Low Energy Automated Networks (LEAN)

SDRC 9.3 Phase Two Decision Point

Document Ownership

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SDRC Report Specification

Criterion 9.3 Phase Two Decision Point	• Internal presentation of results to business representatives • External presentation of results with considered stakeholders including GB DNOs
Evidence	Written confirmation from external stakeholders that the solution proposed in conjunction with the projected benefits is applicable for GB wide rollout. In order to move into Phase Two of the project, the modelling work must show a positive return on investment and acceptably mitigate the risk to network security and asset health.
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Executive Summary

The Low Energy Automated Networks (LEAN) project considers the use of Transformer Auto Stop Start (TASS) and Alternative Network Topology (ANT) technologies to reduce losses at 33/11kV primary substations.

This report presents the activities undertaken by the LEAN project team to deliver a conclusion pertaining to the Phase Two Decision Point, in accordance with the project bid document and to meet the requirements of SDRC 9.3.

The Phase Two Decision Point was incorporated into the project plan to ensure that there is value in proceeding to the trial stage on the basis of the findings from Phase One of the project and the conclusions regarding the business case for the technology. As set out in the Project Direction, the decision to continue to Phase Two rests with SEPD. The project team must present robust evidence to justify the business's decision, and support from internal and external stakeholders must be demonstrated for the work to proceed to Phase Two and the trialling of the LEAN technology on the SEPD network.

An overview of the LEAN project is presented in Section 1, providing the context for the Phase Two Decision Point.

Section 2 presents the process of obtaining internal approval for the project to proceed to Phase Two, informed by the work undertaken in Phase One.

Section 3 details the process of engaging with external stakeholders to present the findings from Phase One and proposals for Phase Two, and the responses received.

SEPD's conclusion with regard to proceeding to Phase Two, as informed by the Phase One work and stakeholder engagement process, is presented in Section 4.

The project team has gathered evidence to meet the requirements of the bid document and Project Direction, and this evidence has been used by the business to inform the Phase Two decision. In light of the findings from Phase One of the project and the responses received from external stakeholders, SEPD's decision is to continue to Phase Two of the project.

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1 Introduction

1.1 Overview of LEAN

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

Southern Electric Power Distribution (SEPD) is considering two methods to reduce losses within this project. The Transformer Auto Stop Start (TASS) method is the controlled switching out of one in a pair or group of transformers at selected substations at low load periods to reduce overall losses. To maintain high security of supply the Alternative Network Topology (ANT) method is considered for deployment alongside TASS where appropriate. At commencement of this project, the information available suggested that these methods could save over 31,000 MWh of electricity over 45 years, worth over £40m to GB customers, equating to savings of 6,421 tonnes of CO_2.

1.2 Project Structure

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: In-depth study and analysis to investigate actual load profiles and potential energy savings across the network.

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

(iii) Supplier engagement: Engagement with manufacturers and suppliers of SEPD's existing asset portfolio to provide 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 and benefit case study: A functional requirement for necessary equipment will be developed and made available to the supply chain to ensure that the cost assumptions for the project are correct and that there is a robust and secure supply chain available to support a widespread rollout of LEAN.

The work undertaken in Phase One allows the project's business case to be re-evaluated. The project will only proceed beyond this phase 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 approach through deployment and demonstration of the technologies, and is comprised of the following activities:

(i) Final site selection: A number of primary substations will be selected for LEAN deployment (TASS, with ANT where appropriate). These substations will be selected to be representative of SEPD and GB distribution network scenarios, but also ensuring that there is minimal risk of supply interruptions.

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

Phase Three

The third phase encompasses monitoring at the primary substations selected for LEAN deployment, with the activity summarised as follows:

(i) Operation and monitoring: The selected transformers will be monitored over two years of operation to capture learning related to the use of these technologies. The monitoring to be implemented and data to be captured will depend on the type of equipment used and on which blend of TASS and ANT has been deployed.

