Electricity Network Innovation Competition

Report and Recommendations 2015

Prepared for

The Gas & Electricity Markets Authority

By

The Electricity Network Innovation Competition Expert Panel

November 2015

1 Introduction

1.1 This report prepared by the Electricity Network Innovation Competition Expert Panel (the Panel) sets out the Panel's recommendations to the Gas and Electricity Markets Authority on the portfolio of projects to be funded in the 2015 NIC funding round. Members of the Expert Panel are as follows:

- Dr Robin Bidwell (Chair)
- Jo Armstrong
- Alan Bryce
- Sharon Darcy
- Prof Nicholas Jenkins

1.2 We received seven submissions. The total funding requested from the ENIC was £65.3m and the fund available this year is £81m. Full details of each submission will be available on the Ofgem website. The names of the Funding Licensee, titles of the submissions and the amount requested from the NIC Fund are as follows (the values in brackets indicate the total cost of the projects).

- **New Suite of Transmission Structures (NeSTS) - Scottish Hydro Electric Transmission PLC (SHE Transmission) - £6.6m requested (£7.5m in total)**

- **Offgrid Substation Environment for the Acceleration of Innovative Technologies (OSEAIT) - National Grid Electricity Transmission PLC (NGET) - £12.0 m requested (£26.0m in total)**

- **Telecoms Templates for a Low Carbon Future - Western Power Distribution (WPD) - £12.6m requested (£14.2m in total)**

- **Celsius - Electricity North West Ltd (ENWL) - £4.7m requested (£5.6m in total)**

- **Angle-DC - SP Manweb PLC (SPMW) - £13.1m requested (£14.8m in total)**

- **Future Intelligent Transmission Network Substation (FITNESS) - SP Transmission PLC (SPT) - £8.3m requested (£11.0m in total)**

- **Evolution - SP Distribution (SPD) - £6.1m requested (£6.8m in total)**

1.3 The Expert Panel followed the evaluation process set out in the Electricity Network Innovation Competition Governance Document (v2.1 2015). Initial submissions were received by Ofgem and were screened by Ofgem staff for compliance with the requirements set out for the Initial Screening Process. Consultants were appointed by Ofgem to assist in the review process. The Panel and the Consultants met the Funding Licensees early in the evaluation process to allow the project teams to present their submissions. The Panel met the Funding Licensees a second time to allow them to clarify points and address matters of concern to the Panel. Throughout the process the Consultants, Ofgem and the Panel sent each of the Funding Licensees a number of questions with the purpose of clarifying the submissions and highlighting areas of concern.

Following these meetings, the Panel met to review each of the submissions in the context of the criteria set out in the Governance Document. In evaluating the submissions, the Panel took into account all of the documents that had been made available: the submissions, their appendices, the Consultants' advice as well as any additional information that had been submitted via Ofgem or the Consultants from the Funding Licensees; they also took account of information from meetings that were held with the Funding Licensees and any material provided during those meetings. Based on this evaluation, the Panel reviewed the projects against the criteria. This report sets out the Panel's recommendations to the Authority.

1.4 The Panel evaluated each submission using the criteria set out in the governance document under the following headings (see the full governance document for details).

(a) Accelerates the development of a low carbon energy sector and/or delivers environmental benefits whilst having the potential to deliver net financial benefits to future and/or existing customers.

(b) Provides value for money to electricity customers.

(c) Generates knowledge that can be shared amongst all relevant Network Licensees.

(d) Is innovative (ie not business as usual) and has an unproven business case where the innovation risk warrants a limited Development and/or Demonstration Project to demonstrate its effectiveness.

(e) Involvement of other Project Partners and External Funding.

(f) Relevance and timing.

(g) Demonstration of a robust methodology and that the Project is ready to implement.

1.5 This report should be read together with the Funding Licensees' submissions and the other information that is published concurrently with these on the Ofgem website. This report sets out the results of the Panel's deliberations and its recommendations for the Authority. As such it is primarily concerned with the views of the Panel; all the details of the projects are contained in the other published documents.

2.0 EVALUATION OF SUBMISSIONS

2.1 New Suite of Transmission Structures (NeSTS)

Scottish Hydro Electric Transmission PLC (SHE Transmission)

NIC funding: £6.6m

Total cost: £7.5m

The Proposed Project.

The objective of the project is to develop a new 'suite' of 275 kV and 132 kV overhead line (OHL) structures.

SHE Transmission note there is a continuing demand to connect renewable capacity to the network; this often requires new overhead lines, frequently in rural areas where there is little or no infrastructure, where weather and ground conditions can be particularly extreme, and where such lines can have a considerable impact on the landscape. There is also a need to replace a number of lines supported on pylons or wooden poles that are coming to the end of their lives. The submission notes that the existing steel lattice pylons were largely installed in the 1950s, based on a design from the 1920s.

Preliminary design work for the proposed suite of OHL pylons has already been undertaken using the Network Innovation Allowance (NIA) mechanism. Eight types of tower have been developed, all using a single pole arrangement with what are described as novel insulator and conductor arrangements. Consideration has been given to minimising construction costs, as well as reducing long term maintenance requirements (eg through new types of coating and reduced need for access tracks for maintenance plant and equipment).

The project is in two distinct stages. Stage 1 would include a review to determine the technical robustness of the structure, initial testing of parts of the structure, as well as stakeholder workshops to determine the relative acceptability of the designs. A contractor will be selected at an early stage; the contractor will be responsible for the detailed design work and the eventual construction of a new line. At the end of Stage 1 a decision will be taken as to whether or not to proceed to the next stage. This decision will be based on a full range of factors including relative cost, technical and amenity considerations. Stage 2 would include full scale testing, planning and consent applications and the construction of the line; this will be followed by monitoring and evaluation and dissemination of the results of the work.

The initial work suggests that this design will result in supports and lines being easier and potentially less costly to install, as well as possibly having less impact on the landscape. SHE Transmission notes that a significant proportion of the lines that need to be renewed or provided for low carbon generation are in remote areas with difficult terrains. Traditional steel lattice towers can be difficult to erect, particularly in hilly landscapes, and a single pole arrangement is preferred. In developing their

design, SHE Transmission have taken account of the difficulties associated with a similar project (the design of the T-Pylon).

2.1.2 **Carbon, Environmental and Financial Benefits.**

SHE Transmission submit that NeSTS will help deliver the Carbon Plan by providing an additional option for OHL structures that is (i) potentially more visually acceptable – thereby reducing planning delays, (ii) one that specifically can cope with difficult terrains and that can be installed with less associated environmental damage and (iii) that will potentially be at less cost than a traditional tower or the T-Pylon.

The first stage of the project will help to determine whether these proposed benefits can, in practice, be delivered.

The financial benefits depend particularly on reduced groundwork and foundation costs arising from the use of a single pole. Overall it is estimated that these structures will reduce the cost of a new line by around 10%; SHE Transmission suggest that these poles might be the preferred option for 15% of the new/replacement lines. In very rough terms, this could amount to a saving of around £120,000 per kilometre. One estimate provided in the submission suggests there is a need for 200 kilometres of new/replacement lines per year across GB.

2.1.3 **Value for Money.**

Depending on the outcome of the trials, this project will offer considerable value for money for customers; and will reduce network costs.

The Panel was satisfied that SHE Transmission had committed to use appropriate procurement approaches to select their suppliers.

2.1.4 **Generates knowledge.**

The project plan includes the opportunity for all three transmission owners (TOs) to influence the functional specification and we understand that they will remain engaged throughout. Similarly, we understand that after the contractor has been selected, workshops will be held to ensure that knowledge gained during the design and construction phase is fully shared with the contractor community.

