Scottish and Southern Energy Power Distribution

LEAN | Low Energy Automated Networks

LEAN (Low Energy Automated Networks)

Project Progress Report

Project Number	SSET2007
DNO	Southern Electric Power Distribution Ltd
Reporting Period	January 2015 to June 2015

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1 Executive summary

Ofgem guidance: Executive Summary (This section should be no more than 4 pages) This section should be able to stand alone and provide a clear overview of the Project's progress and any significant issues over the last period. All stakeholders, including those not directly involved in the Project, should be able to have a clear picture of the progress. The DNO should describe the general progress of the Project and include any notable milestones or deliverables achieved in the period. The Executive Summary should also contain two subsections: one for the key risks and one for the learning outcomes.

The LEAN (Low Energy Automated Networks) project is a ~£3m project which is primarily funded by Ofgem's Low Carbon Networks Fund (LCNF) and aims to establish whether it is technically feasible and economically viable to implement the proposed energy efficiency methods at our 33kV to 11kV substations.

SEPD will trial two methods to reduce losses. The Transformer Auto Stop Start (TASS) method will switch off one in a pair of transformers in selected substations to reduce fixed losses. To further reduce losses and maintain network supply integrity the Alternative Network Topology (ANT) method will be deployed alongside TASS where appropriate.

The project is split into three distinct phases:

Phase One

The first phase of the project consists of the following activities:

(i) Development of loss-reduction model: This activity involves in-depth study and analysis to investigate actual load profiles across the network.

(ii) Engagement with a specialist: In-depth investigation and consultation with a transformer specialist.

(iii) Supplier engagement: SEPD will engage with manufacturers and suppliers of its existing asset portfolio to make further validation of assumptions made

(iv) Off-network trials: Pre-deployment testing will be carried out on a transformer that is not currently connected to the distribution network.

(v) Requirements specification: A functional requirement for necessary equipment will be developed and made available to the supply chain. This is to ensure that (i) the cost assumptions for the project are correct and (ii) there is a robust and secure supply chain available to support a

At the end of Phase 1 the project's benefit case will be re-evaluated. The project will only proceed if the trials can demonstrate clear benefits for customers without causing financial detriment to DNOs.

Phase Two

The second phase of LEAN is concerned with validation of the model i.e. actual deployment and operation, and is comprised of the following activities:

(i) Final site selection: A number of primary substations will be selected for LEAN deployment (TASS options 1, 2 and 3, and where appropriate, ANT). The substations will be representative of SEPD's and GB's distribution network scenarios, but will also be selected to ensure that there is minimal risk of supply interruptions.

(ii) Deployment and demonstration: The LEAN methods will be applied over a two-year period.

Phase 3

(i) Operation and monitoring: The selected transformers will be monitored throughout two years of operation, to capture learning related to the operation of LEAN in real life scenarios. The types of monitoring will depend on the type of equipment used and on which blend of TASS and ANT has been deployed.

The project at this early stage is progressing as per the intended plan. Focus to date has been on the project set up and recruitment. The 'Management and Delivery' document was completed to ensure the project is managed in accordance with internal and external governance and procedures.

Key milestones to date:

- Engagement with key internal departments to discuss the disseminate the project aims, take on feedback and secure resource to aid the project implementation
- Project dissemination with numerous potential supplier including equipment manufacturers, academia, consultancies and specialists in the area of transformers
- Successful recruitment of the Project Engineer has concluded with the candidate starting in September 2015
- Literature review of current and historic loss reducing projects / techniques was put out to completive tender. This was won by S&C Electric Europe Ltd and has since been completed
- Completed review of transformer switching techniques and potential monitoring practices
- An understanding of the challenges associated with on site measurements of transformer losses and potential contingency measures proposed;
- Completion of the original business case validation
- Work in progress to obtain detailed yearly demand profiles for all of our Primary substations

1.1 Risks

Ofgem guidance: The risks section reports on any major risks and/or issues that the DNO encountered, including any risks which had not been previously identified in the Project Direction. The DNO should include a short summary of the risk and how it affects (or might affect) delivering the Project as described in the full submission. When relevant, the DNO should group these key risks under the following headings:

a. recruitment risks – describe any risks to recruiting the numbers of customers to take part in the Project as described in the full submission and how these will impact on the Project and be mitigated;

b. procurement risks – describe any risks to procuring the equipment and/or services needed for the Project, as described in the full submission, and how these will impact on the Project and be mitigated;

c. installation risks – describe any risks to the installation of the equipment (including in customers' homes, and/or large scale installations on the network) and how these will impact on the Project and be mitigated; and

d. other risks.

