Notes on Completion: Please refer to the appropriate NIA Governance Document to assist in the completion of this form. The full completed submission should not exceed 6 pages in total.

NIA Project Registration and PEA Document

Date of Submission

Jan 2026

Project Reference Number

NGED_NIA_085

Project Registration

Project Title

Flexpectation

Project Reference Number

NGED_NIA_085

Project Licensee(s)

National Grid Electricity Distribution

Project Start

January 2026

Project Duration

2 years and 3 months

Nominated Project Contact(s)

Laurence Hunter

Project Budget

£841,733.00

Summary

Flexpectation aims to deliver accurate short-term (1 hour to 2 weeks ahead) forecasts of demand and embedded generation for every NGED primary substation. By improving visibility of network loading during outages and abnormal running, the tool will help target flexibility more efficiently and reduce unnecessary procurement. Ultimately, it will give control and planning teams a clearer, data-driven picture of upcoming constraints to support faster and more confident operational decisions.

Third Party Collaborators

Open Climate Fix (OCF)

Problem Being Solved

At present, NGED’s short-term forecasting remains a largely manual process, reflecting an era when network behaviour was more predictable. In practice, engineers estimate future demand by reviewing recent load flow profiles and assuming tomorrow will resemble yesterday, without accounting for the influence of weather, solar output, or customer behaviour. This limited approach offers little resilience under abnormal running, such as during outages or planned switching. In addition, embedded generation, particularly rooftop PV, masks true demand at primary substations, while data needed for accurate modelling is fragmented across systems with inconsistent formats and limited interoperability. NGED’s Energy Management Centre faces a similar challenge, relying on manual, short-horizon forecasts and over-procuring flexibility as a safeguard against uncertainty. The result is a process that is reactive, labour-intensive, and risk-prone, leading to unnecessary operational costs and under-utilised capacity. These are issues Flexpectation aims to resolve through a data-driven, automated forecasting framework.

Method(s)

Flexpectation is structured around a dual-track, two-phase delivery model designed to test how forecasting methodologies can offer immediate operational value, and longer-term innovation exploring state of the art Artificial Intelligence methodologies. The Live Service Track will deliver an operational forecasting API using machine-learning techniques for initial testing and benchmarking, while the Research Track will run in parallel to investigate more advanced modelling approaches. Both tracks will progress through Phase 1, focused on the development of a minimum viable product (MVP), and Phase 2, which will scale the solution to cover all 1,161 primary substations across the NGED licence area.

Live Service Track

The Live Service Track will demonstrate a 'version one' operational forecasting system within the first 12 months. This component focuses on producing an MVP capable of generating probabilistic net-load, wind, and solar forecasts with a 14-day horizon for a selected group of primary substations. Initially, forecasts will be deployed to 10–20 sites to enable early validation. The modelling approach will build on Open Climate Fix's established architectures, such as the Temporal Fusion Transformer, combining numerical weather predictions with recent substation power-flow data at half-hourly resolution. Estimates of solar and wind generation will be derived using physical models informed by the Embedded Capacity Register (ECR) and SMITN outputs. Periods of abnormal topology will be identified using changepoint-detection techniques and excluded from training data. Once operational, the forecasting engine will be provided via an API integrated with NGED's IT systems. Feedback from this phase will feed into the development of Version 2, which will ultimately expand coverage to all NGED substations.

Research Track

Running concurrently, the Research Track will explore advanced methodologies to address incomplete data, DER disaggregation, and inference of network topology. Research activities will include developing Graph Attention Networks to better model electrical relationships between substations; applying contrastive learning and synthetic data approaches to estimate DER capacities where telemetry is absent; and testing retrieval-augmented methods that identify "similar days" from historical data to improve forecast accuracy. This track will generate open-source artefacts and benchmarked models, assessing performance, interpretability, and computational efficiency. The strongest techniques will be integrated into later releases to develop a more advanced version 2 of the system.