Overall, the Panel was satisfied with the knowledge dissemination arrangements.

2.1.5 **Innovative.**

The Panel concluded that the risks associated with the project were such that this work would not be undertaken in the normal course of business; nor did the Panel believe that this work could be funded through any other funding mechanism such as the Volume Driver or Visual Amenity Allowance. The Panel recognised that the work will address a number of specific technical issues and that the design will need to undergo rigorous technical testing before the construction of a demonstration line can proceed. Should the detailed preparatory work conclude that the design does not offer sufficient environmental or cost advantages, or should the technical tests identify any flaws that cannot be overcome – then the project will need to be abandoned. On this basis, the Panel considered the project to be innovative.

2.1.6 **Other Partners.**

All the project participants are either suppliers or collaborators (eg TOs and the contracting industry). We considered the expertise of these participants (Energyline, Social Market Research and TNEI) to be appropriate given their roles. The Panel was initially concerned about the apparent reliance of the project on Energyline, but were satisfied during subsequent discussions that early action would be taken to ensure that the next stage of the design work would be in the hands of the contractor that would eventually build the project and would be responsible for the relevant construction warranties and guarantees.

2.1.7 **Relevance and timing.**

The Panel considered this project to be relevant and timely given the new/replacement lines and the particular problems facing SHE Transmission in relation to rural areas.

2.1.8 **Robust methodology.**

In general, the Panel felt that the project methodology was clear and well-constructed; the submission itself was also well-presented and clear. The Panel had a number of concerns that were discussed with SHE Transmission. First, it was not

initially clear as to how the risk of constructing a line to a new design would be shared between SH Transmission and the contractor; we were told the contractor would play an early role in the design of the new structure and would be responsible for overseeing the structural testing. As already noted, the Panel was concerned about the central role played by Energyline and how the design risk would be managed over the duration of the project; the subsequent clarifications around Stage 1 (including peer review and the early appointment of a contractor) allayed these fears. The Panel was reassured that the work undertaken in the NIA project and the costing of the foundations, on which this project are based, would be reviewed early in the project by a firm of consulting engineers.

The Panel also felt that insufficient attention had been paid to the importance of trying to gain an insight into potential visual acceptability; which could be particularly important if the next best alternative to reinforcing and developing the network is undergrounding at considerable higher additional cost. While recognising this is a difficult area for robust research, nevertheless it is an area that has the potential to provide useful learning and provide strong indications as to whether in different terrains certain visual structures would prove more acceptable. The Panel was partially assured by a commitment to engage stakeholders at the start of the project and through an increase in the number of workshops intended to address this issue, but would urge that more attention is paid to this aspect of the work as it will be relevant in determining whether or not the project should proceed to Stage 2.

2.1.9 **Conclusions.**

The Panel recommends that this project should be funded. However, work will need to be undertaken to determine whether or not these benefits will be delivered and the Panel considers that the agreed decision point at the end of Stage 1 should also be seen as a 'stage gate' and that Ofgem should review that decision before agreeing whether or not Stage 2 should proceed. A further SDRC should be put in place to require SHE Transmission to assess the need for a customer engagement plan and data protection strategy early in the project.

2.2 Offgrid Substation Environment for the Acceleration of Innovative Technologies (OSEAIT)

National Grid Electricity Transmission PLC (NGET)

NIC funding: £12.0m

Total cost: £26.0m

2.2.1 The Proposed Project.

NGET is currently decommissioning a 20 bay outdoor air insulated 400kV substation that occupies a site that will be extended to cover 18 acres. The objective of this project is to convert the decommissioned substation into a facility that will allow NGET to test equipment off grid and provide a relatively safe environment for developing new procedures and for training purposes. NGET state that this facility will enable them to expose equipment to the rigours of climate and pollution over a longer period and in more realistic conditions than is possible in a test laboratory.

At any one time, NGET has a number of assets that are nearing the end of their lives; similarly, they face the problem that the failure of one particular piece of equipment might suggest it prudent that all other similar pieces of equipment should be replaced. They note that predicting the remaining life of network assets has been made more difficult by the changing nature of generation and demand arising from the connection of Low Carbon Technologies (LCTs). This OSEAIT facility will enable them to run the necessary tests on their equipment and investigate their options for managing asset life – whether to extend the life of existing assets or whether to consider other options.

As part of the NIC submission, NGET has listed 14 specific projects they expect to carry out once the facility has been converted. A Technology Advisory Board (TAB) will be established with membership open to other UK Network Licensees supported by a limited number of independent technical experts; this will govern the facility for the duration of the NIC. Ofgem will be invited to all meetings. The TAB will have overall responsibility for the management and use of the facility and will determine which projects will be undertaken and the timing of each project, whilst also

ensuring adequate resources are made available. Examples from the project list include circuit breaker monitoring, conductor audible noise evaluation and SF6 management and repair techniques.

2.2.2 **Carbon, Environmental and Financial Benefits.**

OSEAIT will, in principle, facilitate the Carbon Plan by allowing work to be carried out to determine the most efficient solution for managing the network changes arising from LCTs; it will also allow for investigations into asset deterioration arising from these changes in network loads. An estimate of carbon savings has been included in the submission. In addition, the Panel noted that by extending the life of assets, there is potential for savings arising from the carbon embedded in the assets themselves.

The benefit calculations in the submission show that the 14 projects to be undertaken during the NIC period would offer savings of at least £100m (in cash terms by 2050). These are benefits that it is suggested would either not accrue in their entirety or would be severely delayed without the facility.

The Panel noted that the NIC benefit case depended on the selection of projects to be undertaken (75% of the benefits arise from 5 of the projects) and this selection would be the responsibility of the TAB. NGET however assured the Panel that it was likely that all of the projects would be undertaken over the period and Ofgem would be invited to be a member of the TAB.

2.2.3 **Value for Money.**

The total cost of converting the substation to a test facility and conducting the 14 trials is expected to be £26m; it was suggested that by comparison the cost of a purpose built test facility could be around £80m.

The Panel was concerned about the apparently high cost associated with certain aspects of the conversion. Following discussion, NGET proposed a number of cost reductions. The Panel was keen that NGET should continue to look at how to deliver the conversion in the most cost effective way.

However, the Panel agreed that overall the project offered value for money and considerable potential financial benefits for the transmission network and for consumers. It is anticipated that the cost of network renewal over the period to 2050 will be considerable. This facility should be able to provide an opportunity for the realistic assessment of how to extend asset life and how to manage the grid under changing conditions and so accelerate the smart grid.

2.2.4 **Generates knowledge.**

As noted, the TAB will include other UK Network Licensees as participants.

There is a dissemination plan including a dedicated website and associated engagement work.

The Panel concluded that the 14 projects proposed to be carried out during the NIC period would generate a significant body of new knowledge to the benefit of TOs and their customers. This knowledge could potentially accelerate the deployment of Low Carbon and associated network technologies, prove the efficacy of new techniques to monitor plant condition, and inform decisions to do with asset life extension and replacement. As such it would also be helpful for Ofgem in the RIIO-T2 price control and beyond.

2.2.5 **Innovative.**

There is no facility within GB where off grid testing can be undertaken under realistic conditions. This project will provide such a Test Centre. It will be of particular value for assessing the feasibility of asset life extension as well as providing the ability to carry out trials in a way that would not be possible on the live network; the facility will be energised at full voltage and the risk of failure can be contained in a way that would not be possible on the network – or at least not without the potential for disrupting customers.

It would not be possible to carry out many of the trials without converting the substation and therefore the panel considered the conversion is a necessary prerequisite of undertaking the trials. The panel was satisfied that the trials would

provide new learning that would create significant benefits to customers – in particular to provide information that will be of value in the RIIO-T2 determination.

