Scottish and Southern Energy Power Distribution

Network Innovation Allowance Summary Report

1 April 2015 to 31 March 2016

Scottish Hydro Electric Transmission

Scottish and Southern Energy Power Distribution

FOREWORD

This report summarises the progress achieved by Scottish Hydro Electric Transmission (SHE Transmission) in Network Innovation Allowance (NIA) projects during the period between April 2015 and March 2016. NIA has been running since the onset of RIIO-T1 in April 2013 and is targeted at smaller innovations projects which can deliver value to network customers.

SHE Transmission subscribes to the same core value of all Scottish and Southern Energy Power Distribution (SSEPD) networks which is to provide the energy people need in a reliable and sustainable way. This is complicated by the rapid evolution of networks which has been witnessed in recent years within Great Britain and outside. The ongoing shift towards lower carbon technologies and proliferation of large scale renewable sources of generation are placing pressure on our network infrastructure. In the face of these challenges, innovation has become an absolute necessity that has to be embedded within the culture of our everyday activities. The seven Innovation Strategy objectives of SHE Transmission are a statement of how we intend to tackle these challenges going forward.

As of the 31st March 2016, we have a portfolio of twelve live NIA projects at various stages in their lifecycles. Each of our NIA projects addresses at least one of the seven objectives which are outlined in this report and covered in greater detail within our Innovation Strategy. This approach ensures that our core purpose can be achieved whilst also helping us in mobilising our efforts to prioritise and tackle the relevant challenges faced by our networks as well as those of the entire UK electricity sector.

We are now in the third year since the commencement of the RIIO framework in Transmission and our experience of delivering NIA funded projects continues to grow. We continue to get useful learning from our closed projects as well as those in flight. Within SHE Transmission, we take the learning from our innovation projects seriously and seek any opportunity to exploit applicable learning and push viable solutions into deployment. In the same vein, we keep a constant lookout for learning generated by other network licensees to implement innovations as a fast follower whenever feasible. We also continue to engage with our stakeholders and collaborate with other interested parties in the energy supply chain to ensure that our innovation efforts can deliver the best possible value to our customers.

Stewart A Reid
Head of Asset Management and Innovation
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1 SHE Transmission Innovation Strategy

SHE Transmission's Innovation Strategy document sets out the priorities for innovation based on seven main objectives identified as part of the RIIO-T1 submission. Each SHE Transmission innovation project is derived from one of the seven objectives to meet our core purpose of providing the energy which people need in a reliable and sustainable way. The seven objectives which shape our innovation activities are shown below:

1) Accelerate network development and connections including the integration of increasing amounts of renewable generation

Historically the priority of SHE Transmission has been to ensure that electricity supplies are available with minimal interruptions; to 'keep the lights on'. Over the years we have supported innovative practices in this area to improve our overall performance.

In recent years the challenges faced by our networks have significantly changed, driven by the UK's move towards a low carbon economy. Our transmission network is evolving from delivering energy from a small number of large generation sources to a large number of customers, to a more complex situation where it must accommodate bi-directional power flows created by an influx of new renewable generators, both large and small. Such demand for new connections is unprecedented. The transmission network, mostly built 50 years ago, was not designed to accommodate the collection of energy from such geographically disparate source locations. The rate of increase in demand for such connections was not previously matched with innovative funding, disallowing us to meet the new challenges created by the needs of developers in innovative ways. This is an area which will benefit greatly from new innovation investment.

2) Minimise the cost of providing network capacity

Whilst it is clear we need to act swiftly and effectively to provide the capacity required by our customers, we must ensure that in meeting this demand we minimise the costs of the work required.

Our ultimate stakeholder is the UK electricity consumer; people who pay electricity bills have a legitimate interest in how they are made up. Given that transmission costs are a contributor to energy bills, it is important that we minimise the cost of building and running our transmission network. Our electricity connections customers and other stakeholders with an interest in the availability of grid capacity, have a direct interest in the costs associated with the development and operation of the transmission system. They wish to see costs minimised, but at the same time wish for the network to provide capacity quickly and easily to allow them to pursue their plans.

The need for SHE Transmission to ensure the costs are kept to a minimum is illustrated in quotations from two stakeholder organisations with a direct interest in the matter. These and other quotations from our stakeholders can be seen in SHE Transmission's Innovation Strategy which can be accessed by following this link; Transmission Innovation final .

3) Maximise the use of existing assets to deliver capacity and speed connection

Widely favoured by our stakeholders, one of the most efficient ways to swiftly provide capacity for new renewable energy developments is to 'make the most of what we have' – to maximise the efficiency with which we use current assets. Transmission networks have capacity which is traditionally reserved to provide security of supply. This is known as system redundancy, an as yet largely untapped resource which could provide capacity for generation connections, reduce waiting times for connections and lower costs.

4) Maintain and improve safety and environmental performance

SHE Transmission's primary responsibility to its stakeholders – including employees, contractors and customers – is to ensure their safety. Safety is the number one value of our company where we pride ourselves on 'doing everything safely or not at all'.