Project risk management is considered in detail in section 5 of this report; a high level summary is shown in the table 1 below:

Risk Description	Further details and impact	Controls
Recruitment None – the project does not involve customer recruitment		
Procurement Inability to attract suitable suppliers to engage in the various tender processes throughout the first phase of the project	If we do not have the right mixture of supplies aware of the project and the upcoming tenders it could leave the project in a position where it is unable to complete the work to a suitable standard to allow the project to progress to the next phase.	At the outset of the project the team did a significant amount of proactive supplier engagement. This involved multiple meetings with a range of different potential suppliers including equipment manufacturers, academia and specialist consultants in areas relevant to the project aims.
The costs of the study work are significantly higher than originally budgeted.	If the costs are too high, the scope of the work would need to be reduced; this would impact the quality of the overall technical analysis or business case and hence make the results less credible. This could reduce the confidence in the project when presenting the results to internal and external stakeholders.	The first tender invited the suppliers to pitch below a particular price. This worked well with all five suppliers submitting tenders below the maximum indicated price. In addition to the indicative pricing we intend to have additional engagement with the potential suppliers to get a suitable balance between the best price (for both parties) and the scope of the work.
Installation Suitable equipment cannot be procured to suit the project needs within the second phase.	From the initial analysis it is clear that the majority of the equipment is off the shelf, however the innovative part is combining this equipment with a suitable control scheme. If we cannot find a supplier competent and interested in implementing the required control architecture it puts significant risk on the TASS and ANT methods and the options within these methods.	As part of the supplier engagement the project team have discussed the intended options with multiple organisations. In addition a formal expression of interest was sent to ten switchgear manufactures to gauge their interest in supplying the required equipment. The expression of interest received more than five positive responses. This work will continue as part of the method analysis work.
Other None		

Table 1 - High level summary of project risks

1.2 Learning Outcomes

Ofgem guidance: The learning section reports on the learning outcomes outlined in the Full Submission. This section should include, but is not limited to:

a. a summary of the key learning outcomes delivered in the period;
b. a short overview of the DNO's overall approach to capturing the learning;
c. the main activities towards third parties which have been undertaken in order to disseminate the learning mentioned in a.; and
d. the DNO's internal dissemination activities.

Please note that these two subsections should only give an overview of the key risks and the main learning. They should not replace the more detailed information contained in the "Learning outcomes" and "Risk management" sections of the progress report.

Learning outcomes are considered in detail in section 6 of this report, however during this initial period, the main focus has been on setting up the project to ensure successful trials in the future.

Key learning outcomes

At this early stage in the project the key learning outcomes are summarised below:

- A detailed review of the historical loss reduction projects in GB and internationally has been completed detailing the various techniques employed by other network operators;
- the GB network has been benchmarked against 30 other EU countries to quantify where we rank and what potential there is for further loss reduction;
- a high level review of the potential techniques to mitigate transformer inrush current has been completed with interim recommendations for further analysis; and
- a review of the various transformer monitoring options suitable for the TASS implementation has been completed with recommendations on various methodologies

In addition, the following 'Learning Moments' have been captured (ad hoc and process related learning):

- An understanding of the requirements for on site fixed and variable transformer losses measurements and the difficulties or limitations in comparison to factory based measurements

Approach to learning capture

The approach to learning capture is focussed on capturing both structured learning in the forms of SDRC reports, and unstructured learning via lessons learned reviews and ad-hoc recording of insights. This aims to capture results drawn out from data analysis and reviews of activities, and also tacit knowledge that may not typically be captured in formal documents.

Crucial to learning capture is the dissemination of this knowledge, and building on previous experience and feedback the project will seek to tailor the messages and methods of dissemination to the audiences' needs to maximise the effectiveness.

Summary of Third Party targeted dissemination

- Initial LEAN project funding confirmation press release
- Institute of Engineering and Technology (IET), Berkshire
- LEAN website published

A 20 minute presentation was given to the members of the IET in Berkshire to provide an overview of the project aims and objectives. The session was well attended with a number of useful insights and thought provoking questions from industry experts. In addition the session also led to engagement with an existing LCNF Tier 2 project managed by another DNO. The intention is follow up with this link as the project progresses.

Summary of internal targeted dissemination

The project uses organised events such as Steering Boards and Team Briefs as a means of internally disseminating progress and information in a structured manner, with informal communications between colleagues and departments also acting as a means of raising awareness of the project and progress towards delivering learning. To date the project team have presented the initial aims and objectives to the senior System Planning staff members. This session proved to be of significant value and should help the project progress towards the trail phase.

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2 Project manager's report

Ofgem guidance: The Project manager's report should be a more detailed version of the Executive Summary. This section should describe the progress made in the reporting period against the Project plan. Any key issues should be drawn out and described in detail, including how these issues were managed. The DNO should also include details of deliverables and/or events, referring where necessary to other sections of the PPR. This section should also provide an outlook into the next reporting period, including key planned activities. It should describe any key issues or concerns which the Project manager considers will be a major challenge in the next reporting period.