The Panel was satisfied that the project (conversion and trials) is innovative. The outcome of many of these trials is uncertain and there is a risk that they will fail to deliver a positive result. The Panel was concerned that this conversion and the trials would not go ahead unless it received NIC funding – in which case the considerable potential benefits to the customers of all UK Network Licensees would not be realised.

2.2.6 **Other Partners.**

Other UK Network Licensees would be invited to join the governing body of the facility and would help to set priorities. In addition, suppliers and research institutes will be able to trial new products and services and carry out other investigations.

The Panel was not entirely clear whether during the NIC period the use of the facility would be primarily limited to the NGET and other TOs' agenda; or whether other interested parties (academia, suppliers, etc) would be allowed to use the facility. In discussion, it would appear that the facilities would be made available to third parties, even during the NIC period.

The Panel urged NGET to consider whether a safety expert should also be invited to join the TAB, which NGET addressed in the resubmission.

2.2.7 **Relevance and timing.**

The Panel considered the project to be both relevant and that it was important this project should go ahead promptly so as to provide information in time for the RIIO-T2 negotiations.

2.2.8 **Robust methodology.**

This submission was well articulated and the Panel considered the project methodology to be robust.

NGET has noted that they had for a number of years been considering an opportunity to create such a facility, but that the cost is prohibitive; that substations of this nature are rarely decommissioned but the NIC grant provides the necessary funding to secure an excellent opportunity to make use of this decommissioned asset in this way. The Panel recognised the potential value this project would bring. There was concern over whether or not the conversion itself was innovative but the Panel concluded that it was an integral part of the project to enable the trials to go ahead. The trials themselves were considered innovative as they are attempting to find new ways of extending the life of assets and looking at non-traditional approaches to managing and maintaining the network.

The Panel is concerned that they were not able to evaluate in detail whether the costs of the proposed trials were reasonable; while the objectives and benefits of 14 projects were part of the bid, it was recognised that detailed scoping, prioritising and costing would be the responsibility of the Technology Assessment Board and management. Ofgem will be invited to be a member of this board and the Panel was satisfied that this would allow Ofgem to probe the trial details and the costings.

The Panel had one further concern. Even if there is no slippage in the timing of the work plan, the full test facility does not become available until towards the end of the NIC project period and it is clearly important that sufficient trials are undertaken to justify the considerable conversion cost. The Panel understood that some parts of the conversion will be completed earlier on, allowing certain of the trials to go ahead before the full work is completed.

Finally the Panel expressed concerns about the costs of maintaining and running the test facility past the NIC period, to ensure it remains both cost effective and available for future use. NGET assured the Panel that this would be an issue that the TAB would actively review.

2.2.9 **Conclusions.**

The Panel recommends that this project should be funded subject to the following conditions.

Ofgem should approve the final estimates for the conversion costs prior to work starting.

In addition, if the trials (or trials achieving similar benefits to the GB transmission system) are not achieved in the NIC timescale, NGET should continue to maintain the facility at their own cost until the trials are complete or return an appropriate proportion of the conversion costs.

The Panel remains concerned about the future of the facility following the NIC period. It was recognised that from the narrow perspective of this competition, if all the trials are completed within the period, then the benefits are such that the use of £12m of NIC funds would appear to be justified. However, it was felt that Ofgem should engage with NGET at least one year from the end of the period to examine the options for how the facility will be managed and paid for following the NIC period.

2.3 Telecoms Templates for a Low Carbon Future

Western Power Distribution (WPD)

NIC funding: £12.6m

Total cost: £14.2m

2.3.1 The Proposed Project.

Telecommunications will play an important role in the successful deployment of smart grid solutions. Identifying appropriate telecommunication links and ensuring they work to the standard required (and at the lowest cost) has presented DNOs with a real challenge. The submission notes "from a DNO perspective, communications are commonly considered to be the single biggest challenge for active network management deployment at distribution level (and future networks as a whole)". By way of example, WPD commented on the problems they faced integrating some equipment from a major telecom vendor into the Falcon project.

To address this problem, WPD proposes to undertake a 'global appraisal' to determine the communication requirements of smart grids. They plan in particular to draw on the experience of previous Low Carbon Networks Fund (LCNF), NIC and similar projects to understand the associated smart grid challenges; they also plan to hold interviews across Europe and 'globally' in order to build a picture of what is required and where the problems lie. They will, at an early stage of this project, carry out workshops and interviews to gain an agreement on likely future smart grid applications; they will also evaluate available telecom technologies and services and determine how these fit with the agreed 'functional templates' of potential smart grid applications. As an output from their initial work stage, they plan to create some 'baseline templates' linking the telecom systems and the electrical network applications and provide a telecoms encyclopaedia intended to provide an easy source of reference on the language used by the different technology sectors. Throughout, the project will be addressing the important criteria of: security, quality, performance, scalability and cost.

Working with Newcastle University they will establish a test laboratory that will undertake trials to validate the capability of the telecoms solutions in terms of the key criteria as well as integrity, reach and longevity. The applications to be trialled

will be selected based on the work carried out in the first stage. They anticipate there will be 154 individual trials of a range of telecom technologies for each smart grid service. For selected applications, field trials will be undertaken to determine the robustness of the solutions under realistic conditions.

Finally, the results will be integrated in a 'solutions finder' to assist the DNO network planners with understanding the most suitable telecoms approach for particular applications and its current availability and reach.

WPD undertake to continue to support the Newcastle telecoms laboratory following the end of the NIC project.

2.3.2 **Carbon, Environmental and Financial Benefits.**

Making available the most appropriate telecoms solutions is an essential element for delivering the Carbon Plan. The developments in the smart grid sector require telecom links – developments such as active network management and monitoring to make more effective use of assets. In calculating their benefits, WPD have looked at both how telecommunications costs can be reduced by a coordinated 'top down' approach and they have also estimated the carbon and financial benefits from accelerating the full implementation of LCNF smart grid projects by two years. Apart from the large benefits associated with the more efficient roll out of the Carbon Plan, the specific carbon benefits arising from more efficient deployment of the relevant LCNF projects would provide considerable carbon and financial benefits. If this approach is adopted across GB the assumptions used suggest savings in the £1-2bn region.

The Panel recognises that this is an important area and that providing fit for purpose telecoms will considerably enhance the effectiveness of the smart grid revolution and provide associated benefits. It also recognises that this is a difficult area in which to robustly quantify benefits.

2.3.3 **Value for Money.**

This is an expensive project. The total cost is £14.2m; the second stage (laboratory and field testing) costs around £11.6m. A large proportion of this money is allocated

for subcontractors and IT. The plan is for WPD (and its in-house telecoms company) to go out to subcontractors once the early work has been done and specify the requirements. In some cases specific work packages have been clearly specified (Newcastle University and the cost of adapting their laboratory facilities) and in others there is a line item for a particular task: eg providing the 'solution picker' at £1.8m.

The Panel was uncomfortable with the lack of clarity around how the money would be spent following the completion of the first stage.

2.3.4 **Generates knowledge.**

This area of investigation has the potential to create a considerable amount of knowledge for the DNO companies. WPD intends to manage this work primarily through its in-house telecom company, Surf Telecom. WPD noted, "Surf Telecom has the most comprehensive in-house telecommunication oversight of any UK distribution network operator" with a full time staff of 86 employees. This project has received letters of support from Scottish Power, industry groups and others. The work plan includes a detailed dissemination programme.

2.3.5 **Innovative.**

The project was considered by the Panel to be innovative and could potentially provide valuable new learning.