1.3 Overview of SDRC 9.3 Report

The LEAN Phase One activities have been now been successfully completed, and the knowledge and findings obtained from this stage of the project are presented in SDRC 9.2 ‘Business Case Validation’. This represents the conclusion of Phase One of LEAN, and the project is now at the Phase Two Decision Point stage. In accordance with the bid document, for the project to proceed to Phase Two the project team must obtain approval from the business, and demonstrate support for the project from other DNOs as external stakeholders.

The Phase Two Decision Point was incorporated into the project plan to ensure that there is value in proceeding to the trial stage on the basis of the findings from Phase One of the project, and the conclusions regarding the business case for the technology.

The LEAN full submission bid document sets out that the first stage of the Phase Two Decision Point is for the project team to present the findings and recommendations of Phase One to the Innovation Steering Board and senior management. Where internal approval is received for the project to proceed, the second stage of the Decision Point sees the results of Phase One and proposals for Phase Two being presented to other DNOs as external stakeholders, with the aim of providing sufficient information for these stakeholders to make an assessment of the benefits of LEAN technology and its applicability for GB wide roll-out. Written confirmation that the technology should be further studied in line with the Phase Two proposals is required from the external stakeholders as the evidence for their support.

The Successful Delivery Reward Criteria for this report are defined in the LEAN full submission bid document. The key topics covered within this report, as defined by the SDRC evidence requirements, are as follows:

- Obtaining approval from the business to proceed to Phase Two
- Obtaining support from other GB DNOs as external stakeholders

2 Internal Approval

In accordance with the Phase Two Decision Point, approval for the project to proceed to Phase Two must be obtained from the Innovation Steering Board and senior management. The project uses regular 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. This section summarises the findings and conclusions from Phase One of the project that have been presented to internal stakeholders and senior management to inform the decision to be made, and confirms the business approval for proceeding to Phase Two.

Phase One Business Case Assessment

Phase One of the LEAN project has proven that TASS technology is technically feasible and economically viable as a means to reduce losses at primary substations. The site specific analysis undertaken in Phase One demonstrates that positive benefits are achievable from deployment of this technology at specific sites. However, the number of SEPD 33/11kV substation sites suitable for TASS at present has been found to be lower than anticipated based on the findings from the Innovation Funding Incentive (IFI) Isle of Wight Losses Project that was assessed to inform the figures for the project bid document.

The four work packages of Phase One were undertaken to provide a clear understanding of the benefits, costs and risks associated with implementation of LEAN technology. Transformer losses and potential risks to security of supply and network assets have been investigated, and the transformer energisation procedures and switching options required to ensure compliance with relevant codes and practices have been evaluated. This work informed development of a stepwise process for assessing the technical feasibility of TASS and ANT on a site specific basis, and the TASS Tool was created to undertake Cost Benefit Analysis (CBA) consistent with the RIIO-ED1 CBA approach. This work allowed the business case to be refined for deployment of the LEAN technologies, and the work undertaken in Phase One is presented in SDRC 9.2 ‘Business Case Validation’.

As a high-level summary, the analysis of all primary substations within the SEPD network area based on the mid-range Capex cost for business as usual deployment of TASS indicates that around 10% of SEPD primary substations would be suitable for implementation of the technology. This would give a total cumulative discounted net benefit over the remaining life of the transformer of £700,000, and save approximately 2,090 MWh of energy per annum.

Considering the individual site data, the value of losses and CO_2e savings per site at present prices is in the region of £2.2k to £4.6k per annum across the 34 sites that generate a positive CBA with the mid-range Capex figure, with an average of £3.2k.

Step One of the assessment process uses the TASS Tool to provide an initial evaluation of sites with a positive CBA, allowing these sites to be investigated for technical feasibility. The SEPD results from this stage have been extrapolated to derive a GB wide financial benefit assessment of TASS deployment. This suggests that TASS may be suitable for implementation at around 428 sites across the GB distribution network, providing an energy saving in the region of 1,185,000 MWh, and equating to around 467,000 tonnes of CO_2e. The cumulative discounted net benefit associated with this saving would be in the region of £18 million over 45 years.

To work through the subsequent steps of the assessment process on a GB basis would require detailed site specific information for all primary substations across all other regions. It is clear, however, that the number of 33/11kV substation sites meeting the relevant criteria for each stage is likely to vary between DNOs.

