ELECTRICITY NETWORK INNOVATION COMPETITION 2021

REPORT AND RECOMMENDATIONS

Prepared for

THE GAS & ELECTRICITY MARKETS AUTHORITY

By

THE ELECTRICITY NETWORK INNOVATION COMPETITION EXPERT PANEL

November 2021

1 INTRODUCTION

This report, prepared by the Electricity Network Innovation Competition (NIC) Expert Panel, sets out the Panel's recommendations to the Gas and Electricity Markets Authority on the portfolio of projects to be funded in the 2021 Electricity NIC funding round.

Panel Membership

Members of the Electricity NIC 2021 Expert Panel (the Panel) are:

- Maxine Frerk (Chair)
- Mike Kay
- Jiggy Lloyd
- Julian Wayne
- David Newbery

Electricity NIC 2021 proposals

There were three submissions made to the 2021 Electricity NIC which, collectively, bid for £19.92 million of the £40 million available NIC funding. Full details of each submission will be available on the Ofgem website.

The names of the Funding Licensee, titles of the submissions, the total project costs and the amount requested from the NIC Fund are as follows:

Project	Licensee	Project Cost (£m)	NIC Request (£m)
EQUINOX	Western Power Distribution (WPD)	15.38	6.98
BiTraDER	Electricity North West (ENWL)	8.37	6.79
Smarter Heat	Electricity North West (ENWL)	7.14	6.15

Evaluation methodology

The Panel followed the evaluation process set out in the Electricity Network Innovation Competition Governance Document (v3.0, 2017). 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 (Jacobs) 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 and the Consultants 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 and the Panel sent each of the Funding Licensees a number of supplementary questions (SQs) 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, responses to the SQs, the Consultants' advice as well as any additional information that had been submitted via Ofgem or the Consultants from the Funding Licensees. The Panel also took account of information from meetings that were held with the Funding Licensees and any material provided during those meetings. Finally, the Panel reviewed resubmitted bids that updated the originals by providing points of clarification raised at the bilateral sessions as well as correcting any factual errors (note: no material changes to the proposals can be included in these resubmissions). Based on this evaluation, the Panel reviewed the projects against the criteria in the Governance Document. This report sets out the Panel's recommendations to the Authority.

The evaluation criteria used by the Panel to review each submission are as follows (see the 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

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 EVALUATION OF SUBMISSIONS

The following section provides the Panel's assessment of the factors that underpinned its recommendations.

2.1 EQUINOX

Licensee	Western Power Distribution
Total Project Cost	£15.38m
NIC Requested	£6.98m

The proposal

Most pathways for the decarbonisation of heat involve a significant uptake of heat pumps (HPs) with an associated increase in electrical demand and hence impact on networks. EQUINOX aims to release network capacity through the flexibility that can be offered by customers with HPs by trialling three novel commercial arrangements using an existing network flexibility platform, Flexible Power. Flexible Power is already used by five of the six DNOs.

New learning will come from studying the engagement and participation in heat flexibility markets of a group of 800-1,000 network customers in social housing and private homes, the latter recruited by working with an energy supplier (Octopus Energy). The project will compare customer response to three possible commercial methods for customers providing flexibility in their heat demand:

1. An upfront flexibility payment in return for offering a fixed, minimum obligation of flexibility.
2. No commitment to a fixed, minimum obligation but instead more control over the flexibility offered based on (near) real-time signals delivered in an automated way.
3. A mixture of the other two methods.

Panel's Assessment against the criteria

(a) Financial, Carbon and Capacity Benefits

Financial benefits

WPD's business case shows an NPV across GB of £238 million by 2030 rising to £1,107 million by 2050 based on deferred reinforcement and increased liquidity in the flexibility market. For WPD's licence area the figures are £58 million NPV by 2030 and £290 million by 2050. Given that 5 out of 6 DNOs currently utilise the Flexible Power platform (the platform through which the commercial methods

are being tested) the Panel's view is that there are good prospects of GB wide benefits being delivered.