2.3.6 **Other Partners.**

The project proposal had apparently been prepared with the help of Siemens and there was an expectation that Newcastle University would be engaged to provide the laboratory testing facilities and assist with some of the trials. At this stage, there were no other nominated partners or suppliers. However, Scottish Power as well as the Joint Radio Company, National Grid and EDF were named as collaborators or supporters, but with no specifically assigned roles (apart from Newcastle University).

The Panel recognised WPD's preference for waiting until after the award of the project before developing bid packages for the purposes of selecting suppliers.

However, this meant that from the Panel's perspective, exactly who would play what role with what budget was extremely opaque.

2.3.7 **Relevance and timing.**

The Panel considered this project to be both relevant and timely. Given the potentially rapid pace of change, the Panel questioned whether the proposed approach would be sufficiently future-proofed.

2.3.8 **Robust methodology.**

The Panel (and the consultant who was asked to assist the Panel) had some very real concerns about the methodology. While recognising the validity of identifying specific applications associated with current smart grid issues, the Panel would have liked to have seen more of a 'systems approach' designed to examine what the DNOs' communications requirements were likely to be associated with the existing and proposed smart grid developments. It seemed to the Panel, for example, that in practice, for scale roll-out, the design of the smart grid solution and the requirements for telecoms would be considered together and choices made to optimise the overall systems solution. Similarly, a clearer methodology on how building an understanding of telecoms developments and their applications in different industrial sectors would potentially be helpful. The initial stage of evaluating likely future communication requirements for smart grids (and a preliminary evaluation of the essential characteristics required by the network) is very much the cornerstone on which this project is built. The Panel was not convinced that the approach that was to be adopted or the proposed cost allocated to this first stage would provide an adequate foundation.

Secondly, the Panel questioned whether WPD, together with Newcastle University, were either the most appropriate or cost effective organisations to rigorously test the various applications. It is the role and responsibility of suppliers to meet the specifications outlined by the industry and to ensure that the applications work and associated on-going support is provided. The Panel recognises that considerable expertise may be required to specify the appropriate telecoms solution and integrate it onto the network. However, the Panel considered that in many instances suppliers might be better equipped to collaborate on designing the appropriate solution(s), to

test whether the equipment was fit for purpose and so retain and manage any relevant telecoms risks. WPD pointed out that many telecom suppliers considered this to be a market of little interest – particularly compared with the consumer marketplace. It was also WPD's view that many of the applications would be point to point and given the limited telecoms coverage of parts of the rural areas would not require a high tech telecoms solution.

A third concern of the Panel was that this appeared to be a slightly 'static' approach to what might be considered a rapidly changing market. If the DNOs do embrace some of the existing ideas for monitoring and controlling their assets on the network, as well as running a marketplace for supplying electricity flexibility services, then it is possible that the level of complexity associated with telecoms might well shift into a higher gear. WPD argued that the telecommunications that they are installing in new, or retrofitting to existing, equipment today may easily need to be there for many years to come and that, given the nature of electricity distribution, they did not anticipate dramatic changes in the applications or requirements.

2.3.9 **Conclusions.**

The Panel considered this a very important area for investigation. It wholeheartedly supports WPD in its desire to provide more clarity on what will and will not work in relation to the available telecoms and the developing smart grid industry. However, the Panel was uncomfortable with the approach and the cost. If this had been a more limited project to investigate and come up with recommendations for appropriate ways to specify telecoms requirements and potential solutions for current known grid applications at a very much lower cost, then the Panel would have had less difficulty in recommending that it should proceed. However, given the cost and very broad scope of the project, the Panel was concerned about the robustness of the methodology, the lack of high level strategic telecoms expertise as part of the core project team and the lack of clarity about who would do much of the work and what their specific role would be.

Based on the above, the Panel is unable to recommend that the Authority should fund this work.

2.4 Celsius

Electricity North West Ltd (ENWL)

NIC funding: £4.7m

Total cost: £5.6m

2.4.1 The Proposed Project.

This project addresses the problem associated with increased loads in the low voltage distribution network – an increase partly arising from the adoption of Low Carbon Technologies (LCTs). The higher loads increase the heat generated in the 11kV/415V transformers and adjacent 415V cables at distribution substations. Each substation has an 'assigned capacity rating' and where the substation load exceeds this rating, some or all of substation has to be replaced with new, higher capacity equipment. However, the life of this type of equipment is really determined by its internal temperature, which in turn depends in part on the ambient temperature and the profile of the load current. Thus even when the load current is higher than the nominal rating, if the temperature remains within the safe operating range, the need for replacement is avoided. Replacement is costly and disruptive.

The project will measure temperature and load at 520 distribution substations (51 pole and 469 ground mounted). These will be selected from ENWL's fleet of distribution substations to provide a representative sample. ENWL note that it is impractical to measure the temperature of the core of every distribution transformer, so the goal is to develop a methodology to allow the internal hotspot temperatures to be estimated from the measured external temperature and load. This methodology will be developed by undertaking detailed internal measurements from 21 distribution substations; this will involve internal measurements using sensors within the transformer and demonstrating the relationship between the internal temperature and the substation ambient temperature and load. Similar relationships will be developed for low voltage cables.

The data from these trials will be used to develop a Thermal Rating tool designed to assist DNOs determine available capacity based on the external temperature of the transformer, the load current (which may in future be obtained from Smart Meter data), and the ambient environment.

The project will also examine different ways of enhancing the cooling of transformers and the adjacent cables to enable extra capacity to be released. A range of interventions are proposed (including fans for transformers and novel backfill materials for cables) and their value will be assessed against a range of criteria (cost, safety, ease of installation, etc).

The University of Southampton have been engaged to examine whether running these assets at a higher loading is likely to affect their useful life.

2.4.2 **Carbon, Environmental and Financial Benefits.**

In their presentation, ENWL noted that the growing number of LCTs being connected to the network is increasing the loading on distribution substations and potentially necessitating their replacement. This project will increase the ability of the distribution network to manage this change associated with the delivery of the Carbon Plan. The benefits therefore arise from the delay (or avoidance) in replacing substation assets through securing more efficient use of them. ENWL claim that this method will enable DNOs to deliver additional thermal capacity up to much faster than traditional network reinforcement techniques. The benefit case depends on the mix of trials adopted; within ENWL benefits of around £43m are claimed by 2050; a considerably higher figure is shown for financial benefits if the solutions developed by the project are rolled out across GB.

2.4.3 **Value for Money.**

The Panel was satisfied with the approach adopted for selecting suppliers and managing costs.

If this project is successful, the learning created should result in considerable savings on the network and, as such, the Panel considered it to be value for money.

2.4.4 **Generates knowledge.**

The Panel considered that this project has the potential to generate information that will be of considerable value to DNOs. The trials will provide data on acceptable operating limits based on external temperature measurements, as well as offering a

means of prioritising interventions and the practicality of various cooling techniques. The Panel was concerned about the possibility that other DNOs would not be comfortable exceeding the traditional rating limits (based only on load current) and noted that this would require a change in a number of operational practices. ENWL have a detailed and well-constructed dissemination programme designed to engage with the wider industry, including manufacturers, in a timely way. In discussion with the Panel, they recognised the need to address early in the project how the industry could develop standards for determining asset load-carrying capacity, based on thermal modelling and measurement, rather than the existing reliance on nameplate ratings.

2.4.5 **Innovative.**

The Panel considered the innovative aspects of this project included: inferring the capacity of the transformer from external temperatures, the use of Smart Meter data once available to determine load history, examining cooling and better heat dissipation techniques and creating a tool for network planning and operation.

