Whole Energy System Resilience Vulnerability Assessment

Ofgem Strategic Innovation Fund project: WELLNESS (Alpha)

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Project Summary

In this work we explored:

- A method for embedding resilience into decision-making processes
- A framework and supporting tools to facilitate this

Network operators

Project Lead & transmission expertise

Distribution expertise

Modelling Experts

Weather event models

Network models

Distributed resource models

Process Experts

Resilience framework and metrics

Project management & BaU roadmapping

Resilience Standards: Landscape & Issues

Current Standards

Electricity resilience is governed by [1]:

- Security and Quality of Supply Standard (**SQSS**)
- Engineering Recommendation P2 Issue 8 (**ENA EREC P2-8**)

Metric Challenges

Difficulty in setting a representative resilience metric as climate risks evolve.

Valuation Methods

Lack of recognised methods for valuing resilience

Investment often penalised under Net Present Value

Ongoing Initiatives

National Infrastructure Commission: Resilience framework and recommendations [2].

Ofgem: Consultation on resilience standards.

UNDRR: Principles for resilient infrastructure aligned with Sendai Framework and SDGs.

ISO 22372: Standard for security and resilience in infrastructure.

Embedding Resilience in Decision-Making

Key contributors:

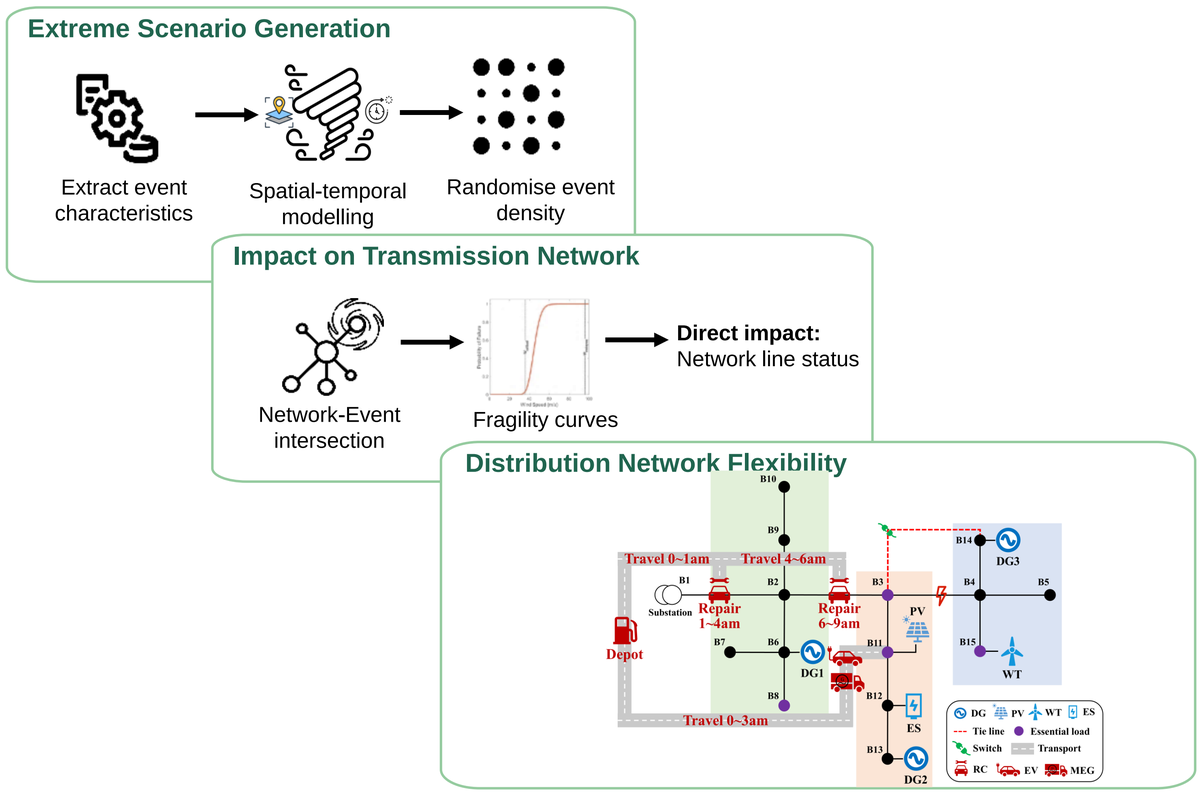
- NG Group Resilience Improvement Manager
- NG Group VP, Resilience & Crisis Management
- ENWL Investment Forecasting Manager

Need for balance:

- **Tools & Models** → To explore possible futures
- **Practical Knowledge & Experience** → To complement technical insights