The project at this early stage is progressing as per the intended plan.

The project commenced at the start of January 2015. The first significant task was to complete the 'Management & Delivery Report'. This document sets out exactly how the project is to be managed, where the various responsibilities lie with regard to delivery and how the delivery milestones will be met. As part of this document, a key events schedule was produced based on the project plan to highlight the critical milestones within the project lifetime.

As part of the original business case validation work a review of the transformer original factory test certificates was completed to confirm the assumed values that were used at the bid stage. The work considered transformers of different ages, types, size and manufacturer to provide a broad view of the transformer demographic on our network at present.

The next main task was to engage with internal stakeholders. The project goal is to create a new methodology of operating electrical networks and hence there are numerous actors within the business that would have a role to play in the implementation or stakeholders that must be consulted. The project team firstly met with senior staff with the System Planning department and explained the aims and objectives. The session proven valuable with learning shared from previous experience 20 years ago of a similar initiative and commitments given to provide all the necessary support required for the project study and implementation phases. This meeting also led to a similar session with the Engineering Protection department.

The focus of the project dissemination turned to external stakeholders, potential suppliers, consultants, transformer specialists and academia. The team had a number of meetings with these groups to explain the aims of the project and to define where there would be opportunities for study work or supplying equipment, on site measurements etc. The list below captures the various dissemination sessions:

- Alsotm
- S&C Electric Europe
- Met Office Energy Consulting division
- EA Technology Ltd
- Imperial College London
- Brush Transformers
- Winders Transformers
- High Frequency Diagnostics and Engineering Ltd
- ABB

The investigation into loss reducing projects / techniques was put out to completive tender. The tender received four credible responses and was ultimately won by S&C Electric Europe Ltd. The work in addition to the literature review also included a piece of desk top modelling to quantify the expected benefits and limitations of point of wave switching with respect to transformer inrush mitigation. S&C Electric recognised within their tender that they did not have the expertise to complete the transformer monitoring recommendations and sub contracted this work to High Frequency Diagnostics and Engineering Ltd (HFDE). HFDE completed a report considering the various inrush current reduction techniques that could be applied within LEAN and recommendations for further study work. The report also considers what effects high frequency switching may have on transformer health and the currently available methodologies to monitor these effects. This work will form part of the first SDRC, due for submission 31st July 2015.

Recruitment process has been completed with a candidate accepting a verbal offer for the role of Project Engineer. Expected start date is delayed until first of September 2015. Although this candidate requested a longer notice period than had been originally planned for; it was agreed with the team that the significant expertise the candidate brought to the role were worth the delay. It is anticipated that this new internal resource will be able to contribute to a number of the studies that would have originally required external resource and hence reduce the total budget.

Work is currently in progress with regard to completing the data request for the loading profiles for all of our Primary substations. This work will aggregate the power flows at all of the circuit feeder circuit breakers at each of our substations to create a load profile over the year. The circuit breakers take an average measurement of demand every half hour which will provide a very detailed view of our sites and hence allow the analysis to quantify the sites suitable for TASS implementation. This is a particularly large request however is key to the site selection process for the trial locations and to

understand and quantify the applicability of a larger rollout of this solution across the SEPD network patch and for the wider GB context.

The project team have had engagement with a number of external suppliers, including the two main GB based transformer manufacturers to complete on site losses investigation work. This work is to confirm whether or not there is any deterioration from the fixed or variable losses over time on the Primary transformers. The one site measurements will be compared with the original factor test certificates. Testing these losses on site presents from significant challenges that make it much more difficult that comparable factory test and as a result there is the option from a manufacturer to complete factory test on applicable units that have been returned for reconditioning. This option is at this stage being considered as a contingency measure if it proves too expensive or onerous to complete site testing.

The next main task is to complete the tender scope for the detailed technical analysis of the switching methodologies proposed. The work will consider the various options, the applicability for the number of sites and provide approximated costs for the implementation of each of the options. Included in this tender will be the business case validation. These two aspects are interlinked very closely and this needs to form the basis of the determination as to whether to proceed to phase 2.

3 Consistency with full submission

Ofgem guidance: The DNO should confirm that the Project is being undertaken in accordance with the full submission. Any areas where the Project is diverging or where the DNO anticipates that the Project might not be in line with the full submission should be clearly identified. The DNO should also include, where appropriate, references to key risks identified under "Risk Management".

The LEAN project is being conducted in accordance with the full submission. To ensure all commitments from this submission are completed in a timely and efficient manner, the project has developed a comprehensive structure with clear linkages to the text of the full submission. A review of the statements in the bid has been completed to ensure there are no contradictions or missing elements.

The project has not identified any potential variances from the bid submission at this early stage.

