Scottish & Southern Electricity Networks

SIF Round 4 Project Registration

Date of Submission

Jan 2025

Project Reference Number

10142974

Initial Project Details

Project Title

FastTrack Discovery R4

Project Contact

Gemma Ennis

Challenge Area

Faster network development

Strategy Theme

Whole energy systems

Lead Sector

Electricity Distribution

Project Start Date

01/02/2025

Project Duration (Months)

3

Lead Funding Licensee

SSEN - Southern Electric Power Distribution Plc

Funding Licensee(s)

SSEN - Southern Electric Power Distribution Plc

Funding Mechanism

SIF Discovery - Round 4

Collaborating Networks

Scottish and Southern Electricity Networks Distribution

Technology Areas

Asset Management

Comms and IT

Modelling

Energy Storage

Resilience

Project Summary

The connection request queue is at least 723GW and growing, driven by lowcarbon technologies, renewable energy and new developments. Assessing the
overall network impact from this volume of applications is challenging, making it difficult to assess available headroom and future investment needs. FastTrack, an AI solution, aims to simulate the impact of both small and large-scale connection requests using data on network capacity, load, and external factors, to present a "rolled up" view of overall demand. This will provide DNOs with risk-weighted insights to make faster, more informed decisions on future investments, helping network planners prioritise interventions improving delivery times.

Add Third Party Collaborator(s)

Faculty Science Ltd

Project Budget

£158,926.00

SIF Funding

£143,033.00

Project Approaches and Desired Outcomes

Animal testing

- ○ Yes
- ◉ No

Problem statement

Distribution Network Operators (DNOs) typically use a rules-based approach to assess likely connection uptake (i.e. how much and when) to determine potential load growth in an area, identifying headroom remaining for further connections and planning future investment needs for local/upstream networks. As a result of supply chain and physical limitations, the volume of reinforcement that can be delivered in a given period is finite. Therefore, it's critical that DNOs reinforcement programmes are optimised both in terms of location and temporally to efficiently meet customer needs.

FastTrack aims to address this challenge by developing an artificial intelligence (AI) solution to forecast the impact of different types of connection requests. These include low-volume, high-magnitude requests (over 1MW connected at HV/EHV) and high-volume, low-magnitude requests (below 1MW connected at HV/LV). Currently, DNOs lack visibility of risk-weighted impact of individual or grouped connection requests on the network. This information gap hampers informed decision-making regarding connection acceptance.

To project load impact of new connections (at HV, where individual requests can have a material impact on network loading), or groups of connections (at LV, where impacts are a function of volume of requests) at individual substation level, FastTrack will utilise AI to leverage data including previous connection requests, substation loads, and network topology to assess risk and project the impact of new connections on upstream Grid Supply Points (GSPs). AI will also evaluate potential queue behaviour at HV/EHV levels, considering external factors like land ownership, socioeconomic factors and policy change to predict likelihood of connection churn.

Once operational, FastTrack will enable DNOs to:

- Determine if connection requests, individually or group, can be accepted based on probabilistic assessment of impact on the network.
- Estimate extent of upstream reinforcement or flexibility required if connections cannot be accepted as-is due to capacity constraints.
- Provide enhanced forecast information at Grid Supply Point (GSP) level, improving DNO/Transmission Network Operators (TNO) coordination.

FastTrack can lead to faster, more informed decisions on accepting new connection requests, offering actionable insights for network planning. DNO network strategy and connection teams, who currently manage a large and timesensitive queue, will be primary users of FastTrack. FastTrack directly addresses Challenge 1 to accelerate network development through digital innovations, supporting more efficient connection management and investment planning.

Previous projects have informed FastTrack (Appendix A5), but no other funding has been used.

Video Description

https://vimeo.com/1021774430?share=copy

Innovation justification

FastTrack builds new capability to address how DNOs assess the cumulative effect of how new connection requests "roll up" to impact the upstream system. To date, work has focused on streamlining specific aspects of the connections request process (e.g. quote generation: UKPN HV Auto Quote; process efficiencies from applicant's perspective: ENA Connect Direct, NGED Click2Connect), rather than to provide network planners/connections teams with tools to rapidly assess cumulative, risk-weighted impacts across the whole queue at GSP, which FastTrack would provide.

