tnei

A specialist energy consultancy

Resilience Services From BESS Degradation

Nov.2023

tneigroup.com

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Our Teams

Environment & Engineering (E&E)

We assist developers in taking their energy projects from conceptual ideas to operational assets

Connections

We perform specialist power systems studies for connecting plant to the electrical grid

Networks & Innovation (N&I)

We assist networks, governments and regulators with specialist studies and innovation services

Software & Scripting (S&S)

We develop specialist software solutions including IPSA2 the power systems modelling software

Key Sectors

Offshore Renewables

Onshore Renewables

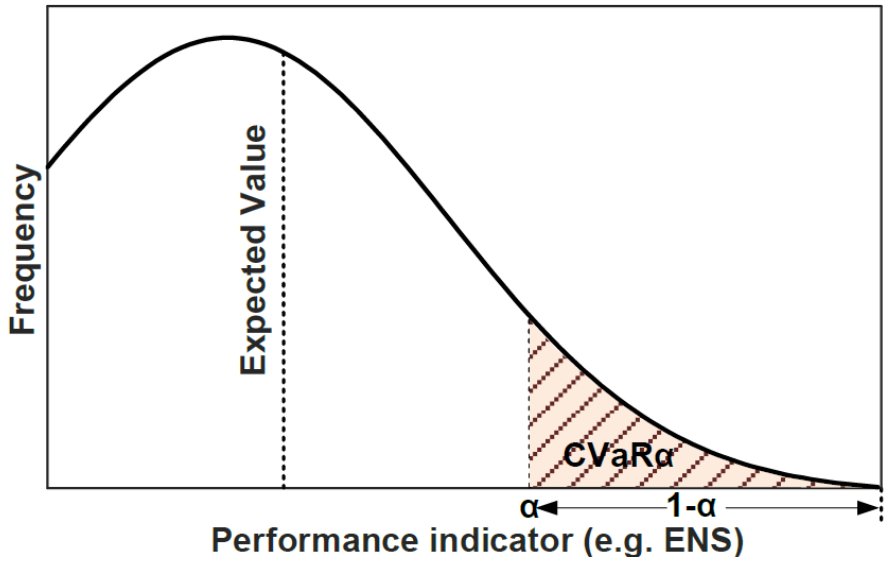
Electricity Networks

Conventional Energy / Industrial

New Energy Systems

Some of our clients

Reliability Vs. Resilience



CIGRE WG C4.47 Survey Response

35.48% of responders selected CVaR as the optimal index to quantify resilience

Weather Hazards impact on UK network

- **Storm Babet** on the 22nd of October 2023 has caused disruption across the UK with 100,000 customers have been affected by power cuts. 96% of affected customers reconnected same day with around 4000 customers reconnected next day.

- **Storm Arwen** on November 2021 affected nearly 1 million homes in the UK with almost 4000 homes left without power for over a week. This event costs UK DNOs around £44 million.

The Ofgem report on storm Arwen stated that although the network is reliable to common outages, it is not resilient to natural hazards and more action should be taken to enhance the network resilience.