The Panel considers that the Project's chosen counterfactual of increased reinforcement is reasonable, at least in the period to 2030. In the Panel's view time-of-use tariffs and other digital offerings to encourage flexibility are almost certain to be available at some point in future, even without this project. The Panel therefore placed particular weight on the net benefits the project delivers to 2030.

Forecast heat pump volumes are based on the "Leading the Way" scenario from WPD's Distribution Future Energy Scenarios. Recognising the uncertainty, WPD also considered a scenario with a 23% lower level of heat pump growth (based on WPD's best forecast) which showed that EQUINOX would still deliver significant financial benefits across GB.

The Panel noted that there are other optimistic assumptions underpinning this CBA, namely that 100% of customers on constrained sub-stations will take up the flexibility option, and that a household peak demand reduction of around 35% of heat pump demand is achievable. The Panel asked WPD to provide a sensitivity analysis on take-up which showed that even with only 20% of HP customers participating the project still returned an NPV of £200m by 2050. The second assumption is based on a small GB trial and research in other countries where the heat pump regime includes heat storage in hot water tanks that are much less common in GB.

There are also significant uncertainties around the cost of operating the market on an enduring basis, the costs of the in-home equipment required and the share of benefits that will need to go customers to drive participation.

However, the Panel recognises that one of the reasons for wanting to pursue the project is to provide greater clarity around these costs and benefits. Moreover, given the relatively limited costs and the potential size of the prize, the Panel's view is that there would remain a strong financial case for the project even if the benefits were considerably lower than assumed.

Overall the Panel was satisfied that, notwithstanding the uncertainties around many aspects of the business case, there is a strong financial case for EQUINOX, reflecting the very significant impact that

heat decarbonisation will have on the electricity networks and hence the potential benefits from mitigating some of that impact.

Carbon and Capacity Benefits

WPD estimates that with full rollout to GB by 2050, the capacity benefit will total 779 MVA. The forecast capacity benefit would generate a carbon saving of 1,900 tonnes CO_2e by 2050 (836 tonnes by 2030) in the base case. The uncertainties discussed above around the benefit assumptions also apply to the capacity and carbon savings. For example, if heat pump uptake were 23% lower (as in the scenario discussed above) the capacity benefit would be a release of 613 MVA to 2050 (205 MVA to 2030) and the carbon savings 1,495 tonnes CO_2e (501 tonnes) respectively.

The carbon benefit of deferred reinforcement is derived using a conservative estimate of the embodied carbon of reinforcement works. However, in common with all benefit forecasts employed to assess projects that defer traditional reinforcement, there is always the prospect that the carbon penalty associated with traditional reinforcement will in time be reduced anyway by technical improvements and/or alternative techniques.

In addition to avoided reinforcement, WPD envisages the project facilitating the faster adoption of heat pumps by reducing the financial costs of running a heat pump. While not quantified, this benefit could be material. The Panel also notes that shifting demand away from the peak could lead to lower emissions (if generation at peak periods is more carbon intensive than that at other times), and although this was not quantified, its benefits could be considerable.

Overall, the Panel is satisfied that, notwithstanding many uncertainties, there is a strong case in terms of capacity and carbon savings covering both the direct benefits of avoided reinforcement and the broader support for heat decarbonisation.

(b) <u>Value for Money</u>

The Panel noted that in general, the costs associated with the project appear proportionate.
In response to SQs, WPD has indicated that the customer equipment required for the trials (shown as costing £7 million) will be funded by Project Partners through various decarbonisation funding programmes. The assumption is that the participants will have smart heat pumps that do not require modification. This is not therefore part of the NIC funding request and, in the Panel's view, means that the project provides value for money.

(c) Generates new knowledge

The Panel considers that EQUINOX could be a route to valuable new knowledge in relation to the significant challenge of heat decarbonisation and in particular the role of flexibility in domestic heat. The Panel considers that this new knowledge is applicable to other Network Licensees.

As noted above there is currently little GB evidence about likely customer interest in the provision of flexibility through heat pumps or how that would best be achieved, which this project would provide. It would also provide insights on the technical capabilities of heat pumps to provide flexibility.