Future Influences for Consideration

Though the reduction of losses in networks can be challenging, the Phase One work clearly demonstrates positive benefits from use of TASS technology. Though these are lower that the initial estimates in the bid document, it is also apparent that a number of external factors may influence the costs and financial benefits of the technology in future.

Firstly, Opex and Capex costs influence the financial viability of any technology, and the analysis undertaken during Phase One of LEAN, and presented here, is based on current technology costs in addition to a number of assumptions with regard to site specific factors. Cost ranges have been considered within the Phase One analysis, and it is apparent that the results of the CBA and marginal benefit of implementing TASS at a given site are very sensitive to uncertainties around the assumptions used. The potential for new technologies becoming available at lower costs, or cost reductions due to competition or economies of scale, will each influence the financial viability of TASS and ANT and the marginal costs and benefits associated with implementation of these technologies at a given site.

Secondly, at present prices, the value of the energy saved is predominantly associated with the value assigned to losses, with the CO_2e proportion equating to only 7% of the overall value. Changes to the financial value of both losses and CO_2e, or changes to the energy mix which affect the level of CO_2e associated with grid electricity, will influence these potential economic savings and the marginal benefits of TASS implementation at a given site.

Thirdly, potential changes to energy use patterns may affect substation load duration curves. With increasing levels of distributed generation and low carbon technologies such as electric vehicles connected to distribution networks, or with behavioural changes influenced by the increasing deployment of smart meters or time of use tariffs, the demand patterns recorded at any primary substation may change over time. Such technologies may result in increasingly extreme highs and lows in demand, less predictable load profiles and potentially lower overall utilisation factors, in which case the energy savings achievable through the deployment of TASS may significantly increase, thereby increasing the financial viability of TASS. Conversely, however, it may be that for some sites, future changes in energy usage patterns reduce the financial viability of TASS, for example where the load at the substation falls below the cross over point less often or for shorter periods of time.

Further, for roll-out of the technology as BAU, a number of internal business policy related aspects will support the cost effective application of the technologies.

The CBA undertaken in Phase One takes into consideration the remaining life of the transformer. However, as aspects of the control technology such as the SynchroTeq relay and Programmable Logic Controller may be retained, TASS could remain an effective solution for reducing losses following replacement with a new transformer bringing additional savings beyond those currently incorporated into the CBA, albeit that the losses reductions achieved may be less with the modern design and construction of a new transformer.

With regard to ANT, consideration of the functional benefit provided by implementation of ANT with TASS suggests that it is not financially viable to deploy this technology with TASS as a matter of course at present, since the low likelihood of a fault occurring on a primary transformer together with the ability of the TASS system to quickly switch in the TASS transformer in the event of a fault equate to minimal risk to supply or impact on CIs & CMLs. It is acknowledged, however, that interruptions to supply are not acceptable, and the work undertaken within the LEAN project supports progress to the point where it is possible to reduce losses without any risk to continuity of supply. For BAU roll-out a process of customer engagement would be essential to ascertain the value that customers would place on avoiding a short interruption to supply (restoration within the 3 minute threshold that defines CIs & CMLs) in the event of a failure with the non-TASS transformer whilst the switched out TASS transformer is brought back into service. This would allow the value of avoiding an interruption to be balanced against the cost of deployment of ANT and the benefits of the energy savings and carbon reduction due to reduced losses.

Phase Two of the project will also evaluate the capacity to monitor operational parameters or environmental factors and incorporate a risk based approach into the control regime such that TASS can be deactivated at times of increased operational pressures, for example during storm situations, to minimise risk under such circumstances.

One further consideration with regard to the roll-out to BAU is that the assessment undertaken in Phase One of the project considers the costs of direct retrofitting of LEAN technologies at substations. An alternative would be to incorporate TASS as part of the standard automation and protection system when a primary substation is scheduled to be updated in line with business processes, or when a new substation is to be constructed. Whilst the overall energy savings and associated costs of this approach have not been considered within Phase One, it is expected that this approach could result in lower costs for installation of TASS, thereby increasing the financial viability of installing the technology at a given site. The current view of the project team and the SSEPD Innovation Steering Board is that for BAU roll-out the business would look to implement LEAN technologies at refurbishment and new substations, where the technology can be designed into the overall scheme, minimising additional costs. This view may change should any of the factors described above influence the financial viability of the technology through time, and this will be kept in review by the business.