This 'system-view' of the impact of connections stack at GSP level would provide connections teams/network planners with new tools and capability to understand network risk - information that's currently missing with existing tools. Integrating diverse connection data into a unified model rolled up to GSP level, will facilitate better decision-making, potentially enabling additional connections, betteridentifying investment needs and improved information sharing with Transmission Operator.

Leveraging advanced AI techniques including probabilistic forecasting and simulation, FastTrack surpasses current state of the art by a) projecting aggregated impacts at substation-by-substation level and b) rolling these up to develop a probabilistic outcome at the GSP; an unmet need that isn't addressed by existing solutions; this is entirely new capability.

Currently, FastTrack is TRL2, anticipating TRL4 by the end of Discovery, demonstrating experimental proof of concept is feasible at Alpha; IRL and CRL will increase from Level 2 to Level 3 by the end of Discovery. Discovery allows us to efficiently identify user-needs, validate technical feasibility, and refine our solution design, to streamline solution build at Alpha. The solution would ultimately be designed to apply to the entirety of the connections queue.

SIF funding is crucial because this custom AI solution is at TRL2 and cannot be advanced under BAU. Its ambitious scope, including projecting the impact of the connections queue stack at the substation level and modelling the roll-up to GSP, makes it inherently risky and unsuitable for development under BAU.

Alternative approaches, e.g. expanding existing resource capability, were considered but found inadequate. A key benefit of AI solutions is they can be rapidly scaled across the network, in a way that existing approaches (e.g. bottomup substation-by-substation analyses) cannot. Existing tools lack aggregate, forward-looking impact assessments at GSP level; this cannot be addressed by repurposing existing tools or capability. An AI-driven approach is preferred for its inherent ability to incorporate diverse connection requests (and other data).

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Impacts and benefits selection (not scored)

Financial - future reductions in the cost of operating the network

Financial - cost savings per annum on energy bills for consumers

Environmental - carbon reduction – direct CO2 savings per annum

Environmental - carbon reduction – indirect CO2 savings per annum

New to market – processes

Others that are not SIF specific

Impacts and benefits description

Pre-innovation baseline

DNOs currently face significant challenges in assessing the impact of high-volume connection requests. Existing rules-based processes could lead to network capacity not being fully utilised, which could delay connection dates. A lack of tools that enable connections teams/ network planners to assess applications in the context of the cumulative impact across the network, make informed decisions on available capacity and investment needs more challenging, which can slow the release of capacity for new connections. Key baseline metrics include:

*Some customers offered connection dates in late 2030s;

*Connections queue for both Distribution and Transmission estimated to rise to
800GW by end-2024;

Forecasted benefits to energy consumers

Financial

***Future reductions in network operating costs**: Improved connections forecasting enables more accurate, lower-cost forward investment. Probabilistic forecasting enables risk-weighted prioritisation of investment needs, making the network easier to monitor and maintain. Anticipated operational cost savings will be investigated at Discovery.

***Cost savings on consumer energy bills**: Reducing deep reinforcement costs through accurate connections queue forecasting and investment targeting.

Environmental

***Direct CO2 savings**: FastTrack may enable customers to adopt low carbon energy solutions earlier than the counterfactual world, enabling benefits from reduced carbon emissions to be realised earlier, improving chances of meeting GB's net zero targets. The accelerated and wider scale adoption of low carbon pathways by consumers will result in reduced direct CO2 emissions and direct CO2 savings per annum.

***Indirect CO2 savings**: Potentially reduced requirement for network infrastructure investments and reinforcements may result in carbon emission savings from otherwise required construction works (embodied carbon emissions).

New to market

***Novel data analysis**: Combining connection queue data with third-party data (e.g., macro-economic indicators like house prices) provides new insights into connection request behaviours, enabling DNO engineers to process applications more effectively.

Wider benefits

*UK Government has formally recognised the challenge of grid connections within Connections Action Plan with Ofgem. FastTrack directly supports delivery of this objective, as well as wider Net Zero ambitions.

*By improving connection forecasting to better assess impacts on not only the distribution system but the upstream transmission system should allow more lowcarbon technologies to connect sooner.

Example metrics for impact quantification

*Operational measures: Reduction in connection delivery times and increase in acceptance volumes (GWh), indicating FastTrack's effectiveness in driving efficiencies.

