SIF Discovery Round 2 Project Registration

Date of Submission

May 2023

Project Reference Number

10061245

Project Registration

Project Title

WARN (Weather Alerts and Risk analysis for Network operators)

Project Reference Number

10061245

Project Licensee(s)

UK Power Networks

Project Start

Apr 2023

Project Duration

3 Months

Nominated Project Contact(s)

innovation@ukpowernetworks.co.uk

Project Budget

£121,830.00

Funding Mechanism

SIF Discovery - Round 2

SIF Funding

£109,647.00

Strategy Theme

Optimised assets and practices

Challenge Area

Improving energy system resilience and robustness

Lead Sector

Electricity Distribution

Other Related Sectors

Funding Licensees

Lead Funding Licensee

UKPN - South Eastern Power Networks Plc

Collaborating Networks

UK Power Networks

Technology Areas

Asset Management, Measurement, Resilience

Equality, Diversity And InclusionSurvey

Yes

Project Summary

WARN aims to address Challenge 3: Improving energy system resilience and robustness. Over the past few years extreme weather events have become more common and this has a direct impact on customers and the network given the direct relationship to faults and failures. WARN will provide better decision making and planning to mitigate against and reduce the impacts from these events. The WARN project will develop and test an integrated digital solution that monitors weather and climate-related asset vulnerabilities. This will enable DNOs to make decisions that will improve the robustness and resilience of their networks and operations in the face of weather shocks and future climate change.

WARN will require UK Power Networks to delve deep into the data they have and understand how they can use the innovation to improve their processes and decision making. Understanding how - and if - the weather impacts different aspects of the network is still unproven using real time data. The project will therefore focus first on using advanced statistical methods to identify relationships in past weather and UK Power Networks' network data. These will establish how weather variables combine to cause faults and induce slow onset performance risks, and the thresholds at which these emerge. This insight will then provide the basis for improved monitoring and alerting over three time periods:

1. Short-term (up to seven days)
2. Seasonal (e.g., upcoming winter)
3. Long-term (climate impacts on problematic weather conditions)

WARN has two key project partners:

1. The Institute for Environmental Analytics: an applied R&D centre specialising in modelling the impacts of weather and climate on the energy sector. WARN will build on an existing IEA proof-of-concept already demonstrated in the energy context in Columbia and on pre-existing software libraries and weather data pipelines used within a commercial weather monitoring platform.
2. UK Power Networks: distribution network operator and the end user of the innovation. They will utilise the integrated solution developed by the IEA to better understand how the weather and climate will impact their assets and operations.

If the project moves to Alpha Phase, SSEN have shown interest to be involved. DNOs and stakeholders involved in the planning of network operations and assets are the primary users of WARN and they are actively involved in the Discovery Phase to ensure the solution meets their needs.

Project Description

WARN aims to address Challenge 3: Improving energy system resilience and robustness. The project will develop and test an integrated digital solution that monitors weather and climate-related asset vulnerabilities. This will enable DNOs to make decisions that will improve the robustness and resilience of their networks and operations with the emphasis on reducing customer vulnerabilities. Over the past few years extreme weather events have become more common with potential major impacts on customers and the network given the direct relationship to faults and failures. WARN will inform better decision making and planning to mitigate against and reduce the impacts from these events.

The project will focus on the distribution networks. It will combine the best available data with state-of-the-art statistical analysis and machine learning to develop a user-focused solution that will benefit from continuous improvement. This will enable UK Power Networks to use resources more efficiently, improving service levels and reducing contact timeframes between UK Power Networks and its customers.

The system will provide:

1. Vulnerability profiles for network assets through comparison of historical weather data with UK Power Networks' historical fault and asset performance data.
2. Automated monitoring, alerting and functionality to explore risks at three relevant time horizons:
   a. Short-term (up to seven day-ahead forecasting): Enable more efficient field operations. b. Seasonal (three-six month ahead outlook): Inform improved seasonal preparedness. c. Long-term (10-50 year ahead climate projections): Optimize strategies for ensuring future system resilience.
3. A machine learning capability to continuously assess how weather is impacting the network.
4. The ability to integrate climate-scale projections into an associated network model (being developed as a digital twin in a related UK Power Networks SIF bid CReDo) to explore critical network vulnerabilities in the context of differing climate change scenarios.

