New Energy Quarterly

New Energy Meets New Tech

Summer 2025/26



Hamilton Locke

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Editorial

As the world continues its pursuit of net zero goals, the convergence of clean energy and cutting-edge technology is reshaping the landscape of Australia's energy transition at an unprecedented pace. Artificial intelligence (AI), robotics, advanced materials science, and digital infrastructure are no longer peripheral innovations. They are becoming central to how renewable energy is generated, distributed, managed and protected. This technological revolution presents both extraordinary opportunities and complex challenges that demand sophisticated legal, commercial and strategic responses.

The 'cleantech' sector is transforming. AI-powered systems are optimising energy networks through virtual power plants (VPPs) and digital twin technology, whilst also driving significant increases in energy demand. Robotics have the potential to revolutionise the speed and safety of renewable installations. Breakthrough materials like perovskites are pushing the boundaries of solar efficiency. Electric vehicle charging networks are expanding rapidly, bringing with them new cybersecurity imperatives.

For businesses, investors, and developers in the new energy sector, understanding these technological shifts is no longer optional. The integration of advanced technologies into renewable energy projects affects every aspect of the project lifecycle: from project feasibility and risk allocation to financing structures, regulatory compliance and long-term commercial viability. Developers must strike a balance between unlocking value through innovation whilst managing the inherent risks of deploying emerging technologies at scale. Investors need clarity on how these innovations impact returns, bankability and market positioning. We, as legal advisors, strive to stay ahead of the curve to provide meaningful guidance in an environment where technology is evolving faster than regulatory frameworks can adapt.

This edition of New Energy Quarterly was curated to demonstrate that the future of clean energy is inseparable from the future of technology. Each article offers timely, practical insights into the forces shaping the next generation of Australia's energy landscape by comprehensively examining critical issues we are seeing in cleantech, and what it means for those developing, implementing, financing and advising on renewable energy projects.

At Hamilton Locke, we recognise that staying ahead in the cleantech sector requires more than legal expertise. It demands a deep understanding of the technologies driving change. As cleantech continues to develop and become firmly embedded into the renewable energy landscape, we are committed to providing our clients with the legal guidance they need to navigate this complex and changing environment. The convergence of new energy and new technology is not just transforming how we power our world, it is redefining what is possible for generations to come.

Authors: Matt Baumgurtel, Adriaan van der Merwe, Kylie Zih, Anne Pan.






Watt's Happened at Hamilton Locke



3rd July 2025

Harbour City Renewables - Women in Energy

Hamilton Locke hosted the Harbour City Renewables - Women in Energy event, bringing together around 80 attendees. Jo Ruitenberg delivered an address, sharing insights from her leadership journey and advocating for workplace cultures that embed gender equity.



9th July 2025

Bond University Job & Internship Fair

Matt Baumgurtel, Ally Frizelle and Marni Riley attended the Bond University Job & Internship Fair on the Gold Coast, meeting students and sharing insights about careers at Hamilton Locke.



18th July 2025

Australia Wind Energy 2025 Conference and Exhibition

Matt Baumgurtel moderated a panel at the Australia Wind Energy 2025 Conference and Exhibition in Melbourne, focusing on Australia's offshore wind industry, including advanced manufacturing, logistics, infrastructure planning, and strategies to address key sector challenges.



29th July 2025

Clean Energy Summit - Women in Renewables lunch

The Hamilton Locke New Energy team attended the 'Women in Renewables' lunch hosted by the Clean Energy Council. The panel explored how artificial intelligence is reshaping decision-making, problem-solving and leadership in the clean energy sector, emphasising the importance of diverse perspectives in ensuring technology enhances human insight.



29th July 2025

Clean Energy Summit – Gala Dinner

The Hamilton Locke New Energy had a fantastic time at the Australian Clean Energy Summit Gala Dinner alongside our clients, collaborators and the broader clean energy community.



1st August 2025

Phillip Riley Renewable Energy Golf Day

David O'Carroll and Cory Johnson attended the Phillip Riley Renewable Energy Golf Day, joined by Lucas Sadler and Christian Cronje as part of the Hamilton Locke four ball team.



12th August 2025

Critical Minerals and Energy Transition Summit 2025

Matt Baumgurtel presented at the inaugural Critical Minerals and Energy Transition Summit 2025, providing legal insights on the Critical Minerals Production Tax Incentive.



20th August 2025

Hamilton Locke x Pottinger

Hamilton Locke hosted the Pottinger team at the Sydney office for a presentation on valuation of renewable energy projects. The session examined key factors that determine project purchase price and how these vary depending on the stage of development

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26th August 2025

Battery Asset Management Summit Series - Commercial Asset Management panel

Matt Baumgurtel spoke on the Commercial Asset Management – Energy Trading & Revenues panel at the Battery Asset Management Summit Series hosted by Solar Media Limited. The panel discussed how batteries are reshaping energy trading and revenue strategies, including managing market volatility and the shift from FCAS revenues to energy arbitrage.



27th August 2025

Battery Asset Management Summit Series - Social Licensing panel

Matt Baumgurtel hosted a panel on social licensing at the Battery Asset Management Summit Series. The panel explored the challenges and opportunities facing developers and communities, including the importance of continuous engagement, transparent communication, and exploring models of community equity to build lasting trust.



11th September 2025

River City Renewables event - Aboriginal and Torres Strait Islander perspectives in energy

Hamilton Locke hosted the Phillip Riley River City Renewables event which had a session on embedding Aboriginal and Torres Strait Islander perspectives and leadership in energy and infrastructure projects, emphasising the importance of genuine ongoing consultation, culturally safe workplaces, and benefit-sharing agreements that reflect community priorities.



18th September 2025

Swan River Renewables event - Mining and renewables in WA

Matt Baumgurtel spoke on a panel at the Swan River Renewables event held at the Hamilton Locke Perth office. The panel discussed how critical minerals, policy, investment, geopolitical factors and innovation are shaping the intersection between the mining industry and renewables in WA, including the state's potential to become a global hub for clean value-added mineral processing.

Market Insights

Planning for net zero requires planning for people

Achieving net zero targets depends not only on technology and infrastructure but critically on workforce planning and community engagement. The renewable energy sector faces significant skills shortages and must develop strategies to attract, train, and retain talent whilst ensuring local communities benefit from the transition. A people-first approach is essential for delivering Australia's clean energy ambitions.

Read more

Social licence in renewable energy projects: Part 1 & Part 2

Social licence has become a critical success factor for renewable energy projects, with community opposition capable of delaying or derailing developments. Part 1 explores the foundational principles of social licence, including early engagement, transparency, and alignment with community values. Part 2 examines practical strategies for engaging diverse stakeholder groups including landholders, Traditional Owners, local councils, and broader communities.

Read more

Solar and battery storage surges ahead of wind generation in Australia

Recent data shows solar and battery storage installations are outpacing wind generation development across Australia, driven by falling costs, shorter development timeframes, and favourable policy settings. This shift has significant implications for grid planning, investment strategies, and the energy mix required to meet renewable energy targets. The trend reflects both technological maturity and evolving market preferences.

Read more

Trust me, I'm a developer: what the Developer Rating Scheme means for developers and communities

The Developer Rating Scheme introduces a framework for assessing and publicly rating renewable energy developers based on their track record, community engagement, and project delivery. For developers, strong ratings can facilitate approvals and community acceptance; poor ratings may hinder future projects. The scheme aims to drive industry accountability and rebuild trust where community confidence has been eroded.

