Predict-4-Resilience

Risk Day 2025

Birmingham

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Project partners:

SP Energy Networks

Scottish & Southern Electricity Networks

SIAPARTNERS

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Background

Storm Arwen

On November 26-27, 2021, Storm Arwen brought severe weather with 98 mph winds to the UK, causing approximately 9,700 faults and leaving over 1 million customers without power.

Public Review

Due to the widespread disruption, Distribution Network Operators (DNOs) were reviewed by Ofgem and BEIS through the Energy Emergencies Executive Committee (E3C).

DNOs' Commitment

DNOs have committed to enhancing their preparedness, resilience, and customer support to respond even more effectively to severe weather events.

Predict-4-Resilience

- **2022: Discovery**
- Initial analysis and survey of existing practice and available tools. Potential benefits identified.

- **2022-23: Alpha**
- Proof-of-concept developed, and desk-based studies verify potential skill of fault forecasts. Business case developed.

- **2023-27: Beta**
- Fault forecasting methodology has been productionised and live trials are under way. Enhancements continue to be developed and rolled out to trial participants. Commercialisation strategy under development.

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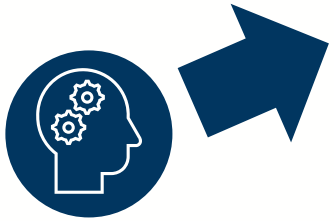
Severe weather can have major impacts on the electricity network, resulting in **power outages,** which cause **significant inconvenience to customers**

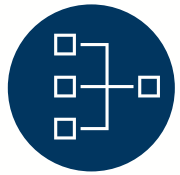


Reliance on Tacit Knowledge for Risk Assessment

Not backed by data, subject to human bias and limited/differing experience

Reactive Management of Severe Weather Risks

Limited DNO information about the potential risks of upcoming severe weather



Financial Impact of Limited Fault Insights

Weather forecasts alone don't quantify range of fault impacts, potentially leading to higher costs

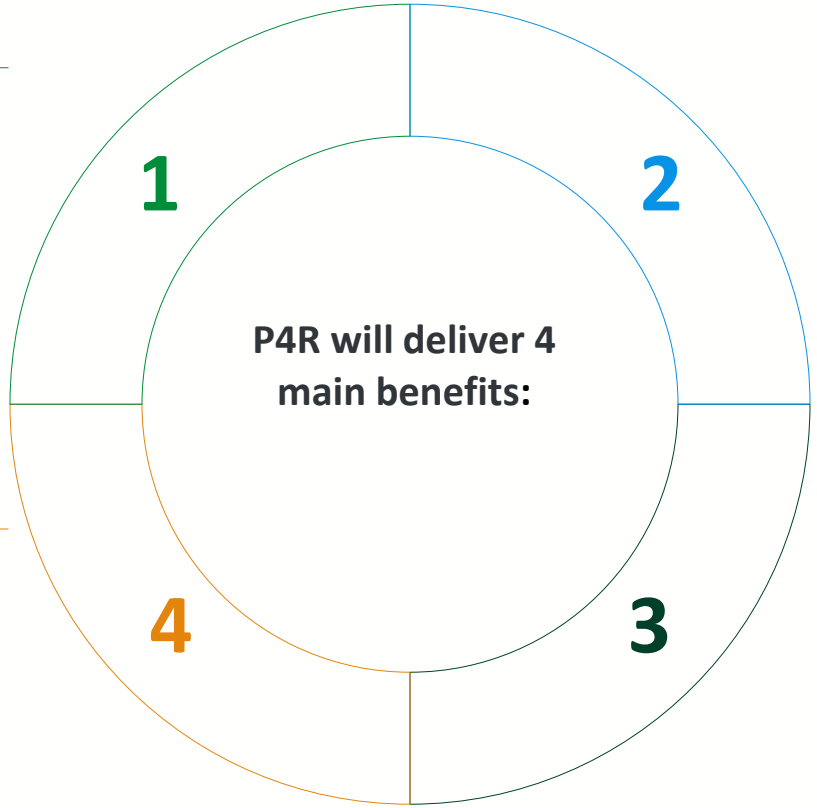
Benefits

1. Direct Financial Benefits

Savings to SPEN through improving performance against **Customer Minutes Lost** incentive scheme and reducing compensation payments to customers for failing to meet a **Guaranteed Standard of Service.**

2. Network Avoided Costs

Savings for SPEN through avoidance of costs that it would have otherwise incurred as part of its **Storm Support**.



