

Artificial Intelligence in Power Systems – System Operator Technical Session

Opportunity and impact

System Operators met in September 2024 to discuss current and potential use-cases for artificial intelligence (AI)¹. AI has the potential to improve business efficiency, and uplift operational capability of System Operators by leveraging new technologies and techniques.

System Operators engaged

The following System Operators were involved:

- AEMO – Australia
- CAISO – United States (California)
- EirGrid – Ireland
- Energinet – Denmark
- ERCOT – United States (Texas)
- National ESO – Great Britain.

Key insights

Current use-cases:

- Most System Operators are exploring the use of AI and machine learning (ML) techniques in operational forecasting, taking factors such as weather and historical data into account for generation forecasting and reserve setting purposes.
 - AEMO developed the Forecast Uncertainty Measure (FUM) model to dynamically set reserves in the National Electricity Market (NEM) – it considers factors such as the weather, time of day, day of year, situational conditions, and historical data,; and sets a probabilistic uncertainty measure, which overrides the traditional N-2 if there is more uncertainty in the ML estimate.
- Several System Operators have introduced general enterprise-wide AI, to support general task efficiencies. Some System Operators have taken this further with specific use of chatbots or General Pretrained Transformers (GPT) for a specialised topic.
 - Copilot for Business to enhance code development, aiding software developers and data analysts in accelerating project delivery with higher accuracy and consistency.
 - Copilot for boosting general task efficiency and productivity across the board for all employees.

¹ The Oxford English Dictionary definition of AI, used throughout this technical session, is “the capacity of computers or other machines to exhibit or simulate intelligent behaviour; the field of study concerned with this. In later use also: software used to perform tasks or produce output previously thought to require human intelligence, esp. by using machine learning to extrapolate from large collections of data.”

- Tools to deploy custom copilots that function as specialised Generative Pre-trained Transformers (GPTs), offering tailored assistance to employees of specific topics (examples: corporate policies, desk procedures, protocols.)

Potential use-cases:

- There is significant research scoping work being done towards addressing System Operator challenges with AI, in the context of AI as an automated decision support in both operations and planning domains. Potential research areas include topology optimisation, rapid contingency analysis, scenario creation for resource adequacy stress tests, and integrated planning.
- There is potential for AI to bridge timescales and models and integrate long-term and real-time models together via ML and smart heuristics.
- Computing limitations pose challenges for research, with many approaches requiring a more effective and targeted use of computing resources – for example via fast-evaluation proxies that make computation tractable.

Recommendations

Based on the presentations in the technical session, it is recommended that System Operators:

- Consider how to best establish trust in AI and AI tools to ensure utilisation and therefore business value.
- Continue to cooperate with other power System Operators, academics, and subject matter experts (SMEs) from other disciplines in resolving shared challenges in effectively harnessing the full potential of AI.
- Stay up to date with technological developments and consider how best to integrate AI tools with existing tools, algorithms, and processes.
- Consider also using AI outside the operational and planning domains, for example for internal training through Large Language Models (LLMs).

Contact

For any specific feedback on this Knowledge Sharing Brief, please contact luke.robinson@aemo.com.au.