Read more

CIS tender reforms: What's changing and when?

The Commonwealth's Capacity Investment Scheme (CIS) is undergoing reforms to improve tender processes, streamline approvals, and enhance project bankability. Key changes include revised eligibility criteria, updated assessment frameworks, and clearer timelines for future tender rounds. Developers should familiarise themselves with the reforms to position projects competitively for upcoming opportunities.

Read more

Curtailment – new energy's silent crisis: what happens when the grid says 'no'

Curtailment, when generators are instructed to reduce or cease output due to grid constraints, is becoming an increasingly common challenge for renewable energy projects. The phenomenon results in lost revenue, complicates financing, and signals urgent need for transmission upgrades and storage solutions. Understanding curtailment risk and contractual protections is now essential for project viability assessments.

Read more

Greenbacks for green acts: insights on the Production Tax Incentives for hydrogen and critical minerals

Australia's Production Tax Incentives for hydrogen and critical minerals represent a significant policy shift towards production-based support rather than capital grants. The incentives aim to bridge the cost gap with international competitors and accelerate domestic manufacturing capacity. Developers must navigate eligibility requirements, compliance obligations, and strategic timing to maximise benefit from these schemes.

Read more

Navigating Western Australia's power system reforms: key implications for the renewable energy industry

Western Australia is implementing substantial power system reforms to accommodate increasing renewable energy penetration and maintain grid stability. The reforms include new market mechanisms, updated technical standards, and revised connection processes that will fundamentally reshape how generators participate in the WA market. Developers and investors must understand these changes to structure projects appropriately and manage commercial risks.

Read more

New Energy Bulletin: Productivity Commission recommends reforms to environmental approval process for renewable energy projects

The Productivity Commission has recommended significant reforms to streamline environmental approval processes for renewable energy projects, acknowledging that current frameworks create unnecessary delays and costs. Proposed changes include consolidated assessment pathways, clearer timelines, and improved coordination between Commonwealth and State regulators. If implemented, the reforms could materially accelerate project delivery and reduce development risk.

Read more

New Energy Bulletin: Queensland Government introduces comprehensive reforms to renewable energy planning framework

Queensland has introduced comprehensive planning reforms designed to facilitate renewable energy development whilst strengthening community protections and environmental safeguards. The reforms establish new assessment pathways for priority projects, updated setback requirements, and enhanced consultation obligations. Developers operating in Queensland must adapt to the new framework to maintain project momentum and secure community support.

Read more

Market Recognition

Hamilton Locke named “fastest-growing partnership” in the Australian Financial Review.

Matt Baumgurtel named finalist in Dealmaker of the Year in Lawyers Weekly Australian Law Awards 2025.

Hamilton Locke wins Law Firm of the Year at the 2025 Australian Law Awards.

Hamilton Locke advises Australian Soil Management on its acquisition partnership with Climate Friendly.

Hamilton Locke shortlisted for the 2025 Energy Storage Investment Awards.

Marni Riley named finalist in Special Counsel of the Year in Lawyers Weekly Australian Law Awards 2025.

Hamilton Locke lawyers Minji Kim and Megan Chau named finalists in the 2025 Women in Law Awards.

Hamilton Locke has increased its ranking for Energy in Legal 500.

Adriaan van der Merwe promoted to Partner, effective 1 July 2025!

Hamilton Locke tops WA Business News’ 2024 Corporate Finance Survey.

Matt Baumgurtel and Veno Panicker named a finalist in the Lawyers Weekly Partner of the Year Awards 2025.

Hamilton Locke ranks in Chambers and Partners 2025 Asia-Pacific and FinTech Guides.

Hamilton Locke advises Enervest on the Stoney Creek BESS sale.

Hamilton Locke excels in national M&A and ECM rankings.

Hamilton Locke ranks equal second in Mergermarket’s Australian M&A league tables for deal count in Q1 2025.

William Ryan named finalists in the 2025 Lawyers Weekly 30 Under 30 Awards for the Projects, Energy and Resources category.

Hamilton Locke Recognised in Best Lawyers 2026 Edition of Best Law Firms – Australia.

HPX Group recognised in AFR Fast 100 List for the second consecutive year.

Matt Baumgurtel recognised as a Lexology Legal Influencer – Q1 2025.

New Starters at Hamilton Locke

Name	Position title	Office	Practice
Lachlan Gepp	Partner	Sydney	Litigation
Dominic Sweeney-Nash	Lawyer	Sydney	Litigation
Catherine Eldabbagh	Work Experience	Sydney	Workplace & Employment
Nina O’Keefe	Senior Associate	Sydney	Litigation
Marisara Muzaffar	Vacation Clerk	Perth	Litigation
Clayton Jones	Vacation Clerk	Perth	Corporate & Commercial
Gabrielle Meys	Vacation Clerk	Perth	Corporate & Commercial
Jesse Keleman	Vacation Clerk	Perth	Corporate & Commercial
Charlotte Hughes	Vacation Clerk	Brisbane	Litigation
Lachlan Carter	Vacation Clerk	Brisbane	Real Estate
Marni Zammatoro	Vacation Clerk	Brisbane	Hamilton Locke Private
Natalie Graham	Vacation Clerk	Brisbane	IP&T
Robert Zhou	Associate	Auckland	Litigation



Spotlight

Hannah Jones



Hannah Jones
Senior Associate

1. Tell us about your journey to becoming a lawyer?

My parents both worked for the police (a police officer and crime scene investigator). I found the law interesting and studied law at the University of Liverpool. After University, I started a training contract at DLA Piper in Manchester qualifying into the corporate team. During my time at DLA Piper, I took part in the international secondment programme and spent three months in Sydney in 2019. After returning to the UK for a brief period, I transferred back to Sydney before ultimately moving to Hamilton Locke's corporate team in 2021.

2. Tell us about your specialisation?

I specialise in private mergers and acquisitions in the renewable energy sector. I really like the impact and relevance of New Energy. We navigate deals in a regulated sector with emerging technologies. I am excited by the work we do to contribute to the current renewable energy transition in Australia. We work on fascinating projects with great people.

3. What are you most proud of in your career to date?

Looking back on my career, I am most proud of when I re-qualified here in New South Wales. I moved to Sydney in 2020, a few months before COVID shut the borders. I was back at university (something I never thought I would do!) in the middle of a global pandemic whilst finding my feet with a new job in a different country.

4. Do you have a favourite book, and what draws you to it?

Having recently returned from parental leave and spending time reading various books about baby sleep (a skill my daughter is still working on!), I enjoyed 'The discontented little baby book'. Aside from parenting books, I recently read Michelle Obamas 'Becoming' which I would highly recommend.

5. Favourite cuisine/meal?

Italian - pizza and pasta. With cheese, lots of cheese and a glass of red!

Rising star

Anna Mouat



Anna Mouat
Consultant, New Energy Team

1. What are you most proud of in your career to date?

I am most proud of following my interest in the energy transition and making the move into the renewables sector. I started my legal career working in the energy industry in Scotland, with a strong oil and gas focus, and spent a year on secondment with a Norwegian multinational energy company. Getting a front-row view of how the sector is evolving piqued my interest in how I could be a part of the change. After a couple of years in offshore corporate M&A, I realised I wanted to apply my commercial experience to work I genuinely care about. Being part of the Hamilton Locke New Energy team has given me the chance to work on complex projects at the cutting edge of the energy transition and develop deep interests in fast-developing subsectors such as distributed energy resources and agrivoltaics.

