ENGINEERS AUSTRALIA

Australian Academy of Technological Sciences & Engineering

18 October 2024

Select Committee on Energy Planning and Regulation in Australia
PO Box 6100
Parliament House
Canberra ACT 2600
epra.sen@aph.gov.au

Dear Senator Van,

Re: Select Committee on Energy Planning and Regulation in Australia

As Australia's national body for engineering, Engineers Australia is the voice and champion of our 127,000-plus members. We provide them with the resources, connections, and growth they need to do ethical, competent and high-value work in our communities. A mission-based, not-for-profit professional association, Engineers Australia is constituted by Royal Charter to advance the science and practice of engineering for the benefit of the community.

The Australian Academy of Technological Sciences and Engineering (ATSE) is a Learned Academy of independent, non-political experts helping Australians understand and use technology to solve complex problems. Bringing together Australia's leading thinkers in applied science, technology and engineering, ATSE provides impartial, practical and evidence-based advice on how to achieve sustainable solutions and advance prosperity.

Engineers are essential enablers of the clean energy transition. Their involvement encompasses all aspects of energy policy, governance, management, and compliance ensuring the efficient, safe and sustainable use of energy resources and optimal management of Australia's energy system.

Engineers Australia and ATSE support a review of energy planning and regulation. Energy is more than a component of the economy; it is fundamental to the prosperity and well-being of all Australians. The scale of the energy transition is transformative and requires a new response. Energy planning and regulation must balance the power systems' physical requirements, the best interests of the end users and market considerations.

Key Messages

The energy system must be planned and regulated to ensure:

- That highly competent engineering advice and decision-making are at the heart of an increasingly complex engineered system-of-systems.
- Energy planning and regulation are bounded by fundamental engineering principles, within which the market must remain, particularly in regard to the safety and reliability of the system.
- That system architecture provides for a new level of sector coupling and coordination that drives whole of system approaches and engages the participation of all stakeholders.
- Place-based approaches are foundational to achieving sustainable solutions.
- The well-being of people and communities are prioritised.
- Demand-side participation, including increased energy efficiency, may potentially play a more prominent role in empowering end users and consumers, reducing total system costs, and lowering the need to invest in the supply-side.

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Systems approach

The increasing complexity of energy systems requires holistic coordination as an integrated and engineered system that cannot be reduced to its component parts viewed in isolation. Despite our best efforts, our current planning and regulation structure looks increasingly inadequate in managing the transition to provide value to all stakeholders. We need a system architecture that drives whole-of-system approaches and engages the participation of all the stakeholders, including to:

- monitor and advise on consumer protections and community benefits
- monitor and advise on power system security and reliability and against agreed benchmarks
- take account of system efficiency, circular economy and environmental impact at local, national and global levels
- account for workforce modelling and planning, including for communities more impacted by the transition.

These systems have cyber, physical and economic aspects. However, the energy system is irreducibly physics-based, and decision-making must reflect that. Governance models should ensure a balanced range of voices, but it is imperative that when it comes to system reliability, safety and stability, experienced power system voices are preeminent.

The task is urgent. Integrating distributed and consumer owned energy resources requires proactive integration strategies and a deeper understanding of locational factors within existing networks which have a profound effect on the long-term value of these investments. A recent IEA report projects that globally, delaying the integration of solar PV and wind puts at risk up to 15 per cent of generation from those technologies, resulting in up to 20 per cent smaller reductions in emissions in the power sector.[1] A balance must also be struck between consumer-owned solar resources and large grid-connected solar resources, otherwise surplus capacity will be available and investments made in both may only be partially recoverable through the use of energy storage.

System architecture

This more complex system will require a new level of sector coupling and coordination. Our old energy and electricity models and structures were designed for a very different context. The physics-based complexity and speed of change of the energy transition require a new theory of change. We need to view this process as transformational, not incremental. New structures are required to empower stakeholders to envision and plan our future energy systems. Separation of functionally differentiated roles will require a greater degree of holistic and multi-disciplinary coordination. Expert engineering advice must be central to these processes.

The Global Power System Transformation (G-PST), in which CSIRO and AEMO are engaged, highlights the need for a holistic approach.

A couple of examples of these issues playing out are:

- Transmission and distribution planning – the development and orchestration of distributed and consumer owned energy resources, including rooftop solar, electric vehicles (vehicle to grid), virtual power plants, makes it challenging to plan the least regret transmission network, and requires more focus on a smart distribution network.
- Anyone can nominate a NEM rule change. We have had more than 200 rule changes, and they take an average of two years, sometimes longer. This process can help to address problems collectively, which is essential, but it can also undermine system stability and increase consumer costs. Sometimes, rule changes are made independently of other changes or are driven by vested interests.