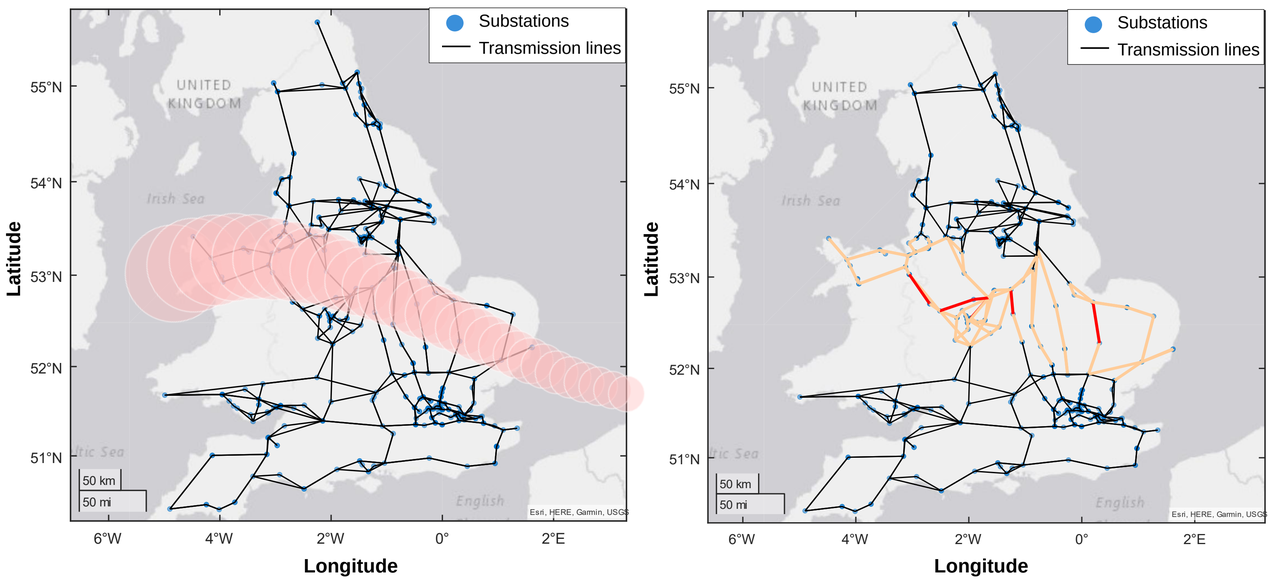
Prototype Software Platform

- Brings together modelling methods (events; networks; distributed solutions) into one toolbox
- Uses free, open-access, software (Python) to ensure accessibility



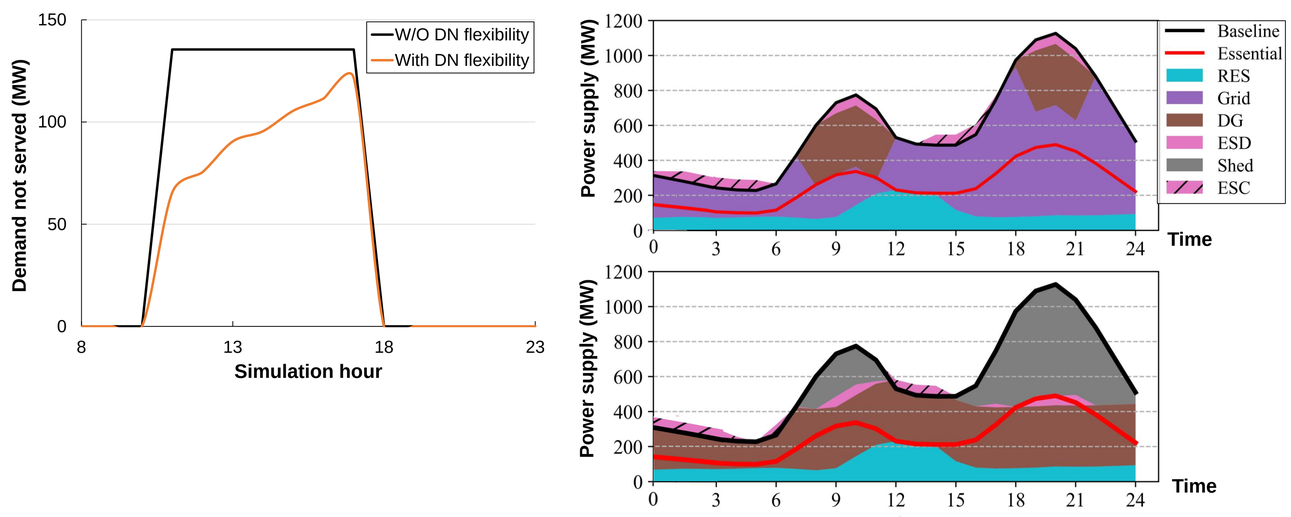
Showcase: Windstorm Case Studies

Spatio-temporal dynamics



Distributed flexibility can mitigate impacts

- Enable customers to self-supply (islanding)
- Prioritise essential demand, including vulnerable customers and critical infrastructure
- Confine losses to non-essential demand **ONLY**



References

[1] F. H. Jufri, V. Widiputra, and J. Jung, “State-of-the-art review on power grid resilience to extreme weather events: Definitions, frameworks, quantitative assessment methodologies, and enhancement strategies,” Appl. Energy, vol. 239, pp. 1049–1065, 2019.

[2] National Infrastructure Commission, “Anticipate, React, Overcome: Resilient infrastructure systems,” 2020.