4 Risk management

Ofgem guidance: The DNO should report on the risks highlighted in box 26 of the full submission pro forma, plus any other risks that have arisen in the reporting period. DNOs should describe how it is managing the risks it has highlighted and how it is learning from the management of these risks.

The project risk register is a live document designed to identify actual and potential barriers to the satisfactory progress of the LEAN project. The register is used to target resources and to develop control measures and mitigations. The LEAN risk register is a single log of risks as identified by the project team. The register is reviewed on an on going basis and is reported to the SEPD Project Steering Group to allow any significant risks to be discussed at this level and potential mitigation measures implemented.

Risks are assessed against their likelihood and impact, where the impact considers the effect on cost, schedule, reputation, learning, the environment and people. Risks are scored before (inherent) and after (residual) the application of controls. Risks which are closed are removed from the live register, with any learning captured through the Learning Moments and Project Trials described in section 7.

Increased focus is placed on risks with amber or red residual scores and also on all risks with a red inherent score (to ensure there is no over-reliance on the controls and mitigation measures). At present, there are four risks that fall into this category:

Ref No.	Description	Existing Controls	Likelihood	Severity				RISK	Mitigation / Contingency	Resp	Target Date	Actions / Status	Residual Likelihood	Residual Impacts				Residual RISK
				People	Envir't	Asset	Reputn							People	Envir't	Asset	Reputn	
Project Management																		
2	Difficulties with supplier recruitment	Standard SSE procurement process	Remote	2	1	1	4	H	Contact to be made with potential suppliers to confirm interest in the project at this pre bid stage.	SSE Procurement	Q3/14	Contract negotiations to start immediately after the positive decision date, again escalation procedure up to ISB available	Remote	2	1	1	2	L
3	Lack of budget to complete project and over spend on budget;	FN procedure PR-PS-FNP-001	Occasional	2	2	2	3	M	Regular meetings and workshops with project suppliers; build up the costs via bottom up approach target in relation to number of sites.	SEPD	Ongoing	Project manager will have control of financial position throughout the lifetime of the project, overseen by the South Delivery Manager and internal review process	Remote	2	2	2	2	L
Work package 1 - Pre-Trial Analysis & Testing																		
1	Inadequate data for the initial modelling	SEPD store all necessary data within PI historian or as part of system planning requirements	Improbable	1	1	1	3	M	The role of the project engineer on the project is partly to be the link between the SEPD core business in order to acquire and validate the data required to perform detailed modelling on specific circuits.	PE	Q1/15	Project engineer to be recruited Q1 2015 if bid is successful	Improbable	1	1	1	1	L
5	Cannot locate a suitable primary transformer or sufficient method to complete the transformer testing	Working together with a GB based transformer manufacturer or independent transformer expert.	Remote	1	1	2	3	M	Need to engage with a number of foreign test labs / manufacturers in order to have a fall back plan if GB based manufacturer cannot provide testing / analysis required	PM	Q1/15	We have spoken with Brush Transformers and they want to work with us on the project. Further engagement is required here to define exactly the scope of that work, how, when and where it will happen.	Improbable	1	1	2	3	M
6	Off site testing considerably more expensive than predicted	SEPD will use the standard Procurement procedure, with cost figures based on previous experience in this area	Remote	1	1	1	3	M	Detailed work with industry experts to specify the most suitable testing that can be completed within the timeframe / budgets available	PM	Q3/15	Industry expert to be appointed das part of WP 2	Improbable	1	1	1	3	L
Work package 2 - Detailed Site Selection & Functional Specifications																		
3	Switchgear equipment cannot meet the intended specification	The initial work has shown that there are a number of options available on the market at present.	Occasional	1	1	3	3	M	Early engagement with switchgear suppliers to inform the market of our intentions	SSE Procurement	Q3/14	In June 2014 an expression of interest was sent to over 20 switchgear manufacturers explaining the project and intentions. We have had 5 positive responses in relation to providing this equipment.	Remote	1	1	3	3	L
5	Switching methods are more expensive than estimates	Significant time and engineering experience based on similar installations were used to predict the costs	Occasional	1	1	1	3	M	If the costs are significantly higher it may result in fewer site deployments for the trial stage	SSE Procurement	Q1/15	Intention is to receive feedback from suppliers in relation to cost estimates are a high priority part of this work package	Occasional	1	1	1	3	M
Work package 3 - Deployment of Trials																		
1	Risk of damaging network assets	Existing protection systems	Occasional	2	2	4	4	H	The purpose of WP 2 is to complete testing and analysis to ensure there is no adverse effect on the plant. In addition detailed monitoring equipment will be fitted to the transformers to provide early warning signs of failure.	SEPD	Q1/15	Work has begun to date on specifications of the detailed monitoring. This will be completed at the start of this work package, however will continue to be monitored throughout the project.	Remote	2	2	4	4	M
2	Risk of customer interruptions	Modified protection schemes	Occasional	1	1	2	4	H	This will form a major part of WP 2/3 to understand how it is possible to implement the scheme with some minor modifications in order to mitigate the risk to that of a traditional network arrangement.	SEPD	Ongoing	Initial engagement with SEPD protection experts has taken place with no significant barriers highlighted. Additional work throughout the entire project in this area will be required.	Remote	1	1	2	4	M
3	Power quality problems affecting customers	Modified protection schemes	Probable	1	1	2	3	H	The project will complete detailed modelling on this subject and will install power quality monitoring equipment at different voltage levels to ensure customers supply quality is not adversely affected by the transformer switching.	PE	Ongoing	This will be completed throughout the various work packages	Occasional	1	1	2	M	M