2.4.6 **Other Partners.**

Four partners were selected: Ricardo-AEA, Impact Research, Ash Wireless and UK Power Networks. A contribution was negotiated with each of these partners. The Panel was pleased to see the inclusion of another DNO (UKPN) – they will play a particular role in the selection of trial sites. All DNOs will be invited to a workshop to shortlist trial techniques. The Panel had some concerns that there was insufficient transformer expertise within the team; however, a specialist with direct experience of transformer thermal ratings has been engaged from Southampton Dielectric Consultants.

2.4.7 **Relevance and timing.**

The Panel considered this project to be both relevant and timely given the increase in LCTs on the distribution network.

2.4.8 **Robust methodology.**

The Panel considered the project to be extremely well designed and presented with considerable clarity.

The Panel had two concerns. Firstly, the success of the work depends on building a reasonable and robust set of relationships between the external transformer temperature, load current and the temperature at the core. This is a non-trivial technical problem: it is difficult and relatively expensive to measure directly the thermal hotspots in these transformers. This was recognised by the ENWL team and it was pointed out that there was no intention of running these assets to a precise limit and, as such, the aim was not to provide precise internal measurements, but to determine at a more general level whether the transformer running at a higher load could do so without overheating.

The Panel was also concerned about how comfortable the industry would be in running an asset at a level above the manufacturer's rating; however as noted above, there is a well thought through dissemination programme that should address this concern. The Panel would like to stress the importance of working with the industry to ensure acceptance of this concept, providing the trials are successful.

2.4.9 **Conclusions.**

The Panel recommends that this project is funded and commends the well-constructed and presented proposal.

2.5 Angle-DC

SP Manweb PLC (SPMW)

NIC funding: £13.1m

Total cost: £14.8m

2.5.1 **The Proposed Project.**

The project addresses how a Medium Voltage Direct Current (MVDC) link could be used to provide increased network capacity to facilitate the integration of higher levels of generation into a distribution network. The island of Anglesey is experiencing rapid growth of low carbon generation and SP Manweb Plc (SPMW) are implementing a scheme to install another 132/33 kV transformer circuit to increase capacity to/from the island. When this is complete, the present arrangement of operating the 33 kV distribution network on the island fully interconnected with

the mainland cannot be maintained with the increased power flows, and the two 33 kV circuits presently connecting the island and mainland will need to be opened, rendering them largely redundant.

SPMW propose to re-use the existing 33 kV cables and overhead lines connecting Bangor to Llanfair PG to provide a new fully controllable power link. In a traditional alternating current circuit the intrinsic impedances of the network and the voltages determine the power flow in a passive manner. In contrast the flows in an MVDC link are fully controlled by the network operator and so power can be routed away from overloaded circuits. The effect of the link will be to provide an additional export capacity from Anglesey of 30.5 MW. The converters can also be used to control voltages on the adjacent 33 kV networks and so reduce network losses.

The link will use Voltage Source Converter (VSC) power electronic technology in a novel way to form a point-point link and will be the first installation of its kind in UK distribution networks. The creation of an MVDC link re-using sections of established overhead lines and cables is particularly novel and the trials will demonstrate how practical it is to change the operation of existing 33 kV circuits from alternating to direct current.

SPMW, supported by an experienced consultant from Parsons Brinkerhoff, has undertaken considerable preliminary work with the main suppliers of this type of equipment – sufficient to develop budget prices. A draft specification for the main equipment has been written and a competitive tender for its procurement will be held early in the project. There has also been engagement with the academic community, where there is considerable research activity funded by the EPSRC on MVDC, and an academic partner will be chosen within 3 months of project start.

2.5.2 **Carbon, Environmental and Financial Benefits.**

SPMW argue that creation of this link will allow local renewable generators to be connected to the system. The MVDC technology should thus enable a potentially considerable uplift in capacity including distributed generation. The Panel found it difficult to determine the extent of the benefits associated with this project. The main

difficulty was identifying what alternative intervention would be open to SPMW and when this would be required.

This scheme is predicted to reduce electrical losses in the local AC networks on Anglesey and on the mainland. SPMW estimate that the average network loss reduction from using this technique will be around 20% - the improvement arising from the enhanced voltage control capability of MVDC.

The Panel also had some difficulty in determining how widespread the application of this type of intervention would be. The submission suggests that there is at least one further site in the SPMW area and at least 25 sites within GB where this method could be replicated.

On this basis the Panel considered the scheme would offer real savings and would provide a useful approach to enhance distribution network capacity in certain situations, including the connection of renewable distributed generators.

2.5.3 **Value for Money.**

This project will provide considerable learning on the practicality and benefits associated with MVDC at the distribution level. The Panel was satisfied that the procurement approach adopted should ensure that the link is sourced competitively. No final decision has been taken on whether the MVDC technology is scaled up from existing industrial products or scaled down from the technology used on HVDC links.

The project is costly. SPMW argue that part of this cost arises from the new parallel 33 kV AC cable that is in part necessary to avoid disruption should the MVDC implementation run into difficulties. The additional 33 kV cable would not be necessary for future applications.

On balance, the Panel was satisfied that this project could be considered value for money given the learning that would be created, the potential for loss reduction and the potential benefits arising from connecting additional renewable generation and other low carbon technologies.

2.5.4 **Generates knowledge.**

The Panel recognised that the local network configuration makes this a very suitable area to test the MVDC circuit. The project would create considerable learning, on the practicality of MVDC technology being applied to links at the distribution level, on aspects to be addressed with the consenting authorities, on the re-use of existing AC overhead lines and underground cables to carry DC, as well as providing guidance for other DNOs on design, maintenance and operating procedures.

There are some similarities with the WPD Equilibrium LCNF project, which used back-to-back VSCs in a single location. The Panel questioned SPMW on the additional learning that would be created by Angle-DC: the Panel was satisfied that there would be additional learning, in particular arising from the convertors being deployed at opposite ends of a distribution circuit stretching for 3km, and the re-use of an existing AC line and cable. Angle-DC also requires the development of systems to control and protect the circuit.

The Panel was concerned that the testing period was limited to six months and should there be delays in consenting or construction, then there was potential for the monitoring and evaluation to be delayed beyond the end of the project. SPMW committed to keeping the project on time and have in their final submission extended the project period by two months for closedown activities. SPMW have also committed to continuing to provide monitoring and evaluation data to other DNOs following the end of the project once the DC line was in regular use.

The Panel was advised by SPMW that they had identified a number of specific sites within several different DNO areas, where there would be potential to employ this solution.

2.5.5 **Innovative.**

The Panel considered this project to be innovative. It will involve the deployment of VSCs at the distribution level (this technology is already proven as HVDC on the transmission network); this technology has considerable benefits in controlling power and reactive power flows. It has not been so far deployed commercially at the

distribution level. In addition, the re-use of the AC circuit to carry the DC load is innovative.

2.5.6 **Other Partners.**

SPMW note that no project participants have been appointed, but that they have been engaged with the main suppliers of MVDC technology and also those who are expected to provide engineering and consultancy support. The Panel considered that the expertise that would be brought to the project by a company such as Parsons Brinckerhoff (who attended one of the bilateral meetings as the technical adviser) would be important to the success of this project.

The project also has a wide range of supporters including the Welsh Government, Anglesey County Council, WPD and SSE Power Distribution.

2.5.7 **Relevance and timing.**

In relation to this specific project, the Panel understands the importance to the economy of Anglesey of renewable generation. The MVDC link will increase the amount of renewable energy that can be transferred to the grid. It was difficult to ascertain how urgently this connection is required given the other works that SPMW are undertaking, including those provided for under RIIO-ED1. However, from the perspective of trialling MVDC technology, the Panel did consider that this was both timely and relevant to the Carbon Plan.