2. What do you enjoy most about Hamilton Locke?

What I enjoy most about Hamilton Locke is its genuine focus on people. The firm is truly invested in development and training, providing meaningful opportunities to grow your skills while encouraging you to pursue work you're passionate about.

I also appreciate how the firm encourages connection and achievement beyond day-to-day work through initiatives like the Adventure Club, which recently took me skiing in Queenstown, New Zealand.

3. Favourite book and why?

I don't think I could pick just one favourite, but my favourite read this year has been Babel by R.F. Kuang. It's such a smart mix of story and ideas and tackles heavy themes of language, power, and identity so effortlessly that you almost forget it's fiction.

4. Favourite movie and why?

Bridget Jones' Diary (and the sequels, of course). It is the perfect reminder to laugh at yourself and that no matter how chaotic life gets, a strong group of friends make everything manageable.

5. You've worked in Scotland, Jersey and now Australia – what has stood out to you about the Australian energy market since you started working here?

What has really stood out to me about the Australian energy market is its scale and pace of change and the unique challenges that creates. Managing energy infrastructure across continental distances drives innovation you simply don't see in more compact markets. There is also a strong collaborative spirit in the industry when it comes to tackling complex problems and driving innovation whilst working together on projects. It creates a real sense that everyone is working towards the same wider goal of advancing the energy transition.

6. From learning to scuba dive at the Great Barrier Reef to 'immersing' in nature at vineyards – what's your next Aussie outdoor escape?

I have been lucky enough to have had an exciting first year in Australia, a couple of highlights being getting my PADI qualification in Cairns and hiking in Freycinet National Park in Tasmania. I am yet to visit Western Australia and there is so much I would love to see out there - perhaps exploring the Ningaloo Reef or visiting the quokkas on Rottnest Island!

Watt is ARENA Funding?

Program	Summary	Funding available	Closing date
Virescent Ventures Investments	The Clean Energy Finance Corporation (CEFC) has spun out Virescent Ventures as a climate-focused venture capital fund. It is an investment portfolio that has deployed over $270 million of taxpayer funds through the CEFC into climate focused technology start-ups. The CEFC has pledged to provide up to a third of the second fund.	$100 million	Ongoing.
Hydrogen Headstart Round 2	Hydrogen Headstart Round 2 was announced in the May 2024 Federal Budget. The Programme provides up to $2 billion in grant funding through Headstart Production Credits to accelerate the development of Australia's renewable hydrogen industry and catalyse clean energy industries. Funding is provided as production credits specified in $/kg of hydrogen or $/unit of derivative, paid on each unit of eligible production over a maximum period of 10 years. The competitive round consists of an Expression of Interest phase and full application phase.	$2 billion	Ongoing. Expression of Interest Phase opened on 10 October 2025 and is due by 5:00pm AEDT on 8 December 2025. Full applications due in August 2026 with decision outcomes expected between October and December 2026.
Battery Breakthrough Initiative	The Battery Breakthrough Initiative is a funding programme delivered by ARENA and is a key part of the National Battery Strategy. The Programme objective is to fund projects that contribute to one or more of the following Programme Outcomes: enhance Australia's battery manufacturing capability to improve supply chain resilience and support emissions reduction; and commercialise battery manufacturing processes/technologies that can contribute to emissions reduction. All funding provided through the Programme will be in the form of a grant which may include Capital Grants, Production Incentives or other payments deemed appropriate by ARENA for the Project. The application and assessment process for the Programme will typically involve two stages, an Expression of Interest (EOI) stage and a Full Application stage.	$523.2 million	Ongoing. The Programme will remain open until funds are exhausted or otherwise terminated or extended at ARENA's discretion.
Solar Sunshot	The Solar Sunshot programme supports Australia's photovoltaic (PV) manufacturing capabilities and aims to support innovative manufacturing facilities in Australia across the solar PV supply chain. The solar PV supply chain includes polysilicon production, production of ingots, wafers, solar PV cells and solar module assembly. The programme may also support complementary aspects of the solar PV supply chain such as solar glass, module frames, deployment technology and other innovation or manufacturing elements required for solar deployment. The programme is delivered through funding rounds, with details set out in funding announcements that serve as calls to market for specific types of projects.	$1 billion	Ongoing. Programme commenced on 31 August 2024 and will remain open until all funds available under the programme are exhausted. Funding announcements will set out specific application and assessment processes for each funding round.
Advancing Renewables Program (ARP)	The ARP awards grants to a range of projects that seek to: • optimise the transition to renewable electricity; • commercialise clean hydrogen; and • support the transition to low emission metals.	Up to $50 million	Ongoing.
Powering the Regions Industrial Transformation Stream	The Industrial Transformation Stream seeks to support existing industrial facilities, and new clean energy developments, in regional areas to reduce their emissions, in line with Australia's 2030 targets and in support of reaching net zero by 2050.	$400 million	Ongoing.
Regional Microgrids Program (RMP)	The Regional Microgrids Programme (RMP) aims to support the development and deployment of renewable energy microgrids across regional Australia that contribute to the Programme Outcomes. Funding has been allocated across two Streams under the Programme, each with its own Outcomes: **Stream A - Regional Australia Microgrid Pilots** - to fund Projects that contribute to the innovation and/or acceleration of developing and deploying equipment that enables the coordinated use of distributed renewable energy technologies, improving the resilience and reliability of electricity supply in regional areas and addressing barriers to deployment of microgrid solutions. **Stream B - First Nations Community Microgrids** - to fund Projects that contribute to the provision of cleaner, cost effective and reliable energy in First Nations Communities and empowering these Communities to participate in electricity supply arrangements and the development of energy infrastructure.	$125 million; Stream A $50 million; and Stream B $75 million	19 December 2025.
Driving the Nation Program	The Driving the Nation Program is delivered by the Australian Renewable Energy Agency (ARENA). The Program is focused on accelerating the uptake of Zero Emission Vehicles (ZEVs). ZEVs include Battery Electric Vehicles, Hydrogen Fuel Cell Vehicles and vehicles using low carbon liquid fuels. The Program Objectives are to: overcome barriers to accelerate uptake of ZEVs; optimise the integration of BEVs into the grid; demonstrate new technology, use cases and business models for ZEVs; and increase skills, capacity and knowledge relevant to ZEV technologies. The Guidelines should be read in conjunction with the Program Focus Areas and any Funding Announcements published on the Program webpage.	Up to the total amount of funds uncommitted and available under Budget Measures applicable to the Program and any additional funding ARENA allocates to the Program from its uncommitted baseline funding	Ongoing.
Future Made in Australia Innovation Fund	The Future Made in Australia (FMA) Innovation Fund administered by ARENA will provide up to $1.5 billion in grant funding to support pre-commercial innovation, demonstration and deployment of renewable energy and low emission technologies, to support Australia's transition to a net zero economy. The funds will be split into three priority areas: Green Metals, Clean Energy Technology Manufacturing and Low Carbon Liquid Fuels.	Up to $1.5 billion	Ongoing.
Community Batteries Funding Round 2	Community Batteries Funding Round 2 (Round 2) is delivered under ARENA's Advancing Renewables Program (ARP). The Round 2 Objective is to fund Projects that contribute to one or more of the following Outcomes: improve the economics of community battery projects through the reduction in, or removal of, barriers to large-scale deployment; build industry capacity to deploy community batteries at scale; support the integration of distributed energy resources into Australia's energy markets and market operator systems; and demonstrate the benefits of community batteries by putting downward pressure on household electricity costs, contributing towards lowering emissions, providing a net benefit to the electricity network, and enabling storage of distributed solar energy for later use or sharing.	$46.3 million	EOI Stage Closed. EOI Due Date was 30 April 2025. Full Application Due Date was 1 September 2025. ARENA aims to assess Applications and issue outcome letters from the Full Application as soon as practicable after the Full Application Due Date.
Ultra Low-Cost Solar PV R&D Funding Round	The Ultra Low-Cost Solar PV R&D Funding Round (Funding Round 4) is delivered under ARENA's Research Development and Commercialisation Program (RDC Program). Ultra Low-Cost Solar (ULCS) is a Strategic Priority for ARENA and is the Priority Technology for Funding Round 4. Funding Round 4 targets accelerated commercialisation of Australian innovation in R&D along the solar PV supply chain towards ARENA's ULCS goal of under $20 per MWh for the Levelised Cost of Electricity (LCOE) for utility-scale solar PV. The objectives of Funding Round 4 are to fund Projects that contribute to one or more of the following outcomes: support ambitious cost reduction, improved efficiency and stability for utility-scale solar PV across one of two Streams; and facilitate commercialisation of solar research and innovation to support research, industry and innovative businesses to drive applied research for solar at scale.	$60 million	Expression of Interest due on 21 October 2025 by 11:59 PM AEDT. Full Applications may be submitted at any time once ARENA's EOI feedback has been addressed and not later than the Full Application Due Date, which will be updated on the Funding Round website and notified to successful EOI Applicants.