Work Package Structure

- Work Package 1 focuses on research and development led by OCF. This includes project mobilisation, securing sponsorship engagement, and acquiring all required datasets such as network telemetry, weather feeds, and market data. Additional activities include updating the Embedded Capacity Register based on SMITN insights, performing data validation, and beginning development of the Version 1 model. R&D on a wide range of modelling techniques will also begin. Two milestones fall within this package: by April 2026 OCF will deliver the full requirements set, solution architecture design, a summary of data sources and API setup, and a common suite of forecast-skill metrics; by July 2026 they will provide a state-of-the-art review of forecasting techniques and a first R&D progress report. This work package runs for six months.
- Work Package 2 develops the minimum viable product model, also led by OCF, over a six-month period. The team will select a suitable GSP group and 10 primary substations for testing model transferability. Version 1 of the forecasting model will be implemented in a live test environment via the API. The package also includes testing candidate forecasting approaches, developing automated detection of abnormal network running, and continuing experimentation across modelling families. The milestone for this stage is the delivery of Version 1 for the test sites, alongside a summary report comparing model approaches and recommending the method most likely to achieve the highest accuracy.
- Work Package 3 covers model acceptance and testing, led by NGED over two months. NGED will compare competing modelling practices, assess input-feature importance, and quantify uncertainty in relation to flexibility procurement KPIs. The milestone for this stage comprises a comparison of existing versus improved forecasts and their associated flexibility volumes, alongside user feedback provided to OCF. This stage also includes a formal stage gate prior to wider rollout.
- Work Package 4 delivers the network-wide scale-up over six months. OCF will refine the version 1 model based on operational feedback and incorporate the most successful R&D techniques from earlier stages into version 2. The model will then be scaled to all 1,161 primary substations, as well as our BSPs and GSPs, with improved separation of unmasked demand from embedded generation. The milestone requires delivery of the half-hourly forecasting model at full scale, along with a comprehensive performance evaluation and implementation recommendations.
- Work Package 5 focusses on the testing of the Version 2 model in BAU contexts. Over three months, OCF will support operational adoption, maintain the live service, and continue iterative improvements informed by user feedback. The milestone includes a full user acceptance testing report and a final R&D summary of forecasting techniques and future model development opportunities.
- Work Package 6 focuses on cost–benefit analysis, led by NGED over three months. NGED will prepare a full business-case assessment for BAU adoption, evaluating implementation costs, reduced flexibility spend, and efficiency gains for the control room. OCF will supply supporting data and performance evidence. This stage culminates in the delivery of an Ofgem-compliant CBA approved by NGED Finance Business Partners.
- Work Package 7 covers project closedown and dissemination over three months. NGED will prepare the closedown report, implement guidance documentation, and all required ENA reporting. Dissemination activities could include participation in conferences such as EIS, CIRED, IET and 25 to Zero, as well as online workshops.

Scope

The scope of Flexpectation is to design, develop and demonstrate a short-term probabilistic forecasting platform that enables DSOs to operate a more dynamic, decarbonised electricity system efficiently and safely. Its objectives include delivering accurate half-hourly forecasts of demand and embedded generation across all primary substations, improving operational awareness during abnormal running, and enabling more targeted and proportionate use of flexibility services. These capabilities will provide net benefits for consumers by reducing avoidable operational costs, enhancing network reliability, and supporting the integration of low-carbon technologies such as EVs, heat pumps and distributed solar, thereby contributing to environmental goals and a fairer energy transition. Financial benefits will directly accrue to the GB electricity distribution system through more efficient procurement of flexibility, reduced reliance on conservative operating margins, and the potential to defer reinforcement where improved foresight allows the network to be managed more effectively. Over time, these efficiencies will help lower the cost of running the distribution network, ultimately reducing customer bills while improving service quality.

Objective(s)

1. Develop an operational-ready short-term forecasting platform that provides accurate, probabilistic forecasts of demand and embedded generation.
2. Strengthen network visibility and situational awareness by enabling reliable detection of switching events and improving estimation of distributed energy resources.
3. Support more efficient and targeted use of flexibility services by reducing uncertainty in operational decision-making.
4. Generate and share innovative forecasting methodologies and open-source tools that advance sector-wide understanding of DER disaggregation, topology inference, and spatio-temporal forecasting.
5. Establish a robust business case and pathway for BAU adoption, demonstrating financial and operational benefits, securing user acceptance, and ensuring the solution integrates effectively with NGED’s internal processes.

Consumer Vulnerability Impact Assessment (RIIO-2 Projects Only)

A) During Project Development

While Flexpectation is under development, there will be no direct interaction with, or impact on, consumers in vulnerable situations. The project is entirely data- and software-based, with no physical works on the network and no operational changes that would alter the service received by customers. As such, there are no technical, financial or wellbeing-related distributional impacts during the development phase. The project therefore poses no risk of disproportionate effects on vulnerable groups while it is being designed, tested, or trialled within NGED’s internal systems.

