painting

We plan to focus on the 132kV network during RIIO-T1, as the priority during TPCR4 and the Roll Over period has been on the 275kV network. Further to this we will continue to implement our painting policy cycle on a 12 year basis.

We expect to peak in activity over the next two outage seasons (£3.3m), and further to this reduce the activity (£1.7m) in line with the capital investment programme as detailed below. This is consistent with our discussions with Ofgem through RRP.

The year on year costs during RIIO-T1 will be flat lined, and in addition the number of towers completed annually will change subject to the mix of towers.

This physical size between 132kV and 400kV towers is very different. We further explain this in the tables below, as it is key to the cost of tower painting that the actual square metre painted per annum is the determining factor in policy compliance. Our policy is to paint circa 115,000 sqm pa, which is equivalent to either 89 large 400kV towers or 763 small 132kV towers.

Tower Type	Tower Size	Voltage	Area in M Sq
PL16	Small	132kV	151
PL16	Med	132kV	202
PL16	Large	132kV	344
L2	Small	275kV	365
L2	Med	275kV	447
L2	Large	275kV	993
L6	Small	400kV	701
L6	Med	400kV	831
L6	Large	400kV	1294

Voltage	Total Number of Towers	Total Towers p.a.	Capex*	Opex	Average Area (m^2)	Opex Area Per Year (m^2)
400 kV	2252	188	-120	68	682	46,149
275 kV	1323	110	-58	52	579	30,253
132 kV	3554	296	-102	194	200	38,833
Total	7129	594	-280	314	n/a	115,235

*Major conductor and steelwork refurbishment

Costs for Tower painting from TPCR4 to RIIO-T1

£m p.a.	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Tower painting £m	1.7	1.7	3.2	3.3	1.61	1.61	1.61	1.61	1.61	1.61	1.61	1.61

Scope / Policy: Vegetation Management

Our maintenance policy for vegetation management is continuing on the published cycles as shown in the table below.

- **Table 2 - Transmission Lines**

Year	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Statutory & Legislative															
Tree Management		✓					✓					✓			
Foot Patrol (Hazard Inspection)	✓		✓		✓		✓		✓		✓		✓		✓
Helicopter Patrol (Hazard Inspection)		✓		✓		✓		✓		✓		✓		✓	
Condition															
Thermal Vision (Helicopter Inspection)	✓		✓		✓		✓		✓		✓		✓		✓
Condition Assessment		✓										✓			

Condition assessment shall include Distribution Steel Lattice Towers as per Section 9.0

In addition to the above strategic circuits identified in appendix 2 will be thermal vision inspection by helicopter annually.

Our tree vegetation management work stream is a well developed and efficient programme of works. As previously discussed with Ofgem through the RRP process, we intend to increase the activity in line with the system asset growth.

Costs for Tree Vegetation Management from TPCR4 to RIIO-T1

Costs £m p.a.	2011	2014	2015	2016	2017	2018	2019	2020	2021
Vegetation Management	0.5	0.52	0.52	0.52	0.52	0.54	0.56	0.57	0.57

6. Summary: Total Direct Costs

Costs £m p.a.	2011	2014	2015	2016	2017	2018	2019	2020	2021
Fault Repair £m	0.6	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9
Inspections and Maintenance £m	3.3	4.09	4.19	4.19	4.13	4.19	4.19	4.19	4.19
Tower Painting £m	1.7	1.61	1.61	1.61	1.61	1.61	1.61	1.61	1.61
Vegetation Management £m	0.5	0.52	0.52	0.52	0.52	0.51	0.56	0.57	0.57
HV DC& New Technology		-	-	-	1.5	1.5	1.5	2.8	2.8
Total £m	**6.1**	**7.1**	**7.2**	**7.2**	**8.7**	**8.7**	**8.8**	**10.0**	**10.1**

The RIIO- T1 total cost is £67.8m

Fault Repair

- Marginal increases in fault repair associated with substation plant and civil ageing assets.

Inspections & Maintenance

- Increased volumes of plant and OHL requiring routine annual inspection.
- Increased maintenance costs associated with maintaining the current ageing asset fleet and the additional volume of plant commissioned as a result of generation connections.