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Investing in clean tech: What clean tech investors really care about



1. Introduction

Australia is establishing itself as a clean tech hub, with exciting new ventures ranging from record breaking solar and battery projects to cutting-edge waste-to-energy solutions, carbon capture and pioneering sustainable aviation fuel initiatives that turn sugarcane waste into jet fuel. The growth in the clean tech space has been driven by accelerating investment in clean energy, with $12.7 billion invested in clean energy in 2024.[1]

Deals in this space are often complex. They often involve joint ventures, staged capital raising, and multi-party shareholder arrangements, each requiring careful navigation of competing interests and complex governance structures. Unlike traditional financial investors, many clean tech investors are strategic players—corporates, utilities, superannuation funds, and government-backed entities—whose priorities extend beyond financial returns to include access to critical IP or technology assets, decarbonisation targets, and supply chain resilience. This makes the legal work particularly intricate, as it demands bridging diverse investment horizons, risk appetites, and governance expectations to craft agreements that are both commercially viable and strategically aligned.

2. Investor motivations

Clean tech investors can be more hands-on than investors in other industries because of the capital intensity, long development timelines and strong focus on regulation and technology. There are a number of ways this plays out – investors will often push for a board seat or at least observer rights and voting rights over major corporate actions and strategic decisions. Intellectual property will also be a key diligence item for investors as this will be important to the value ascribed to the clean tech business, and to its ability to scale the business going forward.

Board seat

In the clean tech space, investors commonly ask for board seats given the unique risks and complexities of the industry. Clean tech businesses are usually faced with long development timelines, capital-intensive scale up requirements, reliance on government policy or subsidies and difficult regulatory hurdles. Given these complexities, investors typically want rights in relation to shaping strategy and oversight, to ensure that key project milestones are met and their investment is deployed effectively over the long term.

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Not every investor will push for a board seat – some may prefer observer or information rights, however we note that this is more common if they hold a minority stake and are purely financial investors rather than strategic investors. Observers have access to the information of a business without the investor taking on fiduciary responsibility.

From the company's perspective, whether a board seat is granted to an investor depends on a number of factors, including the size of the investment, the stage of the company, the appetite of the founders to accommodate investor oversight without diluting their own control and whether the investor is a strategic partner or purely a financial investor. It is important for the company to assess the credentials of any proposed director including whether they have relevant technical, commercial or regulatory expertise, as well as whether they align with the company values and goals. Companies need to carefully balance the desire for incoming capital against governance considerations, including whether a leaner board composition may help preserve agility and reduce the risk of deadlock in decision-making.

Voting rights

Clean tech investors often push for veto or consent rights to safeguard their capital and influence key project decisions.

This will generally always include consent rights over issuing further shares or options. Due to the capital intensive nature of clean tech companies, these companies often require multiple funding rounds. Therefore it is important for investors to have rights that protect their ownership position in future rounds. This can be achieved in a number of ways, as set out below.

- Pre-emptive rights in shareholders agreements are common, giving investors the ability to participate pro rata in new equity issues to avoid dilution.
- Some investors may wish to seek a stronger position by asking for a right of first refusal (ROFR), which requires a company to first negotiate a deal with a third party and then present the investor with the option to take up those securities on the same terms. While a ROFR gives an investor control over future investment, it is a heavy handed right that can slow down future investment and deter new investors.
- A softer alternative is a right of first offer (ROFO), which requires a company to first offer new securities to the investor and if the investor declines, the company can then approach third party on the same terms.

Often clean tech investors settle for pre-emptive rights, with larger or more strategic investors pushing for a ROFR or, in some cases, parties land on a ROFO to balance protection for the investors and flexibility in raising money for the company.

Other corporate actions that investors will commonly require the right to approve include:

- new financings, mergers and acquisitions, changes to the capital structure or the sale of substantial assets; and
- strategic decisions that could affect the company's technology, intellectual property or regulatory compliance, entry into material contracts such as major offtake and supply contracts, or material changes to business plans or budgets.

Given these asks from the investor often conflict with the desire for the owners of the business to maintain control, it is important to carefully draft the shareholders agreement such that there are clearly defined reserved matters (so the parties are clear on which decisions require investor consent versus routine operational approvals), exit triggers (when a party can force a sale, drag/tag provisions), robust deadlock and dispute resolution provisions to ensure that any conflict is appropriately managed and an investment remains workable throughout the life of the project.



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Intellectual property

For investors in the clean tech space, robust intellectual property protection is paramount. Businesses who are looking to raise capital must ensure that they hold clear title to their IP – not only through formal registration on relevant IP registers, but also by securing ownership of any underlying copyright and other unregistered rights.

During investor due diligence, there are certain themes which are raised as red flags on a recurring basis. A primary concern for investors is where the company's R&D collaborations result in an unclear IP ownership position, particularly where those collaborations involve independent contractors and other external partners. R&D partnerships can be critical for clean tech ventures, particularly in the early stages of the business when the business is reliant on external expertise to supplement its in-house technical skillsets or to validate its technology on a larger scale. However, without proper assignment agreements transferring title in R&D outputs from collaborators to the business, ownership can remain ambiguous or even vest in the external party. Investors will scrutinise whether these kinds of historical ownership arrangements need remediation, which can be a costly and time-consuming exercise (and, at its worst, can derail a prospective investment).