2.5.8 **Robust methodology.**

The Panel considered the methodology to be sound and clearly set out. As noted, the Panel was concerned about whether sufficient time had been allowed within the project period for adequate monitoring and evaluation, but was satisfied with SPMW's undertaking that information would continue to be supplied subsequently. The Panel noted that public perceptions of this new approach could potentially be an issue and SPMW have incorporated this in their stakeholder engagement plans.

2.5.9 **Conclusions.**

The Panel recommends that this project is funded through the NIC subject to the following condition. When the work is complete, SPMW should provide Ofgem with

an assessment of whether this link had enabled SPMW to reduce any of the network reinforcement work for the area already agreed under RIIO-ED1 , or outperform on any related incentives/allowances, and, if so, an appropriate proportion of the RIIO-ED1 allocation should be returned to customers.

2.6 Future Intelligent Transmission Network Substation (FITNESS)

SP Transmission PLC (SPT)

NIC funding: £8.3m

Total cost: £11.0m

2.6.1 The Proposed Project.

This project is to demonstrate a fully integrated digital substation with associated protection, control and monitoring. In their submission, SPT note that control and protection requirements are changing significantly as low carbon generation and DC interconnections increase; and that these changes are introducing new challenges for the traditional network control and protection functions. In addition, they argue that conventional substations allow little flexibility for adopting the necessary new monitoring, protection and control functions – especially where these are to be linked with external measurements and information systems. Carrying out retrospective work to fit such equipment is difficult. They also note that it is currently difficult to access the necessary measurements from conventional instrument transformers and this impedes the use of wide area monitoring and control technologies and applications.

The proposed project will equip two bays of a 275 kV substation with new fully integrated digital controls. These will be run in parallel with more conventional technology for a trial period and will then be operated as business as usual. The project will also trial new sensor technologies for voltage and current measurements. The substation will be designed with digital communications using fibre optic cables instead of the analogue signals using copper cables from switch yard to control building. SPT will use two vendors with the specific objective of ensuring that the equipment is interoperable; non-proprietary equipment and the development of common standards that are not manufacturer specific should in the longer term encourage further innovation and reduce costs.

SPT argue that by digitising the communications within the substation, they will be able to increase controllability, reduce environmental impact, improve substation safety and allow for faster deployment where network improvements are needed – they should also reduce costs.

2.6.2 **Carbon, Environmental and Financial Benefits.**

SPT believe that this project will increase the efficiency and reliability of the network and will support the Carbon Plan by allowing the integration of more low carbon generation – particularly wind. In the submission, SPT state that implementing the digital substation will allow them to increase the availability of the network to wind generators by reducing outage time when carrying out substation replacement and modernisation; a digital substation will also allow for a greater use of the network through the improvements in visibility and control of actual operating conditions. In particular this technology will support the deployment of wide area network monitoring and control, which are the subject of previous NIC projects, such as VISOR and EFCC. SPT state that the project will also reduce the environmental impact of substations and through decoupling wires enhance safety. In the submission, a number of assumptions are made, demonstrating a considerable carbon saving.

By the end of RIIO-T2, SPT assume a 10-12% reduction in the cost of new build and replacement substations and a 4-5% reduction in constraint payments. In calculating their benefit case, they have not included the potential benefits to DNOs and OFTOs.

2.6.3 **Value for Money.**

SPT note that the standard that defines communication protocol IEC 61850 has been widely adopted, but the associated standard 9-2, which requires an entirely different approach to the substation architecture, design and construction has not yet been adopted within the industry. They point out that this reluctance stems from an uncertainty over the technical maturity, performance, reliability and robustness – in particular because there is no experience within the industry of demonstrating how a full IEC 61850 digital substation will work. They argue a key benefit from this project will be providing the industry with confidence in the new systems, allowing

a quicker deployment into business as usual. If the trials are successful, the Panel was satisfied that this project would be of considerable value to transmission and distribution customers, as well as offering financial savings and carbon benefits.

SPT have undertaken a well-designed procurement process in order to select their vendors. They were able to identify the equipment suppliers prior to submitting their proposal while ensuring that the services were obtained at a competitive cost and that a contribution was made by two of the larger suppliers: Alstom and ABB.

2.6.4 **Generates knowledge.**

The project has a well-developed knowledge dissemination plan. PAC World is a member the advisory group for the project – PAC is a specialist journal addressing this sector.

The Panel queried how the results of this project would be used to change the necessary international standards. We understand that SPT, Alstom, ABB as well as the University of Manchester are all engaged with the relevant standards committees and were committed to feeding the findings into the relevant working groups.

2.6.5 **Innovative.**

SPT suggest that the proposed integrated system of protection, monitoring and control is globally innovative. They also note that multi-vendor interoperability has not been proven in a live substation. They see this as a critical step for proving standardization and progressing to business as usual.

The Panel was satisfied that the project is innovative.

2.6.6 **Other Partners.**

The project participants include Alstom and ABB (who together are contributing £1.4m to the project). SPT have also encouraged a UK SME (Synaptec) to participate in the project; they will provide some of the distributed sensing technology. The project will also be supported by the University of Manchester (who are also making a contribution). One of the University of Manchester's key roles is to perform an independent assessment of the proposed substation architecture and equipment and

to perform independent operability tests on the multi-vendor equipment using their laboratory setup. The Panel was concerned about the level of cost associated with the University of Manchester's involvement; following further discussion this has been reduced. The University of Manchester has also undertaken to provide their testing facility to other network companies at a discount of 40% to the price they would normally charge.

Technical experts from NGET and SSE will take part in the project's Advisory Board. The Offshore Catapult has also expressed support for the project.

2.6.7 **Relevance and timing.**

The Panel considered this project to be timely. Digital technology will provide considerable benefits, but its use needs to be demonstrated before it will become business as usual. If successful SPT anticipate that this project will help accelerate its use as business as usual by 8 years.

2.6.8 **Robust methodology.**

The Panel considered this project had a robust methodology and that the project plan was sound and the organisation appropriate. By converting two bays of the substation and running these initially in parallel with conventional protection and control, any risk of disruption to customers is reduced while real experience can be gained and disseminated widely, to form the basis of new standards for design and operating procedures. While the project will deploy the new technology in parallel with a conventional design, SPT expressed confidence that in future, provided the project is a success, digital technology will become business-as-usual.

2.6.9 **Conclusions.**

The Panel recommends this project is funded.

2.7 Evolution

SP Distribution (SPD)

NIC funding: £6.1m

Total cost: £6.8m

2.7.1 **The Proposed Project.**

SPD's stated objectives are as follows:

- To deliver the UK's first trial of a Distribution System Operator (DSO) model.
- To demonstrate how operating a localised balancing market can reduce costs of network operation.
- To facilitate growth in local generation, demand side response and energy storage.
- To aid the national System Operator (SO) to balance national supply and demand.

SPD argue that the DNO acting as a DSO could: offer market access to currently locked-out consumers, improve overall visibility and control of embedded generation by the System Operator and reduce system operation costs throughout GB.

At present the SO can be impacted by fluctuations in generation and demand from below the grid supply point (ie at the distribution level) and in order to balance the system, relies on contractual agreements that enable it to acquire services primarily from larger industrial plants and generators at the distribution level.

At the same time, the DNOs are facing greater stresses on their distribution system and there are limited opportunities at present for actively managing their network by curtailing generation and demand to minimise constraints. Previous LCNF projects have addressed aspects of this issue: in particular, active network management approaches and demand side response at the distribution level have been trialled. There is obviously a potential conflict between the DNO requiring services to manage their system while, at the same time, plant contracted to the SO is required to act in a way to help balance the transmission system.