In keeping with our commitment to sustainability, SHE Transmission's target every year is to achieve zero environmental incidents. These priorities are shared by our stakeholders who have expressed their desire for safety and sustainability to be identified as priorities in a number of ways.

5) Maintain and improve network performance

The past performance of our transmission network has been excellent. As the UK's energy infrastructure evolves to accommodate more widespread generation sources, we must adapt to ensure this high standard of performance is maintained. It is notable that customers appear to take this aspect of SHE Transmission's responsibilities as 'a given'. This is reflected in the infrequency that system reliability was mentioned as a priority by our stakeholders. In contrast we strongly believe that in line with our company's core purpose of providing the energy people need in a reliable and sustainable way, this should remain a focal point for our future development. As such, maintaining and improving network performance is one of our innovation objectives.

6) Provide more accurate information on the short and long term asset condition information to allow more informed decision making

There is a desire amongst stakeholders that SHE Transmission makes the best possible use of existing assets. A key way of doing that is to ensure that assets are maintained and replaced at the right time – before they fail, but at a time when they have contributed as much as possible to the network. Currently our assets are replaced in line with a standard methodology agreed jointly with National Grid (NG), Scottish Power Transmission (SPT) and SHE Transmission. We believe that to meet our customers' needs we must make the most of existing infrastructure to maximise security of supply and minimise costs. We must gain a better understanding of how our assets age and fail, and put in place an asset replacement programme which best meets this. Similarly, innovations and techniques can allow the re-use of existing assets in new roles such as the use of insulated crossarms to allow existing towers to carry higher voltages.

7) Remain at the forefront of innovation to maintain our record of providing the highest standards of service at the lowest possible cost

New ideas, improvements to process and design, and innovation have been key to SHE Transmission's success to date and are fundamental to our ability to adapt to the challenges of the future. To deliver the changes and improvements our stakeholders desire, we must maintain a strong culture of innovation within SHE Transmission, by actively promoting and supporting new idea generation to provide the feedstock for tomorrow's innovations. We are building on our underlying innovative flair and will utilise the Network Innovation Allowance (NIA) to push the boundaries and accelerate the rate and effectiveness of innovation on the network.

2 NIA Project Portfolio

For the year ending 31 March 2016, there were 12 projects funded under SHE Transmission's Network Innovation Allowance (NIA). Three of these projects had been completed whilst three had been registered during the year. Two of the new projects have yet to provide significant learning which can be shared, hence, their initial progress reports will be published at the end of the 16/17 year.

A crucial aspect of SHE Transmission's NIA projects is that each of them has to satisfy at least one of our Innovation Strategy objectives.

Table 1 on the following page shows all the registered NIA projects for the last year and how each maps onto our Innovation Strategy objectives.

		Objective 1	Objective 2	Objective 3	Objective 4	Objective 5	Objective 6	Objective 7
Project Number	**Project Name**	**Accelerate development and connections**	**Minimise new capacity costs**	**Maximise use of existing assets**	**Safety and Environment**	**Network Performance**	**Accurate Asset performance**	**Innovation leaders**
NIA_SHET_0004	Dynamic Line Rating – CAT1	●	●	■	●	●	●	●
NIA_SHET_0008	HVDC Nanocomposite Insulation		●			■		●
NIA_SHET_0009	DC/DC Converter		●			■		●
NIA_SHET_0010	New Suite of Transmission Structures	■	●	●	●	●		●

KEY: ● **Primary Objective** ■ **Relevant Objective**

		Objective 1	Objective 2	Objective 3	Objective 4	Objective 5	Objective 6	Objective 7
Project Number	**Project Name**	**Accelerate development and connections**	**Minimise new capacity costs**	**Maximise use of existing assets**	**Safety and Environment**	**Network Performance**	**Accurate Asset performance**	**Innovation leaders**
NIA_SHET_0011	Lightning Protection		●			■		●
NIA_SHET_0013	Modular Approach to Substation Construction	■	●					●
NIA_SHET_0014	Partial Discharge Monitoring to Reduce Safety Criticality			●	■		●	●
NIA_SHET_0015	Controlled Backfill for Peatland		●			■		●
NIA_SHET_0016	Alternatives to Wood Poles					●		●
NIA_SHET_0017	Pole Reclassification System Evaluation					●		●
NIA_SHET_0018	Transformer Intrascope Phase 2			●	●			●
NIA_SPT_1502	Distributed Photonic Grid Instrumentation (DPGI)		●			■		●

KEY: ● **Primary Objective** ■ **Relevant Objective**

3 Summary of Progress

3.1 Strategy Objective 1: Accelerate network development and connections

3.1.1 NIA_SHET_0013 Modular Approach to Substation Construction (MASC)

Start Date: April 2014

Duration: 33 months

Description:
This project is aimed at researching the potential market, developing a functional specification and engaging with manufacturers for the design development of a permanent substation using a modular approach to substation construction.