Employee-generated inventions forming the basis of patents can present another critical consideration for investors. Under Australian common law, an implied term is generally recognised in employment contracts that inventions created by an employee in the course of their employment are owned by the employer. However, this requires the employee to have 'a duty to invent' – that is, it is generally not sufficient that the employee created an invention on the employer's time and using the employer's resources. Therefore, where the core value of a business is in its patent portfolio, the business may again need to take remedial or confirmatory steps to ensure that the relevant corporate entity has clear title to those patents.

Investors will also want to have confidence that the business has a clear runway to scale, and that there are not any third party IP rights which will limit the business' growth strategy. In this regard, investors will at times want to see freedom-to-operate searches before committing funding. These searches provide assurance in two ways: first, they provide confidence that commercialisation of the business' IP will not infringe third-party rights; and second, they can point to a clear gap in the IP landscape which the business will be able to protect and own (and, ultimately, commercialise through the intended channels).

In summary, it is critical that a clean tech venture seeking to raise investment can show clear IP ownership; proper assignments of IP title where relevant; and (ideally) evidence of its freedom to operate, so that the business can gain investors' confidence and capitalise on funding opportunities. Proactive IP management is essential for successful capital raising in this sector.

3. Form of investment

Clean tech investors are increasingly favouring hybrid structures such as convertible notes and preference shares to account for the capital-intensive and higher risk profile of clean tech projects. This approach is more favourable for investors for the following reasons.

- **Funding tied to milestones** – Investors can deploy funds progressively by linking contributions to the achievement of technical or regulatory milestones. Milestones should be drafted carefully so that they are expressed objectively to reduce the potential for future disputes.
- **Preference shares** – Often include liquidation preferences, dividend entitlements, and anti-dilution
- **Convertible notes** – Common in early-stage Australian clean tech start-ups because they allow investors and founders to defer agreeing on a valuation until a later funding round, reduce upfront negotiation friction, and bridge to strategic milestones. Convertible notes will often be structured as follows:
  - Conversion into shares on a material equity investment or liquidity event; and
  - Voting rights on reserved matters as if the investor is a shareholder, on a deemed conversion basis on a predetermined price, to ensure the investor's position is protected before conversion.

Hybrid structures also help reconcile differing investor objectives, allowing one investor seeking long-term involvement to coexist with another who prefers staged exits or milestone-based de-risking.

Investment through ordinary shares is more common for later-stage investments with reduced valuation uncertainty and a lower risk profile than early-stage clean tech projects, or joint ventures where parties are contributing non-cash assets such as technology or land.

Of course, investor objectives differ depending on the type of investor. Superannuation funds and listed corporates often seek stable, predictable returns, whereas early-stage venture funds may prioritise rapid growth and liquidity events. Because these objectives differ, it is critical for companies to align investor interests with the structure of the investment.

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Conclusion

Investing in clean tech requires a nuanced understanding of the sector's unique challenges and opportunities. From governance rights like board seats and voting protections to the strategic use of hybrid investment structures, clean tech investors are deeply engaged in shaping the trajectory of the businesses they back. Their motivations often go beyond financial returns, encompassing long-term sustainability goals, technological innovation, and regulatory alignment. For clean tech companies, aligning investor expectations with the right investment structure and governance framework is critical—not only to secure capital, but to build resilient partnerships that can support growth through the complex and capital-intensive journey of clean tech development.

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1 Clean Energy Council, Clean Energy Australia 2025 report, (Web Page, 28 May 2025) <https://cleanenergycouncil.org.au/getmedia/f40cd064-1427-4b87-afb0-7e89f4e1b3b4/clean-energy-australia-report-2025.pdf>.

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AI for renewable energy developers: Three ways to unlock value while managing risk

Artificial intelligence (**AI**) can be effectively deployed by renewable energy developers to address regularly encountered challenges.

We examine three key challenges facing developers and how AI can be strategically applied – and carefully managed – to unlock value while mitigating risk.



1. Addressing the skills shortage: expanding capacity without additional headcount

The renewable energy sector faces ongoing recruitment challenges, with the Australian Government recognising that 40,000 additional workers are required by 2030. This shortage increases developer labour costs and extends project timelines.[1]

AI can bridge skills gaps through automation, transforming resource allocation and cutting time spent on routine analysis, which in turn allows teams to focus on strategic decisions that directly impact project returns. This expands existing team member capacity by redirecting time towards higher-value activities and increasing productivity.

However, AI cannot provide the contextual judgement that experienced professionals bring to complex projects. For example, AI processes cannot replace the ability of an experienced developer to understand stakeholder dynamics, adapt strategies based on relationship history, or apply the pattern recognition that comes from navigating multiple projects from conception to completion. Developers and legal advisers must combine AI's efficiency gains with deep contextual knowledge of how renewable energy projects unfold over time, ensuring technology serves strategic objectives within an experience-driven framework, rather than simply processing information faster.

2. Improving project management: combining data with commercial judgement

Renewable energy projects involve coordinating multiple interconnected workstreams such as procurement, construction scheduling, contractor management, regulatory compliance, and stakeholder engagement. Developers face rising material costs, supply chain disruptions and uncertain component availability. Such external pressures must be effectively managed before they contribute to higher delivery costs and longer project timelines.

AI-driven project management systems can analyse scheduling options, track milestone dependencies, compare supplier lead times, optimise resource allocation, and monitor budget variances to minimise delays and cost overruns. Effective project management requires expert assessment of the qualitative factors that AI cannot replicate, such as contractor reliability and performance history, supplier financial stability, contractual risk allocation, and the relationship dynamics that determine how issues are resolved when problems arise.

Developers can address the AI shortfall by combining high-quality AI-generated data with their deep understanding of project interdependencies, contractor and supplier relationships, and contractual structures to develop management strategies that balance efficiency with risk management.

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3. Streamlining regulatory compliance: accelerating approvals while managing risk

The planning and development landscape is increasingly complex and expensive. Australian states and territories operate individual regulatory systems with rigorous requirements and substantial financial commitments. Application and assessment fees are significant costs faced by developers during the pre-construction phase.[2]

Developers can deploy AI to process vast regulatory datasets and generate summaries of complex frameworks in minutes, where it would have previously taken days. Continuous monitoring of environmental and financial risks allows teams to identify critical changes as they emerge offering significant time savings.

Yet regulatory success also depends on factors that AI cannot assess. Securing approvals requires an understanding of how requirements apply to specific project circumstances, evaluating the likelihood of discretionary decisions, and navigating the political and stakeholder dynamics that may heavily influence outcomes. Experienced legal judgement is required to translate AI-generated regulatory analysis into advice tailored to each project.

Moving forward

The real-life examples outlined above demonstrate how AI can help developers navigate challenges. When applied strategically and guided by expert judgement, AI can be a valuable tool to enable developers to unlock value, reduce risk, and accelerate the delivery of successful projects.



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1 Clean Energy Council, Clean Energy Australia Report 2025 (Report, 2025) <https://cleanenergycouncil.org.au/getmedia/f40cd064-1427-4b87-afb0-7e89f4e1b3b4/clean-energy-australia-report-2025.pdf>.