B) During Rollout into Business as Usual

Once implemented, Flexpectation is expected to deliver positive impacts for consumers in vulnerable situations by improving the reliability, predictability, and cost-efficiency of network operations. Technically, more accurate short-term forecasts will help reduce unplanned supply interruptions and minimise the duration and frequency of planned outages, events that can disproportionately affect vulnerable individuals who rely on continuity of supply for medical equipment, safe home heating, or daily wellbeing. Financially, more efficient use of flexibility services and reduced operational uncertainty will help contain network operating costs, supporting downward pressure on customer bills and reducing the risk of vulnerable households facing affordability challenges. From a wellbeing perspective, improved operational foresight reduces the likelihood of stressful or unsafe periods without power, helping ensure that vulnerable customers experience a more resilient and dependable service. Overall, no adverse distributional impacts are anticipated; benefits are expected to be broadly shared but likely to be felt most strongly by those for whom supply interruptions or cost increases would have the greatest consequences.

Success Criteria

Demonstrated improvement in forecasting accuracy at primary substations

The project should significantly outperform NGED’s current manual heuristics by reducing forecast error for half-hourly demand and DER output out to 14-day horizons.

Successful delivery of Version 1 forecasting API

The Live Service Track must deliver an MVP system for 10–20 substations, meeting NGED’s operational integration, data latency and security requirements.

Ability to scale to a fully operational Version 2 service covering all primary substations

Version 2 must incorporate learnings from the research track and deliver consistent, reliable probabilistic forecasts across primary, BSP and GSP levels.

Accurate detection and handling of switching events

A core success measure is whether the system can infer abnormal network topology changes from time-series data and maintain forecast reliability during such periods.

Improved estimation and disaggregation of DER output

The project should produce reliable estimates of solar/wind generation and total DER behaviour per substation, despite incomplete telemetry and ambiguous ECR data, enabling more accurate constraint management.

Production of comprehensive research outputs informing future operational forecasting

Success requires delivering validated research findings on model architectures, DER disaggregation, topology inference, uncertainty quantification, and similar-day retrieval methods.

A complete business case demonstrating net financial benefit for BAU adoption

The final success criterion is the production of an Ofgem-compliant CBA showing savings from reduced flexibility spend, fewer overload incidents, and efficiency gains in the control room.

Project Partners and External Funding

Open Climate Fix Open Climate Fix have already taken Machine Learning forecasting into live control-room use at NESO with PV Nowcasting, a probabilistic solar forecast to 36 hours that cut Mean Absolute Error (MAE) by ~38–39% compared to NESO's previous forecasting tool: Platform for Energy Forecasting (PEF) and Elexon's Balancing Mechanism Reporting Service (BMRS) and was delivered via API/UI with quantified reserve and cost benefits. They also helped NESO overhaul national demand forecasting using a Temporal Fusion Transformer, more than halving 1-hour-ahead MAE and improving 24-hour accuracy, which shows capability beyond PV into net-load. Their Cloudcasting work (AI satellite nowcasting) further improved short-term accuracy by ~4.9% at two hours ahead, useful for volatile intra-day periods. At DSO level, OCF's project with UK Power Networks targets "invisible" behind-the-meter generation using disaggregation and aims to reduce flexibility OPEX by 5–10%, which aligns directly with our masked-demand and over-procurement issues. For NGED specifically, they propose a pragmatic dual-track: a year-one operational forecasting API at primary-substation level alongside a research strand on DER disaggregation and switching-event detection, delivered open-source and with a clear route to BAU integration. Taken together, that mix of proven delivery, relevant R&D, and API-first openness aligns well with our two use cases and a clean BAU adoption path.

No external funding will be used during Flexpectation.

Potential for New Learning

The project will generate the following learning that can be used by network licensees:

- Insights into which data sources, model architectures, and features deliver the highest forecasting accuracy.
- Learning on how to infer and disaggregate DER behaviour from incomplete or noisy system data.
- Methods for detecting, interpreting, and correcting the impact of switching events on substation time-series data.
- Evidence of the operational value of improved forecasts, including impacts on flexibility procurement, constraint management, and control-room decision-making.
- Practical lessons on integrating ML-based forecasting into DNO IT, EMC and ADMS workflows.
- Open documentation of methodologies and results, enabling other network licensees to replicate or adapt the techniques.
- Benchmarking and comparison of multiple modelling approaches, supporting future innovation across the sector.

