

SIF Alpha Round 3 Project Registration

Date of Submission

Oct 2024

Project Reference Number

10128461

Initial Project Details

Project Title

Road to Power (Alpha)

Project Contact

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Challenge Area

Whole system network planning and utilisation to facilitate faster and cheaper network transformation and asset rollout

Strategy Theme

Optimised assets and practices

Lead Sector

Electricity Distribution

Project Start Date

01/10/2024

Project Duration (Months)

6

Lead Funding Licensee

NGED - National Grid Electricity Distribution

Funding Licensee(s)

NGED - National Grid Electricity Distribution

Funding Mechanism

SIF Alpha - Round 3

Collaborating Networks

National Grid Electricity Distribution

Technology Areas

Demand Side Management

Electric Vehicles

Project Summary

Our project addresses the critical challenges from the electrification of plant machinery in the construction industry. The Discovery Phase found the non-road mobile machinery sector alone is projected to increase NGED's electricity demand by 1.5 to 2.0 TWh in 2050, powered via temporary grid connections on construction sites. The existing manual process of requesting temporary connections will not meet the evolving needs of an electrified construction sector, with significantly increased and more complex temporary connections.

To solve this, a self-service tool for temporary connections, focusing on flexible and interruptible connections, is needed.

Construction schemes are ideal for these connections having a variable but predictable load across the day and year, and where agility is preferable to reinforcement related delays. This tool will extend existing self-service connection tools, providing improved functionality with a consistent user experience.

Project Budget

£486,051.00

SIF Funding

£437,404.00

Project Approaches and Desired Outcomes

Animal testing (not scored)

- Yes
- No

Problem statement

Project Summary and Evolution

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To solve this, a self-service tool for temporary connections, focusing on flexible and interruptible connections, is needed. Construction schemes are ideal for these connections having a variable but predictable load across the day and year, and where agility is preferable to reinforcement related delays. This tool will extend existing self-service connection tools, providing improved functionality with a consistent user experience.

Evolution of Project Scope

Originally focused on electrifying roadworks, following stakeholder feedback the scope has expanded to include all construction projects. This reflects the common challenges across the sector and the need for a comprehensive, scalable solution that can address a broader range of construction activities.

Meeting Innovation Challenges

The project directly supports the Innovation Challenge aim of "Whole system network planning and utilisation to facilitate faster and cheaper network transformation and asset rollout" by maximising the ability to provide these large temporary connections with minimal reinforcement, facilitating the transition to an electrified construction industry. By enabling flexible and interruptible connections, our tool has the potential to drastically reduce the time and financial barriers associated with the network connections necessary for supporting electrified machinery, aligning perfectly with the innovation challenge theme.

Understanding User Needs

In stakeholder workshops, construction planners and network operators have expressed the need for quicker, more cost-effective connection solutions. Our understanding of their needs has evolved to recognise the importance of flexibility in connection options, especially as most of their projects have varied loads and they have detailed with predictable load profiles. A self-service connection tool for temporary connections will reduce the anticipated workload on ONO network planners, accelerating the adoption of electrified solutions.

Previous Work and Contribution to Current Project

Previous funded initiatives have laid the groundwork for our current approach. EA Technology (EATL) developed a self-serve connections tool for HV connections, HV AutoQuote, leveraging the expertise developed by providing LV self-serve connections

tools via the VisNet Modelling products (AutoDesign, Connectlite, ConnectLV).

HV AutoQuote was developed for UK Power Networks and allows its customers to self-serve firm quotes for HV connections from 300kVA to 1MVA, and budget estimates for 300kVA to 2.5MVA connections. The tool generates a valid HV connection design based on user's inputs and produces a bill of materials for the connection along with construction costs and traffic management requirements.

EATL have also developed the 'ConnectMore' tool which provides real time network capacity and projected EV demand between 2025 and 2050. EATL are currently working on projects that tackle flexible connections such as the FLEX Project, which looks at identifying locations where flexibility services will be required, specifying the technical and commercial arrangements for different types of demand and generation flexibility providers, and supporting the trial dispatches.