2 Australian Energy Market Operator, 2025 IASR Planning and Installation Cost Escalation Factors (Report, 2025) https://www.aemo.com.au/-/media/files/major-publications/isp/2025/stage-2/2025-iasr-planning-and-installation-cost-escalation-factors.pdf (https://www.aemo.com.au/-/media/files/major-publications/isp/2025/stage-2/2025-iasr-planning-and-installation-cost-escalation-factors.pdf).

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How AI is redefining the future of VPPs



Introduction

Australia's electricity market is changing quickly, driven by the rapid growth of distributed energy resources (**DER**). New technologies are turning rooftops into miniature power stations and allowing batteries to supply backup power that helps keep the grid stable, flexible, and resilient.

Virtual power plants (**VPPs**) play a key role in this transition by linking thousands of small energy devices so they can operate as a single, coordinated participant in the market. Over the past year, VPPs have become firmly established in Australia, supported by new funding, pilot projects, and regulatory initiatives across several states.[1]

Since our article on Virtual Power Plants: Five things you need to know in August 2024, the VPP market in Australia has shifted.[2] One of the most significant evolutions is the new dispatch mode that will enable VPPs to directly compete in the energy market.[3] The new dispatch mode will commence on 23 May 2027,[4] meaning market participants have approximately 18 months to prepare for the upcoming change.

This article delves beyond the current VPP market to explore the future of VPPs, specifically how emerging technologies such as AI will pair with VPPs to provide optimised efficiency, reliability and market participation in the National Electricity Market (**NEM**).

The current VPP challenge

A VPP is a scheduling system that brings together a variety of energy resources,[5] often including DER such as rooftop solar panels and energy storage systems.[6] A VPP orchestrates these resources by determining how and when energy is used.[7] VPPs can also directly interact with the NEM by participating in market bidding and providing essential services, such as maintaining frequency stability through Frequency Control Ancillary Services (**FCAS**).[8]

Traditionally, VPPs rely on algorithms, predictive models and historical data but do not include real-time data due to limitations in processing speeds.[9] This poses the following challenges:

- **Energy resource analysis**: Perfecting real-time analysis and model fusion.
- **Load and power output production prediction**: Reacting to unexpected events and extreme weather conditions.
- **Data security**: Characterising and scaling to large-scale systems.
- **Resource aggregation**: Improving speed, robustness and system stability under extreme conditions.
- **Scheduling**: Adjusting to changing regulatory environment and data insufficiency.
- **Market trading**: Integrating algorithm with system and balancing efficiency.

The AI solution

AI broadly refers to machines designed to replicate human intelligence, including reasoning, calculating, and learning.[10] In application, AI can be used to analyse data, make decisions, manage large datasets and operate autonomously.[11] In fields that emphasise data analysis and predictive capabilities, AI is increasingly replacing traditional methods by leveraging its capacity to process complex datasets and deliver clear outputs quickly.[12] When applied to electricity grids, these capabilities have the potential to enhance efficiency, resilience and overall performance.[13]

For instance, VPPs could, with the help of AI, monitor environmental conditions such as weather (including sunlight), anticipate energy demand with greater precision, and autonomously participate and optimise performance in real-time electricity trading within the NEM. Already, AI is being applied to VPPs in the following ways:

- In the USA, grid intelligence company LineVision has combined power line sensors and machine learning to model transmission line capacity up to 10 days ahead,[14] cross-checking AI outputs with physics-based methods for reliability.[15] Also in the USA, software company Amperon has used AI-powered forecasting for supply, demand and price predictions relevant to VPP operations,[16] while the National Renewable Energy Laboratory has developed eGridGPT to assess grid conditions and recommend operational improvements.[17]
- In China, State Grid Xintong Company has applied the User-Side Load model to improve forecasting algorithm stability and precision.[18]
- Studies have also analysed how VPPs can apply machine learning to improve grid control during extreme events, enhancing power management efficiency and resilience.[19]

One specific application of AI in VPPs is Digital Twin Technology (**DTT**) – a virtual simulation that replicates physical systems in real-time using sensor data.[20] When applied to VPPs, DTT enables operators to analyse performance patterns, predict maintenance needs and test system changes in a virtual environment before implementation.[21]

DTT addresses several VPP challenges identified above, particularly improving real-time analysis and system integration.[22] Digital twins can reduce unexpected maintenance events, enhance grid stability planning, and allow operators to simulate future grid changes such as adding renewable sources or retiring aging plants.[23] Australian energy companies are already implementing these AI technologies, with Essential Energy deploying digital twins covering 95 per cent of NSW,[24] and Endeavour Energy pioneering an 'engineering grade digital twin'.[25]

As VPPs prepare for the new 'dispatch mode', establishing robust data management frameworks has become essential for operational success. Firms developing VPP projects must implement unified data systems that provide real-time visibility across distributed energy resources, enabling accurate forecasting and optimal resource allocation. This project intelligence approach – integrating pipeline data, resource availability and financial metrics into a single source of truth – directly addresses VPP challenges, particularly improving real-time analysis capabilities and enhancing market participation accuracy.

Navigating challenges in the AI era of VPPs

Cyber security

While an AI-powered VPP future is promising, it also brings a new set of challenges. The integration of distributed energy resources and the use of machine learning focused on real-time optimisation exposes VPPs to various cyber threats, including data breaches.

Specific risks include:

- Vulnerability: The interconnected nature of VPPs makes them susceptible to cyberattacks. Unauthorised control over VPPs can lead to critical functions such as FCAS being interfered with.[26]
- Device Security: Devices can be targeted by cyberattacks that may impede the functionality and health of essential VPP elements, such as inverters, energy storage systems and smart meters.[27]
- Data Security: Data security is essential to protect against unauthorised access and consequent data breaches.[28] Tampered data directly impacts the reputation of VPP operators and the wellbeing of their customers, as well as the authenticity of the information.[29]
- Personal Applications: The use of mobile applications for remote monitoring and dispatch, as seen in South Australian VPP implementations,[30] introduces additional privacy considerations around user data collection, location tracking, and secure authentication protocols.

In light of the above emerging challenges, VPP operators should ensure clear contractual risk allocation between themselves and AI service providers.

Security of Critical Infrastructure Act 2018 (Cth)

The Security of Critical Infrastructure Act 2018 (Cth) (**SOCI Act**) is highly relevant to the operation of VPPs.[31] While VPPs are not explicitly mentioned as an asset class under the SOCI Act, they may fall under existing critical infrastructure categories depending on their specific characteristics and operations.[32] For example, if a VPP has a nameplate generation capacity greater than or equal to 30 megawatts and is connected to a wholesale electricity market it may be classified under the Act as a critical electricity asset.[33]

VPP operators must avoid compliance gaps and ensure robust security frameworks. It is critical for VPP operators and related businesses to build robust data security and reporting provisions into their contracts with subcontractors and service providers, ensuring clear allocation of responsibilities, obligations and risks to safeguard against any potential cyber incident or data breach.