A further issue that the project would wish to address is the limited ability that smaller consumers and generators have to offer services to the network.

The method to be employed is to convert three Grid Supply Points (GSPs) so that they could each act as a Balancing Mechanism Unit (BMU), contracting with the SO

to provide a range of system services. The DNO acting as a DSO will then recruit participants (generators, consumers, energy storage, developers and aggregators) to provide flexibility services and the DNO will actively manage their network and provide a market for these services that will enable them both to deal with their own constraints and also deliver on their obligations to the SO.

The trials will be held in the East Kilbride area and will cover those distribution systems below the three converted GSPs – which at times are net exporters onto the transmission system.

There are six work packages. The first two are primarily concerned with the design of the system; there is also a work package to identify potential service providers. Following discussions with the Panel, it was agreed that a stage gate would be inserted at this point to allow for a full review with Ofgem of the proposed system and market proposed before funding for the remaining work packages was released. These cover the technical solution design, building and testing the system and evaluation and dissemination.

2.7.2 **Evaluation.**

The Panel recognises the significant potential importance of this project. Ofgem has consulted on aspects of the issue; previous LCNF projects have trialled different elements and it is part of the deliberations of Work Streams 6 and 7 of the DECC/Ofgem Smart Grid Forum. The Panel also recognises that this is an extremely complex area. It has the potential to change existing commercial arrangements and contracts; it will change the way generators and consumers interact and so create winners and losers; it has wider implications for the current network responsibilities and whether the SO or a potential future DSO has primacy over different parts of the network; and the design of the system would inevitably require certain decision hierarchies that would require changes to existing contractual arrangements as well as the development of suitable transition arrangements to minimise unacceptable, sub-optimal outcomes. In terms of primacy, a key question to be addressed is whether the SO's needs of balancing the GB system or the DNO's need for managing their system in order to avoid constraints should be given priority; similarly, if the

DNO is controlling their system, what are the commercial arrangements between the DSO and the SO.

These are all important issues that will need to be resolved. In relation to this project, the Panel had a number of fundamental concerns.

- In the initial submission and the initial round of questioning, it was apparent that SPD had not engaged sufficient expertise to undertake this highly complex work and were unable to satisfy the Panel on fundamental commercial questions. Following the Panel expressing serious concern, SPD was able to present specialists on market arrangements but the Panel could still not get comfortable that the project had been scoped and the different stages costed employing sufficient expertise, nor had the project been established with any clarity around how the many and complex commercial issues were going to be addressed.
- In relation to the methodology, the Panel felt there was a considerable amount of prior work that was needed to sort out commercial arrangements and the hierarchies that will be required for managing the network and to design the market. Many of the decisions taken would have real implications for the way in which Network Licensees and other market actors would need to work together and be regulated and there will be a need to evaluate the pros and cons of different solutions in the context of the wider GB perspective. Although SPD envisaged that National Grid and Ofgem would play a role in this, it was not clear to the Panel that sufficient detailed work was likely to be undertaken as part of the early stage of this project to provide the information on which the most appropriate way forward could be selected.
- The Panel did recognise there was a case of supporting this project on the grounds that any work in this area will help to build experience to inform changes that many consider to be potentially beneficial and inevitable. However, there are a number of specific areas of the methodology in addition to those already noted that concerned the Panel.

Firstly, the Panel would have expected to see a detailed feasibility study as Stage 1, to determine whether the costs to all parties associated with establishing and managing a DSO market would really create sufficient benefit, or whether a more technocratic approach to achieving the same goals would be less expensive and less disruptive. The Panel considered for example, that some of the fundamental issues could be identified, and options developed, through using computer simulation as part of a feasibility study. Furthermore, should a market be established at the distribution level, it is essential that the likelihood of certain unintended consequences arising would need to be addressed to ensure the reliability of the system was not and would not be put at risk. It is also not self-evident who should take responsibility for acting as DSO at the DNO level.

Secondly, there are concerns over whether there were sufficient un-contracted services available on the system in that area (ie below the 3 selected GSPs) and whether in practise the organisations that could offer these services would play in a market; whether there are economies of scale for such a DSO role; and whether any valuable new learning can be gained when trialling a market unless there are winners and losers (the trials proposed only create winners for the market participants).

2.7.3 **Conclusions.**

The Panel recognises that this is an enormously important topic that needs to be explored and commends SPD for addressing this issue. The Panel did not consider the methodology to be robust nor was the Panel confident that the project was adequately resourced.

The Panel is unable to recommend that this project is funded.

This is possibly an area where Ofgem should take the lead in close collaboration with all the potential market participants and the network companies.

Alternatively, the Panel would welcome a DNO led project that firstly used an NIA project to disentangle the issues and clarify how each participant would be impacted and in particular identified the decisions that would need to be taken, by whom and

in what order. The Panel believes that some computer simulations might be an appropriate means of examining the implications of alternative approaches.

As highlighted above, we would expect any project that planned to trial a localised balancing market would have as its first stage such a detailed feasibility study that would examine the practicalities and costs and would engage a wide number of stakeholders; there should then be a well-defined decision process before any trials were commenced.

3 Recommendations for funding

3.1 Based on the Evaluation of the submissions set out in the previous section**, the Panel recommends that the Authority agrees to fund the following projects.**

- **Celsius - Electricity North West Ltd (ENWL) - £4.7m requested (£5.6m in total)**

- **Future Intelligent Transmission Network Substation (FITNESS) - SP Transmission PLC (SPT) - £8.3m requested (£11.0m in total)**

3.2 **The Panel recommends the following should be funded subject to conditions to be agreed with Ofgem.**

- **New Suite of Transmission Structures (NeSTS) - Scottish Hydro Electric Transmission PLC (SHE** Transmission**) - £6.6m requested (£7.5m in total).** At the end of Stage 1, Ofgem should be responsible for agreeing whether or not Stage 2 should proceed based on the anticipated cost savings and other benefits that the roll out of these structures would deliver. A further SDRC should be put in place to require SHE Transmission to assess the need for a customer engagement plan and data protection strategy early in the project.

- **Offgrid Substation Environment for the Acceleration of Innovative Technologies (OSEAIT) - National Grid Electricity Transmission PLC (NGET) - £12.0m requested (£26.0m in total).** Ofgem should approve the final estimates for

the conversion costs prior to work starting. If the trials (or trials achieving similar benefits to the GB transmission system) are not achieved in the NIC timescale, NGET should continue to maintain the facility at their own cost until the trials are complete or return an appropriate proportion of the conversion costs. Ofgem should engage with NGET at least one year from the end of the NIC period to examine the options for how the facility will be managed and paid for following the end of the project.

- **Angle-DC - SP Manweb PLC (SPMW) - £13.1m requested (£14.8m in total).** When the work is complete, SPMW should provide Ofgem with an assessment of whether this link had enabled SPMW to reduce the reinforcement work, or outperform on any related incentives/allowances agreed under RIIO-ED1, and if so an appropriate proportion of the RIIO-ED1 allocation should be returned to customers.

3.3 The Panel recommends that the Authority does not fund the following projects:

- **Telecoms Templates for a Low Carbon Future - Western Power Distribution (WPD) - £12.6m requested (£14.2m in total)**

- **Evolution - SP Distribution (SPD) - £6.1m requested (£6.8m in total)**

4.0 ADVICE FOR FUTURE COMPETITIONS

Ofgem may wish to communicate the following points to the companies and where relevant incorporate them into any revisions to the Governance Document

4.1 Clarity of Proposals.

While a number of the submissions were very clearly written, a significant minority lacked clarity, failed to inform and placed too much emphasis on 'selling the idea' as opposed to describing exactly what the team proposed to do at each stage of their project.