Innovation justification

The self-service temporary connection tool is crucial as it supports the construction sector's shift towards decarbonisation by managing connections more efficiently and sustainably.

Existing self-service tools across Great Britain are limited to managing fixed, permanent connections, which the Discovery Phase shows will be insufficient for the complex, temporary needs of modern construction sites. These sites require large temporary connections and are strong candidates for flexible and interruptible connections due to predictable yet varied load profiles and the transient nature of their operations. Our tool uniquely fills this gap, providing an automated solution that facilitates temporary connections with an option for flexibility and interruptible connections —a significant advancement over the current state of the art.

The Discovery Phase provided critical insights into the deficiencies of current practices. We learned the importance of stakeholder engagement and iterative development to align technical solutions with practical field requirements. This has shaped our Alpha Phase, ensuring the tool is designed with direct input from our project partners Kier, and our industry stakeholders including Highways Authority and Utilities Committee, Keltbray, HS2 and National Highways, who have highlighted the necessity for this innovation.

The project's scale and design are tailored to meet SIF objectives by demonstrating significant innovation beyond incremental improvements. The tool assesses current capacity across the duration of the works and across half-hourly periods, offering users multiple, tailored connection options.

The tool will present end users with several options for the connections including fixed, flexible and interruptible connections. Each connection type will include a costing, time to connection and time to restore in case of fault. The end user can then select the connection based on their risk appetite and scheme requirements. Utilising flexible and interruptible connections will drastically reduce the cost and timing for a connection due to avoided reinforcement while providing the supply resilience needed for a construction site. Automating the process and visualising the options to the end user should significantly increase the uptake of these connections.

This capability represents a substantial technical leap in the automation of electrical connections for construction, promising significant time and cost savings. By the end of the Alpha Phase, we aim to advance from TRL3 to TRL6, and similarly improve integration and commercial readiness, marking a clear progression towards market viability. This will involve the development of a proof-of-concept (POC) tool, focusing on HV connections, using a single primary substation within NGED's region. The POC will demonstrate temporary, flexible and interruptible connections, presenting the user with a number of options based on their input load profile.

SIF funding is essential as the project's novel approach and the technical challenges it addresses are not suitable for conventional funding channels within the price control or as part of business-as-usual activities. These sources typically do not support the high-risk, high-reward developments needed for such transformative innovations in the energy sector.

Alternative approaches such as minor enhancements to existing tools or continuing with manual processes were considered. However, these were dismissed because they fail to meet the rapidly evolving demands of the construction sector for flexibility

and automation, particularly under the pressing imperative of decarbonisation.

In conclusion, our project represents a transformative step forward in energy network management for construction, delivering a novel tool that significantly advances the capability, efficiency, and sustainability of temporary electrical connections. Funded by the SIF, this tool will set new standards in the industry, directly contributing to the UK's decarbonisation targets and supporting the broader transition to a sustainable future.

Impact and benefits (not scored)

- Financial - future reductions in the cost of operating the network
- Financial - cost savings per annum on energy bills for consumers
- Financial - cost savings per annum for users of network services
- Environmental - carbon reduction – indirect CO2 savings per annum
- New to market – products
- New to market – processes
- New to market - services

Impacts and benefits description

Financial Benefits: Future Reductions in Operating Costs

Reduced Resourcing to Support Increased Connection Requests

By 2050, we project around 615 works annually in the NGED region requiring temporary grid connections---a dramatic increase from the expected 6 works in 2025. To manage this surge efficiently, the proposed tool will:

- Reduce future resourcing costs for NGED:** By streamlining the process, less staff time and fewer resources will be needed to handle the higher volume of requests.
- Improve current process efficiency:** The tool will cut down on staff time and costs associated with temporary connection requests.
- Increase the number of processed requests:** It will provide applicants with a range of feasible options, enhancing customer service.

These improvements are estimated to save NGED approximately £19.3 million by 2050.