Business Decision for Proceeding to Phase Two

Based on the findings and conclusions drawn from Phase One, as summarised above and presented in detail in SDRC 9.2 'Business Case Validation', the project team submitted a recommendation to business representatives that the project should proceed to Phase Two and trial the technology on the SEPD network. The project team received approval from senior management and the Innovation Steering Board to proceed, and an extract from the ISB Paper from May 2016 confirming this approval is provided in Appendix A. This decision has been reviewed in light of the responses received during the stakeholder engagement process, and the responses received from other DNOs, together with National Grid's interest in the possibility of using TASS to assist the system operator in managing high voltage on the transmission network by increasing the overall reactance of the network, have reinforced SEPD's view that there is value in proceeding to Phase Two.

3 External Support

As internal approval for the project to proceed to Phase Two was received, the results of Phase One and proposals for Phase Two were presented to other DNOs. In accordance with the bid document, this was a key aspect of the process of obtaining written confirmation from these external stakeholders that the solution proposed and projected benefits are applicable for GB wide roll-out and should be further studied in line with the Phase Two proposals.

This section sets out the process of engagement with external stakeholders, and the responses received with regard to whether the project should proceed to Phase Two with trials of the technology on the SEPD network.

Stakeholder Engagement

The planned process for obtaining support from external stakeholders was discussed with the Ofgem Project Officer for LEAN, Lesley Ferrando, during the monthly LEAN Catch Up conference call held on 18 May 2016. The planned approach to hold a Stakeholder Engagement web conference for invited participants from Innovation teams and representatives on the Losses Technical Task Group was considered to be suitable for engaging with external stakeholders, and that the roles of those identified as invitees to the session were suitable senior to be acceptable for demonstrating support for the project to proceed to Phase Two.

To ascertain availabilities for the Stakeholder Engagement session, a Doodle poll was created and a group email circulated to the stakeholder contacts, explaining the purpose of the session and inviting individuals to indicate there availability for a range of 90 minute time slots on 31 May or 1 June 2016. A copy of this email is provided as Appendix B. Follow up emails were sent to individuals five days later to provide a reminder, and inform recipients as to which of their colleagues had also been contacted. A copy of this follow up email is provided as Appendix C.

Once the most suitable date and time had been established, all invitees were informed (not solely those who had indicated their availability for the date and time chosen) and a calendar invitation giving the Genesys web conference system joining information and telephone dial in details was sent out. Further responses were received once the time and date had been finalised and invitees unable to join the call had contacted colleagues who were available to participate.

The invitees and attendees are listed in Table 1 below.

Table 1 - Invitees & attendees for the LEAN Phase One Stakeholder Engagement web conference

Losses Technical Task Group led by the ENA		
Ian Povey	Electricity North West	attended
Iain Miller	Northern Powergrid	attended
Jim McOmish	Scottish Power Energy Networks	apologies received, invitation passed on
Steve Mould	UK Power Networks	apologies received, invitation passed on
Richard Newman (via Steve Mould/ Sotiris Georgiopoulos)	UK Power Networks	attended
Paul Jewell	Western Power Distribution	*n/a - response from colleague*
Ben Marshall	National Grid	apologies received, material requested
Sung Pil Oe	National Grid	apologies received, material requested
Kieran Coughlan	ENA	apologies received, material requested
David Crawley	ENA Consultant	*n/a - response from colleague*
Innovation colleagues from other DNOs		
Steve Cox	Electricity North West	apologies received, invitation passed on
Geraldine Bryson (via Steve Cox)	Electricity North West	apologies received post session, material requested
Chris Goodhand	Northern Powergrid	apologies received, invitation passed on
Jonathan Fallman (via Chris Goodhand)	Northern Powergrid	attended
James Yu	Scottish Power Energy Networks	*n/a - response from colleague*
Geoff Murphy (via Jim McOmish)	Scottish Power Energy Networks	attended
Martin Wilcox	UK Power Networks	*n/a - response from colleague*
Sotiris Georgiopoulos	UK Power Networks	apologies received, invitation passed on
Roger Hey	Western Power Distribution	apologies received, invitation passed on
Ben Godfrey (via Roger Hey)	Western Power Distribution	attended
Ofgem Project Officer		
Lesley Ferrando	Ofgem	declined
SSEPD		
Sarah Rigby	LEAN Project Manager	presented
Maciej Fila	LEAN Project Engineer	presented
Alex Howison	Innovation Programme Team Manager - South	apologies received
Colin Mathieson	Innovation Programme Delivery Manager	apologies received
Stewart Reid	Head of Asset Management & Innovation	apologies received