While the recruitment process may result in a bias towards specific customer groups, complicating the assessment, it does provide access to a statistically significant numbers of customers with HPs allowing the effects to be analysed by demographic and housing type, for example, as well as taking account of the effects of weather and external temperature. A clearer picture of customer behaviour, including the potential for customers to revert to using secondary electric heating, will be obtained through use of smart meter data alongside heat pump performance information and internal temperature monitoring.

Working with at least one energy supplier will provide learning about how the network benefits can be stacked alongside other considerations such as energy costs.

(d) Is Innovative

While heat pumps are widely deployed in other countries, the particular characteristics of the GB market, climate, and housing stock mean that learning from overseas cannot be simply adopted here. While there have been some smaller scale heat pump trials in GB, the Panel considers that the scale of this project, bringing in a wider demographic mix and testing alternative approaches to obtaining flexibility from heat pumps, is innovative.

WPD acknowledges that this project overlaps with other projects on EV flexibility and other smaller heat pump projects but the Panel is satisfied that none of the other projects bring together flexibility solutions for heat pumps in this way.

The Panel considers that the scale of the Project means it meets the criteria of being a limited demonstration project. The Panel considers that given the unproven nature of this Project and the need for scale to capture the range of customer responses, WPD is unlikely to develop it without innovation funding. While there is some prospect of heat flexibility offers being developed unilaterally by aggregators or suppliers this is unlikely to happen in a coordinated way, looking across

all customer segments and properly incorporating network benefits. While competitive offerings by rival companies could lead eventually to a more attractive solution, the cost advantages of developing a single widely used platform would seem to outweigh such possible competitive benefits.

(e) Involvement of other Partners and external funding

The project appears to be well-developed, with key partners (Octopus Energy, West Midlands Combined Authority, Welsh Government and Sero) identified to carry out the recruitment of homes with heat pumps and to develop the supplier offering. These partners are making a substantial financial contribution to the project costs of £7.6 million, predominantly to cover the costs of smart heat pump installation.

Other Partners are Passiv and Guidehouse who bring particular expertise. In terms of DNOs, SPEN is a project Partner and letters of support have been provided by three other DNOs and the Electricity System Operator (ESO).

WPD is continuing to work to bring at least one other supplier on board, which the Panel sees as important to ensure the project is developing a solution that would work for a range of suppliers/aggregators. This compatibility of the solution across multiple suppliers/aggregators will also be facilitated by the use of Application Programme Interfaces (APIs).

(f) Relevance and Timing

Given the significant challenge that GB faces with heat decarbonisation, including on consumer engagement, this project is highly relevant. While the full learning will not be available to inform early work on business plans for the next electricity distribution price control period (ED3 business plans) the results will be available at the end of 2025, in good time for submission of ED3 business plans and there should be enough early insights to help with initial business plan preparation.

(g) Robustness of Methodology and ready to implement

The Panel was generally comfortable with WPD's implementation plans for EQUINOX. The timescales for recruitment were noted to be tight but this – and the risks around recruitment generally – are satisfactorily covered in the risk mitigation plan. With the exception of the recruitment of participants, the project is ramped gradually with most of the initial work being modelling, and design and verification of trials and their methodology.

Conclusion

The panel considers that the EQUINOX proposal satisfies all the evaluation criteria set out in the NIC governance document. In particular, the Panel found the EQUINOX proposal had the potential to deliver substantial new learning and to enable significant financial and carbon benefits, recognising the major challenge the GB faces with heat decarbonisation. **The Panel is therefore recommending EQUINOX to be funded by the Authority**.

2.2 BiTraDER

Licensee	Electricity North West Ltd (ENWL)
Total Project Cost	£8.37m
NIC Requested	£6.79m

The proposal

BiTraDER will address concerns that potential providers have in participating in primary flexibility markets or accepting flexible connection arrangements. Currently, customers can be reluctant to accept a flexible connection and offer flexibility services owing to the risk of curtailment. This results in a lack of competition in primary flexibility markets, making it more challenging and expensive for the DNO to obtain flexibility, and resulting in expensive and carbon intensive network reinforcement. These flexible connection customers are also currently precluded from providing services to the ESO. In addition, when contracted to provide services to the ESO, a distribution customer can be limited in providing services to the DNO – limiting revenue opportunities for customers.

