

Australia – United States Energy System Operator Secondment Program Report

Purpose

The Australian Government Department of Climate Change, Energy, the Environment and Water (DCCEEW) supported the Australia Energy Market Operator (AEMO) to participate in an international secondment program with energy system operator counterparts in Texas, California and Hawaii.

Energy system operators play a critical role in maintaining system security and reliability, operating energy markets and responding to increasingly complex system conditions as generation mixes evolve. Engagement with international counterparts provides an opportunity to observe different operational, planning and modelling approaches in practice and to exchange insights on common challenges.

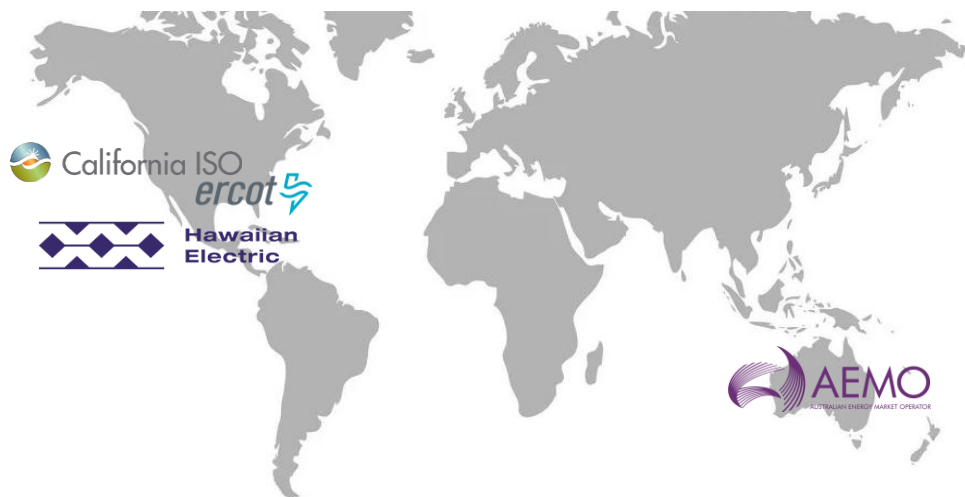
The purpose of the secondment program includes:

- developing AEMO staff capability through overseas immersion,
- strengthening two-way knowledge sharing on power system operations and planning under changing system conditions,
- building enduring networks with international system operators (ISOs),
- understanding advanced operational, planning, and modelling practices, and
- bringing insights back to AEMO to improve processes, tools, and readiness.

System operators engaged

The following energy system operators participated in the secondment program:

- Australian Energy Market Operator (AEMO).
- California Independent System Operator (CAISO).
- Electric Reliability Council of Texas (ERCOT).
- Hawaiian Electric Company (HECO).
- Kauai Island Utility Cooperative (KIUC).



These operators participated based on the opportunity to share experiences and learn from one another about evolving power system operations and planning challenges, particularly the increasing levels of distributed energy resources, data centre integration and battery storage, as well as the broader operational capabilities needed to support reliable, secure, power systems with high levels of inverter-based, distributed, and storage resources.

Six AEMO secondees participated in the program across 2025-2026. Their insights covered technical learnings, organisational culture, operational practices, and opportunities for collaboration.

Benefits and insights for AEMO

The ISO secondment program has provided valuable early insights to support AEMO's operational capability and preparedness for Australia's energy security and operational readiness. Experience shared by overseas operators is helping inform AEMO's approach to operating the power system where increasing levels of renewable generation, batteries, and other emerging technologies are being integrated into the system, as well as planning for peak demand and seasonal operational challenges. Insights from the program are also contributing to work aimed at improving the efficiency, clarity and transparency of connection and operational processes for new energy projects.

Operational and technical improvements

The program has already informed several areas of operational and technical improvements, including:

- enhancements to energy management system design, model conversion, and state estimator robustness informed by CAISO/ERCOT practices,
- a deeper understanding of battery state-of-charge management and frequency response behaviour,
- new insights into seasonal readiness, real-time engineering support models, and outage rejection frameworks, and
- renewed focus on phasor measurement unit integration and system strength planning using grid-forming inverters.

Automation and data quality

- CAISO and ERCOT use industry-standard common information model formats to reduce manual modelling effort and improve data consistency. This approach aligns with AEMO's ongoing work, to improve standardisation and reduce duplication between energy management system and planning models.

- CAISO and ERCOT have implemented high levels of automation for model loads, operator display building and routine reporting. These insights will help inform AEMO's energy management system enhancement activities, including opportunities to streamline display generation and reduce manual intervention in model-load workflows.
- CAISO and ERCOT maintain rigorous data quality metrics and regular weekly and monthly review processes, supported by cross-functional committees. These practices provide a useful reference point as AEMO continues to strengthen supervisory control and data acquisition (SCADA) and network-model quality governance.
- HECO's experience highlights the value of high-quality data for connected consumer energy resources, while also demonstrating the importance of consistent asset identification and data standards to support effective distributed energy resources integration and monitoring.