The Stakeholder Engagement web conference was held on 1 June 2016 to present the findings from Phase One of the project and proposals for Phase Two to external stakeholders, and allow discussion on this work. The technical and business case aspects of the technology were presented by the project team, and the slides are provided as Appendix D. The subsequent email circulating the presentation together with a copy of SDRC 9.2 'Business Case Validation' to both attendees and those who'd requested material following the session is provided as Appendix E.

The event went well, with participants from each of the other GB DNOs working in the areas of losses and innovation. The high level of engagement during the discussions indicated the interest from participants, and provided valuable feedback for the project team.

The questions raised by participants covered a number of issues from technical aspects relating to transformer condition and circuit breaker maintenance, to the suitability of the technology for different network topology types, and the potential effects of increasing levels of distributed generation on the load duration curves and associated implications for the financial viability.

The primary apprehension expressed by DNOs during the session related to the need to ensure that no expectation would be made for all DNOs to roll-out the technology widely across their own networks where the technology may not in fact be suitable, for example on the meshed networks of the Manweb licence area. In response to this concern, and as indicated by the stepwise assessment process developed during Phase One of the LEAN project, the project team confirmed that there are a range of technical aspects that must be considered to identify sites suitable for deployment of the LEAN technologies, and these form the basis for developing the business case on a site specific basis. It is clear from the Phase One work that, whilst the technology provides clear benefits in reducing losses at a number of primary substations, it is not suitable for deployment at all primary substations.

The project team also explained that the basis for SEPD continuing to the next stage of the project is that by trialling the technology on the SEPD network, technical experience can be gained on the use of this technology, together with knowledge that will allow further development of the stepwise assessment process informed by Phase One of the project.

Following the Stakeholder Engagement session, and as agreed during the group discussions, an email was circulated to participants requesting responses that indicate support, or otherwise, for SEPD's wish to proceed to Phase Two of the LEAN project on the basis presented during the session. Participants were also invited to include any feedback on the proposals for Phase Two, and to submit any suggestions that may be considered as part of the second phase of the project. This response request email can be found in Appendix F.

Responses Received

Responses to the request that participants express their views on SEPD's wish to proceed to Phase Two of the project have been received from the following:

- Electricity North West, provided by Ian Povey, Strategic Planning Manager - included as Appendix G
- Northern Powergrid, provided by Iain Miller, Head of System Design - included as Appendix H
- SP Distribution, provided by Geoff Murphy, Technology Development Manager - included as Appendix I
- UK Power Networks, provided by Richard Newman, Electrical Design Engineer - included as Appendix J
- Western Power Distribution, provided by Ben Godfrey, Innovation and Low Carbon Engineer, included as Appendix K

The majority (four) of these responses indicate support for SEPD to proceed to Phase Two of the LEAN project. It is considered that there is value in further researching the technologies to refine the conclusions with regard to the potential for roll-out of the technologies on a GB wide scale, and the network topologies that may or may not be suitable for deployment of the LEAN technologies.

In line with the discussions held during the Stakeholder Engagement session, comments are made by respondees on the potential applicability of the technology on their respective networks (inc. reflecting on the number of sites with a discrete circuit breaker on the high side of the transformer; the iron losses and copper losses of their transformers; the differing network topologies; and the typical load profiles found on the transformer fleet in question). These comments reflect the stepwise assessment process developed during Phase One of the project, and respondees acknowledge that the findings from Phase Two of the project should provide further insight.