Reduced Network Reinforcement through Flexible and Interruptible Connections

The structured shift patterns and high-level planning of infrastructure works present a significant opportunity to use flexible connections. The temporary nature of these works and the availability of alternative power sources make it feasible to accept an interruptible supply. This reduces the need for network reinforcement, potentially saving approximately £828 million by 2050. Avoided CML/CI penalties amount to a further £12.18 million by 2050.

Improved Load Forecasting

While reinforcement will still be necessary in some scenarios, the self-service tool will enable better precision in identifying and prioritising areas with high demand. This will help NGED future-proof their reinforcement strategies, aligning efforts with anticipated demand more effectively.

Cost Savings for Consumers

The project supports the electrification of machinery, enhancing planning and capacity utilization. By minimizing network reinforcement and reducing socialized costs, it contributes to lower energy bills for customers.

Cost Savings for Users of Network Services (Construction Site Planners)

Quicker Temporary Grid Connections

The tool will expedite temporary grid connections for construction planners, offering connection options that require minimal network reinforcement. This speed and ease of access are crucial for construction projects, allowing timely start of construction and facilitating the decarbonization of machinery.

Multiple Connection Options

The tool will provide infrastructure planners with multiple connection options based on cost, risk margins, environmental impact, and network overhead capacity. This will allow planners to quantify and mitigate the commercial risks associated with the connection process. By offering data during the planning stages, developers can evaluate and manage the potential risks, enhancing project feasibility and execution.

Environmental Benefits: Carbon Reduction

By significantly reducing the need for network reinforcement, the tool indirectly reduces carbon emissions. Electricity networks play a crucial role in decarbonizing infrastructure and construction. This tool positions NGED as a key facilitator in the transition towards zero-emission construction sites. Ensuring grid connections are readily available will help construction sites reduce their reliance on diesel generators, which are major sources of carbon emissions.

Additionally, reduced reinforcement works will decrease potential network outages, lessening traffic congestion and reducing stress on vulnerable customers.

New Market Products and Services Products:

Currently, there are no tools that automate temporary grid connection requests. This new tool, designed as an add-on to existing connection tools, will significantly enhance their functionality while providing a consistent user experience.

Processes & Services:

The tool will revolutionize the current manual process of requesting temporary grid connections. It will offer users multiple connection options, detailing their costs, feasibility, and fault tolerance. This streamlined process will be simpler than the current approach, allowing more resources to be allocated to complex connection requests requiring manual intervention.

Teams and resources

EA Technology has substantial experience developing software tools specifically designed to assess network capacity, notably VisNet Design (also branded as Connect/LV) and VisNet Connectlite for NGED. This expertise is supplemented by our work on various scenario analysis projects (such as SILVERSMITH), which

has provided a comprehensive understanding of the unique challenges that NGED and other DNOs face.

EA Technology are a pivotal partner in the 'Road to Net Zero' project, a 3-phase project funded through TfL's Lane Rental Scheme. This has provided an in-depth understanding of the complexities of the street and road works sector and provided a clear picture of the nature, scale, and emerging trends in the sector's operations. It has also enabled us to establish a broad

network of stakeholder relationships. These relationships encompass all four major utilities (water, gas, electricity, and telecoms), highway and local authorities, contractors, and other organisations of note such as HAUC(UK), the Greater London Authority, Transport for London, and the Scottish Road Works Commission.

The discovery phase strengthened our understanding and stakeholder network in the construction sectors. National Highways, Kier, Keltbray and Flannery's plant hire have been invaluable contributors the project and we expect to utilise these relationships heavily in the Alpha phase.

The combination of these two areas of expertise---grid management and construction ---uniquely positions EA Technology to address the project's challenges; not just having the right tools or the right contacts but also having a holistic understanding that can be translated into actionable solutions.

To ensure that our approach addresses the sector's requirements, we have enlisted the support of one of the biggest construction companies in the UK, Kier Transportation, as project partners. As one of the main contractors for National Highways, they are actively striving to decarbonise their operations and recognise the issues in obtaining grid connections for their future electrified schemes. It is expected that they will be pivotal in the development of the user journey and specification of the tools, ensuring that it meets the requirements of the end-user projects in the UK.