The main high risks at present are focussed on the trail stage within the second phase of the project. The work in the first phase will however aim to mitigate these risks from a theoretical and modelled perspective; the outcomes will be then implemented at the trial stage and hence either verified or disproven.

5 Successful delivery reward criteria (SDRC)

Ofgem guidance: The DNO should provide a brief narrative against each of the SDRCs set out in its Project Direction. The narrative should describe progress towards the SDRCs and any challenges the DNO may face in the next reporting period.

The LEAN project has identified eight Successful Delivery Reward Criteria (SDRC). These are split into a number of sub components with each component having defined criteria, evidence and a target date for completion. The following table lists the individual SDRC components in chronological order and details the Project's progress towards their achievement for those due to be completed in this reporting period (up to December 2014) and into the next reporting period (up to June 2015).

	Completed (SDRC met)		Emerging issue, remains on target		SDRC completed late
	On target		Unresolved issue, off target		Not completed and late

SDRC	Due	Description	Status
Criterion 9.1 Project setup and review of related projects	July 2015	• Finalise work breakdown structure. • Review and complete project programme. • Produce report on GB and international projects related to reduction of losses in distribution networks including recommendations and key suggestions to improve the project design and implementation. **Evidence**: The final WBS and programme submitted to Ofgem and a report detailing the project recommendations will be delivered by 31 July 2015.	On target to deliver

Beyond the next reporting period, the following table lists the remaining SDRCs in chronological order:

SDRC	Due	Description
SDRC 9.2	31/03/16	**Business case validation**
SDRC 9.3	31/07/16	**Phase 2 decision point**
SDRC 9.4	30/11/16	**Initial learning from trial installation and integration**
SDRC 9.5	31/03/18	**Monitoring & analysis**
SDRC 9.6	31/08/18	**Site performance to date**
SDRC 9.7	31/12/18	**Network losses evaluation tool**
SDRC 9.8	31/03/19	**Knowledge & dissemination**

6 Learning outcomes

Ofgem guidance: The DNO should briefly describe the main learning outcomes from the reporting period. It should update Ofgem on how it has disseminated the learning it generated as part of the Project over the last six months

The learning objectives for the Project are:

- Quantify the level of losses, which can be reduced by using the TASS and ANT methods in a variety of scenarios;
- understand the impact that the various combinations of LEAN methods have on asset health, life and power quality;
- information regarding effects on customer supply and reliability;
- improve the management and efficiency of the elements of the network that incur highest losses; and
- provide learning to inform network equipment manufacturers to assist the creation of a robust supply chain.

.
The main focus at the outset of the project related to the set up of the different works packages, staff recruitment, engagement with appropriate external supplier and dissemination to internal departments integral to the project success. Despite this focus the project has still delivered a number of learning outcomes in areas specific to the delivery of LEAN and also of interest to GB electrical network operators.

As part of the first SDRC a literature review was carried out to consider the findings from previous network operator's projects with a focus on losses as a primary or secondary driver. The report has considered work on losses from both the GB network and internationally. The report firstly considers where the GB network ranks in comparison to other EU countries in terms of total Transmission and Distribution losses over a twenty year period. The GB network is approximately 15th out of the thirty countries within the study.

The work then considers the methods employed by network operators both GB and internationally to reduce losses. From traditional methods such as reducing conductor resistance through larger cables / overhead lines through to more advanced potential measures such as switching plant not critical to security of supply.

A number of GB and international losses related projects are summarised in detail with the key outcomes focused on traditional loss reduction techniques with some more advanced methods such as:

- Installing parallel feeders for overloaded feeders;
- introducing transformer(s) for overloaded substation;
- improving the power factor as well as reducing the reactive power losses; and
- introducing more links between the feeders to facilitate load sharing.

The second main area of learning has come from the study of the effect of high frequency switching on the health of transformers from implementation of the TASS methodology. The work was completed by specialist consultant in the area of transformers.