Similarly, the single response that presents a reluctance to support the continuation of the project cites the fact that the DNO in question does not believe that the solution is applicable to one of their network areas, as that region typically has only one transformer per primary substation. They also express their belief that the losses benefit provided by switching out a transformer does not outweigh the operational risk of doing so.

Their view reiterates the point made during the Stakeholder Engagement session with regard to the meshed structure of the Manweb network. Whilst it's clear that TASS technology is not suited to single transformer primary substations, the stepwise assessment process developed during Phase One and presented during the Stakeholder Engagement session is designed to identify the primary substations for which TASS may be technically feasible and economically viable. As such, though the technology may not be universally applicable, SEPD believe that there is value in continuing to Phase Two to generate learning that will be of value for sites at which the technology is feasible.

With regard to their perception of operational risk, it is known that large voltage and current transients can occur when a power transformer is energised, which may cause electrical and mechanical stress to the transformer itself, as well as to other network assets and potentially customers' equipment. The required operational limits relating to these effects are defined in Distribution Code (Section DPC 4.2.3.3) and Engineering Recommendations P28 (ER P28).

In recognition of this, four switching strategies for ensuring that any effects of transformer switching associated with TASS are maintained within the required limits were assessed during Phase One of the project, as detailed in SDRC 9.2 'Business Case Validation' and presented during the Stakeholder Engagement session. By trialling the technology in Phase Two of the project SEPD will be able to study the effects of using TASS, and allow us to provide evidence as to the level of any associated risks.

Further, as set out in Section 2 of this report, 'Internal Approval', SEPD believe that the low likelihood of a fault occurring on a primary transformer together with the ability of the TASS system to quickly switch in the TASS transformer in the event of a fault equate to minimal risk to supply or impact on CIs & CMLs. As such, SEPD maintain their view that the project should proceed to Phase Two and the trialling of the LEAN technology on the SEPD network.

One DNO also enquired as to how the solutions considered through SEPD's LEAN project, ENWL's CLASS project and the TDI (Transmission and Distribution Interface) High Volts Working Group (HVWG) align, as each proposes the switching out of transformers though for different purposes. SEPD's review of the CLASS project and the 'High Volts Working Group: Technical Feasibility Report' published by the ENA in April 2016 supports SEPD's view that these projects reflect different approaches that each provide benefits in given situations. Indeed, the findings from these projects or other related research may indicate that equipment deployed for one use case may be adaptable and enable other use cases under different network conditions.

The CLASS project proposes the use of tap stagger to create circulating current between transformers, thereby increasing the reactive current absorbed from the transmission system. Though it's clear that the switching out of a transformer using TASS precludes the operation of a tap stagger solution, further research is required to understand how these solutions may align, and the situations to which they are each best suited.

The HVWG proposes the possibility of switching out DNO circuits and transformers to support voltage containment on the transmission network, particularly during low load conditions. The project team believes that TASS compliments this proposal as the primary substations transformers will be switched out only during low load conditions. Further, the control systems and switching technologies used to implement TASS can be utilised for switching out transformers in response to other network conditions.

In addition, and further to circulating the invitation to the Stakeholder Engagement session, National Grid have contacted the LEAN project team to enquire about the potential for using TASS to increase the overall reactance of the network and help the system operator to manage high voltage on the transmission network. This interest relates to the HVWG activities, and the possibility of using TASS to switch out one of a number of transformers operating in parallel across a high number of supply points at times of low demand. This potential application represents an additional use case for the technology, supporting the case for further research and trialling of the technology.

As National Grid believe that this application of TASS may provide a distinct benefit between distribution and transmission systems and have a significant effect on managing high voltage if used extensively overnight, this is something that SEPD will consider and continue discussions on with National Grid beyond the Phase Two Decision Point.