4. Social Benefits

A reduction in **stress** for vulnerable customers and minimising the **inconvenience** of a disruption in power supply to all customers, assessed using the SROI model.

3. Environmental Benefits

A reduction in **CO_2 emissions** and an improvement in air quality. A Social Return on Investment (SROI) model helps capture and quantify these benefits.

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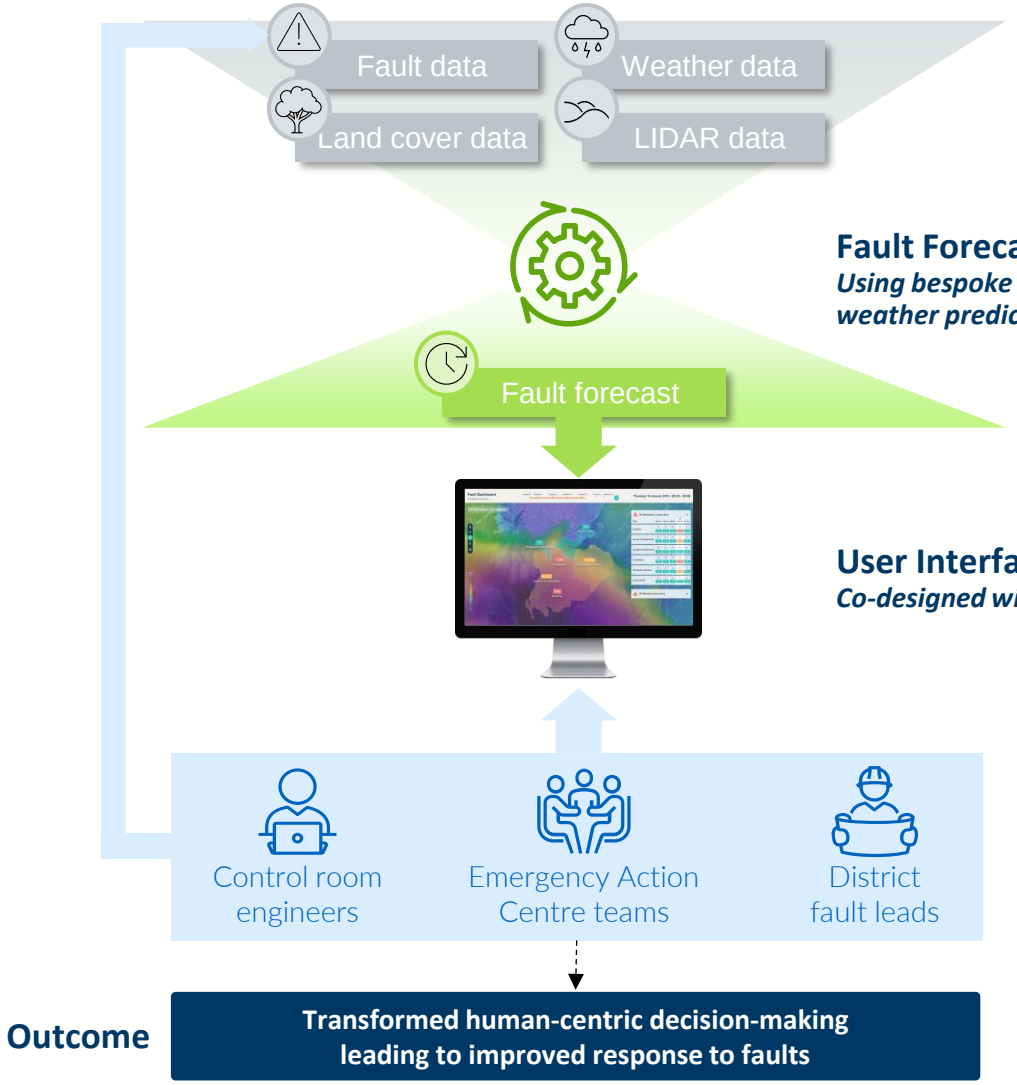
P4R Fault Forecasting



Fault Forecast Engine
Using bespoke statistical methods and ensemble numerical weather prediction

