SIF Discovery Round 2 Project Registration

Date of Submission

Jun 2023

Project Reference Number

NPG_SIF_002

Project Registration

Project Title

Diversified Flexible Queue Management

Project Reference Number

NPG_SIF_002

Project Licensee(s)

Northern Powergrid

Project Start

Apr 2023

Project Duration

3 Months

Nominated Project Contact(s)

chris.goodhand@northerpowergrid.com

Project Budget

£155,000.00

Funding Mechanism

SIF Discovery - Round 2

SIF Funding

£147,000.00

Strategy Theme

Flexibility and market evolution

Challenge Area

Preparing for a net zero power system

Lead Sector

Electricity Distribution

Other Related Sectors

Electricity Distribution

Funding Licensees

NG ESO - National Grid ESO, NPg - Northern Powergrid (Northeast) Limited, NPg - Northern Powergrid (Yorkshire) Plc

Lead Funding Licensee

NPg - Northern Powergrid (Northeast) Limited

Collaborating Networks

National Grid Electricity System Operator, Northern Powergrid

Technology Areas

Distributed Generation, Energy Storage, Low Carbon Generation

Equality, Diversity And InclusionSurvey

Yes

Project Summary

• This project explores technical innovations to increase the pool of available renewable, storage and demand side response (DSR) resources via integrated, faster and more efficient connection to the network considering resources' natural diversity and the dispatchable flexibility services they may provide.

• This approach will rely on a combination of better use of existing and enhanced network data to enable NPg and NGESO to identify congestion, track the status and capabilities of its connection queue and a streamlined process for identifying solutions to actively manage the queue to bring innovative and flexible resources on stream.

Project Description

• Net zero relies on the integration of renewable energy sources and storage (RES), which may need to be connected in specific locations (e.g. where it is windy or shade-free, southerly aspects) on the distribution networks, increasing the load at specific points on the network.

• Traditionally, magnitude of generation and storage connection requests has been treated on a cumulative nameplate basis resulting in either significant restrictions on how the connectee can operate (e.g. through ANM schemes), or queues with long delays and expensive costs due to reinforcement needs.

• We have always known demand has diversity -- circa 90% at domestic level - and we know that there will be at a minimum diversity overnight between PV and wind, and between different PV aspects and wind turbine locations. This means it is highly unlikely that all RES operate at full output at the same time, meaning actual available capacity will be greater than the "on paper" aggregate calculations.

• There may also be instances where a customer in the connection queue is able to offset connect customers, providing a local network benefit by using their load flexibly to create further diversity. This might enable them to move earlier in the queue.

• This project seeks to investigate the viability of data to drive network operation and adaptive management of distrubtion connections. It will assess diversity of customer loads and the flexibility of their assets. It is aimed to identify actual existing and potential available capacity on the network, enabling faster connections for customers. The focus is on distribution connections driven reinforcement.

• This is an innovative approach to managing network capacity because it moves from a worst-case approach to assessing network constraints to a data driven approach that assesses actual customer characteristics, operations and diversity to determine network capacity. For new connections, it moves from enabling faster connections by managing customers' usage after they are connected (e.g. through curtailable connections) to incentivising a flexible response during the connection process, potentially allowing the connectee to move up the queue (i.e. not just on a "first come first served" basis), without the current limitations that are placed on faster connections.

Under this proposal, the benefits would not just accrue to new connectees, but also would potentially enable connected customers on ANM schemes to increase their output. There would also be a wider societal benefit, driven by the increase in RES output and connection of LCTs.

Nominated Contact Email Address(es)

yourpowergrid@northernpowergrid.com

Project Description And Benefits

Applicants Location (not scored)

Northern Powergrid (Northeast) pie , a company registered in England and Wales with company number 02906593 whose registered office is at Lloyds Court, 78 Grey Street, Newcastle Upon Tyne, NE1 6AF ("NPg")

National Grid Electricity System Operator Limited, a company registered in England and Wales with company number 11014226 whose registered office is at 1-3 Strand, London, WC2N 5EH ("NGESO");

WSP UK Limited, a company registered in England and Wales with company number 01383511 whose registered office is at WSP House, 70 Chancery Lane, London, WC2A 1AF ("WSP");

Project Short Description (not scored)

Accelerating decarbonisation by the considering diversity and flexibility of already connected large assets and those within the connection queue.