Expected Benefits:

- Reduce costs for substation design, construction, installation and operation;
- Increase speed of deployment;
- Develop lower cost options for increasing substation capacity to give increased flexibility;
- Allow substations to be better matched to the anticipated connection – especially for renewables – and to provide flexibility to;
    - increase capacity;
    - Reduce consenting times;
- Reduce the overall carbon footprint of the development.

Progress:
A functional specification for modular substation has been developed based on SHE Transmission standards for substations. As part of the tender negotiations that followed the functional specification, manufacturers have highlighted product developments that are deemed acceptable by European parties and are supported by operational evidence. At the same time, they have also presented ideas that are in the pipe-line and require further testing and validation.

3.1.2 NIA_SHET_0010 New Suite of Transmission Structures

Start Date: December 2013

Duration: 22 months

Description:
This project leverages existing innovations to design a suite of conductor support systems for transmission at 275kV. The aim of the project is to take advantage of new materials and products that will allow us to design a support and foundation that has a reduced impact on the environment.

Expected Benefits:
The project will provide new designs that take account of the wide ranging challenges that are faced by the industry, namely a new conductor support system that:

- Is a more efficient design for supports and foundations;
- Reduces the impacts on Statutory Authorities and Stakeholders so that it is easier to gain consent;
- Is easier, cheaper and quicker to build;
- Reduces the whole life impact on the environment; by assessing the overall impact of the materials we select; by considering how we harvest, manufacture, transport, process and build the structure.

Progress:
The project has now been completed. In its final stage, the project recommended two designs of tower structures which showed great potential and gave sufficient confidence that further development was warranted. To do this, a successful application was made for funding under the Network Innovation Competition (NIC). Details about ongoing NIC work can be found on the learning portal under the project 'NeSTS'. A detailed project report is published alongside the NIA closure report for this project.

Figure 2: Photomontage of one of the eight structures considered **Source:** Energyline

3.2 Strategy Objective 2: Minimise new capacity costs

3.2.1 NIA_SHET_0008 HVDC Nanocomposite Insulation

Start Date: June 2012

Duration: 42 months

Description:
This project is concerned with investigating the development and scaling of nanocomposite electrical insulation materials for HVDC power transmission applications. Insulation represents a major cost of network assets and use of nanocomposite materials is expected to bring the costs down.

Expected Benefits:
It has the potential to address the need for advanced electrical insulation materials dedicated to high performance next generation HVDC power transmission applications. It is expected to demonstrate improved HVDC performance of materials compared to traditional thermoset micro-composite insulation. The overall benefit is that if this technology is successful, it will significantly lower the cost of HVDC insulation. This reduction in costs is will be in line with SHE Transmission's strategy of minimising new capacity costs.

Progress:
The project has now been completed. Investigation has been done into production/development of insulators including challenges of controlled nano-dispersion, matrix nano-filler interfacial control and reliable reaction behaviour. Since the technology is still at an early stage, the scope of a follow-on project is currently under discussion by relevant stakeholders.

3.3 Strategy Objective 3: Maximise the use of existing assets

3.3.1 NIA_SHET_0004 Dynamic Line Rating CAT-1

Start Date: April 2009

Duration: 108 months

Description:
The project is aimed at evaluating an innovative system with potential to provide real time monitoring of overhead line networks. The method involves measuring tension and sag on the line in conjunction with known line characteristics to obtain accurate rating values for the line at any moment.

Expected Benefits:

- Securement of Transmission line outages, given increased confidence in current carrying ability of the rest of the network under fault conditions;
- Increased generation output hence allowing further generation connections to the 132kV network;
- Advance warning of impending clearance violations through sag monitoring;
- Matching of line ratings to load and weather conditions.

Progress:
Four CAT-1 field units have successfully been commissioned with real-time data now available on SHE Transmission's Supervisory Control and Data Acquisition (SCADA) system. Good progress is being made to evaluate the levels of additional capacity achievable on the trial line using the purpose built analytical tool supplied with the CAT-1 units. Initial analysis of the real-time data confirms that additional capacity is available on the trial overhead line beyond expected design levels.

Figure 3: CAT-1 system installation

3.4 Strategy Objective 4: Safety and Environmental Performance

3.4.1 NIA_SHET_0014 Partial discharge monitoring to reduce safety criticality

Start Date: January 2015

Duration: 36 months

Description:
The scope of this project is to install online trial Partial Discharge (PD) monitoring systems incorporating alternative technologies and suppliers at selected sites and integrate with SHE Transmission's SCADA system in order to collect, store and analyse output PD event data to establish if this can be used to improve the management of safety critical plant. Learning from this project will also be used for further work to incorporate PD failure precursors into control and protection schemes.