Vegetation Management

- Year on year increased tree vegetation management costs to account for the additional 200km of new ohl to be commissioned as a result of the generation connections.

HCDC & New technologies

- New annual cost associated with the operation and maintenance of the East and West Coast DC link due for connection during the price review, plus new series & shunt compensation equipment

7. Indirect Costs

Our indirect costs will naturally increase in the lead up to and during RIIO-T1, directly as a consequence of our increased investment. We have described in this document why we must increase our internal resources in the following areas:-

- Environmental Planning & Wayleaves – from 7 at March 2011 to 17 by 2021.
- Transmission Operational Engineers – from 47 at March 2011 to 77 by 2021
- System & Engineering Design – from 10 at March 2011 to 16 by 2021
- Asset Management & Investment Planning – from 12 at March 2011 to 17 by 2021.
- Major Projects Delivery (only SPT, ie excl IEC) – from 9 at March 2011 to 11 by 2021

This equates to an increase of 53 staff from a total base of Transmission staff of 224 (excluding IEC) at March 2011. However this only explains part of the increase in our overall indirect costs.

Our indirect costs will also increase through, what Ofgem would recognise as, a reclassification of costs (from direct capex). This is a result of our strategic decision to move away from a traditional turnkey EPC model delivery using Tier 1 Principal Contractors, to delivering our investment plan through our affiliate Iberdrola Engineering & Construction (IEC). This change in direction brings responsibility for detailed design and project management activity in-house and thereby the requirement to report their costs (from 2010/11) as Closely Associated Indirect costs.

That is to say, under the traditional EPC approach we previously employed, these activities were typically bundled into a principal contractor's overall tender price, with the result being that for 2007/08 to 2009/10 RRP cost reporting these costs were included within Direct Capital Costs.

For 2010/11 RRP reporting we have reclassified £7.6m (£4.4m FTE related) into indirect costs reflecting fully the establishment of IEC's organisation during the year. By March 31st 2011 the IEC organisation had rapidly grown to 156 staff, 131 of which are fully employed on Transmission projects (the other 25 being employed on SP Manweb 132kV works).

The IEC mobilisation plan (attached as Appendix 2 in Section 7 on Delivering the Plan) describes IEC's assessment of SPTL's workload projections through to 2020/21, and the translation of that to an increase in their Engineering Services and Project Management capability from 131 to a peak of 241 by 2014/15, across the following disciplines:-

- Engineering - from 55 at March 2011 to 116 by 2021
- Pre-Delivery - from 4 at March 2011 to 10 by 2021
- Delivery - from 31 at March 2011 to 44 by 2021

- Key Account Management - from 6 at March 2011 to 9 by 2021
- Construction (on-site co-ordination of contractors) - from 24 at March 2011 to 43 by 2021.
- Health & Safety - from 3 at March 2011 to 5 by 2021.
- Environment & Planning - from 5 at March 2011 to 9 by 2021.
- Finance - from 3 at March 2011 to 5 by 2021.

The FTE cost will rise from £4.4m in 2010/11 (equivalent to ca £7m on a having 131 for a full year) to a peak of £13.2m by 2014/15.

The mobilisation plan also describes how the Engineering Team is also supported by seven framework agreements to provide additional specialist resources. The reliance on these frameworks is also estimated to rise in the lead up to and during RIIO-T1 from around £2.5m in 2010/11 to over £12m by 2014/15 before falling away again. At the peak of activity in 2014/15 the staff to external resource ratio will be around 50/50.

It is important to understand that these costs are not incremental to a traditional EPC turnkey approach, but simply a reclassification of costs from direct to indirect. Our business plan assumes a direct trade-off between directs and indirect costs, but it is our belief that our change in strategy can, as well as improving the deliverability of a challenging investment program, reduce overall costs.

However, whatever we may think about the size of principal contractor margins, an unhelpful consequence of our change to utilising IEC is that the margins which they forecast to earn will not be allowable by Ofgem under current rules.