The main outcomes from the work relate to the issues associated with 'Energising of Transformers' and recommendations for 'Diagnostics and Monitoring of Power Transformers. The work considering transformer energisation has the following areas:

- Ageing and failure of transformers;
- magnetic inrush current;
- consequence of energizing transients; and
- techniques for mitigating transformer inrush currents

Within the techniques for mitigating inrush currents a number of potential methods were considered at high level and the applicability for the LEAN project quantified. Principle among these is point-on-wave switching, which is an elegant solution, but not without its complications, as it usually requires additional switching operations to calibrate its performance prior to use. These operations involve subjecting the transformer to potentially large inrush currents under randomly-timed switching. A number of additional, but less effective, means to mitigate inrush currents have been discussed – these tend to be related to the network configuration and control / operation that could be implemented using existing hardware and control systems.

The final significant leaning outcome relates to the transformer monitoring requirements necessitated by the LEAN project. This is a key area that needs to be understood and quantified in the first phase of the project and implemented during the second phase. The monitoring will allow any changes in transformer health to be assessed on a continuous basis and hence quantify the effect of implementing TASS. The report conclusions are summarised below:

Transformer life is consumed primarily through the depolymerisation of its paper insulation. This mechanism and its measurement have been outlined in the report. The rate of ageing depends on moisture and oxygen content but the most critical issue is the accelerated rate of ageing that occurs when the transformer is operated above its rated temperature for which 'normal' life is predicted. The report has described the loading trade-offs that can be implemented when a transformer is periodically operated above its thermal rating to ensure that loss of life is not excessive. Historical records of specific substation loading could be used to study / model the extent to which the thermal operating regime of the transformers will change in terms of maximum temperatures of units that must supply a larger load and those that are periodically de-energised and spend more time at ambient temperature. Recognised modelling techniques could be applied to this problem in order to estimate whether there will be any significant effect on transformer lifetime from the perspective of paper ageing. There seems a good probability that this may not be an issue or could be managed by placing appropriate caps on the extent to which the on / off scheme is applied.

In order to validate the LEAN switching approach during a trial phase, it is recommended that transformer suitability and health be assessed prior to implementation. This would include a full set of standard tests and recording the ‘fingerprint’ type measurements described in this report, which would allow electrical and mechanical integrity to be evaluated before, during and after the trials. In monitoring the health of a transformer population there is no substitute for a good regime of dissolved gas analysis with oil sampling conducted to a rigorous and repeatable standard. Trending and expert analysis will be needed to ensure that results are interpreted effectively. Fingerprinting through periodic off-line tests is an important means of checking for deterioration in the main characteristics of the transformer, which would identify any incipient damaged caused by inrush currents (in addition to other, unrelated deterioration). Sweep frequency response analysis is particularly recommended as a periodic off-line test to check units for any signs of internal mechanical change due to energisation inrush (particularly if point-on-wave switching is not implemented). For transformers that may remain de-energised for long periods, good moisture management is the key to ensuring that they remain in good condition for use when next called upon. Care should be taken to establish that existing systems (such as breathers) have been functioning properly and are in good condition. More specialised techniques, such as systems that employ molecular sieve technology to keep the oil dry might also be considered.

7 Business case update

Ofgem guidance: The DNO should note any developments or events which might affect the benefits to be gained from the Second Tier project. Where possible the DNO should quantify the changes these developments or events have made to the Project benefits compared to those outlined in the full submission proposal.

Southern Electric Power Distribution's core purpose is to provide the energy people need in a reliable and sustainable way. As a licensed electricity distribution operator, SEPD has statutory duties, which are set out in the Electricity Act 1989. Principal duties are to (i) develop and maintain an efficient, co-ordinated and economical system of electricity distribution and (ii) facilitate competition in the supply and generation of electricity.

Losses at all stages of the electricity supply chain i.e. generation, distribution and transmission, are included in a settlement system and these costs are factored into customers' energy bills. Therefore, SEPD is keen to minimise network operational costs through loss reduction while maintaining a resilient and secure supply of energy; the LEAN project will focus on this.

Additionally, the European Commission has recently introduced Directive 2009/125/EC4 regarding the design of electrical equipment. This obliges DNOs to procure and install lower loss models to replace old transformers at the end of their asset life, and for new substation projects. These transformers tend to be more expensive and potentially larger than their traditional equivalents.

Therefore a key aspect of the project within the first phase is to quantify in detail the potential business case for the implementation of the LEAN methodologies on an individual basis and at scale. This will be completed within the first phase of the project in combination with the technical analysis and form part of the gate process to commence to the second phase of the project.

The table in Table 2 depicts the potential savings over 45 year period for the different options within the TASS methodology as it currently stands. This is the basis on which the revised business case will be built on and refined with more accurate data based on the study work in the first phase using actual loading data from the SEPD network.