Expected Benefits:
The most significant benefit from this project is safety. If equipment is isolated from the network prior to disruptive failure then the risk to safety will be minimised. Furthermore, where assets have been earmarked for replacement just as a result of their being identified as having high safety criticality, deferring their replacement through the continuous monitoring method proposed in this project will have a financial benefit.

Progress:
Since project commencement, installation and commissioning of two independent PD monitoring systems (see figure 4 overleaf) has been completed at two nominated sites. A new tender is ongoing to install the systems at the third and last site. In one of the sites being already monitored, benefits have already been obtained when an important plant item was replaced as a result of observations confirmed by this project. In the forthcoming year, the focus will turn to establishing ways of optimally exploiting the data that is being collected by these systems.

Figure 4: Antenna for monitoring radio frequency PD signals on site

3.5 Strategy Objective 5: Improve network performance

3.5.1 NIA_SHET_0009 DC / DC Converter

Start Date: September 2013

Duration: 42 months

Description:
The scope of the project comprises:

- Design and develop the software models of high power DC/DC converter;
- Study DC/DC converters, DC hubs and their integration with HVDC systems
- Optimize the design of a DC/DC converter;
- Produce conclusions and recommendations on the design of DC/DC converters and their use integrating HVDC systems.

Progress:
A PhD student doing research on this project has progressed well with the studies and the project is nearing completion. The project has now delivered several reports which have been reviewed and accepted by SHE Transmission. A journal article has also been published in a leading international journal with plans for a presentation at an international conference.

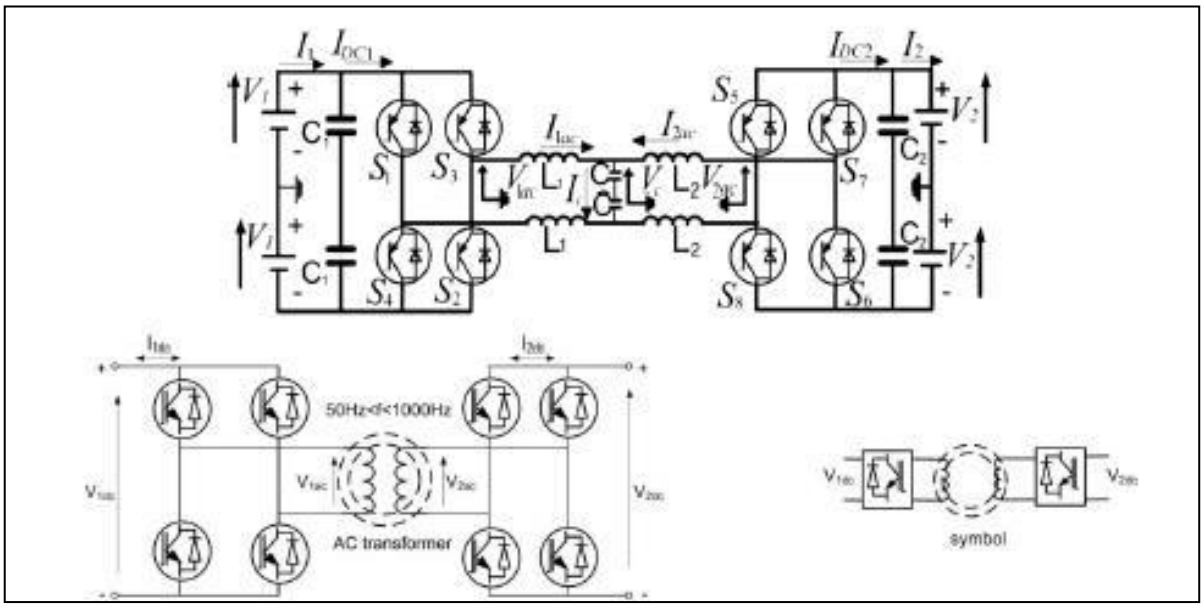

Figure 5: DC-DC converter **Source**: University of Aberdeen, PhD research project

3.5.2 NIA_SHET_0011 Lightning Protection

Start Date: December 2013

Duration: 36 months

Description:
This project involves building and verifying simulation models of lightning strikes on lines at 132kV and above with towers that have high footing resistances. This will enable investigation of protection options which will inform decisions on lightning protection approaches.

Expected Benefits:
This project's aim is to optimise the design of lightning protection for towers with high footing resistance in order to cut costs. At the moment, the choices are limited and the process is largely based on trial and error until the resistance is acceptable. This project, if successful, might avail alternative options and the ability of informed decision making. It is therefore envisaged that savings of up to £30k may be made per tower with high footing resistance.

Progress:
A PhD student is doing research on this project. So far, an evolving technical project report has been provided at each quarter detailing work to date. Literature reviews of lightning source, overhead line, tower structure and insulators have been completed. Modelling, simulation and laboratory work on the lightning source has been completed and work is ongoing on the remaining three models that would form part of the final model. Also ongoing is work to create a calculation methodology for acceptable levels of footing resistance.