We have been transparent in reporting IEC's forecast Related Party Margins in our business plan, but we shall want to discuss with Ofgem not allowing "efficient margins" if our overall unit costs (inclusive of these margins) are deemed by Ofgem's Engineering Consultants to be at benchmark levels or below.

Existing rules penalise Transmission Operators which wish to insource activities in the interests of efficiency, insofar as efficiently assessed external costs (including margins) are allowed through to the RAV, whilst efficiently assessed internal affiliate costs have margins deducted for RAV purposes.

We believe that Ofgem should set incentives that are indifferent to insourcing /outsourcing decisions.

By contrast our Business Support costs, which are largely unaffected by movements in our capital program, remain fairly flat.

Attached below is an extract from our Business plan summarising our indirect costs (prior to capitalisation):-

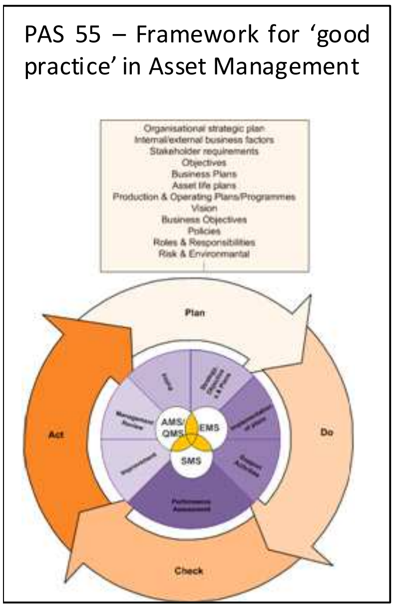
Indirect Costs														
£m (2009/10 prices)	TPCR4 & Rollover						RIIO-T1							
Yr ending	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**
Information Systems & Telecommunications	5.4	5.1	4.9	5.1	4.4	4.4	5.0	4.8	4.6	4.6	4.6	4.5	4.5	4.6
Property Management	1.8	1.1	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
HR & Non-Operational Training	0.5	0.6	0.7	0.6	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.8	0.8	0.8
Finance, Audit & Regulation	1.0	1.7	1.5	1.6	1.9	1.8	1.8	1.9	1.9	1.9	1.9	2.0	2.0	2.0
Insurance	0.9	0.5	0.5	0.5	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6
Procurement	0.1	0.1	0.1	0.2	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3
CEO & Other Corporate Functions	1.2	1.2	1.4	1.9	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1
Business Support Total	**10.9**	**10.3**	**10.1**	**11.0**	**10.9**	**10.8**	**11.4**	**11.3**	**11.1**	**11.1**	**11.1**	**11.3**	**11.3**	**11.3**
Project Management	1.8	1.2	1.2	2.6	3.7	5.9	7.2	7.2	7.3	7.3	7.3	7.3	7.3	7.3
Network Design & Engineering	2.7	2.0	1.9	4.2	12.5	20.6	20.3	22.2	17.0	13.0	15.0	14.7	13.0	2.4
System mapping	0.3	0.4	0.3	0.1	0.1	0.1	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
Engineering Management & Clerical Support	9.0	7.6	7.0	12.1	12.8	13.3	13.5	13.5	13.6	13.6	13.6	13.6	13.6	13.6
Network Policy (incl. R&D)	0.8	0.8	0.6	0.4	0.5	0.6	0.7	0.7	0.8	0.8	0.8	0.8	0.8	0.8
Health, Safety & Environment	0.5	0.3	0.3	0.2	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Operational Training	0.2	0.1	0.1	0.1	0.5	1.2	0.9	0.2	0.2	0.2	0.2	0.2	0.2	0.2
Stores & Logistics	0.5	0.3	0.3	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Vehicles & Transport	1.8	1.8	1.4	1.0	1.0	1.0	1.0	1.1	1.1	1.1	1.1	1.1	1.1	1.1
Network Planning	0.9	0.8	0.8	1.1	1.1	1.1	1.1	1.2	1.2	1.2	1.2	1.2	1.2	1.2
CAI Total	**18.5**	**15.3**	**13.9**	**21.8**	**32.8**	**44.5**	**45.6**	**46.9**	**42.0**	**38.1**	**40.1**	**39.8**	**38.1**	**27.5**
Total indirects (before capitalisation)	**29.4**	**25.6**	**23.9**	**32.8**	**43.7**	**55.3**	**57.0**	**58.2**	**53.1**	**49.2**	**51.2**	**51.1**	**49.4**	**38.8**