Outage management and planning practices

- ERCOT uses a structured, multistage outage approval process, ranging from 90-day to same-day assessments), and may reject outages when reserve margins fall below thresholds. This practice provides a useful reference point for AEMO's approach to outage coordination during periods of tight supply-demand balance.
- ERCOT completes quarterly "look-ahead" studies with dedicated resources to assess seasonal risks. These approaches are relevant to AEMO's ongoing consideration of enhancements to seasonal readiness processes.
- CAISO conducts deliverability studies to identify network upgrades required for capacity accreditation. These approaches provide useful input into AEMO's broader work to improve alignment between connections assessment and future network-planning requirements.

Frequency, reserves and inertia

- ERCOT has observed bimodal frequency effects associated with high battery energy storage system participation, similar to the emerging profile in the National Electricity Market (NEM). These insights help inform AEMO's ongoing review of frequency-performance settings as storage participation increases.
- Both CAISO and ERCOT use phasor measurement units for engineering analysis, including inertia-measurement trials. These learnings support AEMO's phasor measurement unit integration activities and its early work on system strength monitoring and grid-forming inverter capabilities.
- HECO observed ramping challenges associated with the coincident behaviour of distributed household batteries from a particular manufacturer. For example, following warnings from the National Weather Service, or in response to demand response programs, some batteries were observed to charge at the same time. This highlights the importance of understanding aggregate distributed energy resources behaviour and its operational impacts.

Connections process reform

Insights from the program will help shape AEMO's connections reform work, including:

- streamlining the connection lifecycle through portal improvements,
- better integration between planning and connections functions,
- refining electromagnetic transient modelling expectations, and
- strengthening stakeholder engagement as part of reform delivery.

Generator connections

- Neither CAISO nor ERCOT rely on wide-area electromagnetic transient studies, rather they rely primarily on steady-state and short-circuit analysis. This provides a useful benchmark as AEMO continues to refine technical expectations for electromagnetic transient studies in the Australian context.
- Both ERCOT and CAISO discussed clustered or batch assessment approaches. ERCOT is very close to finalising the load batch process, while generator connections continue to be progressed under existing arrangements.
- The connections process is supported by a dedicated portal, although some connection application and coordination activities continue to be managed outside the portal environment. These learnings provide valuable insight for AEMO's ongoing work to improve connections-study efficiency and manage increasing volumes of renewable connections.
- CAISO's deliverability studies and reimbursement model for network upgrades drive efficient investment. These approaches provide useful reference points for AEMO's connections reform program.

Large load connections (data centres)

- Rapid growth of large energy-intensive facilities has led ERCOT to explore batch study processes and new technical requirements. ERCOT currently has around 14 gigawatts (GW) of data centre load commissioned or entering commissioning, with a significant volume of large load connections in the pipeline. Load forecasts indicate strong growth in overall system demand. This growth is creating challenges associated with intermittent and cyclical load behaviour, including coordinated operation across data centre facilities. These insights are assisting AEMO work on large-load access standards and the management of operational impacts associated with increasing large-load connections in the NEM.
- ERCOT is progressing new processes for large load connections, including the development of a batch study approach to assess multiple connections together and allocate network capacity. Ride-through requirements for large loads are also being introduced, with new loads expected to meet these requirements under updated policy arrangements. These approaches are intended to improve study efficiency and support system security as connection volume increase.
- ERCOT is also developing modelling approaches for large loads using a combination of composite load models and electromagnetic transient modelling. Challenges remain in ensuring that models accurately reflect the performance of connected facilities.

Technology and tools

- ERCOT uses AEMO's Dynamic Model Acceptance Test process for model validation and is partnering with a vendor for phasor measurement unit-based inertia measurement trials. These learnings support AEMO's work to strengthen model validation and system-strength assessment processes.
- CAISO's in-house dynamic security tools demonstrate alternative approaches to wide-area system stability assessment. ERCOT has also made significant investment in operational monitoring and visualisation tools, including real-time dynamic monitoring systems based on phasor measurement unit data. These systems support event analysis, oscillation monitoring, and improved visibility of system conditions.
- Advanced visualisation tools are also used to support operational decision-making, allowing operators to view network flows, generation, load, and system conditions across different parts of the network. These insights provide useful context as AEMO considers future planning and operational analytics needs.
- KIUC reported that its system regularly operates for approximately seven hours during the day with 0 megawatts (MW) of synchronous generation. During these periods, an LM2500 gas turbine is operated as a synchronous condenser. KIUC also operates a grid-forming battery that is microgrid and black-start capable

and has been used to supply a subsection of the island grid following a wildfire event. KIUC noted that overly aggressive frequency response settings on batteries have previously contributed to system blackouts.

- HECO noted that the Maui and Molokai systems are beginning to experience minimum system load conditions. At present, HECO has minimal backstop capability to curtail rooftop solar generation and expressed a preference for faster control mechanisms than internet-based protocols.