[1] Integrating solar and wind: Global experience and emerging challenges, IEA, September 2024.

Place-based solutions

Technical and social factors at a local level are foundational. Holistic planning is about supporting and coordinating local solutions derived from engagement with:

- households making choices about solar, EVs and appliances
- community leaders providing spaces for accurate information and consultation
- businesses and industry investing in new and innovative technologies
- state and local government, and
- First Nations peoples.

If the energy transition is to be successful, it will be enabled by a coherent systems-of-systems approach built on solid system architecture, informed by place-based intelligence and managed by experienced power system engineering.

Focus on people and communities

To be viable and maintain social license, the energy system must be planned and regulated for the well-being of all Australians to support our lifestyles and businesses. Sustainable Development Goal 7 is to "Ensure access to affordable, reliable, sustainable and modern energy for all." An expanding range of energy options empowers and challenges end users and consumers. Their needs must be placed at the centre of decision-making processes. Policy settings need to reflect how structural change will be managed equitably across industry sectors and geographies for a 'just transition'.

Communities need to be resourced to participate in these decisions, and every decision should be viewed considering what is best for the community and individual consumers. However, individual consumers do not necessarily want to engage and make decisions within a complex energy system. Many consumers simply want affordable, reliable and clean energy. Despite owning rooftop solar, household batteries and EVs, very few consumers act as true 'market participants' who are willing and capable of making decisions around their timing and energy use. We cannot have a system where consumers must be energy experts, or we risk losing their confidence in the changes and unintentionally harming them. Some may want to engage in this way, and they should be empowered to do so.

The electricity market is in no way natural. It did not evolve over time as a nexus of organic supply and demand. It was created with legislation and a very complex set of rules. It cannot be equated to other markets, and a consumer's ability to shop around or exit the market is limited. As Dr Ron Ben-David said in a recent paper, "all outcomes are enabled and permitted by the market's design."[2]

Demand side participation

Reforms to energy governance and structures are needed to enable demand-side participation. Demand-side measures, including reducing the amount of energy used, the time it is used, and on-site generation or storage, can significantly reduce total system cost by lowering the need to invest in the supply side.

Demand response, the ability of industry and business to ramp up and down energy use, has been investigated and activities like data centres and hydrogen production show great potential. At this stage, Australia does not have the rules in place to encourage or value this market.

The governance structure and legal framework of Australia's energy system need to promote demand-side activities. Policies influencing demand are spread across various portfolios, such as energy, transport, the built environment, consumer protection, etc. The responsibility does not sit with any agency or Minister and can be disconnected from other policy agendas. In contrast, energy supply is concentrated within a few agencies with the resources to collaborate effectively, albeit across Commonwealth and state jurisdictions. Hopefully, the implementation of the National Energy Performance Strategy will help to focus these efforts.

[2] Dr Ron Ben-David, What if the consumer energy market were based on reality rather than assumptions? Monash Energy Institute, July 2024, p 7.

Although anyone can propose market rule changes, rule-making is not a level playing field. The supply side has disproportionally large resources and technical understanding to pursue the changes that suit them, and energy consumers often do not. Market bodies do not always have this perspective on their boards, although there is a growing acknowledgement of this power imbalance in market rule making.

The Australian Energy Market Commission (AEMC) holds numerous consultations and roundtables, calls for and releases numerous papers, and regularly publishes major and minor updates to the rules. We support their investigation of rules to improve the ISP's consideration of demand-side factors, and AEMOs' formation of the Consumer and Community Reference Group (CCRG). Some of these processes have a material impact on consumers, such as new rules to make it easier for households and businesses to capture value from their consumer energy resources (CER) and exercise greater control over their energy use. Many electrical engineers would only have time to be aware of some of these changes. Most energy consumers would not even be aware these processes are taking place.

Public confidence

The public expects that the transition to renewables will lower energy prices. If they cannot see that or understand the reason for the delay, faith in the energy transition will plummet, and for many, it already has. A recent SEC Newgate survey found, "Positivity towards the renewables transition has dipped significantly… and, for the first time since … June 2022, less than half of Australians (47%) now feel positive towards it, down from a peak of (70%) in August 2022."[3]

The Australian Energy Regulator (AER regularly investigates spikes in the wholesale electricity price. The AER is required to investigate prices above $5,000 a megawatt-hour (MWh). The price in South Australia recently went to nearly $16,000 a MWh, which is many times more than the actual cost of supply. This might happen because reserves are nearly exhausted, but that is clearly not the case in many instances. With these sorts of occurrences happening in the market, it is difficult to see how consumers would have trust in the energy transition.