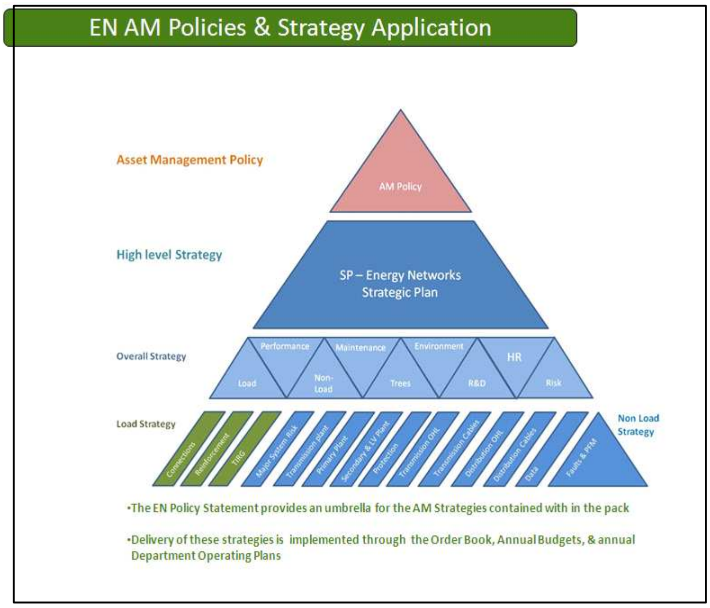
Source: Detailed Data tables 1.3abc_Cash_Contr._Costs

APPENDICES

a) Strategy Pyramid

Asset Management Standard – PAS55/IMS (appendix 1), to which ScottishPower expect to deliver an optimised, effective and policy compliant inspection and maintenance programme.





(i) Asset Inspection Approach

Our strategy is to ensure compliance with legal and licence obligations; whilst safeguarding staff and members of the public from hazards and minimising risk of asset failure. As part of our inspection visits, condition information is collected and stored in our corporate Asset Inspection System (AIS). This information is used in association with other key data to influence our asset health scoring, and ultimately our future investment plans.

We comply with and implement through our asset policies determined through:

- Regulation 5 of ESQCR requires that SP Energy Networks inspects substations with sufficient frequency that we are aware of what action to take to ensure compliance with the Regulations (detailed in ESQCR Guidance Document ref. URN 02/1544).

- Regulation 3(2) of ESQCR requires that, for overhead lines and substations, we carry out risk assessments, which take the form of hazard inspections, keep records of these assessments and take appropriate measures to safeguard the equipment.

The risk of unauthorised access/interference to substations and danger to the public is managed through appropriate construction and maintenance standards.

Our asset inspection policies define:

Frequently of inspection:

Table 1 – Substations

ASSET	TASK	INTERVAL
GRID SUBSTATIONS	INSPECTION (ALL LOCATIONS)	1 MONTH
	POST-TRESPASS / VANDALISM INSPECTION	1 WEEK
	THERMOGRAPHIC INSPECTION	12 MONTHS

- **Table 2 - Transmission Lines**

Year	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Statutory & Legislative															
Tree Management		✓					✓					✓			
Foot Patrol (Hazard Inspection)	✓		✓		✓		✓		✓		✓		✓		✓
Helicopter Patrol (Hazard Inspection)		✓		✓		✓		✓		✓		✓		✓	
Condition															
Thermal Vision (Helicopter Inspection)	✓		✓		✓		✓		✓		✓		✓		✓
Condition Assessment		✓										✓			

Condition assessment shall include Distribution Steel Lattice Towers as per Section 9.0

In addition to the above strategic circuits identified in appendix 2 will be thermal vision inspection by helicopter annually.

These inspections are detailed in the following documents:

1. Overhead Lines Inspection and maintenance Policy OHL -01-006.
2. Policy for Inspection of Substations and LV Switch points SUB-01-008.
3. Protection Inspection/maintenance Policy PROT -01-016.