*Operating costs: Decrease in costs associated with connection driven investment relative to baseline.

*COI reduction: Increase in LCT sites connected and their export capacity compared to prior years

Teams and resources

FastTrack creates a new relationship between SSEN as network sponsor, with Faculty leading development and scoping of AI solutions.

SSEN owns and operates the distribution network across Central Southern England and the north of Scotland, responsible for ensuring and delivering safe and reliable power supply to over 3.9 million homes and businesses.

Role: End-users of the solution and Lead Partner, leading project management, CBA and providing SME input from their Connections, Engineering & Investment and Operational Technology teams.

Skills: SSEN has well-established project management processes that have successfully delivered SIF projects, as well as NIC and NIA projects.

Faculty Science Limited is UK's leading AI firm specialising in design, build and deployment of bespoke AI systems for critical national infrastructure. Faculty has delivered 400+ projects across energy, utilities, government and enterprise sectors. This includes prior SIF experience and 5 NIA-funded engagements involving both networks and the system operator, collaborating with partners across the energy value chain (e.g. hardware providers, flexibility service providers).

Roles: Faculty will lead the development and technical approach of AI solutions to assess the impact of connections requests. This incorporates user-research and

data science expertise, including:

Associate: Day-to-day project operations including user-research and written deliverables.

Machine Learning Engineer: Design of technical solution architecture and implementation route to BAU.

Data Scientist: Day-to-day design of technical solution including data requirements, methodology assessment and reporting.

Senior Data Scientist: Oversight and design of technical data science solutions.

Senior Manager: Project Oversight and relationship / risk management, ensuring technical solutions are designed to meet SSEN objective and user needs.

Skills: The Faculty team incorporates a blend of technical and commercial expertise to scope solution build for Alpha, assessing technical feasibility and commercial impact.

Resources

No specialist equipment/facilities are required for Discovery; all resources and expertise will be provided by SSEN and Faculty. Static data extracts (e.g. xlsx, pdf, json files) will be provided via secure upload to Faculty's data-science platform for analysis, to assess solution feasibility and inform models being developed in Alpha.

No other external parties, network users or consumers are vital for successful delivery of the Discovery phase of this Project.

For Alpha, we intend to involve other DNOs to ensure wider applicability, and look to engage an academic partner to ensure robust validation of the methodology and project outcomes. In Discovery we will give further consideration to additional partners requirements to ensure FastTrack's success.

Project Plans and Milestones

Project management and delivery

FastTrack project management will be led by SSEN following their wellestablished processes that have successfully delivered SIF, NIC and NIA projects. Partners will employ project management processes, as documented in the PM Book, and utilise tools like Notion, Teams, and Faculty's data-science platform Frontier for effective collaboration and technical development.

Daily stand-ups, weekly coordination meetings and monthly Steering Committees will ensure clear communication, swift issue resolution, and stakeholder engagement. Deliverables and dependencies will be meticulously tracked using UKRI-provided tools (Risk Register, Project Plan) and internal resources (Gantt Chart, Finance Tracker), enabling us to monitor progress and ensure timely, highquality outcomes.

Work Packages

WP1 Project governance: establishes management framework, facilitating effective communication, risk management, and progress monitoring---underpinning all WPs.

WP2 User research and problem statement: focuses on understanding user requirements, validating problem statement, defining solution characteristics, and assessing potential benefits. This WP is critical for informing WP3 technical planning.

WP3 Technical assessment: involves evaluating data samples, analysing the technical environment, and developing initial solution architecture based on WP2 insights.

WP4 Proof of concept planning and reporting: consolidates findings and documents insights, preparing for progression to Alpha.

Dependencies between WPs ensure a logical flow, aligning with objectives and stakeholder expectations and can be viewed in the PM Book.

Risk management

Outcomes for WP2 feed directly into WP3 activities, which in turn informs WP4. To mitigate potential knock-on risks, activities across WPs are staggered with margin for addressing blockers from a previous WP, together with practical mitigations to limit timeline risk.

Highest-impact risks at Discovery relate to developing a solution that maximises the chance of successful implementation and user adoption. These risks will be consistently monitored through weekly coordination meetings and monthly steering committees and mitigated via risk-specific approaches detailed in the risk register. User research is planned at project outset to begin necessary mitigations as soon as feasible. Where risks cannot be fully mitigated, these can be escalated to SSEN management or the UKRI monitoring officer.