BiTraDER aims to address these issues by creating a secondary market where DNO flexibility service obligations, distribution constrainable connection commitments, and ESO service commitments can be traded between distribution connected customers. This reduces or removes barriers for distribution customers who wish to participate in primary markets, while paying the counterparties to release capacity or take on service obligations.

ENWL have identified three key groups of customers who might participate in BiTraDER:

- Participation group (G1): represents existing and future resources with contracted flexibility arrangements in the absence of BiTraDER.

- Participation group (G2): represents resources without contracted flexibility arrangements (or existing customers with flexibility arrangements for part of their capacity) who might be willing to offer (additional) capacity to BiTraDER on an ad hoc basis.
- Participation group (G3): represents resources who might in future accept a contracted flexibility arrangement in the knowledge that there are ad hoc arrangements in place to trade their curtailment obligations.

The project aims to design, build, test, and deploy a secondary market platform and trading rules considering technical constraints, regulatory requirements, and customers' expectations. BiTraDER will be designed to operate up to near real-time. The project will use the Electron trading platform ElectronConnect.

Panel's Assessment against the criteria

(a) Financial, Carbon and Capacity Benefits

Financial benefits

BiTraDER is expected to provide a benefit to ENWL of – £0.9 million (ie a net cost) in NPV to 2030 and £35.5 million NPV to 2050. If rolled out across GB it would deliver £62 million NPV to 2030 and £581 million to 2050. The benefits come from reduced load related expenditure and reduced curtailment of low-carbon generation. The assessment considers the impacts on both existing resources with contracted flexibility arrangements and the scope to bring in new flexibility resources. The costs of rolling out the system are considered to be low as they are essentially platform costs and the potential benefits are material given the increased reliance that networks will have to place on flexibility going forward. This means that if rolled out at GB level the project would break even within a year, at ENWL scale break-even would be in 2030.

In the Panel's view there are significant risks to the project benefits depending on the levels of customer participation. There are acknowledged to be potential barriers to participation including contractual restrictions, internal customer barriers (eg having to reopen financing contracts), and complexity. However, a major aim of the project is to understand and address these barriers and to provide critical learning about the operation and viability of secondary trading markets.

The Panel considers that the Project's chosen counterfactual of reduced low-carbon generation is reasonable although there could be other ways of addressing the underlying concerns.

ENWL acknowledges that the Ofgem Access and Forward Charging SCR could have an impact on the level of customer interest and take-up. Ofgem has published proposals[1] and a decision is expected in 2022. The Panel notes that there is still significant uncertainty around the direction and likely impacts of these reforms.

Overall, while the Panel sees some very significant uncertainties around the financial case, this is inherent in the fact that this is an innovation project in a fast-changing market. Given the scale of the potential benefits (including the growing demand for and supply of flexibility in lower voltage levels of the networks) – and a belief that developing liquid markets should deliver customer benefits – the Panel is satisfied there is a good financial case for proceeding with the project, while recognising the risks that these may not be delivered.

Carbon and Capacity Benefits

Capacity benefits are expected where BiTraDER enables existing customers to offer flexibility which releases capacity, and where it enables future customers to accept flexible contracts such that the provision of new infrastructure is avoided. Although avoided expenditure on infrastructure is included in the financial analysis, ENWL has chosen not to attempt quantification of the capacity benefit.

Carbon benefits are expected where BiTraDER reduces the curtailment of low-carbon sources of generation in the G1 group which would otherwise require replacement (typically by higher carbon sources). Assuming that the pattern of curtailment identified by ENWL is representative of that across GB and that replacement sources reflect average carbon intensity of the grid, the GB benefit would be approximately 92,000 tonnes CO_2e by 2050 with most of this occurring in the first 6 years following GB-wide implementation. With a 10% lower rate of curtailment reduction the GB benefit would be approximately 81,000 tonnes CO_2e. Carbon benefits of infrastructure provision (whether avoided or deferred) are not claimed.