Along with the previously mentioned stakeholder network, we also hope to have the HS2 connections team as stakeholders of the project. Their extensive knowledge and ongoing experiences with HS2 will guide the project and validate that the solutions developed address the sector's requirements.

NGED currently have a wealth of experience in how temporary connections are currently provided but, as demonstrated by the Take Charge project, are willing to embrace revolutionary change where this delivers real benefits. NGED are keen to ensure that the project outcomes enhance our planning and forecasting as well as improving our provision of temporary connections.

Project Plans and Milestones

Project management and delivery

EA Technology will be responsible for the delivery of the Road to Power project and will appoint a project manager with substantial experience in delivery of software solutions for DNOs. The project manager will ensure the project aligns with the proposal and adheres to the timing and cost constraints. Regular online meetings are scheduled with the partners, sponsors and the wider stakeholder group to ensure that the outputs align with stakeholder expectations.

EA Technology employs an Agile project management methodology for software development projects, which will be utilised in creating the POC version of the tool. This management approach is highly effective for software delivery, offering flexibility and enabling extensive stakeholder interaction. EA Technology has a proven track record of integrating Agile with more traditional 'waterfall' methods, as seen in projects like ConnectMore and AutoQuote. The POC will be developed so that, if successful, it can transition into a fully automated tool encompassing all NGED's license areas, with the ability to be scaled for adoption by other DNOs.

Our risk management strategy encompasses a comprehensive RAID (Risks, Assumptions, Issues and Dependencies) log, maintained and regularly updated. Accessible to all project partners, this log facilitates transparent communication, with critical and emerging risks regularly reviewed. Active risk management strategies will be employed to pre-emptively mitigate potential issues.

The project's work packages are interrelated, making timely milestone delivery crucial for the project's smooth overall progress. To maintain these timelines, the project manager will ensure that the deadlines for subtasks are met as scheduled. The model's inputs requires timely provision of data from NGED and stakeholders in the construction industry. If this is not feasible, the risk will be mitigated by using estimated inputs to create the network model, leveraging EA Technology's domain experience. Additionally, the project team will remain consistent throughout the project, with frequent meetings and communication to ensure alignment of outputs.

Potential risks in the project have been reduced by limiting the proof of concept to one substation on the network; creating a POC version of the tool instead of a full model; and adding functionality around pre-existing self-service tools. This keeps the focus on the innovation, which is to automate temporary and flexible HV connection requests. The project will not result in any expected or unexpected supply disruptions and therefore will not affect how consumers use energy services, or how they engage with the industry. It also will not affect any current or future energy consumers directly, except for supporting future applications for new or different connections, if a BAU tool is created under the next (Beta) phase.

Key outputs and dissemination

The initial expected output of the project will be the user journey and specification for the software tool. This will involve multiple workshops with our project partners and stakeholders to understand their requirements and expectations of the tool.

By the end of the Alpha phase, we will provide a Proof Of Concept (POC) self service connection tool for HV temporary connections that demonstrates the essential functions highlighted in the Discovery phase. These functions are:

- The ability to assess a time-based load profile against available network capacity on half-hourly intervals to provide a flexible connection. This will allow the user to plan work and plant machinery charging patterns against the available network capacity.
- The ability to assess the load profile of the connection with respect to time on a monthly or seasonal basis against the available capacity of the network. This will allow planners of works to align their work schedules to periods of lower demand.
- The ability to provide interruptible supplies as a connection option. These will have an increased time to restore in case of a fault elsewhere in the network but should allow for significantly reduced chance of required reinforcement.

All these three options will allow for better asset utilisation, reducing the probability and cost of reinforcement to the network and hence the connection cost | timeline.