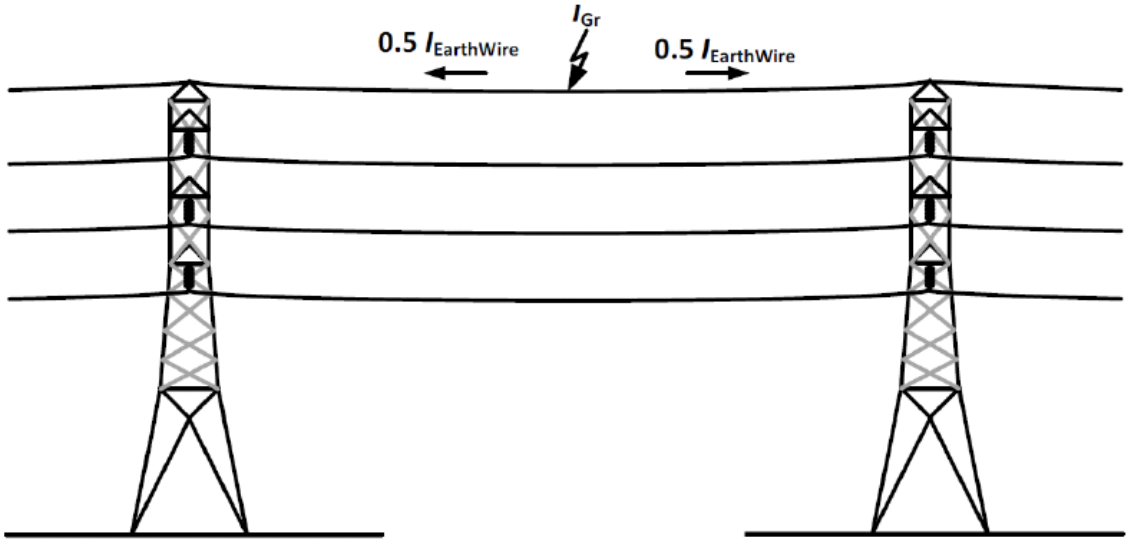

Figure 6: Simplified illustration of travelling waves from lightning strike

Source: Heriot Watt University, PhD research project report

3.5.3 NIA_SHET_0015 Controlled Backfill for Peat Land

Start Date: March 2015

Duration: 18 months

Description:
To find suitable alternative backfill materials, conduct Thermal Resistivity (TR) tests in the lab and in close HV cable proximity in order to identify the material which is most technically suitable, environmentally friendly and cost-effective for use in peat land.

Expected Benefits:

- Reduced cost - through identifying a controlled backfill material which is more economical than Cement Based Sand (CBS);
- Reduced cost of cable installations in peat land by designing projects with appropriate cable ratings and economic use of cable sizes;
- Improved power flows due to increased cable ampacity gained by lowering the backfilling TR;
- Increased cable lifetime by lowering the risk of cable damage or faults due to overheating;
- Improved environmental performance by using a solution that is friendly to the peat land habitat

Progress:
Initial tests were performed on a sample of peat in a high voltage lab. However, it has become apparent that the initial proposal for the field test does not meet the specified requirements in terms of cable loading and temperature which is required to reliably compare the actual performance of the backfills. As a result, there is ongoing work to look into options for the field test as part of the study which can meet the specified criteria in terms of cable loading and temperature.

3.5.4 NIA_SHET_0016 Alternative to Wood Poles

Start Date: July 2015

Duration: 11 months

Description:
During this project, SHE Transmission will undertake a literature review of the available composite, laminated and modular pole alternatives to wooden poles. These alternative poles have not been used in the UK but have been successfully used in North America. A desk top review will be undertaken to ascertain all the potential benefits and costs of these alternative methods through the full product life cycle from procurement, installation, maintenance through to disposal. In addition, the safety case and product specifications will be reviewed to ensure that they will meet the required UK standards

Expected Benefits:
The project will seek to:

- Improve the variability of currently understood costs and benefits of available composite, laminated and modular pole alternatives;
- Identify the appropriate applications for available composite, laminated and modular pole alternatives in the UK;
- Identify the costs and benefits of available composite, laminated and modular pole alternatives and develop a detailed cost benefit analysis case which will support a clear recommendation for their deployment across the SHE Transmission area.

Progress:
A literature review of available products has been carried out in which a comparison of eight manufacturers of non-wood poles has been produced. In order to create technical specifications for assessing 132kV alternative poles, a number of standards have already been identified and will be taken into consideration. The project is nearly complete.

3.5.5 NIA_SHET_0017 Pole Reclassification System Evaluation

Start Date: November 2015

Duration: 6 months

Description:
The purpose of this project is to ascertain if the strength of wood poles in service can effectively be improved through the use of the Pole Reclassification System (PRS) produced by Laminated Wood Systems at a lower cost than replacement with new poles of the relevant class.

Expected Benefits:
If this system is viable, it will be a cost-effective intervention for strengthening existing wood poles to withstand adverse weather conditions. If vulnerable poles are strengthened using this method then the weather induced faults which will be averted will result in improved network performance.