BiTraDER is also expected to create additional carbon benefits where improved opportunity for flexibility revenue encourages additional low-carbon generation into the market, and that for flexibility in demand stimulates greater use of EVs and other demand-side responses. Shifts in peak demand could also produce carbon benefits, depending on the source(s) used in response.

[1] https://www.ofgem.gov.uk/publications/access-and-forward-looking-charges-significant-code-review-consultation-minded-positions

Overall, notwithstanding the uncertainties in the financial case which apply equally here, the Panel is satisfied that there is a good case for BiTraDER in terms of capacity and carbon savings.

(b) Value for Money

The Panel noted that in general, the costs associated with the project appear proportionate. Electron is able to build on their previous TraDER project in Orkney which helps contain the costs of the project and means the project offers value for money.

While some of the benefits would flow to resource owners, there would be benefits to network customers through a more liquid flexibility market and a reduced need for reinforcement where the costs would be socialised.

(c) Generates new knowledge

The Panel considers that BiTraDER could be a route to significant valuable new knowledge in relation to secondary markets, including on the level of interest in participation in secondary markets, the nature of participants, the implications for participation in primary markets and the benefits that can be achieved. While the DNOs are required[2] to set out in their ED2 Business Plans how they will facilitate secondary trading, this appears to be limited to making data available. Creating an effective secondary market will require a more active understanding of potential barriers to participation and design of effective interfaces between any platform and the DNO, which this project will provide.

(d) Is Innovative

While Electron is engaged in a number of other innovation projects funded through other public funding routes, the project team has indicated that the only other project that it considers similar (in terms of developing a platform, not simply providing consultancy) is the TraDER project on Orkney. While TraDER has a full set of mechanisms for managing all the markets associated with an islanded system, BiTraDER takes the work further by including real-time trading and testing that on a live system. In the Panel's view, the extension of the platform to deal with secondary trading in this way represents genuine innovation.

[2] Ofgem ED2 Business Plan Guidance

As noted above, minimum expectations of DNOs in the ED2 Business Plan Guidance published by Ofgem are to facilitate secondary trading; the Panel's understanding is no other DNOs are proposing anything that would help develop the market in this way.

Given the significant uncertainties associated with the way the market will develop and where the benefits will accrue, the Panel does not consider that the project would be taken forward without innovation funding.

The Panel notes that project partners will abide by the NIC rules for IPR. Given the commercial benefits that Electron stand to gain from participation in the project it is important that other platform providers are not precluded from entering the market, building on the learning that the project delivers. As such the IPR rules are seen as particularly important in this case.

(h) Involvement of other Partners and external funding

Electron has developed ElectronConnect (a platform that supports marketplaces for Scottish and Southern Energy and the ESO) and seems a suitable technology partner for this project. Electron also contributes financially to the project.

Other partners, eg, AFRY and Delta Energy and Environment, are experienced in their relevant areas and contribute to the project.

It is disappointing that the ESO is not a formal project partner, but ENWL and the ESO have agreed a scope of work outlining the ESO's role on the project and if the project is funded, ENWL expect to formalise this through a commercial contract.

Other DNOs are involved through the project's engagement with the ENA Open Networks project.

(i) Relevance and Timing

Given the widespread acceptance that flexibility will be a key tool in achieving net zero at least cost, developing secondary markets to allow parties to trade flexibility commitments is considered relevant and timely.

While there are some uncertainties created by Ofgem's Access and Charging Review, this could work both for and against this proposal and hence the Panel does not see it as a reason not to proceed.

Learning from the project will be available in time to inform ED3 business plans.

(j) Robustness of Methodology and ready to implement

The Panel was generally comfortable with ENWL's implementation plans for BiTraDER and the close involvement of Electron which has clearly developed similar offerings previously.