Learning will be disseminated through NGED's proven mechanisms. This includes (but is not limited to):

- Reports
- Workshops
- Stands at NGED and other organiser events
- Website updates
- Publications at national and international conferences

Scale of Project

This project aims to take the proposed solution from research and early development of a minimum viable product, all the way to a forecasting platform that can be incoprporated into BAU. This will involve substantial engagement with the DSO's Energy Management Centre during project delivery.

Technology Readiness at Start

TRL5 Pilot Scale

Technology Readiness at End

TRL8 Active Commissioning

Geographical Area

The project is desktop based but will develop forecasts for our entire network. In the first stage of the work, a minimum viable product will be produced for 20 substations within NGED's licence area, before scaling up to provide a forecast for all primary substations.

Revenue Allowed for the RIIO Settlement

None

Indicative Total NIA Project Expenditure

An indication of the Total NIA Expenditure that the Funding Licensee expects to reclaim for the whole of the Project (RIIO2).

- Total Project Budget: £841,733
- DNO Contribution: £84,173
- Funding from NIA: £757,560

Project Eligibility Assessment Part 1

There are slightly differing requirements for RIIO-1 and RIIO-2 NIA projects. This is noted in each case, with the requirement numbers listed for both where they differ (shown as RIIO-2 / RIIO-1).

Requirement 1

Facilitate the energy system transition and/or benefit consumers in vulnerable situations (Please complete sections 3.1.1 and 3.1.2 for RIIO-2 projects only)

Please answer **at least one** of the following:

How the Project has the potential to facilitate the energy system transition:

Flexpectation directly supports the UK's shift toward a smarter, decarbonised, and more flexible electricity system by providing the short-term operational intelligence required for DSOs to manage increasing levels of low-carbon technologies (LCTs). As electrification of transport and heat accelerates, and as distributed generation such as rooftop solar continues to grow the behaviour of distribution networks becomes far more volatile and weather-dependent. Flexpectation enables NGED, and ultimately all GB DNOs, to anticipate these changes in near real-time through probabilistic, weather-aware forecasts of demand and embedded generation. This improved foresight will allow DSOs to operate networks closer to their true capabilities without compromising security, reducing reliance on conservative planning assumptions and enabling more efficient integration of LCTs.

The project also has the potential to materially improve how flexibility markets function. By providing accurate, location-specific forecasts, Flexpectation will allow DSOs to procure flexibility only when and where it is genuinely needed, ensuring that flexibility becomes a targeted operational tool rather than a broad, stimulus-driven mechanism. This supports Ofgem's transition towards whole-system optimisation, enhances value for consumers, and strengthens the economic case for flexible solutions over traditional reinforcement. The project's open-source approach further accelerates the energy system transition by enabling rapid replication across GB networks, improving data transparency, and fostering innovation within the wider energy ecosystem. Collectively, these capabilities give DSOs the tools required to manage a highly decentralised, low-carbon energy system while keeping costs down and maintaining resilience.

How the Project has potential to benefit consumer in vulnerable situations:

Flexpectation will support vulnerable consumers by improving the reliability, resilience, and cost-efficiency of the electricity network at times when they are most affected by interruptions or operational uncertainty. By enabling more accurate short-term forecasting of demand and embedded generation, the project will allow engineers to plan outages and manage constraints with far greater precision. This will help reduce the likelihood of unexpected supply disruptions and minimise the duration and impact of planned outages, events that disproportionately affect consumers in vulnerable situations, who may rely on medical equipment, have limited ability to heat their homes, or face financial stress during periods of disruption.

Requirement 2 / 2b

Has the potential to deliver net benefits to consumers

Project must have the potential to deliver a Solution that delivers a net benefit to consumers of the Gas Transporter and/or Electricity Transmission or Electricity Distribution licensee, as the context requires. This could include delivering a Solution at a lower cost than the most efficient Method currently in use on the GB Gas Transportation System, the Gas Transporter's and/or Electricity Transmission or Electricity Distribution licensee's network, or wider benefits, such as social or environmental.