Supply interruptions

There will be no planned or unplanned supply interruptions for consumers and the project doesn't anticipate any specific policy and regulatory risks or challenges to deployment, derogations and requests for changes in regulation for Discovery or Alpha Phases.

Wider engagement

There will not be any direct interaction or engagement with energy consumers through Discovery, however if successful the project would have multiple benefits for energy consumers, as outlined in Question 7.

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Key outputs and dissemination

The Discovery objective is to validate user needs, define the problem statement and assess technical feasibility in order to define a robust AI-driven solution for accelerating network connections and enhancing efficiency. The aim is to advance the solution into Alpha, where we will build and test proof-of-concept AI models on historical data, developing a functional PoC tool for user testing.

Key outputs

Discovery will deliver 14 outputs (including 6 outputs relating to project management/ UKRI engagements) as specified in PM Book. The key outputs enabling the objectives at Discovery are:

User research: Engagement with end-users and stakeholders through interviews and workshops to gather insights into their needs, challenges, and expectations (Faculty)

Benefits assessment: An initial cost-benefit analysis to quantify and qualify cumulative net benefits of the proposed solution to SSEN and energy consumers. This assessment will be used to inform the Alpha application and will be further refined during Alpha (SSEN)

Technical approach: Iteration and refinement of the planned technical approach, based on data analysis and understanding of SSEN's environment and a feasibility and impact assessment (Faculty)

Alpha plan: Detailed project plan for Alpha, outlining objectives, deliverables, timelines, resources, and risk management strategies. This will include the updated solution architecture (Faculty)

Planned dissemination activities
We intend to disseminate key outputs and lessons learned through a multichannel approach:

*Report publications: An end-of-phase technical report (deliverable 4.3) reflecting on activities and technical findings at Discovery, along with lessons learned and other relevant materials, will be made freely available to all DNOs and interested parties via SSEN's website and industry platforms.

*Industry collaboration: Active engagement with Energy Networks Association's Connections Working Group to share insights and gather feedback.

*Official channels: Amplification through UKRI, Innovate UK, and Ofgem official SIF communications to reach a wider audience.

*Media and events: Raising general awareness through press releases, participation in annual Energy Innovation Summit, and promotion via websites and social media platforms.

Preventing market monopolies
This project is designed to support competitive markets by:

*Knowledge sharing: Free dissemination of our findings and outputs to encourage industry-wide adoption and innovation.

*Collaboration: Engaging with multiple stakeholders, including other DNOs and industry groups, to ensure that benefits are shared across the sector without favouring a single entity. Non-exclusive solution: AI solution and methodologies developed will be made accessible, avoiding exclusive rights that could limit competition. In principle, aspects of the solution could be completed by additional partners at Alpha/Beta.

Commercials

Intellectual Property Rights (IPR), procurement and contracting (not scored)

To ensure clarity is provided to the Project partners, UKRI and Ofgem regarding the intellectual property (IP) landscape, the Project is using an IP register to track the Background IP provided to the Project, the Foreground IP the Project generates, and the use and access rights to all this IP.

The main contract governing the Project (the Collaboration Agreement) will include detailed, mutually agreed terms governing IP that are in line with the SIF Governance Document. For the Discovery Phase, all the IPR arrangements will follow the default recommendations of Chapter 9 SIF Governance Document.

Investment Needs

Department for Energy and Net Zero

Oxford City Council -- Zero Carbon Oxford Project: The project aims to develop a roadmap and enhance collaboration for industrial decarbonisation in Oxford to help achieve the city's net zero target by 2040 (Status unknown - £415,000)

LCNF

SPEN -- Accelerating Renewables Connections: The project aims to accelerate renewable generation connections to the distribution network by implementing innovative commercial and technical solutions, ensuring efficient future connections across the UK. (Completed)

NIA

UKPN -- Trading Connections (Exploring a Novel Approach to Connection Queues): This project aims to accelerate network connections by improving queue visibility and enabling customers to trade queue positions, facilitating a faster transition to low carbon technologies. (In progress - £773,000)