The tool needs to be able to check for all these options, and combinations of these options, and provide the user with the ability to select based on their own

priorities, budget, timeline and risk appetite. This will require the tool to provide:

- Cost for connection - What is the cost required to connect to the network, including any costs for reinforcement and active network management components.
- Time to connection -- How long will it take for the connection to be made? It is expected that a flexible connection which doesn't require reinforcement should allow for a significant improvement in the time to connect.
- Time to restore following unplanned outage -- How long could the site be off supply following a network fault? It is expected that certain options presented to

the user (i.e. interruptible connections) will have longer but acceptable restoration times.

As part of the proof of concept, we will demonstrate the tool working for a single primary substation with NGED's network against several example construction scheme load profiles based on real-world data provided by project partners. The proof of concept will be demonstrated and can be used by the wider stakeholder group to ensure it meets their expectations. Through stakeholder engagement sessions, we will demonstrate this POC to other interested GB DNOs.

In addition to the SIF End of Phase and Show and Tell presentations, a final report demonstrating the capability and feasibility of the tool, feedback from the stakeholders, next steps and lessons learned will be produced.

These deliverables are separated into the work packages as follows:

WP1: Project Management

WP2: User Journeys and Construction works profile generation

WP3: Learning report detailing methodology and process for HV data creation WP4: Specifications for temporary, flexible and interruptible supplies.

WPS: Wireframe and GUI development for results visualisation along with proof of-concept demonstration

Commercials

Intellectual property rights, procurement and contracting (not scored)

The project will use the default arrangement for Intellectual Property Rights.

The IPR register will continue to be maintained throughout Alpha, as per National Grid Innovation's Project Management Governance.

Foreground Intellectual Property

The IP created in the Alpha phase will be the deliverable reports produced, as detailed in the project management template. Intellectual Property rights will be shared between the creators of the documents, but they will be published externally.

Background Intellectual Property

Each partner will be the sole IP owner of the data provided on their commercial arrangements, including any work completed outside of the SIF funded phases.

The project partners acknowledge and accept the default arrangements for Intellectual Property Rights (IPRs) within Projects as documented within the SIF guidance document.

Please note that most of the IP developed is anticipated to be built into EA Technology's existing Commercial Product, VisNet Connect, and made available for sale. As such, it will be Background IP and not Relevant Foreground IP as per the SIF governance.

The project does not currently intend to use subcontractors or issue any RFI or RFP for additional services or equipment. Any changes in this approach will be notified during the course of the project.

Commercialisation, route to market and business as usual

This project will develop an innovative add-on to existing self-service connection tools currently in use by several GB DNOs. This add-on would provide a significant increase in functionality for these tools, strengthening the benefits and improving the business case for deployment.

EA Technology already have a commercial relationship with NGED for the provision of VisNet Connectlite, a software tool designed to provide LV self service connection budget estimates, and so have a direct route to market with a first client within the project partners. Several other UK DNOs also use the VisNet Connect product, so deployment as part of this product can be efficiently achieved. This will enable the fastest possible route to BAU and enable a demonstrable system for other DNOs to emulate.

Once developed for NGED, and available for use through the connection portal, the tool will be demonstrated to other GB DNOs, with the caveat that the tool will require tailoring to their specific network and requirements. It is expected that a second GB DNO could be involved in the Beta phase of the application.

The Alpha phase is intended to create a proof of concept of the tool, utilising detailed HV network data and a similar methodology to the final product. However, this will be localised to a single primary substation within NGED's network. This will demonstrate the key functionality of the tool. The Beta phase will take the learnings and feedback to develop a full network model which can be deployed.

As demonstrated in the Discovery phase of this project, there will be significant increase in temporary connection requests to enable the rapid transition of construction sites to electric powered alternatives. This highlights the clear value for DNOs to have

this tool ready for deployment as it will ensure the networks are not an impediment to this vital transition. Furthermore, the potential for a reduction in unnecessary reinforcement, by utilising flexible and interruptible connections, has the potential to reduce overall costs to consumers via socialised costs along with those incurred by the construction industry which are also passed on to consumers.

The stakeholders engaged in the project through the discovery phase highlighted wide support for the tool's development and a strong appetite to be involved in the process.