Please provide an estimate of the saving if the Problem is solved (RIIO-1 projects only)

N/A

Please provide a calculation of the expected benefits the Solution

Flexpectation is primarily a research and development project, with the detailed benefits case refined alongside delivery of the machine-learning forecasting capability. Early analysis, based on historic flexibility utilisation patterns, indicates that a material proportion of flexibility dispatch can be driven by uncertainty rather than genuine network need. Introducing a short-term, location-specific forecast is expected to reduce this uncertainty and support a shift to more targeted use of flexibility. This aligns with Ofgem's Sector Specific Methodology Consultation (SSMC), which signals an expectation that DSOs move away from broad, precautionary procurement and toward flexibility that is locationally and temporally targeted, and clearly justified by operational need (for example, to support network operations, consumer outcomes, curtailment reduction, or use of flexibility as an enduring solution). On this basis, the indicative annual benefit range is estimated to be £0.5m to £1.0m per year, primarily from avoided flexibility utilisation costs and more proportionate operational decision-making. Replication costs for other DNOs are expected to be relatively low because the core methods and code will be developed as open source, with adoption costs largely limited to data preparation, integration and operational hosting.

How the benefit estimate was calculated

- **Define the baseline period and scope**. A retrospective analysis was carried out using a full year of NGED flexibility utilisation activity as the baseline, focusing on operational flexibility dispatched to manage thermal constraints.
- **Compile the constraint set and key parameters**. The analysis used the set of operational Constraint Managed Zones (CMZs), including each zone's thermal limit (rating) and the associated utilisation price used for dispatch payments.
- **Extract observed loading data**. Half-hourly network loading profiles for each CMZ were taken from NGED's Time Series Data Store to represent the real loading on the network across each CMZ.
- **Extract actual flexibility dispatch and costs**. Actual dispatch events (timing and volume) and the associated utilisation costs paid to flexibility service providers were aggregated to produce the "BAU" spend and MWh utilised for the year.
- **Construct a proxy forecast to test the concept**. Because a true operational short-term forecast does not yet exist, an "artificial forecast" was created from the observed loading profile with an added uncertainty margin. This was used to simulate how dispatch decisions would change if NGED had a forecast available. The project's live CBA will adjust the uncertainty margin as the confidence of the forecast is known.
- **Apply a dispatch decision rule against thermal limits**. For each CMZ and settlement period, a simple test was applied: if the forecast loading exceeded the thermal limit during the constraint window, flexibility would be required; if not, it would not. This produced a time-series "flex required / not required" signal.
- **Recalculate utilisation cost under the forecast-driven approach**. Using the same utilisation prices and dispatch volumes for simplicity, costs were recalculated by only allowing dispatch in periods flagged as "flex required". This produced a forecast-driven counterfactual cost.
- **Estimate savings and scale**. The difference between the baseline (actual) cost and the forecast-driven cost provides an initial estimate of avoidable utilisation spend attributable to improved forecasting. The result was then used to derive an indicative annual benefit range for public reporting, with a fuller CBA to be completed later in the project using live forecast performance.

In conclusion, the analysis indicates that introducing short-term, location-specific forecasting has the potential to materially reduce uncertainty-driven flexibility dispatch and enable more targeted operational decision-making. The resulting reduction in unnecessary flexibility utilisation is expected to deliver annual financial benefits in the order of several hundred thousand pounds, potentially up to around one million pounds per year, while supporting a more efficient and proportionate use of flexibility in line with regulatory expectations.

Please provide an estimate of how replicable the Method is across GB

The forecasts would be suitable for roll out across other UK DNOs, providing the same data quality is available as NGED.

Please provide an outline of the costs of rolling out the Method across GB.

Roll out costs depend on the data quality available from other network operators. The forecasting algorithms, code, and research materials will be made available at no cost. Costs would arise from an ongoing licencing fee to run the forecasting engine, including cloud compute, analysis and APIs.

Requirement 3 / 1

Involve Research, Development or Demonstration

A RIIO-1 NIA Project must have the potential to have a Direct Impact on a Network Licensee's network or the operations of the System Operator and involve the Research, Development, or Demonstration of at least one of the following (please tick which applies):

☐ A specific piece of new (i.e. unproven in GB, or where a method has been trialled outside GB the Network Licensee must justify repeating it as part of a project) equipment (including control and communications system software).

