SP ENERGY NETWORKS

Flexible Networks for a Low Carbon Future

Project Cost Benefit Analysis

- Dynamic Thermal Rating (33kV Overhead Lines)

September 2015

Part A – Costs of the trial and future roll-out

1. Introduction

This document provides cost versus benefit analysis of the deployment of Dynamic Thermal Rating (DTR) on 33kV overhead lines (OHL). The document aims to quantify the cost per kVA of capacity gain by applying a "smart" or new technology solution against the cost per kVA of the traditional business as usual reinforcement solution.

2. Planned Innovation and Benefits

The objective of this work package was to achieve an increase in the network capacity headroom on 33kV overhead lines, to avoid the large step change reinforcement for relatively small levels of demand growth, for potential Low Carbon Technology loads. The target for this work package was a 7% increase in capacity headroom within the trial sites.

3. Activities of the Work Package

- To establish models and use existing algorithms to determine the dynamic rating on 33kV Overhead Lines.
- To modify IT servers to include 33kV OHL dynamic model.
- To install 33kV conductor temperature sensors and communications.

4. Work package Outturn against budget (Trial Project Cost)

The original submission budget for this work package was £783K for both Transformers and Overhead Lines. The costs were not split between DTR of transformers and overhead lines.

Table 1 below is a summary of the overall work package 2.1 expenditure and lists the original budget against the actual spend for the trial.

Activity	Budget (£k)	Actual (£k)	Variance (£k)	Commentary
Labour	203	90	-113	Contractors used instead of internal labour
Equipment	295	229	-66	Real-time rating changed to 'enhanced' rating. Lower spend on condition monitoring.
Contractors	97	337	+240	Contractors used instead of internal labour and transformer condition improvement work required for enhanced rating.
IT	150	149	-1	
Travel/Exp's	-	-	-	
Contingency & Others	39	20	-19	Condition works necessary for application of DTR to certain transformers.
Payments to users	-	-	-	
Totals	**783**	**825**	**+42**	

Table 1

Labour – The internal labour costs were significantly lower than budget, due to not being able to release staff from the businesses with the required skills to the project for the 3years.

Equipment – For the overhead lines the equipment expenditure was generally as per plan.

Contractors – This included the additional contract resource and the condition improvement to the St Andrews transformers in preparation for enhanced rating.

Contingency – No contingency was required for the overhead line DTR element of the work package.

5. Future Roll out cost of DTR on overhead lines

The table 2 below shows a breakdown of the Trial Project Costs versus Repeated Method Cost for deployment of DTR on overhead lines only. The trial cost shows the cost of undertaking the trial for the DTR on the dual circuit between Cupar Grid and St Andrews primary. The repeated method costs illustrate the costs of further deployment to another 33kV OHL. The benefit column shows the capacity gain of the circuit through the deployment.

Activity	Trial cost (£k)	Repeated Method cost	Benefit (kVA)
Weather stations	25000	15000	
RTU and communications	16000	16000	
Sensors	11000	11000	
IT systems & changes	140000	3000	
Modelling/analysis	107160	20000	
DTR server/licence	Included	10000	
Engineering & project management	95000	15000	
Total	394160	90000	
Cost / Benefit Ratio (£ / kVA)		£45.00	2000

Table 2

Part B – Financial Assessment

Reinforcement Base Cost at 33kV

The trial for the dynamic rating of 33kV overhead line was undertaken at on a dual circuit 17km 33kV overhead line with some cable sections and each circuit has a capacity of 22MVA, the reinforcement costs of rebuilding a single circuit to achieve a higher rating (38MVA max.) are typically £1270k. On a pro-rata basis the unit reinforcement cost for the OHL is £79/kVA. The dynamic rating of a 33kV overhead line is estimated to increase the capacity by 2MVA, therefore the pro-rata base cost for this capacity is £158,750. It must be emphasised that this is an artificial cost calculated as a proportion of the traditional reinforcement cost. Traditional reinforcement could not provide this incremental increase in capacity.

Carbon Saving:

No carbon savings can directly be attributed to this project.

Benefit rating: 0 (nil)

Social and Environmental Benefit

The project provides additional headroom capacity which would allow the connection of additional loads without reinforcement. The speed of deploying the enhanced rating measures would often be much quicker than traditional reinforcement works of a particular network which is at capacity, thereby allowing an accelerated connection of low carbon technologies such as heat pumps or electric vehicles.

Benefit rating: 2 (minor)

Financial Benefit:

Base Cost: £158,750
Method Cost: £90,000
Financial Benefit = Base Cost – Method Cost
Financial Benefit = £158,750 – £90,000
Financial Benefit = £68,750

Benefit rating: 3 (medium)

Safety Benefit:

None envisaged standard health and safety processes will be applied and any new learning gained from the project will be shared.

Benefit rating: 0 (nil)

Network Reliability Benefit:

The project has no measureable reliability benefit to the network.

Saving: N/A

Benefit rating: 0 (nil)Benefit Scorecard

Grading of Benefit	Financial Benefit	Safety Benefit Per Reported Case	Social and Environmental Benefit	Network Reliability Benefit	Carbon Saving
High (5)	Major £1M+	Lead to the reduction of fatalities >£1m	Managed realignment (significant) –High incurred costs and environmental benefit/value > £50k	Leads to significant and permanent improvement in Regulatory performance targets >£100k	Major >£30k £/tCO2e
Significant (4)	Significant £100k-£1M	Significant improvement to public safety £100k-£1m	Managed realignment (minor) –Minor to medium incurred costs and environmental benefit/value > £25k	Leads to sustainable improvement in Regulatory performance targets >£50k	Significant >£10k £/tCO2e
Medium (3)	Medium £10k-£100k	Reduction of reportable injuries >£20k	Improve (significant) Significantly improve existing processes and systems to adapt the existing environmental characteristics > £10k	Leads to improvement in performance >£10k	Medium >£5k £/tCO2e
Minor (2)	Small £1k-£10k	Lead to the reduction of absence due to ill health >£11k	Improve (minor); Improve existing processes and systems to adapt the existing environmental situation > £1k	Contributes to improvement in performance £1k	Minor >1k £/tCO2e
Low (1)	Low £0-£1k	Avoidance of minor injury >£0.33k	Do minimum; This is a continuation of existing processes and maintenance, delaying but not avoiding or improving < £1k	Small but measurable improvement <£1k	Low <£1k £/tCO2e
Nil (0)	None or Negative	No Tangible Benefit	No Tangible Benefit	No Tangible Benefit	No Tangible Benefit

	Financial Benefit	Safety Benefit Per Reported Case	Social and Environmental Benefit	Network Reliability Benefit	Carbon Saving
Benefit Rating	2	0	5	0	4
Total	**11**				