Video description

Innovation justification

• The increase in new connections is leading to GSP interface constraints. Traditional solutions require costly, and delaying, reinforcement or constrained

connections, meaning that renewable resources cannot provide the export they are capable of and the market for flexible demand is reduced.

• Although there have been changes such as the use of ANM to manage capacity on the networks, this project seeks to explore the extent of the issue and whether diversity between network users and the actual outputs that can be achieved by RES means that there is more capacity available than 'on paper'. If there are congestion issues, then the project also seeks to explore the benefits delivered by new or existing customers providing flexibility to the network, and potential provision of improved connection offers.

• Currently, the network companies do not make full use of the potential (but as yet unquantified) diversity of their customers when planning and quoting for large connections, particularly generation and storage. This project will enable NPg to explore the extent that diversity and flexibility data on actual network capacity can enable faster connections, including for those with innovative approaches that could be deployed to manage constraints.

• We expect this project to provide five strands of benefits against the counterfactual, which would be continue with the current approach, which results in long connection delays and costly reinforcement:

o Financial benefit through a reduction in network reinforcement

Direct benefit for customers who are already connected on ANM contracts, who may be able to export more than previously identified

o Direct benefit for customers who are progressed up the queue, enabling them to start generating more quickly

o Wider sustainability benefits through faster deployment of RES and LCTs.

o Increase in available generation will reduce the need for general demand reduction to address any winter power shortages.

• Investigating network diversity benefits from a trial-based approach, as the potential range of benefits and negative impacts is currently unknown and actual implementation would impact on all customers. Should the project provide evidence that diversity and flexibility can work in tandem to reduce the connection queue (noting this would require the project to progress through all SIF stages) the approach would become part of NPg's BAU toolkit for managing constraints and any ongoing benefits would accrue to customers. In addition, the knowledge would be shared with the other network companies, enabling additional customer benefits

Benefits Part 1

Environmental - carbon reduction – direct CO2 savings per annum against a business-as-usual counterfactual
Financial - cost savings per annum for users of network services
Financial - future reductions in the cost of operating the network
Revenues - improved access to revenues for users of network services

Benefits Part 2

1. Financial - future reductions in the cost of operating the network

• Currently, network reinforcement would be sized to accommodate, at a minimum, capacity requirements of new connections. Using a data-driven approach to identify network capacity will reduce or delay the reinforcement needed by unlocking flexibility from the connection stage and prioritising connection of the most flexible assets.

• This would be measured through a cost-benefit analysis that compares the counterfactual against the different use cases to be defined in the Discovery Phase. Note that this would take place during an Alpha phase when the modelling would occur.

• The cost saving for reinforcement avoidance would be in millions of pounds.

3. Financial - cost savings per annum for users of network services

• This would be a simple translation of network reinforcement savings to customer bills, based on the current charging methodology that assigns costs to different voltage levels on the basis of the network use factors and assumptions of downstream-only flows.

5. Environmental - carbon reduction -- indirect CO2 savings per annum against a business-as-usual counterfactual
• Existing users would benefit from faster connections, allowing them to export, carry out industry, etc, sooner than would otherwise be the case.

• Already connected RES may be able to increase their export (offsetting conventional generation) and new customers may be able to connect without being under a non-firm connection agreement

• More flexible use of network assets could also enable faster connection of LCTs.

• Timescales for connection of renewable generation would be reduced by several years.

• We envisioned CO2 saving would be hundreds to thousands of tonnes through this innovative approach.

6. Revenues - improved access to revenues for users of network services

• This will be informed by the stakeholder engagement to identify the current impact of connection delays on customers -- both from investment and revenue delay perspectives.

• Customers would be able to provide flexibility services that they might otherwise have been unable to do under an ANM scheme.

• We will measure this as part of our CBA that assesses different use cases

assuming different mixes of diversified generation, etc.

• As part of this stage, we will also measure the impact on non-flexible customers who may be pushed further down the connection queue in favour of flexible assets, as this will have implications for the acceptability of the project to different customer types.

Project Plans And Milestones

Project Plan and Milestones

WP1. Quantify and define the problem in network congestion and queue management

- Screen the existing GSPs (~40) in NPg's licensed area. Identify what is connected. Review the diversity of existing customers and the extent that the actual network capacity differs from the assumed capacity, based on the capacity of the connecting assets/ request by customers.