Stakeholder engagement

- CAISO and ERCOT have structured and authentic stakeholder consultation practices. At ERCOT, many technical working groups are led by external stakeholders, contributing to strong stakeholder participation in technical development processes.
- These engagement processes play an important role in shaping market design and operational policy.
- These observations provide useful context for AEMO's reform programs, including in relation to stakeholder engagement design and coordination across a complex stakeholder environment.

Connections portals and customer interface

- CAISO and ERCOT have developed custom-built interconnection portals to improve transparency and streamline processes.
- These portals are continuing to evolve in response to energy transition demands, with updates underway using configurable commercial products. This provides useful insight for AEMO's own transformation activities.

Ways of working

- Staff at both CAISO and ERCOT demonstrated a strong appreciation for the critical role of energy management system, which support clearer prioritisation of system upgrades and investment. This provides a useful reference point for promoting the critical role of energy management system across the broader business.
- Operational teams at CAISO increasingly build their own digital tools to respond more quickly to operational needs where enterprise IT processes may be slower. Understanding the role of business-led development can help inform AEMO's approach to business-led digital development.

Strengthened international collaboration

Ongoing relationships have been established, enabling:

- continued exchange on distributed energy resources integration, data centre standards, grid-forming inverters, and frequency scanning, and
- future forums and working groups across international system operators.

Policy considerations

Insights from the secondment program highlight several areas relevant to policy development. Differences were observed across systems in technical requirements and operational approaches particularly in relation to large load integration, distributed energy resources coordination, and model validation practices.

For example, ERCOT is progressing specific technical requirements for large loads, including ride-through standards and batch study processes in response to the rapid growth of data centre connections. These developments provide a useful reference point for AEMO's ongoing work on large-load access standards.

These observations provide useful context for ongoing policy work in Australia and highlight opportunities for continued alignment and knowledge sharing.

Benefits and insights for CAISO and ERCOT

ISOs showed strong interest in AEMO's practical experience operating a power system with high levels of renewable and inverter-based resources. In particular, AEMO's use of real-time operational dashboards was seen as supporting strong situational awareness and reliable system operation. Australia's leadership in integrating household solar, batteries, and other distributed energy resources was of particular interest, as was its early experience with grid stabilising technologies as traditional generators retire.

AEMO also shared insights into the benefits of transparent processes for connecting new energy projects highlighting its role in supporting investor confidence and clearer stakeholder expectations.

Operational and technical insights

Operational dashboards and visualisation

CAISO and ERCOT were interested in AEMO's approach to operational dashboarding, particularly its use of PI Vision¹ for real-time monitoring. AEMO shared insights on its visualisation tools and its transition towards more modern dashboard platforms, providing practical examples of how these tools support AEMO's situational awareness and operational decision-making.

During discussions at CAISO, it was noted that with approximately 16 GW of four-hour battery capacity, economic peak demand on some days has shifted towards the middle of the day. CAISO staff described significant ongoing work to improve how batteries are represented in market processes and how interactions between resource adequacy requirements and real-time operations are managed. A sizeable demand spike and associated frequency deviation around midnight had also been observed at CAISO, driven by coincident electric vehicle charging in response to favourable charging rates.

Distributed energy resources and volt-amp-reactive dispatch

AEMO's experience managing distributed energy resources and implementing volt-amp-reactive Dispatch was an area of strong interest. System operators sought to better understand AEMO's implementation approach and its operational learnings, reflecting recognition of AEMO's comparatively advanced capability in distributed energy resources integration, and the growing focus on distributed energy resources integration across other systems.

Grid-forming inverter integration and system strength practices

CAISO and ERCOT engaged with AEMO's experience in connecting and assessing grid-forming inverter technologies, particularly in weaker parts of the network. AEMO shared learnings from early grid-forming inverter projects and frequency scanning practices, providing useful context for future approaches to system-strength management.

Commissioning and model-validation approaches

CAISO and ERCOT sought further understanding of AEMO's model validation and commissioning processes, including the methodology used to assess whether models supplied by proponents are robust and representative. These discussions drew on AEMO's experience applying structured model-validation approaches such as Dynamic Model Acceptance Test.

¹ See <https://www.aveva.com/en/products/aveva-pi-vision/>

Connections process transparency and performance tracking

The system operators were also interested in AEMO's maturing approach to connections governance, including the use of transparency tools such as the connections scorecard and methods used to manage, communicate, and track connection study progress. These practices provided useful insight into how AEMO approaches process visibility and stakeholder expectations.

Additional collaboration with HECO, KIUC and CAISO

As part of the secondment, AEMO also exchanged information with HECO and CAISO on distributed energy resources and rooftop solar management. HECO expressed interest in AEMO's approach to backstop arrangements, while CAISO was interested in distributed energy resources market integration and minimum system load considerations.

The secondment also enabled connections between AEMO staff and counterparts at HECO, KIUC, and CAISO on issues including distributed energy resources standards, grid-forming batteries, operation with no synchronous generation, and investigation of power system oscillations.

Outlook

The secondment program has strengthened AEMO's technical capability by providing practical insights into international approaches to grid operations, connections, planning, and stakeholder engagement. Lessons learned from the program will continue to inform AEMO's system planning, digital transformation, and operational readiness.

Contact

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