Market conduct

As VPPs increasingly rely on AI for automated market participation, operators should also consider emerging regulatory compliance risks around market conduct. The recently released Staff Working Paper on AI and Energy (**Staff Working Paper**) by the Australian Energy Market Commission (**AEMC**) highlights concerns about algorithmic collusion, where AI systems may inadvertently learn to coordinate pricing strategies in ways that could be considered anti-competitive.[34] The Staff Working Paper highlighted that AI algorithms can systematically learn to collude and charge supracompetitive prices, potentially leading to higher prices for consumers.[35]

The NEM's characteristics make it particularly susceptible to such algorithmic coordination.[36] VPP developers who will bid VPP resources into the market must maintain appropriate safeguards. These should include maintaining human oversight of algorithmic decisions, ensuring transparency in AI decision-making processes, and establishing clear protocols to prevent pricing strategies that could be interpreted as anti-competitive. The AEMC has recommended establishing a working group with the Australian Competition and Consumer Commission and the Australian Energy Regulator to develop appropriate regulatory responses, indicating this will be an area of ongoing regulatory focus as AI adoption in energy markets accelerates.[37]

Conclusion

The integration of AI into VPPs is a step towards a more responsive and efficient energy system. While many of these developments are nascent, early applications suggest that these technologies could help address some of the key challenges faced by VPPs.

The Australian regulatory framework is evolving to facilitate the future of a grid with DER. AI is well placed to address persistent VPP pain points – from forecasting to operation control and maintenance – within a maturing Australian regulatory framework.

However, a critical question emerges: is the current regulatory process adequate given the rapid pace of technological change occurring in the VPP sector? With AI capabilities advancing at an unprecedented rate, and the new dispatch mode not commencing until May 2027, there is a risk that regulatory frameworks may lag behind technological developments, potentially creating compliance gaps or missed opportunities for market optimisation. However, to date, VPP operators have demonstrated a willingness to embrace these challenges and opportunities.

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1 Australian Renewable Energy Agency, Project Jupiter (Web Page, 23 May 2025) <https://arenalla.gov.au/projects/project-jupiter/>; Government of South Australia (Energy and Mining), South Australia's Virtual Power Plant (Web Page) <https://www.energymining.sa.gov.au/consumers/solar-and-batteries/south-australias-virtual-power-plant#about>; Rule Determination, National Electricity Amendment (Integrating price-responsive resources into the NEM) Rule 2024 (Cth) [1] ('Rule Determination').

2 Australian Energy Market Operator, Integrating price responsive resources into the National Electricity Market: High level implementation assessment (Preliminary view, March 2025) 5.

3 Australian Energy Market Commission, Energy market gets clear vision: Reform opens door for all to benefit from virtual power plants (Media release, 19 December 2024) <https://www.aemc.gov.au/news-centre/media-releases/energy-market-gets-clear-vision-reform-opens-door-all-benefit-virtual-power-plants>.

4 Ibid.

5 Xinxing Liu and Ciwei Gao, 'Review and Prospects of Artificial Intelligence Technology in Virtual Power Plants' (2025) 18(3) Energies 3325, 3327 ('Prospects of AI in VPPs').

6 Ibid.

7 Ibid.

8 Australian Energy Market Operator, Virtual Power Plant (VPP) Demonstrations (Web Page) <https://aemo.com.au/initiatives/major-programs/nem-distributed-energy-resources-der-program/der-demonstrations/virtual-power-plant-vpp-demonstrations>.

9 Prospects of AI in VPPs (no 5) 3327.

10 Yongjun Xu et al, 'Artificial intelligence: A powerful paradigm for scientific research' (2021) 2 (4) Innovation (Camb) 1.

11 Prospects of AI in VPPs (no 5) 3327.

12 Ibid.

13 Nuraini Diah Noviati, Sondang Deri Maulina and Sarah Smith, 'Smart Grids: Integrating AI for Efficient Renewable Energy Utilisation' (2024) 3(1) International Transactions on Artificial Intelligence 2.

14 Maeve Allsup and Laura Weinstein, Seven ways utilities are exploring AI for the grid (Web Page, 16 October 2023) <https://www.latitudemedia.com/news/seven-ways-utilities-are-exploring-ai-for-the-grid/> ('Seven ways utilities are exploring AI for the grid').

15 LineVision, How LineVision's Non-Contact Sensors Power Dynamic Line Ratings (Web Page) <https://www.linevisioninc.com/methodology>.

16 Ibid.

17 Danhao Wang, Daogang Peng and Dongmei Huang, 'Application and prospects of large AI models in virtual power plants' (2025) 241 Electric Power Systems Research 111403, 111410; 11409 ('Application and prospects of large AI models in VPP').

18 Ibid.

19 Md Romyull Islam et al, 'Building a Resilient and Sustainable Grid: A Study of Challenges and Opportunities in AI for Smart Virtual Power Plants' (Conference Paper, ACM Southeast Conference, 27 April 2024) 101.

20 Abdelali Abdessadak et al, 'Digital twin technology and artificial intelligence in energy transition: A comprehensive systematic review of applications' (2025) 13 Energy Reports 5196, 5200 ('Digital twin technology and artificial intelligence in energy transition').

21 Orhan Korhan, Digital Twin Technology – Fundamentals and Applications (IntechOpen, 2023) Introductory Chapter.

22 Ildar Idrisov et al, 'Microgrid Digital Twin Application for Future Virtual Power Plants' (Conference Paper, 49th Annual Conference of the IEEE Industrial Electronics Society, October 2023) 1.

23 Digital twin technology and artificial intelligence in energy transition (no 20) 5201.

24 Essential Energy, Digital Twin increases opportunities for renewable energy (Web Page, 22 May 2023) <https://www.essentialenergy.com.au/media-centre/media-release/news-7-digital-twin>.

25 Endeavour Energy, Endeavour Energy pioneers Neara digital twin in transition to modern grid (Web Page, 13 December 2021) <https://www.endeavourenergy.com.au/news/media-releases/endeavour-energy-pioneers-neara-digital-twin-in-transition-to-modern-grid>.

26 Sriram Prabhakara Rao, Ranganathan Prakash and Shree Ram Abayankar Balaji, 'Virtual Power Plants Security Challenges, Solutions, and Emerging Trends: A Review' (Conference Paper, Cyber Awareness and Research Symposium, October 2024) 3.

27 Ibid 4.

28 Ibid.

29 Ibid.

30 Tesla, Tesla App for Energy (Web Page) <https://www.tesla.com/en_au/support/energy/powerwall/mobile-app/tesla-app-for-energy>.

31 See the types of critical infrastructure energy assets at: Critical Infrastructure Security Centre, Australian Government Department of Home Affairs, SOCI Act 2018 for energy (Web Page, 5 December 2023) <https://www.cisc.gov.au/information-for-your-industry/energy/legislation-regulation-and-compliance/soci-act-2018>.

32 Ibid.

33 Ibid.

34 AEMC, 'Addressing the risk of algorithmic collusion' (Staff Working Paper, July 2024) <https://www.aemc.gov.au/sites/default/files/2025-09/AI%20and%20the%20future%20of%20energy%20regulation%20-%20Algorithmic%20Collusion.pdf> 13.

35 Ibid.

36 Ibid 14.

37 Ibid 9.

The AI energy crisis: When innovation outpaces infrastructure

The growth of artificial intelligence (AI) is driving profound transformation in global data infrastructure and energy demand. The integration of AI into a range of commercial and industrial products, from refrigerators to virtual assistants, is placing mounting pressure on both domestic and foreign energy networks. With global data centre demand projected to surge 165% by 2030, concerns around the adequacy of existing legal frameworks, energy access, and environmental sustainability have been raised.[1]

This article will explore the significant energy demands of AI, the capacity for the NEM and national transmission infrastructure to adapt, and international responses to this evolving demand-side challenge.