Proposed innovation idea

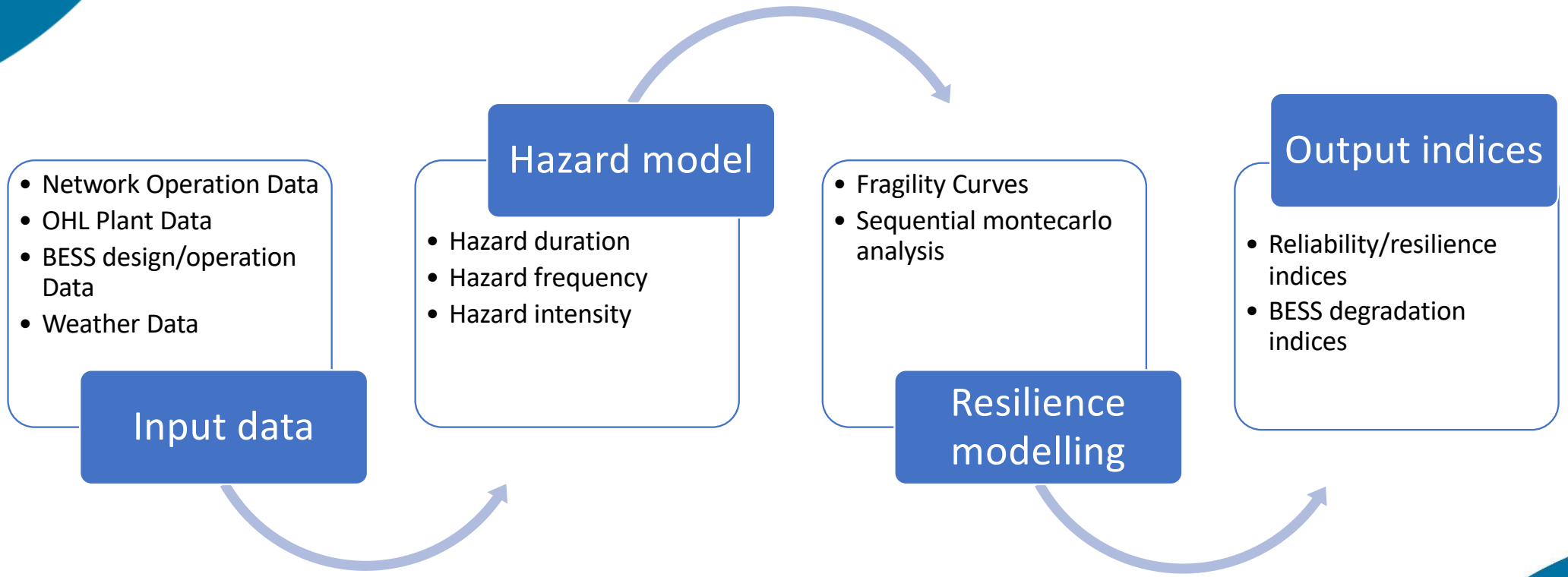
The innovation idea is to

- Investigate the economic benefit of procuring BESS degradation as a resilience service for DSOs.
- Provides a business case to evaluate such benefits by comparing the added value to network resilience and the accelerated degradation costs identified by customers depending on the battery technology type.

The proposed work will provide:

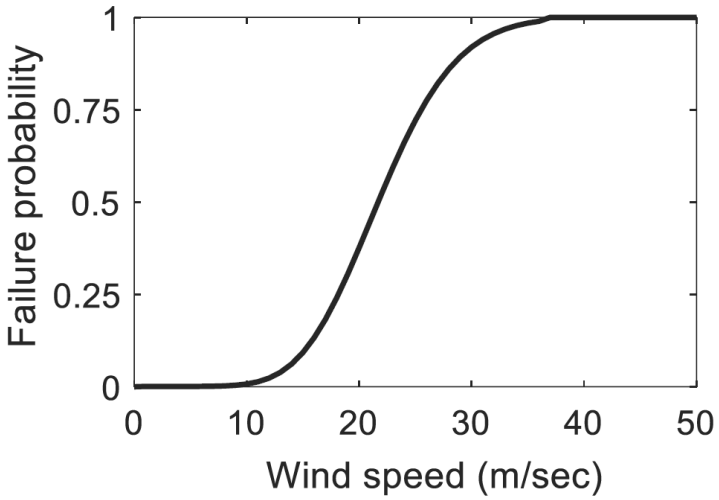
- Development of a generic BESS degradation model that captures the capacity and cycle degradation of the BESS.
- Integrating the developed model within the standard reliability/resilience framework to assess the risks and benefits of BESS degradation.
- Developing new indices that describe the expected BESS degradation risks named: a) Expected equivalent cycle accelerated degradation (EECAD), and b) expected battery degradation costs (EBDC).