Weather and climate-related risk is a major concern for DNOs. Other initiatives have also looked at the problem, however, we are not aware of another weather and climate intelligence platform that specifically focuses on the distribution networks (asset types differ between the transmission and distribution networks, with associated differences in vulnerability profiles) and addresses all three relevant time horizons through a single solution. This requires strong network innovation for UK Power Networks to challenge their current processes, operations, data and systems, and work collaboratively with the IEA to achieve success. WARN has therefore raised significant interest with other DNOs, having also been shortlisted by both SSEN and NPG.

Third Party Collaborators

Institute for Environmental Analysis (IEA)

Nominated Contact Email Address(es)

innovation@ukpowernetworks.co.uk

Project Description And Benefits

Applicants Location (not scored)

UK Power Networks (Operations) Limited: Newington House, 237 Southwark Bridge Rd, London, SE1 6NP

University of Reading

Project Short Description (not scored)

The WARN project aims to develop and test an integrated digital solution to monitor weather and climate-related asset vulnerabilities and enable Distribution Network Operators (DNO) to better respond to weather shocks, improve operational preparedness, make better decisions, and inform planning that will improve the robustness and resilience of distribution networks and their operations to future climate change.

Video description

https://www.youtube.com/watch?v=06CfJY9JPw4&list=PLrMOhOrmeR6ldr-EVoT8ABGhTCxgyBKqs&index=31

Innovation justification

UK government has made it a priority for all DNOs to improve capabilities for managing disruption caused by severe weather events (Ofgem Storm Arwen Report, June 2022). WARN will support this by developing a comprehensive new digital system to monitor weather and climate-related risks and enable more effective decision making.

DNOs have experimented with solutions to extreme weather and long-term climate change to some degree. Examples include Storm Resilience, MIVOR, Predict4Resilience, ERA, Ice Project and ACCELERATED. To date, no project has developed an operational system for the distribution infrastructure that is comprehensive across all relevant time horizons and types of risk. Predict4Resilience, for example, focuses on the transmission infrastructure and does not consider long-term climate projections, impacts to contact centres from increased call volumes or use of machine learning for continuous improvement, all of which are considered in WARN. Our aim is to provide a seamless approach for the DNOs, covering the near-term, medium-term, and long-term. Whilst UK Power Networks does undertake some high-level forecasting of weather impacts, it is not well understood at an asset level, does not include real-time weather data, and does not yet form part of day-to-day operational decision making.

WARN will enable step-change improvements in key metrics such as Customer Interruptions and Customer Minutes Lost. More intelligence on the impacts of extreme weather events will improve and reduce these metrics as UK Power Networks are better able to prepare the resourcing of their staff and equipment. In turn this will reduce total staff costs per annum as resourcing levels are better matched with operational requirements. If WARN is not deployed, we will continue to see the impacts of weather and climate on the cost of operating the network and on customers.

We will use relevant network data from recent weather disruptions as our counterfactual and benchmark against which we will evaluate our success.

Significant investment is required to develop WARN which would not typically be achievable as part of BaU or elsewhere within the price control as the approach, analysis, scope, and systems are new, unproven and carry a degree of risk. The initiative is highly strategic and will be developed in an agile way that is well suited to SIF as the feasibility must be proven before it can proceed. Given WARN's complementarity with CReDo+, it may be possible to include the WARN system as a module plugged into the CReDo digital twin.

Benefits Part 1

Environmental - carbon reduction – direct CO2 savings per annum against a business-as-usual counterfactual
Financial - cost savings per annum for users of network services
Financial - cost savings per annum on energy bills for consumers
Financial - future reductions in the cost of operating the network
New to market – products, processes, and services

Benefits Part 2

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

1. WARN improves efficiency of field and contact operations:
   a)Metrics: i)Reductions to CML; ii)Improved utilisation of on-call staff (less redundancy); iii)Improved customer satisfactioniv)Improved utilisation of contact centre staff
2. Network-wide analysis informs evidence-based approach to network planning.
   a)Metrics: i)Reductions in CI and CML ii)Improved RoS.
3. Weather inputs to inform vegetation growth models improve vegetation management practices
   a)Metrics: i)Reductions in CI and CML ii)Reduced # of flying hours iii)Reduced #/distance of vehicle patrols

Financial -- cost savings per annum on energy bills for consumers

Directly related to reduced costs for network operations, flowing through to consumers as reductions on energy bills.

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

Cost reductions for operating the network drive related cost savings for other users of network services.

