Draft program. Times, talks and speakers may still change.

2026 Asia-Pacific Solar Research Conference

Open-Source Energy System Modelling Workshop

An interactive workshop combining presentations, demonstrations, tutorials and open discussion on topics relevant to the open-source energy modelling community.

Monday 30 November 2026
11:00 am for an 11:30 am start • Finishes 4:00 pm, followed by networking
Room 6.02, Marie Reay Teaching Centre, Australian National University, Canberra • In person only

Sponsored by:

RACE for 2030 — RELIABLE AFFORDABLE CLEAN ENERGY

Australian Government — Department of Climate Change, Energy, the Environment and Water

11:00 — 11:30 am	Arrival, tea & coffee Informal catch-up and networking before the official start.
11:30 — 11:45 am	**Welcome & introduction** Opening remarks from RACE for 2030, then an overview of the day from the organisers, housekeeping, and an introduction to the all-day activities.
11:45 am — 12:15 pm	**'Short-circuit' talks, part 1** Five-minute 'lightning talks' on open-source projects, tools and datasets. NEMX.jl: an open-source Julia package for NEM dispatch modelling Ghulam Mohy Ud Din (CSIRO) OpenISP: an open-source electricity system model based on AEMO's Integrated System Plan Ellie Kallmier (UNSW) Resource adequacy modelling suite for the NEM Tim Kopka (UniMelb) Energy Research Information Stack (ERIS) Michael Thomas (ANU) Model-Based Systems Engineering for Alumina Decarbonisation Adnan Qamar (CSIRO) How open is your modelling? Wendy Russell (ANU)
12:15 — 12:45 pm	**Open floor: demos & discussion** Part 1 presenters host tables for demos, questions and discussion. Explore the projects that interest you.
12:45 — 1:30 pm	Lunch

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1:30 — 2:00 pm	**‘Short-circuit’ talks, part 2** Five-minute ‘lightning talks’ on open-source projects, tools and datasets. Modelling green industrial hubs in Indonesia Jenny Hayward (CSIRO) AEMC market modelling toolkit - an extended weather reference year dataset Daniel Condon (AEMC) Modelling investment uncertainty: agent-based modelling to quantify economic uncertainty Markus Mannheim (DCCEEW) Power-system experiments in the browser: Tellegen and PowerIO Fred Geth (UQ) BMOPF tools (TBC) Sleiman Mhanna (UniMelb) Rapidly exploring future grid configurations with FIRM_CE Timothy Weber (ANU)
2:00 — 2:30 pm	**Open floor: demos & discussion** Part 2 presenters host tables for demos, questions and discussion. Explore the projects that interest you.
2:30 — 3:30 pm	**Panel session** Presentations and a panel on ideas, issues and practice in open-source energy modelling, opening up to questions and discussion from the floor. Trustworthy Computational Research in the Age of AI Archie Chapman (UQ) Interoperability in open-source energy modelling tools Michael Thomas (ANU) Open-source modelling at CSIRO James Foster (CSIRO) Building consensus and participation around shared energy models Fred Geth (UQ)
3:30 — 4:00 pm	**Wrap-up & next steps** Reflections from the day’s activities and a discussion of what this community wants to do next.
From 4:00 pm	Networking Informal drinks and conversation.

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‘Short-circuit’ talks, part 1

NEMX.jl: an open-source Julia package for NEM dispatch modelling

Dr Ghulam Mohy Ud Din
CSIRO

NEMX.jl is a Julia package for simulating dispatch in the Australian National Electricity Market. It provides three complementary dispatch models: (1) a zonal model that runs directly on the NEMDE/NEMWEB database and reproduces historical dispatch prices; (2) a nodal model built on the physical Synthetic NEM Network, also driven by NEMWEB data, which reproduces dispatch prices under a range of network formulations from DC through convex relaxations to non-convex AC representations; and (3) lightweight OPF/FCAS models designed for long-term, market-informed planning studies.

The session will give an overview of the package and its capabilities, present benchmark simulations against historical NEM outcomes, and walk through how to set up and run the tool. It will close with a live demonstration of a BESS dispatch investigative study, showing how NEMX.jl can be used to analyze storage behavior and its impact on market outcomes.

Repository: github.com/csiro/ensys-NEMX.jl
Documentation and BESS study: csiro.github.io/ensys-NEMX.jl/dev/bess_study

OpenISP: an open-source electricity system model based on AEMO’s Integrated System Plan

Ellie Kallmier, Dylan McConnell, Nicholas Gorman
The University of New South Wales

The OpenISP project is building an open-source, accessible and transparent electricity system model based on the Australian Energy Market Operator’s (AEMO) Integrated System Plan (ISP) methodology and data. This initiative aims to facilitate wider access to energy system modelling and enable more rapid, inclusive collaboration across researchers, policymakers, and institutions. This presentation will provide an introduction to the OpenISP modelling suite, alongside a showcase and opportunities for discussion and feedback from the broader energy research community.