SSEN -- ExtenDER: Feasibility study to assess the risks and potential benefits of market-based connection services, aiming to inform mitigation strategies and explore economic benefits if feasible. (In progress - £1,410,000)

SPEN -- Connected Island: This project aims to explore improvements in the planning and connections process to support low-carbon technology integration, including feasibility studies, microgrid development, and streamlined connection procedures to facilitate a net-zero network transition. (In progress - £196,000)

NGESO -- Construction Planning Assumptions Methodology Review: This project aims to update the Construction Planning Assumptions process to better accommodate net-zero technologies, improve modelling accuracy, and standardise and automate CPA development, enhancing efficiency and connection timelines (In progress)

Cadent -- Connections Forecasting Feasibility Study: The project focused on developing a forecasting model for future connection demands across the UK industry, aiming to enhance data accuracy, automate processes, and use machine learning for improved predictions, leading to more efficient resource management and better customer service. (Complete - £26,022)

Northern Powergrid -- AutoDesign (LV Connections Self-Service Tools): This project aims to develop a customer-friendly online tool to improve the efficiency of low voltage connections, including electric vehicle charging and renewable generation, through phased tool development, beta testing, and pilot implementation. (In progress - £1,100)

*Northern Powergrid -- Diversified Flexible Queue Management: This project aims to optimise resource allocation for new grid connections by incorporating diversity factors into connection assessments, improving capacity utilisation, reducing constraints, and accelerating connections timelines. (In progress - £155,000)

SIF

*Northern Powergrid -- Inform: This project aims to develop a self-service online tool for high voltage connections to expedite the integration of low carbon technologies, focusing on complex site developments, building on earlier successful feasibility phases (Status unknown - £138,731)

Value for money

FastTrack is an ambitious project bringing together a strong partnership to build a firm foundation for future phases. Faculty Science Limited is the UK's leading AI firm specialising in design, build and deployment of bespoke AI systems for critical national infrastructure, and provide a high-level of technical expertise that represents value for money for consumers.

The team has carefully prepared Discovery phase project plan and resources used are necessary to fulfil the scope and to deliver a quality output. We are confident that the proposed benefits of the project significantly outweigh the initial costs of launching the project through Discovery and then developing it through later phases. The future Alpha and Beta phases are realistic and achievable and will aim to commercialise solutions ready for adoption as BAU by Network Owners to significantly improve operations and delivering value for money.

Total project costs and SIF funding

Total Discovery costs: £158,926

*SSEN-D: £28,496

*Faculty: £130,430

SIF Discovery funding requested: £143,033

*SSEN-D: £25,646

*Faculty: £117,387

Discovery contributions: £15,893 (10%)

*SSEN-D: £2,850

*Faculty: £13,043

The balance of costs and SIF funding across the consortium is shown below and reflects effort required to deliver assigned work package content. There are no subcontractor costs associated with this application:

*SSEN-D: 18%

*Faculty: 82%

BAU adoption and commercialisation

The project will actively explore the most suitable route to market, with emphasis on developing a robust and effective approach that facilitates seamless integration. As we progress, project partners will collaborate closely with relevant teams within SSEN to ensure that the intended benefits are realised and that the solution is implemented into BAU operations efficiently.

The proposed solution is designed to be scalable, offering potential applicability not only across other DNOs in Great Britain but also within a wide range of sectors, including Transmission Operators and similar industries. We aim to validate the solution with other stakeholders and potential adopters in subsequent project phases, ensuring broad applicability and value.

An essential element of the commercialisation and BAU adoption process involves examining change management requirements necessary for successful deployment. This includes identifying and building key capabilities that will enable SSEN and other DNOs to seamlessly adopt an AI solution into their BAU framework. Change management will focus on mitigating potential barriers to adoption by fostering readiness for AI adoption, training relevant teams, assessing skills need, comprehensive support documentation and ensuring alignment
between technology capabilities and operational needs.

The finances of all project partners are included in the https://apply-for-innovation-funding.service.gov.uk/application/10142974/milestones-summary

Supporting documents

File Upload

SIF Round 4 Project Registration 2025-01-09 9_58 - 72.9 KB
FastTrack_Application_10142974.pdf - 324.9 KB
10142974 FastTrack PD_Signed Dec2024.pdf - 248.2 KB

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