☐ A specific novel arrangement or application of existing licensee equipment (including control and/or communications systems and/or software)

☐ A specific novel operational practice directly related to the operation of the Network Licensees system

☐ A specific novel commercial arrangement

RIIO-2 Projects

☐ A specific piece of new equipment (including monitoring, control and communications systems and software)

☐ A specific piece of new technology (including analysis and modelling systems or software), in relation to which the Method is unproven

☑ A new methodology (including the identification of specific new procedures or techniques used to identify, select, process, and analyse information)

☐ A specific novel arrangement or application of existing gas transportation, electricity transmission or electricity distribution equipment, technology or methodology

☐ A specific novel operational practice directly related to the operation of the GB Gas Transportation System, electricity transmission or electricity distribution

☐ A specific novel commercial arrangement

Specific Requirements 4 / 2a

Please explain how the learning that will be generated could be used by the relevant Network Licensees

The learning generated through Flexpectation will be directly applicable across all GB electricity network licensees, enabling them to improve the accuracy, efficiency and reliability of short-term operational forecasting. The project will produce detailed insights into which data sources, modelling architectures and feature-engineering approaches deliver the greatest forecasting accuracy for demand, embedded generation and abnormal running conditions. It will also provide replicable methods for DER disaggregation, switching-event detection and uncertainty quantification, capabilities that are increasingly essential as networks experience greater volatility driven by electrification and distributed low-carbon technologies. Because all model code, data pipelines and research outputs will be published openly, other licensees will be able to adapt the methodologies to their own systems, integrate the forecasts into their operational tools, and assess the impact on flexibility procurement, outage planning and network reliability. This transparency supports sector-wide standardisation, reduces duplication of effort, and accelerates the transition toward more proactive, data-driven DSO operations across Great Britain.

Or, please describe what specific challenge identified in the Network Licensee's innovation strategy that is being addressed by the project (RIIO-1 only)

n/a

Is the default IPR position being applied?

☑ Yes

Project Eligibility Assessment Part 2

Not lead to unnecessary duplication

A Project must not lead to unnecessary duplication of any other Project, including but not limited to IFI, LCNF, NIA, NIC or SIF projects already registered, being carried out or completed.

Please demonstrate below that no unnecessary duplication will occur as a result of the Project.

No unnecessary duplication will occur through this project because there is currently no equivalent short-term forecasting solution in place that provides probabilistic, weather-aware forecasts at primary-substation level, incorporates DER disaggregation, and can operate reliably during abnormal network running. While other DNOs have explored elements of forecasting in previous innovation projects, none have delivered a fully integrated, open-source approach that combines these capabilities or is designed specifically for operational use within control-room and flexibility-procurement workflows. Ahead of initiating Flexpectation, NGED reviewed the outputs of recent UK-wide innovation projects and confirmed that the proposed work fills a genuine gap rather than replicating existing tools. In addition, the project has been shared with other Network Licensees through the ENA's early engagement process, and no concerns about duplication were raised. By publishing all outputs openly, Flexpectation will also help avoid duplication in the future by allowing other DNOs to adopt and adapt the methods directly, rather than needing to undertake parallel development.

If applicable, justify why you are undertaking a Project similar to those being carried out by any other Network Licensees.

While several previous innovation projects across GB have explored aspects of load forecasting, DER visibility or PV-specific modelling, none have delivered the breadth, depth or operational focus proposed within Flexpectation. Earlier projects typically relied on single-model approaches, narrower scopes (such as PV-only forecasting), or legacy machine-learning methods that pre-date recent advances in spatio-temporal modelling, graph neural networks and retrieval-augmented forecasting. Flexpectation builds on this earlier work but moves significantly beyond it by applying state-of-the-art ML research, incorporating topology-aware modelling, handling switching events explicitly, and delivering fully probabilistic forecasts suitable for real operational decision-making. The project also introduces open-source tooling and a dual-track development model that combines an early operational system with ongoing research, something not featured in previous projects. As a result, Flexpectation complements rather than duplicates existing work, providing a modern, scalable forecasting capability that reflects the latest developments in AI and the evolving needs of DSOs.