Whenever we have outages or price spikes, the blame game gets played out in the media and political commentary. As Engineering Executive and retired Australian Army Colonel Neil Greet recently wrote:

> *"Disinformation of the most perverse kind has arguably created an existential risk in addressing global warming by limiting the intention to act on energy transformation. Rather than assessing the veracity of a statement, individuals tend to look at how they align with the source. It is now an open question whether the public will trust an energy expert or place more trust in a social media influencer. "*[4]

In this context, it is more important than ever that the energy system has coherent and stable policy settings focused on community benefit and certainty for investors, and that information is communicated clearly to the public.

Power system control

Given the increasingly complex nature of decarbonising energy systems, highly competent engineering advice and decision-making are more critical than ever for their design and reliable operation. The quality, safety and reliability of electricity supply depend on good engineering control practices, which should never be overridden by commercial concerns. Energy planning and regulation must be bounded by fundamental engineering principles, within which the market must remain. The regulatory bodies must leverage independent power system expertise for informed decision-making and assessing changes to the rules from a systems perspective.

- For example, primary power system controls are essential for a reliable electricity supply. These controls are local, autonomous and operate very quickly to respond to disturbances in the power system. These primary controls should never be undermined (detuned) by market mechanisms or a centralised control system that may become more complex with more components and,

[3] https://www.secnewgate.com.au/sec-newgate-mood-of-the-nation-september-2024-summary/
[4] https://www.engineersaustralia.org.au/publications/enabling-energy-security-profoundly-changing-world

therefore, be more likely to fail or to operate incorrectly due to poor or partial data and/or changes over time which invalidate the original control system architecture.
- The flow of power needs to be managed 24/7. Electricity flows from generation to load/ground and if we have too much generation and insufficient load the energy becomes destructive. [5]

The system requires some level of centralised planning. For example:

- The open access regime of predominantly renewable generator connections means generation can connect to insufficient transmission infrastructure. This means that generation is underutilised and costs to end users and consumers increases.
- Without a holistic perspective some generation cannot reach end users, compounding the challenge of balancing power generation and demand 24/7 to avoid unsafe voltages and equipment damage.
- A transmission line with a mine or industrial customer that needs electricity 24/7. Then, a battery connects partway along the line, discharges in the evening when demand is high, and recharges during the night when demand is low and/or when wind is producing. The battery is now in competition with the mine or factory and getting a better marginal price.
- Renewable Energy Zone planning (REZ) needs to consider land-use to avoid competing with agriculture.

The market will not coordinate these activities for the best interests of end users and consumers.

Network Service Providers are diligently working through these issues to prepare the network for more CER and extreme weather events and to prepare for increased maximum demand and decreased minimum demand. And the Australian Energy Market Operator (AEMO) should be commended for working through these engineering issues methodically in the Engineering Framework[6] and Integrated System Plan.[7] It is not 'business as usual,' and these activities need to be supported by national energy planning and regulation.

Power system expertise must be at the heart of the decision-making process to ensure the correct balance between the system's technical and economic aspects. Markets are not infallible and can only do so much. Commercial concerns should never override physical power system requirements, and prioritising the needs of our community should always be paramount.

Safety

With residential solar booming in Australia, active controls in distribution systems are more important than ever to counter reverse power flow, phase imbalance and voltage fluctuations. Beyond debates about who should pay to manage these flows, they can have real-world implications for human safety and property. In some scenarios, it may be necessary for distribution system operators to have the ability to remotely control customer systems for safety purposes, which is contrary to existing market structure and rules. Experienced power system engineering advice is paramount in decision-making around these issues.

Closing remarks

The governance, planning and regulation of Australia's energy system were designed to deliver reliable, secure, and affordable energy from large synchronous generators. However, the transformation to a decarbonised system that is partially reliant on highly variable and consumer-owned generation requires a different structure.

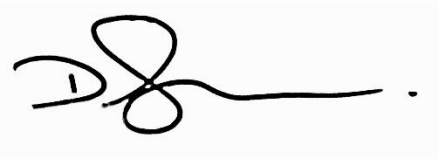
The regulatory bodies are working hard across an extremely broad range of issues to provide reform at a pace to keep up with changes in technology, digitalisation, decentralisation and to achieve the needed pace of decarbonisation. We are currently focused on incremental rather than transformational strategic

[5] For more on this please see ATSE's Electricity Security Explainer.
[6] Engineering Roadmaps https://aemo.com.au/en/initiatives/major-programs/engineering-roadmap
[7] Integrated system Plan https://aemo.com.au/en/energy-systems/major-publications/integrated-system-plan-isp

change. This situation risks ad hoc interventions to address immediate problems rather than long-term planning. The consequences of getting this wrong are system blackouts, loss of safe electrical supply, price increases for businesses and communities, and impacts on other essential services.

The Terms of Reference for this inquiry are broad and the submission timeframe is short. We have covered some issues broadly and look forward to discussing these and other relevant matters further.

Yours sincerely



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