The documents confirms:

1. how inspection data should be interpreted and,
2. post inspection remedial (risk and hazard mitigation) actions.

Hazards and Defects

An extract from our current policy for hazards and defects describes that

Hazards & Defects shall be rectified by means of remedial maintenance with the following degrees of urgency:

Priority	Urgency	Timescale[1]	Comments
I	Immediate attention	Within 24 hours	May require emergency network shutdown
U	Urgent repair	Within 3 months	Not an I but requires Urgent attention.
P	Condition/Investment Requirements		Part of a planned programme.

This is published in our Hazard/Defect Management Policy EPS–01–002 Issue 9.

The risk of unauthorised access or interference and danger to the public arising from hazards is managed through appropriate asset construction standards. The primary purpose of inspection is to ensure that transmission assets remain in an adequate operational condition and that hazards continue to be effectively managed throughout the life of the asset.

(ii) Overhead Line Inspection, Tree Management and Condition Assessment Approach

To ensure compliance with Regulation 3(2) of ESQCR our inspection regime, gather ongoing condition assessment data to support our investment plans and to comply with our Tree Management policy for steel lattice tower lines and OHL conductors. The following inspection regime is illustrated below:

- **Table 2 - Transmission Lines**

Year	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Statutory & Legislative															
Tree Management		✓					✓					✓			
Foot Patrol (Hazard Inspection)	✓		✓		✓		✓		✓		✓		✓		✓
Helicopter Patrol (Hazard Inspection)		✓		✓		✓		✓		✓		✓		✓	
Condition															
Thermal Vision (Helicopter Inspection)	✓		✓		✓		✓		✓		✓		✓		✓
Condition Assessment		✓										✓			

This is published in our Overhead Lines Inspection & Maintenance Policy OHL-01-006.

<u>Summary</u>

- Tree Management - every 5 years
- Foot Patrol - 50% pa
- Helicopter Patrol – 50% pa
- Thermal Vision - 50% pa (critical circuits annually)
- Condition Assessments (high definition helicopter camera) – 10% pa

During the next 10 years we expect to increase the number of inspections due to the volume increase in OHLs, and further to this gather detailed ongoing condition information to determine the asset health of these assets.

During RIIO-T1 we plan to climb and inspect towers in order to gauge the condition of metalwork and fittings not captured on the inspections previously mentioned. The earlier year of the price review will see a more frequent inspection regime due to the current age and condition of our assets. At the end of the price review, and upon the completion of our investment plans, we will have an inspection regime based a prioritised regime for assets not part of the investment programme. We expect that in RIIO T2 we move to a 10 year condition based climbing inspection policy.

Tree management will continue under ENATS 43-8, with increased costs due to the increasing size of the network due to the increased km of OHL mainly associated with the numerous wind renewable infrastructure connections and the rural (forestry) nature of these connections.

(iii) Substation Inspection (including Cable Termination Points) and Condition Information

All grid substations are inspected at least once every month to ensure compliance with Regulation 3(2) of ESQCR. There are two levels of inspection; hazard and security inspection and trespass / vandalism inspection.

ASSET	TASK	INTERVAL
GRID SUBSTATIONS	INSPECTION (ALL LOCATIONS)	1 MONTH
	POST-TRESPASS / VANDALISM INSPECTION	1 WEEK
	THERMOGRAPHIC INSPECTION	12 MONTHS

This is published in our Policy for Inspection of Substations and LV Switch points SUB-01-008

Summary

Information obtained during asset inspection is retained and used to inform future decisions on asset policy development, asset replacement and prioritisation of investment.

The level of spend for substation inspections and data gathering will increase mainly due to the numbers of substations connected through wind farms, and the level of inspection required to look after an ageing asset base.

(iv) Plant Maintenance Approach

All transmission maintenance work is carried out in accordance with the relevant health, safety and environmental legislation, and associated SP Transmission documentation and procedures and in accordance with approved plant maintenance procedures.