Table 2 - Table depicting benefits of LEAN extrapolation to GB-wide distribution system

GB Wide Cost Benefit Assessment	Option 1	Option 2	Option 3
GB total number of sites	4800		
% of sites viable for LEAN	30%	24%	5%
GB sites for Option Modifications - pro rata	1416	1166	219
Total Investment [£]	£17,029,565	£21,036,522	£17,808,696
Gross Benefit [£]	£65,551,040	£61,743,388	£23,002,922
45-Year Savings NPV [£]	**£49,056,635**	**£46,207,091**	**£17,214,768**
45-Year Losses Savings [MWh]	1,521,079	1,432,732	533,768
45-Year CO2 Savings [$ktCO_2e$]	306,773	288,948	107,641

SEPD has not noted any developments or events which might affect the wider business case outlined above and as detailed in the full submission proposal.

8 Progress against budget

Ofgem guidance: The DNO should report on expenditure against each line in the Project Budget, detailing where it is against where it expected to be at this stage in the Project. The DNO should explain any projected variance against each line total in excess of 5 per cent.

Project expenditure is within the budget defined in the Project Direction. The table below details expenditure against each line in the Project Budget and compares this with planned expenditure to date[1]. Projected variances are also listed for changes >5%.

	Budget	Expenditure ITD	Comparison with expected expenditure	Projected Variance (at project conclusion)		
				(£K)	%	#
LABOUR	£1,077,300	£37,642	£80,878	43	54	
EQUIPMENT	£489,600	0		0	0	
CONTRACTORS	£649,800	£1,300	£26,500	£25,200	95	
IT	£33,300	0	0	0	0	
TRAVEL & EXPENSES	£254,700	0	0	0	0	
PAYMENTS TO USERS	N/A	-	-	0	0	
DECOMMISSIONING	£49,500	0	0	0	0	
OTHER	£207,000	0	0	0	0	

Notes:

The internal labour is less than expected as we have had a delay in the recruitment of the Project Engineer. The contractors labour is also less than expected as the invoice for the literature review and transformer study with S&C Electric has not gone through the system yet. The IT and Travel & Expenses will be costed onto the project at the year end as an overhead.

[1] Expenditure is compared with a dynamic assessment of project phasing which reflects the nature of specific contract payments and physical delivery milestones. A comparison of expenditure with phased budget will often indicate a payment lag due to the nature of invoicing processes.

9 Bank account

Ofgem guidance: The DNO should provide a bank statement or statements detailing the transactions of the Project Bank Account for the reporting period.
Where the DNO has received an exemption from Ofgem regarding the requirement to establish a Project Bank Account it must provide an audited schedule of all the memorandum account transactions including interest as stipulated in the Project Direction.

Transaction details for the LEAN Project Bank account during this reporting period are listed in the Appendix. This extract has been redacted to protect the financial details of transacting parties; the full, un-altered copy has been submitted in a confidential appendix to Ofgem.

A summary of the transactions to date are shown in the table below:

Description	**Totals £** (project inception to end of May 2015)
Electricity North West Limited	0
Northern Electric Distribution Limited	58,647.98
Scottish Hydro Electric Power Distribution Plc	11,448.75
Southern Electric Power Distribution	167,410.49
SP Distribution Limited	160,250.02
SP Manweb Plc	22,681.26
UK Power Networks Plc	88,817.73
Western Power Distribution Plc	99,525.22
Interest Received	0
Payments out of account	57,468.02
Balance	**551,313.45**

10 Intellectual Property Rights (IPR)

Ofgem guidance: The DNO should report any IPR that has been generated or registered during the reporting period along with details of who owns the IPR and any royalties which have resulted. The DNO must also report any IPR that is forecast to be registered in the next reporting period.

In commissioning project partners to commence project activities, the LEAN project has applied the default IPR treatment to all work orders (as defined in the Low Carbon Networks Fund Governance Document). This will ensure IPR which is material to the dissemination of learning in respect of this project is controlled appropriately.

No Relevant Foreground IPR has been generated or registered during the December 2014 – June 15 reporting period. No Relevant Foreground IPR is forecast to be registered in the next reporting period.

11 Other

Ofgem guidance: Any other information the DNO wishes to include in the report which it considers will be of use to Ofgem and others in understanding the progress of the Project and performance against the SDRC.

No further details.

12 Accuracy assurance statement

Ofgem guidance: DNO should outline the steps it has taken to ensure that information contained in the report is accurate. In addition to these steps, we would like a Director who sits on the board of the DNO to sign off the PPR. This sign off must state that he/she confirms that processes in place and steps taken to prepare the PPR are sufficiently robust and that the information provided is accurate and complete.