The Panel was mindful of the risks that customers may not be interested in participating in such a market and were slightly disappointed that no attempt had been made to test the concept with potential customers. However, it was recognised that this would only have provided limited insights in advance of the detailed offer being developed; that indirect evidence of customer interest was available; and that customer engagement will be done in the early stages of the project to feed into project planning.

The project methodology appears sound. It has clear milestones and a phased approach. It also has a stage-gate to cover for the risks associated with the level of customer interest noted above and the broader challenges of live network trials.

Conclusion

The panel considers that the BiTraDER proposal satisfies all the evaluation criteria set out in the NIC governance document. In particular, the Panel found the BiTraDER proposal addressed an important aspect of future flexibility markets, providing valuable learning while building on an established platform to aid delivery. While there are significant risks and uncertainties, this reflects the genuinely innovative nature of what the project is seeking to achieve. **The Panel is therefore recommending BiTraDER to be funded by the Authority.**

2.3 SMARTER HEAT

Licensee	Electricity North West Ltd (ENWL)
Total Project Cost	£7.14m
NIC Requested	£6.15m

The proposal

Most pathways for the decarbonisation of heat involve a significant uptake of heat pumps (HPs) with an associated increase in electrical demand and hence impact on networks. Smarter Heat aims to defer this network investment by developing two new tools – Variable Rating and Customer Flexibility – and packaging them together with a number of existing tools to create a toolkit. This package of interventions is the Smarter Heat method.

Variable Rating builds on earlier innovation (the Celsius NIC project) that established higher static ratings for distribution transformers. In particular, the rating developed by Celsius is for planning and is static (not seasonal) and based on conservative ambient temperature assumptions. Variable Rating will extend this to a near real-time thermal rating utilizing the fact that more capacity can be made available in colder temperatures which is when it is needed to deal with high HP demand.

Customer Flexibility will test customer attitudes to flexibility of heat and quantify the network capacity it can release. The project will carry out research with around 3,300 domestic and SME customers (of whom around 100 are expected to have heat pumps) to explore attitudes to heating. The project will then test the levels of flexibility that can be accessed and its customer acceptability through a pilot with 100 customers of whom it is intended that at least 10 will have heat pumps.

The toolkit will look at how best to deploy these new tools alongside other existing smart technologies.

Panel's Assessment against the criteria

(a) Financial, Carbon and Capacity Benefits

Financial benefits

ENWL is projecting an NPV for its licence area of -£8 million by 2030 (ie a net cost due to the Project and rollout costs), rising to £26 million in 2050. If the project is rolled out GB wide, ENWL is

projecting an NPV of -£1 million by 2030 (again a net cost) rising to £409 million by 2050. This financial case has been built bottom up by comparing the interventions that would be deployed at individual substations with and without Smarter Heat tools. The Panel was concerned about the relatively long delay in delivering net benefits (beyond 2030) given that this is a fast-changing area.

This business case is based on the most aggressive of the FES scenarios in terms of heat pump take-up (ie Consumer Transformation). Under the most cautious scenario (System Transformation) ENWL is projecting an NPV of £69 million (or only 17% of the base case) for GB by 2050.

For Customer Flexibility the business case assumes 50% of homes fitted with HPs are equipped and willing to offer flexibility and that heat pump demand in those homes can be reduced by 25%. There is clearly some uncertainty around these assumptions. Moreover, in the Panel's view, the contribution of this project to delivering customer flexibility is limited at best. Given that ENWL acknowledges that to actually deliver customer flexibility a further project (like EQUINOX) would be needed, it does not seem appropriate to include the benefits within this CBA (even if the estimated costs of this additional project are included as ENWL has done).

Overall the Panel is not persuaded that there is a financial case for pursuing Smarter Heat as proposed.