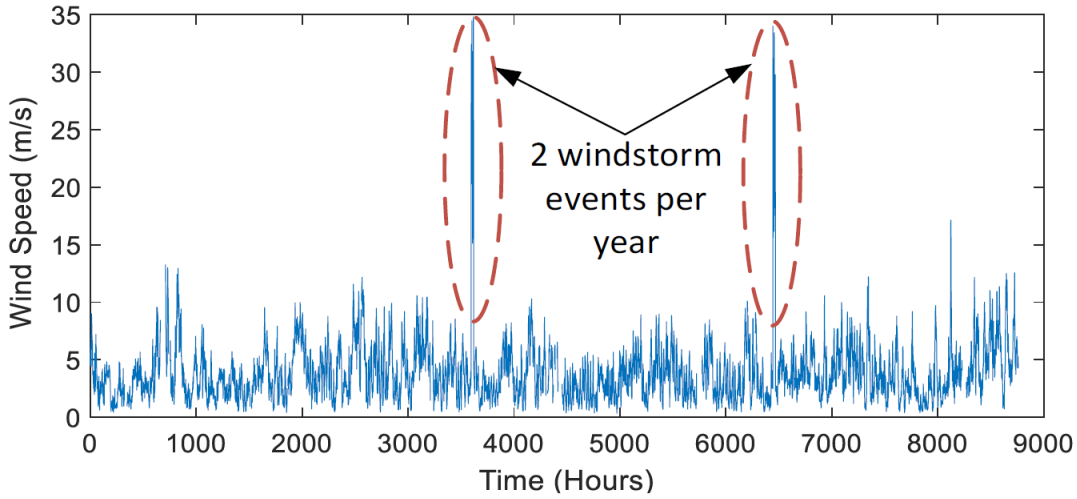
Methodology



Case Study

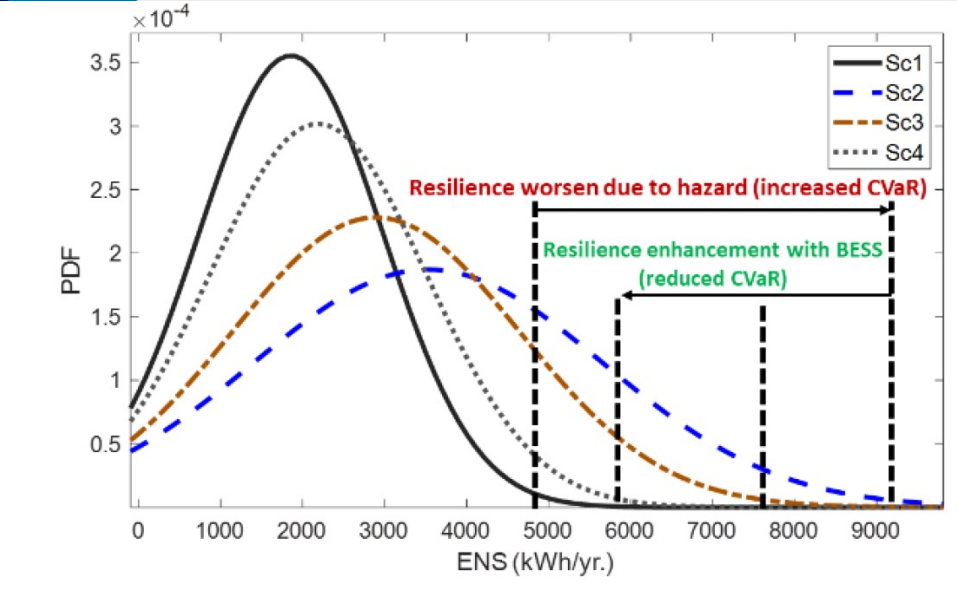
- 37 bus distribution network is utilised as test network including 22 load points.
- Li-ion battery technology is used.
- Two windstorms are assumed per year with max speed between 15-35 m/s.
- Only OHLs are considered in this work as an asset affected by windstorms.

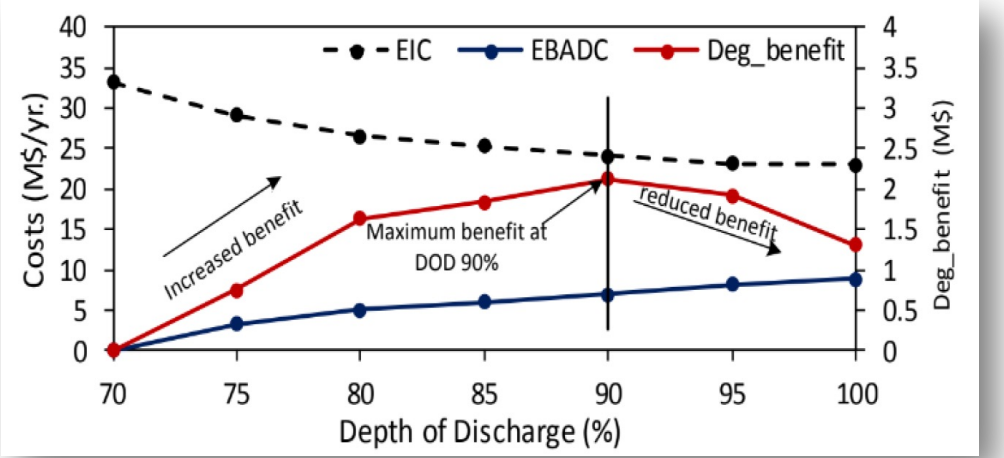




Scenario ID	Description
Sc-1	Normal failures without BESS
Sc-2	Hazard failures without BESS
Sc-3	Hazard failures with normal DoD of BESS
Sc-4	Hazard failures with BESS elevated DoD

Results





Scenarios	Sc-1	Sc-2	Sc-3	Sc-4
EENS (kWh/yr.)	1864	3416	2874	2094
$CVaR_{ENS}$ (kWh/yr.)	4936	9828	7624	5837
EIC ($/yr.)*10^3	99.4	203.69	161.07	79.59
$CVaR_{IC}$ ($/yr.)*10^3	189.6	359.8	286.3	172.4
EECAD (Cycles/yr.)	0	0	0	164
EBDC ($/yr.)*10^3	0	0	0	34.6

Conclusions

It is worth incentivising BESS owners to provide **resilience support** and in turn NOs could provide compensation for their added degradation risks.

However

BESS technology type may be affecting the findings and size of test network, hence as a **future work**:

- ✓ Different BESS technologies to be tested.
- ✓ Different network sizes to be tested.

References

M. Galeela, W. Zhu and D. Chakravorty, "Resilience services from battery energy storage degradation," *27th International Conference on Electricity Distribution (CIRED 2023)*, Rome, Italy, 2023, pp. 2084-2088, doi: 10.1049/icp.2023.1181.