This Project Progress Report has been prepared by the Project Manager and reviewed by the Project Delivery Manager before sign-off by the Director of Distribution, who sits on the Board of SEPD.

This report has been corroborated with the monthly minutes of the Innovation Steering Board to Ensure the accuracy of details concerning project progress and learning achieved to date and into the future. Financial details are drawn from the SSE group-wide financial management systems and the project bank account.

Prepared by:	Alistair Steele	Project Manager	8th June 2015
Reviewed by:	Nigel Bessant	Project Delivery Manager	10th June 2015
Final sign off:	Stuart Hogarth	Director of Distribution	

Appendix - Redacted copy of bank account transactions

Bankline

RBS
The Royal Bank of Scotland

Statement for account 60-17-21 95678026 from 01/12/2014 to 31/05/2015

Short name:	SOUTHERN ELECTRIC PO	Currency:	GBP
Alias:	SOUTHERN ELECTRIC PO	Account type:	SPECIAL INT BEARING
BIC:	xxxxxxxx	Bank name:	NATIONAL WESTMINSTER BANK
IBAN:	xxxxxxxxxxxx	Bank branch:	READING MKT PLACE

Date	Narrative	Type	Debit	Credit	Ledger balance
	CLOSING BALANCE				**551,313.45Cr**
28/05/2015	NORTHERN ELECTRIC LCNF	BAC		17,283.88	551,313.45Cr
28/05/2015	NORTHERN ELECTRIC LCNF	BAC		12,040.10	534,029.57Cr
28/05/2015	R B S-SP MANWEB	BAC		11,340.61	521,989.47Cr
28/05/2015	R B S-SP DISTRIBUT	BAC		15,154.18	510,648.86Cr
26/05/2015	SOUTHERN ELECTRI SOUTHERN ELECTRI	EBP		58,138.62	495,494.68Cr
26/05/2015	SOUTHERN ELECTRI LEAN SEPD DNO	EBP		25,566.67	437,356.06Cr
26/05/2015	SCOTTISH HYDRO-E LEAN SHEPD DNO	EBP		5,724.36	411,789.39Cr
26/05/2015	/RFB/RE: SEPD PL PCM55CI63929614 WESTERN POWER DI STRIBUTION (SW)P CHAPS TFR	CHP		49,762.64	406,065.03Cr
22/05/2015	UK PN OPERATIONS LEAN PROJECT ACCOU	BAC		27,057.07	356,302.39Cr
22/05/2015	UK PN OPERATIONS LEAN PROJECT ACCOU	BAC		17,351.80	329,245.32Cr
21/05/2015	SOUTHERN ELECTRI LEAN COSTS	EBP	31,251.36		311,893.52Cr
21/05/2015	SCOTTISH HYDRO-E LEAN	EBP	26,216.65		343,144.88Cr
28/04/2015	NORTHERN ELECTRIC LCNF	BAC		17,283.93	369,361.53Cr
28/04/2015	NORTHERN ELECTRIC LCNF	BAC		12,040.07	352,077.60Cr
28/04/2015	SCOTTISHPOWER PCM55CI63528623 SP MANWEB PLC	CHP		11,340.65	340,037.53Cr
28/04/2015	SCOTTISHPOWER PCM55CI63528624 SP DISTRIBUTION PLC CHAPS TFR	CHP		145,095.85	328,696.88Cr
27/04/2015	SOUTHERN ELECTRI LEAN SEPD DNO	EBP		25,566.63	183,601.03Cr
27/04/2015	SOUTHERN ELECTRI LEAN SEPD LCNF FUN	EBP		58,138.57	158,034.40Cr
27/04/2015	SCOTTISH HYDRO-E LEAN SHEPD DNO	EBP		5,724.39	99,895.83Cr
24/04/2015	/RFB/RE: SEPD PL PCM55CI63465045 WESTERN POWER DI STRIBUTION (SW)P CHAPS TFR	CHP		49,762.58	94,171.44Cr
21/04/2015	UK PN OPERATIONS LEAN PROJECT ACCOU	BAC		27,057.04	44,408.86Cr
	BALANCE BROUGHT FORWARD				**17,351.82Cr**

NB: Transactions with today's date may still be subject to confirmation and may subsequently be reversed from your account.

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Statement for account 60-17-21 95678026 from 01/12/2014 to 31/05/2015

Date	Narrative	Type	Debit	Credit	Ledger balance
	BALANCE CARRIED FORWARD				**17,351.82Cr**
21/04/2015	UK PN OPERATIONS LEAN PROJECT ACCOU	BAC		17,351.82	17,351.82Cr
	OPENING BALANCE				**0.00Cr**
Totals			**57,468.01**	**608,781.46**	

NB: Transactions with today's date may still be subject to confirmation and may subsequently be reversed from your account.

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