User Interface
Co-designed with users and user experience (UX) experts

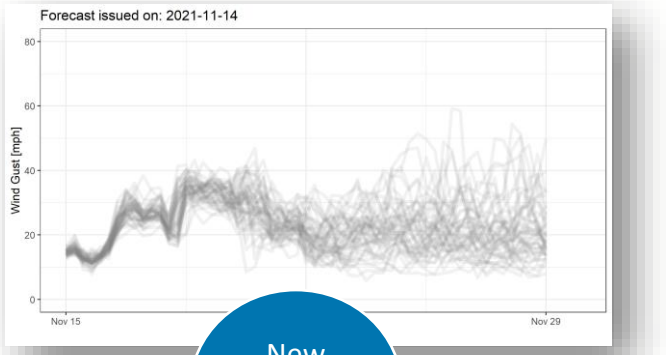
Outcome

Transformed human-centric decision-making leading to improved response to faults

P4R Fault Forecasting

Weather Forecast

- Ensemble NWP
- Captures **weather uncertainty**



New forecast every 6h

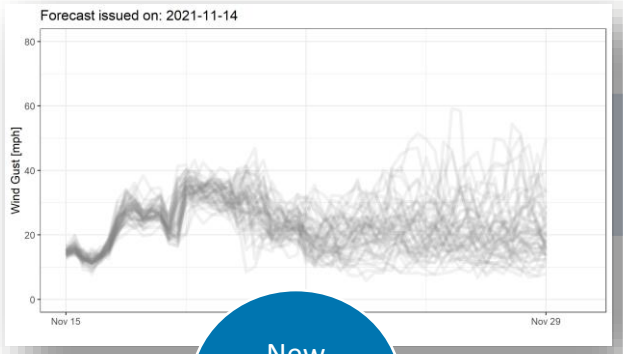
P4R Fault Forecasting

Weather Forecast

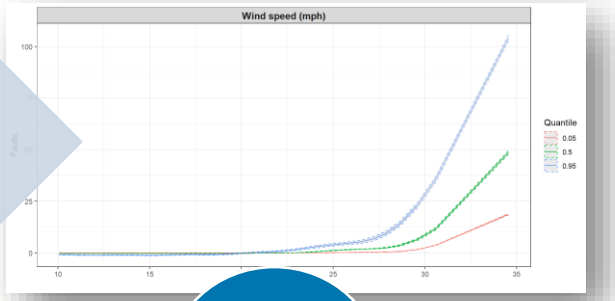
- Ensemble NWP
- Captures **weather uncertainty**

Weather to Fault Model

- Learned from historic weather and fault data
- Captures **weather-to-fault uncertainty**



New forecast every 6h



Models trained on 12+ years of data

P4R Fault Forecasting

Weather Forecast

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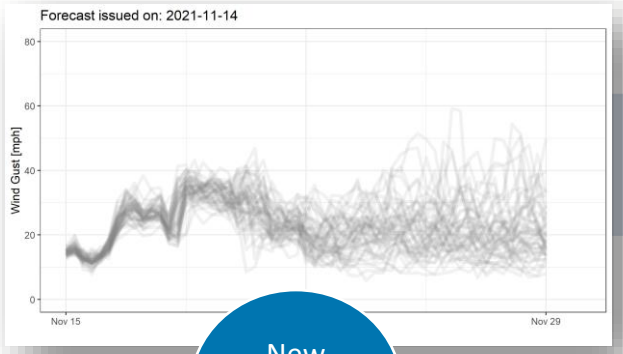
Fault Forecast

- Probability forecasts for number of faults
- Probability of fault being within **RAG** bands