The Panel would find the following helpful.

- The problem should be briefly described: a lengthy explanation is usually unnecessary. To enable a clear understanding of the project benefits, it should be clear to the Panel what the outcome will be if the Project is NOT to proceed.
- The tasks to be undertaken should also be clearly described and referred to consistently (by name or number); where the work is undertaken in stages (or work streams), again these should be described consistently (by name or number).
- The section dealing with compliance with the project selection criteria should be organised with a separate section dealing with each of the criteria/sub criteria. Each of these should include supporting evidence and should be as brief as possible.
- The appendices should be well focused and informative and only used to provide essential information. The information provided in the appendices should support the information in the main body of the submission and should be summarised in the main text.
- The Panel should be able to cross-reference data in the report and appendices with that in the spreadsheets.

In addition the Panel has less confidence that a project methodology is robust and the work will be executed successfully if extensive changes are made to the approach and/or the team following the initial bilateral discussions.

4.2 Engagement of Senior Management.

The Panel believes it is important that senior management should understand at an early stage the nature of the bid that is being put forward on their behalf. It was clear that for more than one of the projects presented this year, the senior manager attending the Panel appeared to only fully understand the implications of the work as the meeting progressed. These meetings also exposed a number of flaws and it is possible that questioning by a senior manager at an earlier stage would have ensured that these problems were properly addressed.

It could perhaps be helpful for the bid team to present their proposed project at a relatively early stage to a sceptical audience within the company. This 'devil's

advocate' approach would help identify problems and allow these to be addressed before the submission was completed. It could also provide useful feedback to help shape dissemination plans.

4.3 **Partners and Expertise.**

Some of the bids relied heavily on external expertise – and in some cases the proposal itself appeared to have been prepared largely by an external supplier. The Panel strongly supports the inclusion of external expertise (see below), but believes it important that the company should 'own' their bid and that they should have a grasp of the entirety of their own project.

As technological and commercial innovations continue to offer new opportunities for non-traditional solutions to Smart Grid problems, it is to be expected that the companies may not have sufficient specialist expertise to undertake the proposed work in-house. This year, in a number of instances, the Panel was not convinced that the project teams doing the presenting had sufficient expertise to carry out the proposed work. In most cases this was subsequently remedied. However, the Panel finds it difficult to recommend that a project should be funded if there is insufficient indication of how the expertise will be provided or if it is apparent that the team presenting the proposal does not fully understand what is required.

Buying in the expertise does pose a dilemma. The Panel recognises that some companies prefer not to procure the expertise until they have secured funding as they believe this allows them to ensure competitive bids. But without the prior involvement of such participants, the Panel has no opportunity to test whether the expertise is sufficient to undertake the work, or indeed if the experts that are selected will be given a large enough role in the planning and execution. In addition the submission may lack sufficient technical input on key topics.

Where expertise central to the success of the project is required, the Panel would prefer for the companies to:

- Identify the expertise required and the specialist organisations that can supply it using a full procurement process and then formally involve the preferred bidders at the proposal and presentation stage.

- Where this expertise is critical to the success of the project, the Panel would expect to see such organisations having a lead role in the work and being provided with sufficient resources and authority within the team. The Panel would also expect to see the key external experts at least at the initial bilateral.

Finally, the Panel needs to be assured where individual specialists or very small companies have a pivotal role that the additional risk to a project that may continue for six years is fully understood and contingency arrangements fully outlined in the risk section of the bid. There is a strong case for encouraging small, innovative SMEs to be part of the bid team, but these do need to be embedded in such a way that the project will not be harmed should they be unable to fulfil their role.

4.4 **Governance.**

A number of the projects this year involved other network companies as important participants – with roles such as prioritising trials, determining appropriate trial sites or involvement post the conclusion of the NIC period. The Panel is a strong supporter of cross industry arrangements and the early involvement of other relevant parties – in particular because it brings different perspectives to the project and helps with eventual dissemination, potentially leading to faster adoption of the solution being trialled.

However, the Panel would like to see these arrangements more formalised. Rather than just including letters of support and a plan for consultation, there should perhaps be clearer statements in the submission supported by exchanges of letters that specify the role of such participants, a demonstration of their willingness to commit resource and, where relevant, how decision making will be carried out at key points in the project.

4.5 **Costs.**

It is essential that every submission includes a summary table of the costs of the work to be undertaken; this summary should be presented in the main body of the submission. The summary should include as a minimum:

- Total Costs shown for each stage and each task analysed by staffing, sub-contractors, equipment to be used and other expenditure in cash terms.

- Staffing and Consultancy Costs for each stage and each task indicating the number of staff to be used (FTEs), the number of days required, the cost per day and the total personnel cost per stage; where outside suppliers are being used (eg consultants, contractors), their cost should be presented in a similar format.
- The main submission should also include a brief statement on the basis on which these costs have been calculated to enable assessment against the value for money criteria.

4.6 **Financial Benefits.**

In many cases, the Panel found the financial benefits very difficult to understand. The information provided in the underlying spreadsheets frequently did not agree with the appendices or the information in the main body of the submission. The assumptions underlining the calculations and the way in which the benefits were presented (eg NPV, cash basis, etc) varied considerably. The assumptions made and the scenarios used to underpin the calculations also differed between proposals.

The Panel would find it helpful if:

- There was a clear narrative describing in words the benefits and how they were calculated and, where relevant, providing a context for the benefits (eg the overall value of GB losses, or the estimated value of constraints on the DNO's network).
- Only one set of scenarios about the future network development should be used: the narrative can refer to the sensitivity of the outcome to other scenarios (eg 'should the Carbon Plan be accelerated, the benefit over the period would double').
- The Net Benefits spreadsheet should set out the costs and benefits for each year up to 2050; this should be accompanied by a note listing the key assumptions.
- A description of the key assumptions should be incorporated in an Appendix to the main report.
- The information in the main body of the text should be prepared on a Net Present Value basis. The appropriate discount rate to be applied is that used in the RIIO-ED1 CBA Tool.
- A summary of the NPV analysis should also be provided in the Appendix; enough information in the spreadsheet should be provided to allow the Panel to

independently calculate the Net Present Value from the summary in the appendix.

- A breakeven analysis would also help illustrate what level of benefits, and broader up-take of learning from the project, would be required to cover the cost of the NIC grant.

4.7 **Carbon Benefits.**

Carbon benefits are notoriously difficult to estimate. They depend on a series of assumptions relating to the future of the network, the success of the trials, the type of carbon emissions that are included and, where relevant, the price of carbon.

The Panel would propose that the carbon calculations are limited to:

- A narrative that describes how the project will assist in the delivery of the Carbon Plan and/or, where relevant, what the other environmental benefits will be.
- A description of the assumptions made relating (for example) to the additional capacity to be released, the amount of extra generation that can be connected, the amount of losses that will be avoided (where these are quantified, they need only be quantified for the years 2020, 2030, 2040 and 2050 and it should be clear what area is referred to, eg the transmission system, the DNO's distribution area).
- Where the carbon benefits are quantified, these should be expressed in terms of carbon dioxide emitted in tonnes (or tonnes equivalent) per year for the same years (2020, 2030, 2040 and 2050).

5. Acknowledgements

The Panel fully recognises the amount of work that each of the bids requires and the amount of time that is required to address the follow up questions that arise. The Panel would like to thank all of the companies for the submissions, the level of engagement and their responsiveness at the bilaterals and in written answers to questions.

The Panel is also extremely grateful to the Ofgem Team that provided exceptional support and hugely facilitated the work of the Panel.