Voltage	Equipment	Maintenance	Interval
132kV – 400kV Switchgear			
132kV and above	Circuit breaker	Minor Service	3 years
132kV and above	Oil and Air Blast Circuit breaker	Major Service	6-12 years
132kV and above	Isolator/ESW/FTS	Minor Service	3 years
132kV and above	Circuit breaker	Operational check	12 months

Voltage	Equipment	Maintenance	Interval
132kV and above	Selector switch	Major Service	9 years
132kV and above	Diverter switch	Major Service	6 years
132kV and above	Transformer*	Examination and operational check	Annual
132kV and above	CT and VT	Minor Service	6 years
132kV	Wound VT	Minor Service	3 years
33kV	Selector switch	Major Service	6 years

The Maintenance frequencies are detailed in the following documents:

1. Plant Maintenance Policy SUB-01-009.
2. Protection Inspection / Maintenance Policy PROT-01-016.

Our transmission maintenance policies comprise of a time-based regime for the majority of equipment driven by ongoing rolling programmes and a service duty based regime as noted above for the remainder.

Transmission maintenance activities:

1. Plant maintenance work: programmed according to policies, system access and also depending on asset type as detailed in the policy matrix.
2. Protection maintenance: time based and is normally carried out during the same outage as the plant maintenance, this work is undertaken in conjunction with Site Engineers.
3. Hazard rectification (plant and overhead line) minor remedial repairs based on discovery rate of hazards from routine planned inspection activities.

(v) Overhead Lines Approach

Our strategy for overhead lines maintenance is to deliver an effective policy compliant maintenance programme which reduce legal and safety risks of network assets and maintain failure rates.

Further to this our tree strategy is to reduce safety risks arising from network assets in proximity to trees via ENATS 43-8 compliant vegetation management programme, and improve storm resilience via ETR 132 programme.

Overhead line maintenance activities include:

1. tree vegetation management,
2. tower painting based on a twelve year cycle,
3. minor remedial repairs (such as installation of danger of death warning notices and anti-climbing device replacement). Major defects are rectified on a prioritised basis through incorporation into the capital major refurbishment work programme, and
4. CORMON testing.

- **Table 2 - Transmission Lines**

Year	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Statutory & Legislative															
Tree Management		✓					✓					✓			
Foot Patrol (Hazard Inspection)	✓		✓		✓		✓		✓		✓		✓		✓
Helicopter Patrol (Hazard Inspection)		✓		✓		✓		✓		✓		✓		✓	
Condition															
Thermal Vision (Helicopter Inspection)	✓		✓		✓		✓		✓		✓		✓		✓
Condition Assessment		✓										✓			

(vi) Trees Maintenance Approach

Tree management is a well developed programme of works and our approach to tree management comprises six key processes:

1. Identification of tree hazards;
2. Planning tree cutting operations;
3. Executing tree cutting operations;
4. Auditing tree cutting operations;
5. Monitoring and recording tree cutting operations; and
6. Financial control of tree cutting operations.

Tree hazards are identified from the routine inspection visits and from ad-hoc reports received from operational staff, members of the public and managed through our minor refurbishment and major programmes of works. Any urgent defects are progressed immediately as per our hazard policy.

(vii) Tower Painting

Tower painting requirements will continue to be identified and prioritised using the helicopter patrols and the implementation of climbing condition assessments.

The majority of the towers that require painting were constructed in the 1960's and condition reports have indicated that the galvanising is starting to break down and surface rust is appearing particularly on the steelwork nearer the tops of the towers.

We plan to focus on the 132kV network during RIIO-T1, as the focus has been on the 275kV network during TPCR4 and the Roll Over period.