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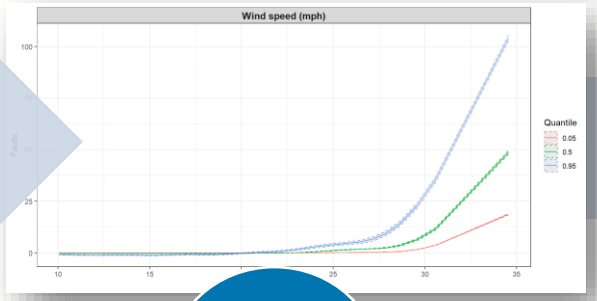
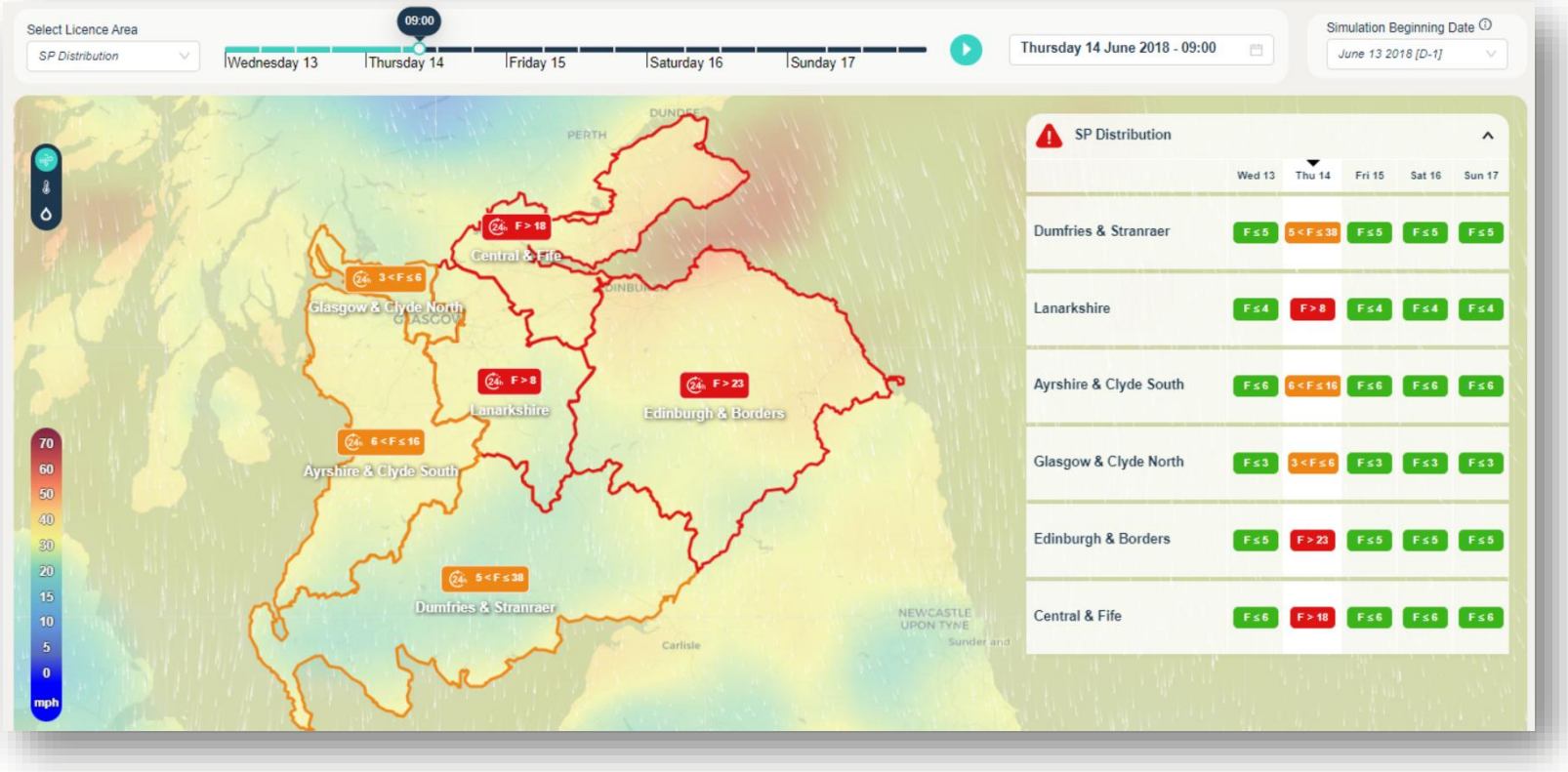


Models trained on 12+ years of data

Users alerted to risks

P4R Fault Forecasting

- Interactive user interface designed for ease-of-use and options to deep-dive into forecast information
- Map view displaying five-day weather and fault forecast for all districts in a licence area (right)
- District dashboard displaying detailed forecast at 24h and 6h resolution
- Event library and matching to compare and “replay” historic events
- Resource calculator to support allocation of staff and equipment



Next steps

ENHANCE FAULT FORECASTING MODEL

- Integration of additional variables to account for different types of faults
- Experiments using downscaled and multi-model weather data
- Develop forecasts for License Area and "sub-districts"
- Inclusion of extreme/worst case scenario analyses

IMPROVE USER INTERFACE

- Implementation of feedback from trials.
- Development of new features and interfaces (e.g. resources and materials dispatching).

DEVELOP MODEL FOR SSEN AND START TRIALS

- Review of model fit with new datasets and potential adaptation of the models.
- Implementation of infrastructure and development of software.
- Training and onboarding.

FINALISE COMMERCIAL STRATEGY

- Organisation of the legal structure and contractual arrangements between project partners.
- Preparation of the marketing and template materials.
- Preparation of roll out.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