Carbon and Capacity Benefits

ENWL has suggested that, in comparison with the base case, and although reducing capacity in the short-term, Smarter Heat could create additional GB-wide capacity of approximately 5,000 MVA by 2050. The Panel has had difficulty in accepting this estimate, notwithstanding the limitations associated with capacity estimates in all NIC bids. Firstly, ENWL level capacity benefits (based on calculations of capacity released for each substation in the network) have been scaled up to GB using numbers of customers rather than substations. Secondly, the capacity that would be released through traditional reinforcement (in both the base case, where it features heavily, and in Smarter Heat where it is deployed on only limited occasions) has been disregarded. In the Panel's view this is inappropriate (especially because a different approach is used to estimate carbon benefits) and gives an overly-optimistic view of the capacity potentially created by Smarter Heat in the long-term.

The forecast carbon benefits (approximately 2,000 tonnes CO_2e by 2030 rising to 127,000 tonnes CO_2e by 2050 GB -wide) are heavily dependent on the inclusion of traditional reinforcement in the

base case, plus the selection of high-end estimates for the embodied carbon associated with it. Carbon benefits attributable to a reduction in active cooling play only a small part. Given the methodology and the prospect that the carbon penalty associated with traditional reinforcement will in time be reduced anyway (by technical improvements and/or alternative techniques), the forecast carbon benefits have not played a significant part in the Panel's evaluation.

However, the Panel does accept that tools which help create capacity to accommodate the forecast increase in heat pumps and other low carbon technologies help enable a Net Zero future. In this respect, Smarter Heat could have a role to play. However, as with the financial case, the Panel does not consider it would be appropriate to attribute such benefits to the Customer Flexibility method given a further project would be needed.

Overall, the Panel recognises the wider carbon benefits that facilitating heat decarbonisation could deliver but is not persuaded that Smarter Heat would be an effective method of delivery.

(b) Value for Money

The Panel is concerned that the proposed consumer research (which would involve asking hypothetical questions of customers with no experience of heat pumps) will not yield meaningful evidence. In particular, the Panel notes that the very different way in which heat pumps work means that questions about the impact on comfort cannot be extrapolated from customers with gas and other conventional heating. Similarly, the Panel is not convinced that the pilots using mainly customers with conventional heating will provide useful evidence. As such the proposed consumer research and pilots do not represent value for money.

The Panel also had concerns that project deliverables 3 and 4 (individual tool initial definitions and toolkit specification) appear to be reports based on the outcomes of the technical trials and together cost over £1.5m, which seems disproportionately expensive.

Overall the Panel is not persuaded that Smarter Heat represents value for money.

(c) Generates new knowledge

As indicated above the Panel is not convinced that the consumer research and small pilots involving primarily customers with conventional heating will provide any relevant new knowledge in relation to the behaviour of customers who own heat pumps. The nature of the heat provided is very different

with heat pumps providing steady, low grade heat while most conventional systems provide near instantaneous heat. As such customers' reaction to changes in temperature is likely to be very different.

The Panel believes that Smarter Heat would provide additional valuable new knowledge about the real time operation of Variable Ratings, building on Celsius. In particular the project would establish the relationship between the hot spot temperature and tank/frame temperature through hot spot measurement of a sample of transformers, develop methodologies for introducing variable ratings for transformers (dependent on the actual ambient temperature), and look at the impact of operating at higher loading. The Panel does however consider that there is potentially a missed opportunity here to look at variable ratings across all times of year not just winter, to help in understanding any risks from summer peaks for example.

(d) Is Innovative

The Panel considers that the customer research proposed would be innovative if it involved heat pump customers as efforts to understand the implications of flexibility for customer comfort have not previously been explored. However, as it stands the Panel believes that the research will not achieve its stated aims and hence is not innovative.

The Variable Rating element of the project is considered innovative and has not been tested elsewhere. Two real-time thermal rating projects have already been funded, one by UK Power Networks and the other by Northern Powergrid. However, the UK Power Network's project focused on primary transformers, while Smarter Heat will focus on secondary transformers and learning between these classes of transformer may not be transferrable due to differences in their design. Northern Powergrid's Customer-Led Network Revolution project included secondary transformers but, as with Celsius, the temperature was measured on the frame, not in the oil. The Panel is therefore satisfied that the Variable Rating aspect of the project has not been tried before.