Environmental -- carbon reduction -- direct CO2 savings per annum

1.Efficiency in field operations includes more intelligent deployment of mobile back-up generation: Metrics: Reduction in litres of consumed fuel/conversion to CO2 equivalents

2.Efficiency in field operations improves deployment of on-call staff:
Metrics: Reduced journey times and distances save fuel/conversion to CO2 equivalents

3.Improved targeting of vegetation management practices:
Metrics:
i.Reduced # (number) of flying hours reduces fuel consumption/conversion to CO2 equivalent
ii.Reduced #/distance of vehicle patrols reduces fuel consumption/conversion to CO2 equivalent

All benefits are linked to deployment into operations of WARN. Timeline to achieve is Discovery + Alpha + Beta = 24 to 36 months.

Project Plans And Milestones

Project Plan and Milestones

WP1: Scope and needs: Scope and user requirements analysis (IEA)

- Aims: Consolidate user requirements for the WARN system and summarise current practice for making decisions on extreme weather/system emergency. To include processes, procedures and systems used.
- Success criteria: UK Power Networks' acceptance of the requirements as captured. A comprehensive assessment of the scope and user requirements.
- Outputs: User requirements document and baseline approach on current practices.
- SIF funding: £29,907

WP2: Data analysis: Identification and initial data preparation (IEA)

- Aims:- Identify and characterise the available data (UK Power Networks' operational records, forecasting options and climate data) and the implications for addressing priority use cases.
- Detail how UK Power Networks discover, categorise, store, and use asset failure data and risks linked to weather/climate.
- Relevant financial KPI data on the implications of weather-related asset failure.
- Success criteria: Relevant UK Power Networks data is available together with the required weather and climate data.
- Outputs: Data discovery report, Asset data catalogue, Overview of costs and wider implications of asset failure.
- SIF funding: £28,615

WP3: System design: Initial concepts for the integrated solution (IEA)

- Aim: Explore initial system design options and functional specifications with UK Power Networks. Assess options for integration with existing systems.
- Success criteria: Initial design concepts prepared and presented. Technical feasibility established and agreed.
- Output: System design options and assessment of technical challenges.
- SIF funding: £23,173

WP4: Route to market: Exploitation potential and business case (IEA)

- Aim: An initial exploration and verification of the strategic vision, business case, route to operations and success criteria for integration to BaU.
- Success criteria: UK Power Networks' acceptance of strategic vision and proposed route.
- Output: Preliminary strategic approach to Alpha Phase.
- SIF funding: £17,352

WP5: Project Management (IEA)

- Aim: To deliver the project objectives on time and to budget.
- Success criteria: Project delivered to plan, budget and UK Power Networks' satisfaction.
- Output: Monitoring and progress reports.
- SIF funding: £10,600

Main risks (more details in Project Management template)

- Technical risks: (i) Access to appropriate data, to include historical operational records, weather forecasts and climate projections; (ii) Insufficient expert input from UK Power Networks.
- Management risk: Loss of key staff
- Commercial risk: Initial ideas are unable to satisfy UK Power Networks' requirements.

The risk register will be managed by the IEA and reviewed weekly.

Regulatory Barriers (not scored)

No policy or regulatory barriers have been identified that will hinder the delivery of Discovery, Alpha, and Beta Phases or Business as Usual and does not require any derogations.

Commercials

Route To Market

To ensure new solutions and services can be quickly adopted into business-as-usual practices, the project will work with UK Power Networks and other relevant stakeholders throughout the project lifecycle to ensure the solution is fit for purpose to address real BaU situations and is scalable across networks.

The outputs of WARN will be made available to all distribution network operators and therefore does not undermine competitive markets. The IEA will lead the development of the WARN innovation but require UK Power Networks' systems, expertise and data to test and deploy it. The IEA have experience developing data and software solutions from concept through to commercial deployment. The team includes all competences necessary to develop the required solution (data science, data modelling, User Experience design, software engineering, meteorology, and customer relationship management). A single development lead also simplifies the IP arrangements, de-risking the commercialisation effort. The IEA has successfully commercialised an existing software solution in the energy sector (EnergyMetric) and is currently rolling this out across several international markets, either directly or via third party distributors.

For WARN, the plan for commercialisation starts with progression through the three phases of SIF to a deployed, operational system in place with UK Power Networks. If this is achieved, then the intent is to seek further commercialisation through adoption by other GB DNO networks in the first instance.