Progress:
This project is nearing completion. A Trident line was successfully constructed offline with similar attributes to a line being considered to be a use case for the proposed method. A demonstration (see figure 8 overleaf) to show the installation of PRS using different tools available was then subsequently held in the presence of relevant stakeholders. The feedback from the stakeholders will make up some of the recommendations on the viability of the method when the report is completed in due course.

Figure 8: Trident line pole with PRS installed

3.5.6 NIA_SPT_1502 Distributed Photonic Grid Instrumentation (DPGI)

Start Date: May 2015

Duration: 12 months

Description:
This project is a collaboration with Scottish Power Transmission and it involves the development of photonic sensors which can demonstrate the potential for faster, safer, more accurate and less expensive instrumentation for monitoring, control and protection.

Expected Benefits:
This project's method will

- Provide technical benefits through enhanced system monitoring, protection and automation
- Reduce secondary wiring and complexity
- Facilitate the 'smart grid' by providing accurate information on system status.
- Through reduced material use as is currently the case for standard instrument transformers, this method is likely to lead to reduction in carbon footprint.

Progress:
The project has now been completed. In the completed phase of work, a full optical current sensor and the constituent prototype low voltage transducer were designed and successfully tested for relevant protection classes to IEC-60044-8 standards.

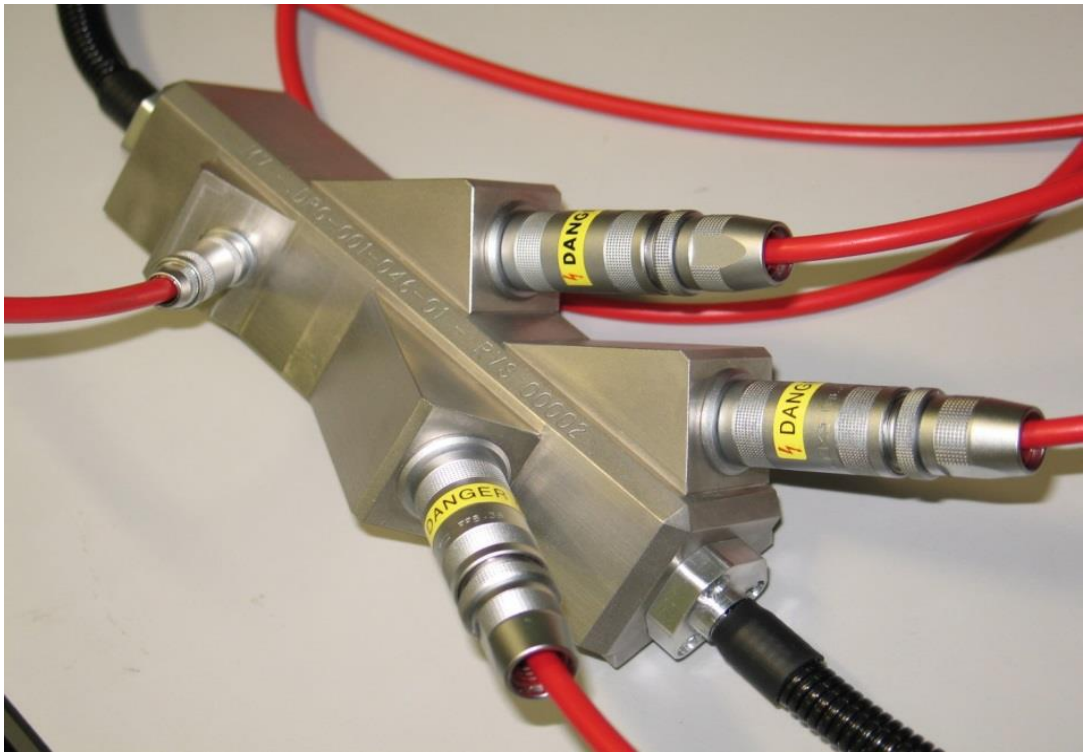

Figure 7: Three phase, 5kV Voltage sensor
Source: Synaptec Ltd

3.6 Strategy Objective 6: Accurate asset information

3.6.1 NIA_SHET_0018 Transformer Intrascope Phase 2

Start Date: December 2015

Duration: 24 months

Description:
The transformer intrascope system has been developed in phase 1 of this project as an asset management tool to assist with the condition assessment of internal paper winding insulation within electrical power transformers. It is in the form of a controllable probe which can be inserted through the hatch of a defective transformer to analyse the chemical composition of the Kraft paper insulation to assess the health of the asset in situ.

This project seeks to improve upon and overcome the limitations of the phase 1 design to allow for better access, physical range, positional control and visual imaging capability, whilst accepting any improvements that can also be made to spectroscopic measurements. The scope of the project is to have a fully refined, assembled and functional intrascope probe system which has been both mechanically and functionally proven within a laboratory-based environment and via field trials.