Taking the project as whole, the Panel is satisfied that this level of research in a new and uncertain area and is not something ENWL could be expected to undertake without innovation funding. The Panel is not clear if there could be other routes to take forward the Variable Rating aspect of the bid in isolation, as the costs of that aspect are not separately identified. The work required to develop the Variable Rating appears to be largely laboratory and desktop driven with limited field trials. The

latter should carry very little risk as there is ample opportunity to conduct tests away from an operational network.

While a Toolkit is referred to, it is not an integrated tool but rather a menu of tools that designers should consider when trying to manage network loading. A hierarchy will be developed to allow designers to identify the best tool or combination of tools. While useful the Panel does not consider this to be particularly innovative.

Overall the Panel is not persuaded that Smarter Heat can be considered innovative.

(e) Involvement of other Partners and external funding

The project appears to be well-developed, with key partners identified to carry out the research. This project is the combination of two proposals made independently by Delta-EE and Ricardo Energy & Environment. In accordance with the guidance given by Ofgem, their selection as project partners without a competitive process is appropriate. Benchmarking of their rates provides some assurance that the project is being delivered at a fair cost.

It appears that Impact Research was single sourced and no details are provided regarding the basis of their selection. Impact Research will contribute about £22,000 and earn a fee of about £21,000.

UKPN is the only other DNO involved in the project and their support is relatively small scale (about £22,000) but aimed at proving the wider applicability of the solution. Given the potential applicability of Variable Ratings and the toolkit to all distribution transformers it would have been good to have seen the involvement of other DNOs.

(f) Relevance and Timing

Given the significant challenge that GB faces with heat decarbonisation with the need for substantial consumer engagement and major network impacts, this project is highly relevant. It would be timely in that it would allow learning to be gathered ahead of ED3 when heat pump deployment can be expected to ramp up.

(g) Robustness of Methodology and ready to implement

The Panel had concerns about a number of aspects of this proposal. The main flaws in the methodology remain the very small number of HPs in the population sample, the reliance instead on

customers with conventional heat sources, and the fact that transformers would only be studied for part of the year. ENWL recognises that it would have been better to involve HP users. Structuring the bid in a way to enable this (as EQUINOX have done working with partners) would have made the overall package more robust.

Aside from these aspects the proposals for implementation seem well thought through and ready to implement.

Conclusion

The Panel recognises the important challenge that the Smarter Heat proposal is seeking to address. However, the Panel considers that the Smarter Heat proposal fails to meet a number of the evaluation criteria set out in the NIC governance document. In particular, the consumer research and pilots, which focus on homes without heat pumps, are, in the Panel's view, of limited relevance. In contrast, the use of Variable Rating is an interesting idea which the Panel hopes ENWL might find a way to pursue. The packaging of these into a toolkit is a small element of the proposal and in the Panel's view could be taken forward as BAU. **As such the Panel is not recommending that Smarter Heat be funded by the Authority**.

3 RECOMMENDATIONS FOR FUNDING

In summary, based on these evaluations the Panel makes the following funding recommendations to the Authority, subject to the various conditions outlined above:

Recommended for funding

Project	Licensee	NIC Request (£m)
EQUINOX	Western Power Distribution	6.98
BiTraDER	Electricity North West Limited	6.79

Unable to recommend funding

Project	Licensee	NIC Request (£m)
Smarter Heat	Electricity North West Limited	6.15

4 ACKNOWLEDGEMENTS

As in previous years, the Panel fully recognises the amount of work required to make NIC bids, including the time and effort taken to provide the Panel with answers to over 150 detailed questions posed through the SQ process. Consequently, the Panel would like to thank all the companies for their active engagement both in their written answers and at the bilateral meetings.

The Panel is also particularly grateful to the Ofgem team that provided exceptional support to the Expert Panel. Their technical and administrative input along with the technical support of the Consultants (Jacobs) ensured the Panel was able to undertake full and effective scrutiny of the NIC proposals.