Whilst the IEA is unable to internally fund large scale technology development, it is in a position to fund future commercialisation and go-to-market adoption. Our view is that the system would be fully deployable by the end of the Beta Phase and ready to be scaled up to other users. We envisage this would involve a degree of product/service customisation and will do this through our own funds and/or with joint investment from potential customers. How this will ultimately be funded will be explored in Discovery Phase. For example, DNOs may pay a fair market rate to license the WARN technology.

We believe there is a strong value proposition (reductions in CML and CI, improved service levels for WSC, enhanced intelligence for long term investment strategies) for DNOs, based on potential for more resilient infrastructure, lower operating costs and increased consumer satisfaction. DNOs are thus the focus, but expansion potential is considered realistic with operators of transmission infrastructure.

Prior scoping work has already also confirmed interest from international network operators.

Intellectual property rights (not scored)

The IPR arrangements for this project will be in line with the terms set in the SIF Governance Document and the project participants agree to comply with the default IPR conditions.

The IEA is working directly with UK Power Networks and is the sole technology developer which simplifies the IP arrangements. The basic principles for IP will be as follows:

Both parties will retain ownership of any pre-existing Background IPR (BIPR) and data. This is highly relevant since WARN benefits from building on existing software (e.g., WeatherAsset) and data libraries the IEA currently own.

In line with SIF governance and formalised via a collaboration agreement between UK Power Networks and the IEA, each party will own their own Foreground IPR (FIPR) emerging from the SIF development phases. The IEA is itself part of the University of Reading legal entity, which will have ultimate ownership of the emerging IP created by the IEA.

As per the SIF governance the collaboration agreement distinguishes between FIPR and Relevant FIPR. Relevant FIPR will be made available to all other licensees to assess the usefulness and potential value of WARN. Access to the full system will be made available to all licensees on fair and reasonable terms, most likely under a licensing agreement.

UK Power Networks, as the lead partner on WARN, will receive favourable commercial terms to access and deploy into operations the developed solution.

Any BIPR that may be required to enable proper exploitation of WARN, will be made available under the mentioned license agreement.

The IEA has followed a single developer model for the vast majority of its product development activities, reducing almost entirely any

dependence on third-party rights to relevant BIPR.

Costs and value for money

The total project costs for WARN are £121,830.

- UK Power Networks: £14,200
- IEA: £107,630

UK Power Networks will invest £12,183 (10% of total costs) as contribution in kind. Therefore, the total SIF funding requested is £109,647. There will be no sub-contractor costs.

The balance of costs and SIF funding across the Project Partners

- UK Power Networks: £2,017 (2%)
- IEA: £107,630 (98%)

Key points in relation to value for money:

1. Reduced university overhead: the IEA is part of the University of Reading and as such is normally funded at 80% FEC (100% overhead), as are other universities. Given the strategic nature of WARN, the IEA have been authorised to claim only staff costs and a 20% overhead. Overall, this means that the University loses money on the contract but enables us to achieve more with the budget.
2. Competitive labour rates: IEA staff costs are generally well below market rates compared to industry equivalent roles. Taken together with the reduced overhead, this further extends the team's ability to deliver more for less.
3. Exploitation of pre-existing and related IP: our concept benefits from initial scoping and proof-of-concept work that was funded by UK Space Agency. We are also able to exploit software building blocks and experience from the development of WeatherAsset, a commercially available global weather analytics product. We will be consolidating and building on this experience, and the related synergies, enabling more rapid and focused progress.
4. Efficient technology development practices: having already successfully commercialised two software products, the IEA are now highly efficient in organising and delivering complex technology developments. We have well-established processes built around sprints and the Agile methodology. Our experience is that this significantly reduces potential for increased development iterations and contributes to avoidance of dead-ends -- non-trivial given the ambitious scope and complexity of our proposed concept.
5. Effective stakeholder engagement: ultimately, consumers benefit most from innovations that deliver on operational potential. The IEA will have good access to a wide range of UKPN's subject matter experts during the Discovery Phase which is crucial for prioritising our development focus and improving prospects for delivering value adding innovation.

Document Upload

Documents Uploaded Where Applicable

Yes

Documents:

SIF Discovery Round 2 Project Registration 2023-05-30 10_25

SIF Round 2 Discovery - WARN End of Phase (for upload).pdf

SIF Round 2 Discovery - WARN Show and Tell (for upload).pdf

This project has been approved by a senior member of staff

☑ Yes