There is significant potential for the tool outside GB, however the barrier should not be underestimated. New connectivity models would be required to accommodate differing design standards, asset types, and operational methodologies. Differences in network usage result from differences in climate, construction methods and behaviours.

Following NGED's recent reorganisation, it is likely that the senior sponsor for the Beta phase project should shift to the New Connections Director but that steering group members should represent the Customer Excellence directorate as well as the Data & Digitalisation and Planning and Forecasting teams. To ensure smooth scaling up and roll out it is recommended that the Beta phase includes data from all NGED licence areas as data issues can be region specific.

Policy, standards and regulations (not scored)

We do not foresee any government barriers to this proposal. There are no government policy changes or decisions required for the project to progress to Business as Usual (BaU).

We don't foresee any regulatory barriers so therefore need any derogations or exemptions to deliver the Alpha or Beta project stages. When integrating with ONO systems, we will adhere to all relevant cyber security regulations and standards.

We do not anticipate any issues relating to GDPR as the test data for the tool will reflect applications from commercial entities rather than individuals.

This ensures the security and integrity of data and systems, protecting against potential cyber threats and maintaining compliance with industry best practices.

Value for money

The total cost associated with the project delivery is £483,651 of which £48,407 (10%) will come from project partner contributions broken down as follows:

*EA Technology - £43,477

*National Grid Electricity Distribution - £4,930

It is expected that several project partners will be involved in the project and will contribute to the project with time at several workshops and meetings. This will increase the project partner contributions to greater than the amount specified above but cannot be confirmed at this point.

Value for money

The proposed programme of works has been scrutinised by senior management and experienced consultants within EA Technology to ensure that the maximum value can be achieved for the project, whilst ensuring that the outputs are high quality and reusable for a future beta phase and roll-out to other GB DNOs. As the developer of multiple self-service connection tools for GB DNOs, EA Technology are able to provide an unparalleled level of expertise to the project which allows the proposal to be

developed in a much more cost-effective manner than if it were performed by another party.

The proof of concept will be developed with NGED in mind but the principles and methodology will apply across the rest of the GB DNOs. Ensuring this is rolled out across the country will maximise the benefits for network users. At Alpha, the intention is to develop the proof of concept; at beta it is intended to bring another ONO on board to ensure the development of the tool is suitable for use across GB.

Normal Industry Rates

In the preparation of this proposal we have worked closely with our Project Partners to ensure their involvement is provided at a commercially competitive rate in line with those we've seen from projects delivery elsewhere. This has been achieved through careful discussion and consideration into where the Project Partners can increase efficiency, reduce risk and maximise the value they deliver to the project. As a result, this project offers excellent value for money to consumers whilst ensuring high quality, reliable outputs are achievable.

Contributions

Each partner will contribute to the project through a combination of day rate discounts and by offering days in kind to the project.

Subcontractors

We don't expect sub-contractors to be utilised in the delivery the Alpha Project.

Additional Funding

No additional funding will be required from other innovation fund

Use of existing assets or facilities

EA Technology will use existing knowledge developing the user interface and network capacity modelling from the Inform project and VisNet Connect tools. This will leverage learning captured during the development of these tools.

Associated Innovation Projects

- Yes (Please remember to upload all required documentation)
- No (please upload your approved ANIP form as an appendix)

Supporting documents

File Upload

RTP Alpha End Of Phase Report V2.1 - 322.2 KB
EA29844-TR04-V1.0 HV Network Data Specification.pdf - 784.8 KB
EA29844-TR01-V1.0 Road To Power-Tool Specification.pdf - 716.9 KB
EA29844-TR03-V1.0 RAG Logic Specifications.pdf - 643.7 KB
EA29844-TR02-V1.0 Tool Connections Offer Journey.pdf - 901.3 KB
NIA Project Registration and PEA Document 2022-08-19 12_15.pdf - 72.2 KB
SIF Alpha Round 3 Project Registration 2024-10-24 2_12 - 78.5 KB

Documents uploaded where applicable?