- Review the flexible loads and LCTs be connected in the licensed area to identify additional capacity requirements.

- Investigate what might be happening in these GSP regions and develop test

cases.

- Analyse test cases against system constraints considering a diversified generation mix from RES and the additional benefits of DSR and evaluating the system performance; and,

- Identify and quantify the gap in network capacity for new connections from flexible resources and long queues. Define the problem.

WP2. Identify and review existing network congestion, queue management, and the associated technical and commercial arrangements

- Identify implemented schemes and their technical and commercial requirements, building on the distribution queue management ;

- Identify existing NPg planning documents, with consideration of a whole system

co-ordination view.

- Analyse risks associated with the diversified flexible ONO queue management of connection, and associated mitigation actions and their effectiveness.

- Investigate regulatory and technical restrictions placed on the connection queue promotion of a flexible resource being connected which could benefit other connected projects.

- Identify any existing processes for coordination across transmission, distribution and customers.

- Develop stakeholder engagement plan and engage with stakeholders.

WP3. Development of use cases and high-level assessment of potential benefits

Based on the finding of WP1 and WP2, we will develop the use cases and high level assessment of potential benefits. These use cases will be further explored in the Alpha phase (if successful) to identify and define the solution, carry out cost benefit analysis and outline the delivery plan for practical deployment of the feasible solutions.

- Identify use cases

- Develop key features and differences between use cases

- Explore use cases which could inform future NPg RDPs

- Assess potential benefits

- Validate use cases with stakeholders.

Regulatory Barriers (not scored)

N/A

Commercials

Route To Market

• We do not consider that this project undermines development of competitive markets, as the offer will be available to all customers. As with any connection agreement, we expect that investors, new industrial customers, etc, will

undertake their own assessment of the trade-off between a faster/cheaper connection against the potential services they need to offer, such as increasing import/export during specific times.

• The outcome of this project will be desktop proof of concept that shows the level of actual constraints on the network at each of NPg's GSPs and the impact that adaptive queue management can have on the time to connect flexible

resources and the wider benefit of delayed or deferred reinforcement. If proven (through the Alpha and Beta stages), the BAU roll-out of this approach would be funded through NPg's baseline funding as part of their BAU network management.

• The learning associated with this project and this approach to managing constraints, including any potential commercial arrangements, will be shared with all DNOs and relevant network users, including through the knowledge dissemination arrangements set out in SIF governance document.

• If adopted, the implementation would be undertaken by the DNOs, as it is a process for how they operate their networks, including managing connection queues, rather than being a tangible product that could be purchased or used by third parties.

• The primary customer segment will be renewable generation, storage and DSR connected to the electricity distribution networks that can provide benefits if connected earlier, but there are no specific limitations on the technologies that could provide these services.

Intellectual property rights (not scored)

• IPR ownership will be treated in line with Chapter 9 SIF Governance.

• ONO is the lead partner, partnering with the ESQ as the key stakeholder

• WSP will not own any IPR attached to this project, which will be based on inputs from the DNO and customers and modelled using standard software.

Costs and value for money

The total project cost will be £154,910 with £*147,151* to be funded by SIF. The detailed cost below for each WP:

WP1: Quantify and define the problem in network congestion and queue management £61,015.00 (£55,548.00 to be requested through SIF)

WP2: Identify and review existing network congestion, queue management, and the associated technical and commercial arrangements £61,402.20 (£55,477.00 to be requested through SIF)

WP3: Development of use cases and high-level assessment of potential benefits

£32,492.80 (£28,126.00 to be requested through SIF)

NPg will contribute £15,200.00 (9.8% of the total project cost) with £7,200 contribution to cover their project cost and an additional £8,000 as cash contribution.

NG ESO will contribute £560, which is equal to 10% of their project cost of £5613 as an in-kind contribution (0.36% of total project cost).

WSP sought 100% funding support for their project cost.

NPg and NG ESO will not financially benefit from the project, as the key benefit for them is through avoided reinforcement. As flexibility becomes embedded as BAU, this will be reflected in the forecast reinforcement over future price controls. Given this, the contribution is proposed to be the minimum 10%.WSP costs will be

£142,097 and are necessary to be incurred, as they bring the data and energy modelling expertise to carry out the project.

Document Upload

Documents Uploaded Where Applicable

Yes

Documents:

pdf.pdf

This project has been approved by a senior member of staff

☑ Yes