This physical size of a 132kV and 400kV towers is very different. We further explain this in the table below, as it is key to the cost of tower painting that the actual sq m painted pa is the key factor in policy compliance. The actual number of towers will vary annually based on the mix of work and access to the system, but the square meters actually painted needs to be policy compliant. Our policy is to paint 115,000 sqm pa, which is equivalent to either 89 large 400kV towers or 763 small 132kV towers

Tower Type	Tower Ref	Voltage	Area in M Sq
PL16	DSTD	132kV	151
PL16	D30	132kV	202
PL16	DTE10	132kV	344
L2	DSTD	275kV	365
L2	D30	275kV	447
L2	DTE12	275kV	993
L6	DSTD	400kV	701
L6	D30	400kV	831
L6	DTE10	400kV	1294

(viii) Cormon Testing

Cormon is a non-intrusive conductor internal condition monitoring tool with the ability to determine the condition of the galvanised steel core. The Cormon test gear was developed in the 1990s by the Electricity Association and National Grid. The method involves inducing electrical currents into the conductor and measuring the resultant feedback. The results can be displayed graphically or in tabulated format. The results are best utilised when compared to a previous set of results over the same span indicating a rate of deterioration rather than an expiry date. The most onerous part of the process is the removal of spacers and spacer dampers (on the 275 and 400kV system only) and obviously needs an extended outage to carry out the work. However five spans can be monitored in the time it takes to remove a section of conductor. Cormon is recognised as being the only non-intrusive technique on the market. Our policy for Cormon is based on a rolling 5 year programme of works.

(iX) Cables Maintenance Approach

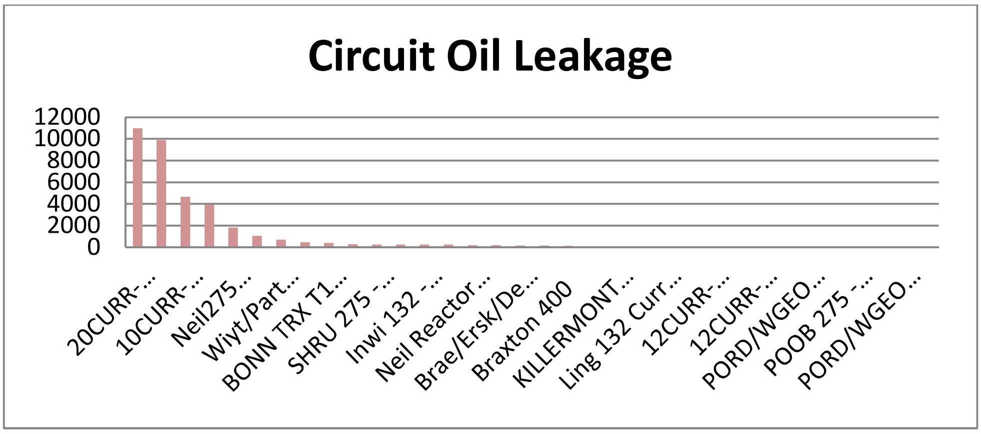
Our strategy for cables maintenance is to:

- Improve availability of the transmission cable network
- minimise environmental impact of fluid filled cables.

We have a total of 789 km of transmission cables, of which 80% of which are oil filled. The remainder are XLPE. We have completed a programme of removal of poorly performing gas compression cables over TPCR4 which has reduced the portfolio of this asset base from 38km to 20km over TPCR4. All GCC (gas compression Cables) will be replaced by the start of RIIO-T1.

As we have addressed issues with gas compression cable during TPCR4 and our XLPE population is relatively young our RIIO-T1 plans will focus on fluid filled cable, however in order to baseline data and trend failure, we will seek to test 3 of our XLPE assets.

Our policy for Cable Sheath Testing (CST) is in development, however we expect to implement a full programme to capture condition data which will supplement type, failure rate and oil leakage information. Over 40km will be tested annually including a cross section of XLPE. The programme will be prioritised and will be based on the following oil cables with the leakage data noted.



c) Fault Repair Approach

Our strategy for fault repairs is:

- Restoration of customers to minimise average duration and avoid GS failures.
- Efficient and timely repair of the network to restore network integrity, prioritised by risk.
- Influence, for poor condition assets and repeat events, planned modernisation and maintenance through condition assessment from fault management.
- Ensure required resource and expertise is available within the business for Emergency Planning requirements.

Over the next price review period we expect fault costs to remain at the stated financial and event level, and these costs will remain low due to increased scope and level of maintenance and inspection condition assessments undertaken to intervene is asset condition and health. Costs include attendance, investigation, isolation, repair and restoration of the faulty equipment.