Quantifying resource adequacy risk in Australia's energy transition

Background

Main goals of power systems

Affordability | **Reliability** | Sustainability

Resource adequacy: Planning to ensure reliability in the future

Objectives

1. Enable any stakeholders to perform adequacy assessments of the NEM based on open-source modelling
2. Visualise the full risk profile of the changing NEM
3. Quantify the adequacy benefits of individual projects and technologies

Methodology and Data

NEM ISP[1] data → **PRASNEM.jl** Enables PRAS[2] simulation and result analysis *Sequential Monte-Carlo Simulation* → Reliability risk profile of the NEM

Inputs and details represented

NEM system parameters

- Generator capacities
- Transmission network constraints
- Demand-side participation
- Power, energy and efficiencies of storage
- Outage parameters

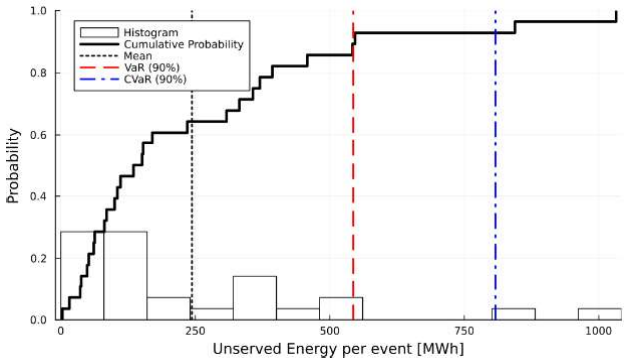
Hourly timeseries data

- Solar and wind traces
- Hydro inflows
- Demand traces

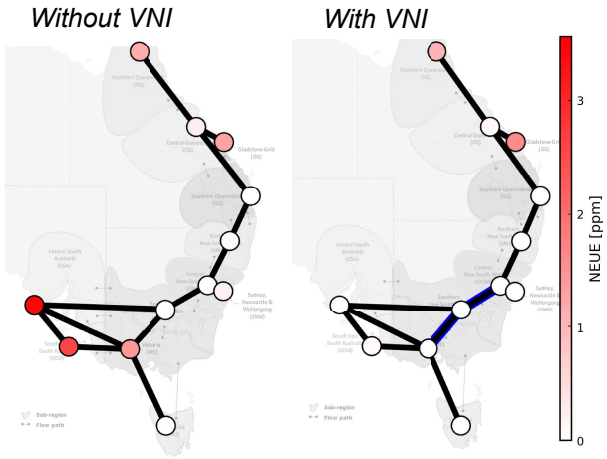
Illustrative Results

Simulation parameters
Step Change scenario | 12-node representation
Anticipated + actionable transmission projects | Weather reference trace 4006 (ODP)
Demand POE 10% | 500 Outage Samples | **Target calendar year 2030**

1. Detailed adequacy risk profile



2. Adequacy benefits of transmission



(C)VaR: (Conditional) Value-at-Risk | **NEUE**: Normalised Expected Unserved Energy | **OPD**: Optimal Development Path
POE: Probability of Exceedance | **VNI**: Victoria – New South Wales Interconnector

Next steps

1. **Storage operation**: Representing imperfect foresight
2. **DER representation**: Modelling payback constraints and coordination levels

[1] Australian Energy Market Operator (AEMO), "2024 Integrated System Plan (ISP).", Jun 2024
[2] G. Stephen, "Probabilistic Resource Adequacy Suite (PRAS) v0.6 Model Documentation," Golden, CO: National Renewable Energy Laboratory, NREL/TP--5C00-79698, May 2021

PRASNEM.jl
Explore the open-source model

Tim Kopka, PhD Student, *EPICS Centre*
Supervisors: *Prof. Pierluigi Mancarella*, *Dr. Sleiman Mhanna*