Expected Benefits:

- Correlation with and increased confidence in using existing methods such as dissolved gas analysis of insulation oil for condition assessment of power transformers;
- Maximising the operation of existing transformer assets by delaying expensive asset replacement;
- Collection and storage of retrievable, reliable and potentially improved condition information of our existing fleet of transformer assets;
- The system can be used as a lower cost tool for investigation of commissioned, faulted and decommissioned out-of-service transformer assets compared with conventional off-site transformer de-tanking;
- Increased confidence in the condition of transformer assets connected to the network.

Progress:
The specification and preliminary design of different components of the intrascope system have been completed. The design reports issued are now under review within SHE Transmission before manufacture of the components.

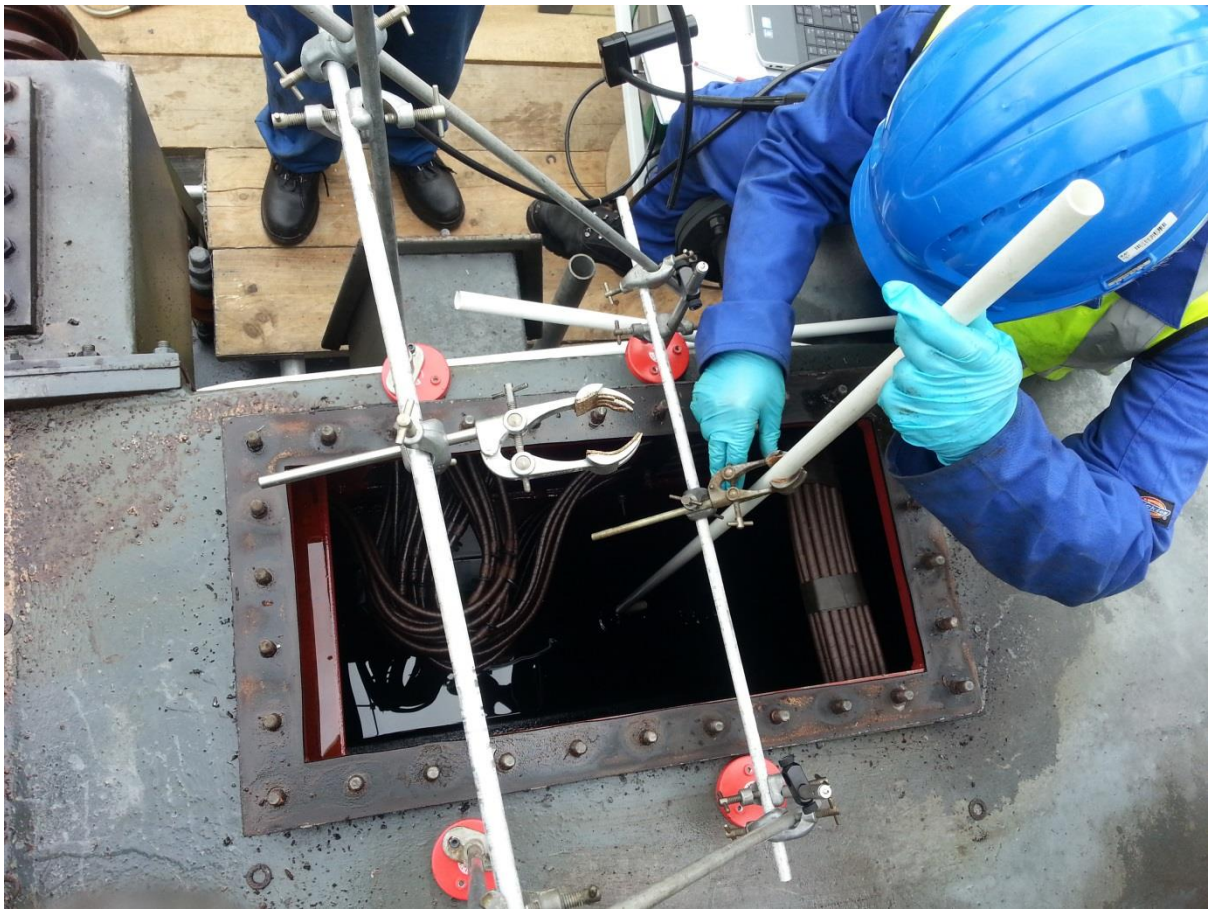

Figure 9: Accessing transformer windings with Phase 1 intrascope prototype

3.7 Strategy Objective 7: Remain at the forefront of innovation

This is an overarching objective which has to be met by all SHE Transmission NIA projects. Improvements are constantly being sought to ensure that great value can be delivered to our customers. The projects summarised in this document are a reflection of the culture of innovation in SHE Transmission and SSEPD as a whole. Our focus on innovation complements our work in research and development, where new processes, services, products and technologies are created, which will enable us to remain a successful company in the future.