Additional Governance And Document Upload

Please identify why the project is innovative and has not been tried before

This project is innovative because it brings together a set of forecasting capabilities that have not previously been combined or demonstrated at operational scale within a GB distribution network. Flexpectation aims to develop forecasting models that can recognise and adapt to switching events, one of the most challenging aspects of short-term prediction, allowing reliable forecasts even when the network is running under abnormal configurations. It also introduces a novel multi-layered modelling approach that blends bottom-up information from primary substations with top-down signals from GSPs and bulk supply points, improving spatial coherence and accuracy across the whole network. In addition, the project tackles the long-standing problem of disaggregating and forecasting DER output in situations where telemetry is patchy or incomplete, using advanced machine-learning techniques to infer behaviour from indirect signals. Taken together, these elements make Flexpectation far more ambitious than existing approaches, combining cutting-edge ML research with practical operational requirements, and pushing the boundary of what is currently possible in distribution-level forecasting. This combination of methodological novelty, operational relevance and open-source delivery creates genuine potential for academic publication and sector-wide impact.

Relevant Foreground IPR

Background IPR
The following background intellectual property will be used within the project and remains the property of Open Climate Fix (OCF):

- Trained neural network weights for OCF’s solar PV forecasting models, including:

1. The PV GSP and National PVNet models used to forecast solar generation across GB with short-term horizons (up to 8–36 hours).
2. The CloudCasting machine-learning model used for short-term solar nowcasting.

- Configuration files used to train PVNet models, including training-data configurations.
- Weights & Biases (wandb) projects containing historical machine-learning experimentation results, model configurations and training metadata.
- Source code for OCF’s operational forecasting applications that perform live inference using PVNet.
- Source code for OCF’s post-processing and blending applications used to produce final forecast outputs.
- The algorithm developed under OCF’s previous NIA project with UK Power Networks for estimating embedded PV generation from power-flow data.

Expected Foreground IPR (Summary)
The following foreground intellectual property is expected to be generated through the Flexpectation project:

- New short-term forecasting models and methodologies tailored to primary-substation-level net load, including handling of abnormal running and switching events.
- Novel approaches for disaggregating embedded generation and demand using incomplete or indirect network data.
- Model architectures and feature-engineering techniques developed specifically for DSO operational use cases.
- Evaluation frameworks, performance benchmarks and uncertainty-quantification methods for operational forecasting.
- Open-source code, documentation and implementation guidance produced during the project to support replication by other Network Licensees.

Data Access Details

Data for this project and all other projects funded under the Network Innovation Allowance (NIA), Network Innovation Competition (NIC) or the new Strategic Innovation Fund (SIF) can be found or requested in several ways:

A request for information via the Smarter Networks Portal at https://smarter.energynetworks.org, to contact select a project and click ‘Contact Lead Network’. National Grid Electricity Distribution already publishes much of the data arising from our innovation projects here so you may wish to check this website before making an application.

- Via our Innovation website at https://www.nationalgrid.co.uk/innovation/
- Via our managed mailbox nged.innovation@nationalgrid.co.uk

Please identify why the Network Licensees will not fund the project as apart of it's business and usual activities

National Grid would not fund this project as part of Business-as-Usual because the level of technical uncertainty and development risk is significantly higher than what would be acceptable for operational expenditure. The project involves testing a range of experimental machine-learning approaches, such as topology-aware neural networks, DER disaggregation techniques, and retrieval-augmented forecasting. These have not yet been proven in a live distribution-network environment. BAU funding is designed for established, low-risk tools with predictable outcomes, whereas Flexpectation requires substantial research, iterative experimentation, and the freedom to explore techniques that may not ultimately be adopted.

Please identify why the project can only be undertaken with the support of the NIA, including reference to the specific risks(e.g. commercial, technical, operational or regulatory) associated with the project

Innovation funding provides the appropriate mechanism to manage the risk uncertainty, allowing the project team to evaluate multiple modelling pathways, refine methods based on performance, and build a solution that may evolve considerably throughout the project. In addition, delivering the project under the innovation framework ensures that all outputs, including models, data pipelines and research artefacts, can be made open source. This would not typically be possible under BAU procurement, where proprietary constraints often apply. By using innovation funding, the project creates sector-wide value: other Network Licensees, academics and technology providers can adopt and build upon the work without duplication or additional cost. This open, collaborative approach accelerates progress across the whole industry while protecting consumers from the risks associated with funding unproven methods through operational budgets.

This project has been approved by a senior member of staff

☑ Yes