Respondees have also provided suggestions as to other aspects that SEPD may consider during Phase Two of the project, including:

- an alternative switching regime based on time of day reflecting a substation's loading characteristics, rather than switching whenever the cross-over point is reached - whist this approach may deliver a sub-optimal losses reduction it may be simpler to apply, and if less switching actions occur per day, this may reduce switchgear stresses and network disturbances, as such a comparison of the two switching regimes in terms of losses reductions, cost and impact on the network and its equipment may be of interest;
- a reassessment of the benefits case using future expected trends in load profiles, including a potential increase in daytime summer reverse power and an increase in winter peak demand due to the uptake of low carbon technologies;
- further analysis with regard to potential increases in short interruptions during fault conditions
- interest in further exploring the impact of frequently energising large network transformers with regard to a voltage change in excess of the 3% limits specified in ER P28;
- interest in seeing the Phase Two trials run on networks typical of other DNO's networks, and based on levels of primary transformer loading typical of these other networks, with the benefits case assessed for these scenarios;
- interest in establishing the maintenance costs associated with the increased switching of the HV circuit breaker and refining the cost of modifying protection settings based on the new running arrangements, such that these can be reflected in the CBA;
- capturing the impacts on asset lifespan and the potential risks to CIs and CMLs in the CBA.

Should the project proceed to Phase Two, these suggestions will be reviewed against the project plan set out in the bid document to assess the potential for addressing one or more of these suggested aspects during Phase Two of the project, where it is believed that to do so will add value and generate useful learning.

As set out in Section 2 of this report, 'Internal Approval', one key output from Phase One of the project is the TASS Tool developed to provide CBA consistent with the RIIO-ED1 CBA approach on a site-by-site basis. This tool provides an understanding as to whether or not it may be financially viable to implement TASS at a site, and the reduction in losses that could be achieved on an annual basis. The tool is now freely available to other GB DNOs, and was offered to participants during the Stakeholder Engagement session. Electricity North West, Northern Powergrid and Western Power Distribution have each requested a copy of the TASS Tool, with the intention to run this to assess the potential for deployment of LEAN technologies on their networks using their own primary substation data and load profiles, and financial inputs. The TASS Tool and been shared with these external colleagues and support in using the tool has been provided.

4 Key Learning and Recommendations

As set out in the Project Direction, the decision to continue to Phase Two rests with SEPD, and robust evidence must be presented to justify this decision. This evidence must include:

- an updated business case for TASS, demonstrating a positive net present value for the switching options considered;
- a full review of the potential risks to transformer health, with mitigation actions identified such that the risks do not outweigh the benefits of the project; and
- written confirmation from the other DNOs that they have been consulted on Phase One of the project and consider that the project approach will be sufficient to allow them to make an informed decision on the future rollout of the solution, should the trials prove that the solution is financially viable and technically practicable.

SEPD has gathered evidence to meet these requirements and inform their decision. In light of the findings from Phase One of the project and the responses provided by external stakeholders as set out in this SDRC 9.3 report, SEPD's decision is to continue to Phase Two of the project.

Appendixes

Note that contact details such as email addresses and telephone numbers have been redacted from these appendices for publication.

Appendix A	An extract from the SSEPD Innovation Steering Board Paper from May 2016 confirming the business's approval to proceed to Phase Two of LEAN
Appendix B	Email from SEPD to external stakeholders inviting them to respond to the Doodle poll regarding availability for the Stakeholder Engagement web conference
Appendix C	Follow up email from SEPD to external stakeholders inviting them to respond to the Doodle poll regarding availability for the Stakeholder Engagement web conference
Appendix D	Presentation given during the LEAN Stakeholder Engagement session held 1 June 2016
Appendix E	Email from SEPD to external stakeholders circulating material from the LEAN Phase One Stakeholder Engagement session
Appendix F	Email from SEPD to external stakeholders requesting responses with regard to the LEAN Phase Two Decision Point
Appendix G	Response from Electricity North West, provided by Ian Povey, Strategic Planning Manager
Appendix H	Response from Northern Powergrid, provided by Iain Miller, Head of System Design
Appendix I	Response from SP Distribution, provided by Geoff Murphy, Technology Development Manager
Appendix J	Response from UK Power Networks, provided by Richard Newman, Electrical Design Engineer
Appendix K	Response from Western Power Distribution, provided by Ben Godfrey, Innovation and Low Carbon Engineer