4 Highlights of the year: Areas of Significant New Learning

4.1 Moving new transmission structure design approach from concept to reality

Our recently completed New Suite of Transmission structures NIA project has produced recommendations for transmission structures which led to the approval and commencement of the NIC project entitled 'NeSTS'. This new, larger project is going to develop and demonstrate a completely new approach to overhead line design, to deliver anticipated environmental benefits and savings for future investment in the country's Transmission System. This will culminate in the building of an overhead line making use of the new approach. In the meantime, a Support Assessment Matrix (SAM) developed in conjunction with Energyline Ltd can now provide a robust tool for use by designers for qualitative assessment of the design aspects of overhead line supports. A detailed technical report of the output from this project is available alongside the standard closure report.

4.2 Exploiting innovation's 'quick wins' to make business as usual decisions

One profound lesson gained in SHE Transmission this year is that events in innovation can quickly have a direct impact on business as usual activities. This was demonstrated unexpectedly during the progress of the 'PD Monitoring to Reduce Safety Criticality' project. PD activity was suspected on a bay within a 275kV substation by one of the suppliers working on the project. After trials were extended to this site to increase learning from the project, during installation a component of the suspected source was found to have deteriorated in a manner consistent with PD generation. It is important to note that this finding was made by a different supplier to the one who had initially detected and pinpointed the source of the suspected PD activity. However, although this was immediately brought to SHE Transmission's attention, due to the elusive nature of PD emissions, it was not possible to draw a concrete conclusion about this component being the cause of the PD activity without further evidence although it was deemed highly likely. This evidence partly came from the PD signals that continued to get detected by both the independent online PD monitoring systems subsequently installed on this bay. This PD level was deemed to be of concern and a decision was taken to intervene.

Based on the coincidence of the pinpointing that had been performed initially and the component deterioration witnessed during installation of monitoring equipment, that component was made the first priority to be replaced. The intention was to then go through another period of observation of readings from site after replacement of the first component to establish if the concerning level of PD activity was still being detected. The readings collected immediately after replacement of the component showed almost complete disappearance of PD activity. Although PD detection technologies are largely accepted as being already mature, this event provided some validation of both principles of detection being used in the project. Furthermore, it provided some confidence that the approach of managing safety criticality through online PD monitoring is likely to be successful if the just described events were to be replicated in other scenarios. If PD activity was detected and

successful pinpointing of the source was done as happened in this case, and if intervention through inspection revealed the source of the problem then the potential causes of catastrophic failure would be isolated in advance. Although this would not necessarily mean a failure would have resulted in every case, it is deemed a preferable approach to managing safety criticality than otherwise.

4.3 Moving innovation concepts towards everyday techniques

SHE Transmission has closed three NIA projects which were completed in the last year. HVDC Nanocomposite Insulation met its objectives and extended knowledge about the potential benefits of the technology in reducing the cost of insulation. Although the technology readiness level (TRL) is still low, this is an important step in the journey towards bringing the benefits of this technology to fruition especially as HVDC installations are likely to increase in the future. A follow-up project aimed at raising the TRL of this technology is under discussion to try and leverage on the momentum gained in the just ended phase.

The Distributed Photonic Grid Instrumentation (DPGI) project was a collaboration led by Scottish Power Transmission. The technology developed and tested has provided an insight into the potential solution for the major difficulty experienced in managing the control and protection of high voltage circuits which are made up of both overhead and underground cables. Currently, the inclusion of cables precludes auto-reclosing on such circuits even if only a transient fault may have occurred on the overhead line part of the circuit. This is a major limitation which, for SHE Transmission, challenges the Innovation Strategy objective to ‘maintain and improve network performance’. Although the just ended phase of work has raised the TRL for the technology only marginally, it is deemed that further work in this area is warranted.

The New Suite of Transmission Structures NIA project did not only lead to a larger NIC project which will result in trials of the proposed support designs, it also produced a beneficial ‘side effect’ that proved very useful. The tool is called a Support Assessment Matrix (SAM) and it is an Excel file which can be used to adjust weightings allocated to design aspects associated with overhead line structures. The allocation of weightings to design aspects makes the process of choosing designs for structures a technical and objective process. The value of SAM observed by the working group involved in this project included its potential for use in business as usual. As a result, SAM has now been recommended as a tool that can be utilised in the process of designing new overhead line circuits.

Other than the closed projects above, any learning that is gained from projects in flight will be assessed and recommended for use in business as usual without the need to wait for natural project completion. Any lessons gained from our current portfolio of projects so far or between now and the 2016 LCNI conference will strongly feature in the conference presentations to ensure that all GB network licensees can make informed choices about whether to exploit the learning for their own networks. In the meantime, the next section provides relevant links for accessing some of the learning discussed in this summary or for finding out further information if required.

Further Information

The complete SHE Transmission Innovation Strategy can be found on the link below:

Transmission Innovation final

Further details of all the NIA projects summarised above can be accessed through the following link:

ENA Smarter Networks Portal

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