Open-ISP project: github.com/Open-ISP

Resource adequacy modelling suite for the NEM

Tim Kopka, Muhammad Yasirroni, Pablo Apablaza, Bastian Moya, Sleiman Mhanna, Pierluigi Mancarella
The University of Melbourne

With the projected retirement of thermal coal power plants and the associated increase in the penetration of variable renewable energy sources and storage in the National Electricity Market (NEM), ensuring reliability across all timesteps will depend strongly on the operation of storage units. In adequacy assessments, storage behaviour is often simplified, adopting, for example, perfect foresight of outage conditions or heuristic, adequacy-optimistic operational approximations. However, operational experience increasingly challenges these assumptions, highlighting a discrepancy between modelled and real-world storage behaviour and leaving the implications of these approximations for NEM adequacy uncertain. To support reliability planning in the NEM, we present an open-source adequacy assessment methodology and related tools developed as part of the Australian Research in Power Systems Transition (AR-PST) Stage 5. We evaluate adequacy under AEMO’s 2024 Integrated System Plan assumptions, comparing different operational representations and their implications for reliability. Results show that reliability levels of the NEM become sensitive to storage operation approximations post-2030, and assumptions about state of charge, charging behaviour, and dispatch incentives materially change the estimated reliability risk.

Modelling suite: github.com/ARPST-UniMelb
Report (AR-PST Stage 5, Topic 4-1): www.csiro.au/en/research/technology-space/energy/Electricity-transition/AR-PST/Stage-5

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Energy Research Information Stack (ERIS)

Michael Thomas, Vivienne Wells
The Australian National University

We are seeing research projects emerge that combine two or more actively developed open-source energy modelling tools in fun and interesting ways. However, combining these tools on an ad-hoc and manual basis is not only time consuming, but minimises understandability, robustness and reusability. ACES has developed an ecosystem of software packages, called the Energy Research Information Stack (ERIS), to improve the interoperability of existing and emerging open-source modelling software.

ERIS: bsgip.github.io/eris

Model-Based Systems Engineering for Alumina Decarbonisation

Adnan Qamar
CSIRO

As part of Work Package 4 of the HILT CRC, NEAC is applying a Model-Based Systems Engineering (MBSE) framework, integrated with Hetero-Functional Graph Theory (HFGT), to support decarbonisation planning for Australian heavy industry. The current case study focuses on the Worsley alumina refinery, where a formally verified systems model has been developed to represent the Bayer process, including digestion, evaporation, precipitation, calcination, and associated steam and water networks.

Rather than constructing standalone demand or supply models, the framework provides an integrated representation of industrial processes and multi-carrier energy systems within a single optimisation environment. This enables the evaluation of technology substitution pathways, electrification strategies, and carbon-price scenarios while preserving system-level operational constraints.

The approach supports identification of least-cost decarbonisation pathways, quantification of fuel-switching thresholds, and assessment of infrastructure requirements under alternative transition scenarios. The presentation will demonstrate how systems engineering methods can enhance transparency, reproducibility, and cross-sector integration in industrial decarbonisation studies, and will discuss opportunities for open and interoperable modelling tools within the broader energy modelling community.

How open is your modelling?

Wendy Russell[1], Dora He[1], Ehsan Nabavi[1], Sophie Adams[2]
[1]The Australian National University [2]La Trobe University

We have been working on how to open up energy modelling to social insights and participatory processes. Much modelling deals with social dimensions of the energy system (e.g. consumer actions and practices; decisions of individuals and organisations; equity and the distribution of costs, benefits and risks), but often through assumptions that are not always supported with social evidence, nor transparent to the users of modelling outputs. In addition, while modelling can underpin operational, investment and policy decisions with wide-reaching social implications, it often excludes input and engagement by non-experts and the publics it is intended to ultimately benefit.

Our research considers ways to integrate social insights into modelling, using both quantitative and qualitative approaches, and how to use models to engage with different stakeholders and publics. We are looking at iterative ways that use models to communicate about systems with non-experts, and to use non-expert input to refine models. We will briefly discuss our progress and approaches, and invite workshop participants to discuss with us how their models could be used to open up to non-expert participation.

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‘Short-circuit’ talks, part 2

Modelling green industrial hubs in Indonesia

Dr Jenny Hayward
CSIRO

The Government of Indonesia (GoI) is interested in developing new industrial hubs that support the use of local capabilities, including workforce and skills, renewable energy resources, land and infrastructure. CSIRO has developed an online modelling tool to support the GoI in decision-making on the supply of energy infrastructure to meet the demand of new industrial hubs. The model optimises for least-cost supply of energy (electricity and hydrogen), within constraints such as land, renewable energy resources, transmission and government policy. The tool will be demonstrated during the presentation, for a case study site in Indonesia, Batam Island.

AEMC market modelling toolkit - an extended weather reference year dataset

Daniel Condon
Australian Energy Market Commission

This talk will cover a new open-source dataset, developed by the AEMC and hosted by the CSIRO, which encompasses projected renewable output and demand across the National Electricity Market (NEM) based on 85 years of historical weather data, from 1945 to 2025. This dataset was developed using machine learning techniques on historical reanalysis weather data and AEMO’s operational market data, and is aimed at helping researchers, modellers and policy-makers understand the impact of weather on dispatch outcomes and reliability in the NEM.

Modelling investment uncertainty: agent-based modelling to quantify economic uncertainty

Markus Mannheim
Department of Climate Change, Energy, the Environment and Water

Modelling investment uncertainty: agent-based modelling to quantify economic uncertainty for different parties, to inform government decision making.

More to come.

Power-system experiments in the browser: Tellegen and PowerIO

Prof Fred Geth
The University of Queensland

What if exploring a power-system model started with opening a web page? This talk introduces Tellegen and PowerIO, open-source tools for interactive power-system studies in the browser. PowerIO reads and converts network data, while Tellegen provides power-flow and optimal-power-flow calculations and visualisation. A short demonstration will show how changing demand or a line rating produces an immediate sensitivity-based preview, followed by a fresh solve. Case files and calculations remain on the user’s device. The talk will explore opportunities for teaching, research and sharing executable studies, with further demonstrations and hands-on discussion during the open-floor session.

Paper (arXiv): arxiv.org/abs/2610.01922
Tellegen: tellegen.dev
Tellegen repository: github.com/eigenergy/tellegen
PowerIO: powerio.dev
PowerIO repository: github.com/eigenergy/powerio
BMOPFTools: github.com/frederikgeth/BMOPFTools.jl
IEEE taskforce community: github.com/distribution-system-opt/math-and-data-model-specifications

BMOPF tools (TBC)

Dr Sleiman Mhanna
The University of Melbourne

Abstract to come.

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Rapidly exploring future grid configurations with FIRM_CE

Timothy Weber
The Australian National University

FIRM_CE is an open-source tool for modelling electricity grid investment and testing reliability over decades of weather data. It is based on the FIRM framework, originally developed by Lu et al. (2021) and adapted in Weber et al. (2026). The purpose of FIRM_CE is to rapidly evaluate thousands (or millions) of grid configurations very quickly through an evolutionary optimisation, testing each configuration for reliability and cost.

Conventional linear programs require separate variables for each investment and dispatch decision, which can drive up computation time when using decades of high-resolution data. FIRM_CE only optimises the investment decision variables, with simple business rules managing the dispatch of generators instead. The fast dispatch rules avoid the need for temporal aggregation methods that skew away from long-duration storage investment.

The RE100 Group is currently developing techniques for performing modelling to generate alternatives (MGA) using the FIRM framework. Using MGA techniques, FIRM_CE can explore thousands of grid configurations in the near-optimal space, allowing decision makers to consider a vast number of alternative pathways that all have the exact same cost (within the very high margin of uncertainty).

Lu et al. (2021): doi.org/10.1016/j.energy.2020.119678
Weber et al. (2026): doi.org/10.1016/j.xcrp.2026.103523
FIRM_CE: github.com/TimWeberRE100/FIRM_CE

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Panel session

Trustworthy Computational Research in the Age of AI

A/Prof Archie Chapman
The University of Queensland

Generative AI is rapidly becoming embedded in software- and data-intensive research, creating new opportunities alongside new integrity risks. Drawing on the principles of the Australian Code for the Responsible Conduct of Research, this talk will explore how established practices including verification and validation, benchmarking, open-source software development, data stewardship, and transparent workflows provide a foundation for the responsible use of AI in research. Using examples from energy systems modelling and computational science, I will discuss practical issues such as AI-assisted software development, management of sensitive data, public versus private repositories, software and data licensing, and reproducibility in increasingly automated research environments. The central argument is that AI does not diminish the importance of research integrity principles; rather, it makes rigorous computational research practices more important than ever, while also creating new opportunities for research translation and impact.

Interoperability in open-source energy modelling tools

Dr Michael Thomas
The Australian National University

To fully realise the potential of interoperable open-source software, we suggest growing and supporting a strong and enthusiastic energy modelling community. In this workshop we will discuss the steps need to achieve interoperability in open-source energy modelling tools and ask open questions on how we might go about growing and supporting the Australian energy modelling community.

ERIS: bsgip.github.io/eris

Open-source modelling at CSIRO

Dr James Foster
CSIRO

The story of how we've evolved over time to using increasing open-source modelling in our work and the various transition points along the way that we chose based on the circumstances at the time.

More to come.

Building consensus and participation around shared energy models

Prof Fred Geth
The University of Queensland

Building shared energy models requires agreement on what the data and equations mean, which assumptions are appropriate, and how those decisions can evolve. Drawing on my experience with collaborative distribution-system modelling, I will discuss how communities work towards that agreement and encourage people to contribute. Topics include making modelling choices explicit, turning disagreements into reviewable proposals, and creating useful entry points through examples, data, documentation and technical review. The discussion will consider how to balance a coherent shared specification with different research needs, and how to turn initial interest into sustained participation. These questions offer practical starting points for strengthening collaboration across the Australian open-source energy modelling community.

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