What's the issue with AI's energy demands?

Data centres are already significant energy consumers, and the rapid uptake of artificial intelligence – particularly generative AI – is accelerating this trend. AI requires immense computational power, placing growing demands on both existing and new data centres. As AI products and services become further embedded in the economy, data centre energy consumption will continue to rise.

Globally, the scale of this demand is striking. For example, ChatGPT alone is estimated to use 39.98 GWh of electricity and 148.28 million litres of water daily for cooling.[2] Meeting the worldwide appetite for AI is projected to require $5.2 trillion in capital expenditure by 2030.[3]

In Australia, data centre development is accelerating. AI-intensive sectors such as finance and telecommunications are driving a substantial surge in demand for high-performance data infrastructure.[4] These facilities require uninterrupted, highly reliable electricity, placing disproportionate pressure on local energy distribution systems. Data centres already consume approximately 4–5% of Australia's electricity,[5] with projections suggesting this could rise to 8% by 2030.[6]

As the scale and complexity of data centres expand, so too do the regulatory challenges surrounding AI deployment. In response, the Federal Government has introduced the Voluntary AI Safety Standards, encouraging companies to self-regulate across all stages of AI development and implementation.[7] While a positive step, the voluntary nature of these standards leaves room for inconsistency and non-compliance. Introducing mandatory regulations would likely be more effective in ensuring responsible, industry-wide adoption of AI and its supporting infrastructure.

Meeting AI's growing energy demands will require major investment in both infrastructure and policy reform. Yet AI is evolving rapidly, outpacing the development of domestic and global energy systems. Without timely and consistent investment, energy prices may surge – ultimately leaving consumers to bear the cost of the AI revolution.

International responses

United States of America

The United States has adopted a multi-pronged strategy to manage rising AI-related energy demand, focusing on investment, regulation, and research. Through the Inflation Reduction Act and CHIPS and Science Act, the federal government is directing billions of dollars toward grid modernisation, clean energy expansion, and semiconductor manufacturing critical to AI development.[8] The Department of Energy is also conducting assessments on improving data centre efficiency and developing performance standards in light of growing AI workloads.[9] However, the continued viability of these federal programs remains uncertain under the Trump administration, which has expressed a desire to repeal the Biden-era AI and clean energy initiatives.[10] As a global hub for AI, the United States' regulatory volatility will influence the industry's future growth.

China

China's energy generation development and policy has shifted significantly as AI becomes a cornerstone of the digital economy. China has responded to escalating AI energy demand by implementing its "Eastern Data, Western Computing" policy. This policy relocates energy intensive computing centres to western provinces with abundant renewable resources.[11] Also, new data centres must meet stringent energy efficiency and carbon intensity benchmarks, with projects failing to comply denied approval. The policy is designed to balance regional development, reduce pressure on eastern urban grids (which trend toward higher residential concentration), and align AI infrastructure with China's broader dual-carbon goals: peak emissions before 2030 and carbon neutrality by 2060.[12]

Ireland

Ireland is a case study on AI regulation and infrastructural lag. The nation is facing an unprecedented surge in energy consumption from AI and data centre operations. In 2024, data centres accounted for 21% of the nation's total electricity use, overtaking all urban residential consumption.[13] This rapid growth has raised concerns about energy affordability, grid reliability, and compliance with European climate targets. In response, Ireland's energy regulator has proposed a policy requiring data centres to match their energy load with equivalent new power generation.[14] This approach shifts the burden of infrastructure expansion – across generation, transmission, and storage – onto developers, effectively making data centre approval contingent on securing additional supply.[15]

Looking Forward

The energy demands of AI are no longer a future challenge but a present and escalating reality. Countries at the forefront of AI adoption are beginning to experiment with policy tools to avoid grid instability, rising costs, and environmental backsliding. Internationally, a clear trend is emerging as governments shift responsibility for infrastructure upgrades onto data centre developers. While the regulatory mechanisms vary, the common goal is to integrate AI into energy systems without compromising grid security or climate targets.

In Australia, a more coherent, enforceable framework is necessary. Current state-federal fragmentation, coupled with voluntary AI guidelines, lacks the clarity and enforceability needed to support long-term planning. Looking ahead, policy reform will likely focus on mandatory emissions reporting, enhanced environmental approval standards, and greater integration of data centre load into national transmission planning. Australia may also consider following international models by linking new data centre approvals to infrastructure contributions or renewable procurement. If the energy transition is to remain viable in an AI-driven economy, legal frameworks will need to evolve just as quickly as the technologies they aim to govern.



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1 Goldman Sachs, 'AI to drive 165% increase in data center power demand by 2030' (Web Page, 4 February 2025) <https://www.goldmansachs.com/insights/articles/ai-to-drive-165-increase-in-data-center-power-demand-by-2030>.

2 Ian Wright, 'ChatGPT Energy Consumption Visualised' (Web Page, 17 February 2025) <https://www.businessenergyuk.com/knowledge-hub/chatgpt-energy-consumption-visualized/>.

3 McKinsey & Company, 'The cost of compute: A $7 trillion race to scale data centers' (Web Page, 28 April 2025) <https://www.mckinsey.com/industries/technology-media-and-telecommunications/our-insights/the-cost-of-compute-a-7-trillion-dollar-race-to-scale-data-centers>.

4 Bronwyn Cumbo, 'Australia is set to get more AI data centres. Local communities need to be more involved' (Web Page, 8 July 2025) <https://theconversation.com/australia-is-set-to-get-more-ai-data-centres-local-communities-need-to-be-more-involved-259799>.

5 Sherif Andrawes, et al, 'The rising energy demand from data centres: A global perspective' (Web Page, 28 April 2025) <https://www.bdo.com.au/en-au/insights/natural-resources-energy/the-rising-energy-demand-from-data-centres-a-global-perspective>.

6 Ibid.

7 Australian Government, 'Voluntary AI Safety Standard' (Web Page, 5 September 2025) <https://www.industry.gov.au/publications/voluntary-ai-safety-standard>.

8 Rhett Buttle, 'Assessing the Impact of the Chips and Science Act and the Inflation Reduction Act' (Web Page, 16 August 2023) <https://www.inc.com/rhett-buttle/assessing-impact-of-chips-science-act-inflation-reduction-act.html>.

9 US Department of Energy, 'Recommendations on Powering Artificial Intelligence and Data Center Infrastructure' (Report, 30 July 2024) 3 <https://www.energy.gov/sites/default/files/2024-08/Powering%20AI%20and%20Data%20Center%20Infrastructure%20Recommendations%20July%202024.pdf>.

10 Simmone Shah, 'How Trump Is Trying to Undo the Inflation Reduction Act' (Web Page, 28 February 2025) <https://time.com/7262600/how-trump-is-trying-to-undo-the-inflation-reduction-act/>.

11 Andrew Stokols, 'Energy and AI Coordination in the 'Eastern Data Western Computing' Plan' (2025) 25(4) China Brief, 6 – 13.

12 Ibid 6.

13 Jillian Ambrose, 'Ireland's datacentres overtake electricity use of all urban homes combined' (Web Page, 23 July 2024) <https://www.theguardian.com/world/article/2024/jul/23/ireland-datacentres-overtake-electricity-use-of-all-homes-combined-figures-show>.

14 Dan Swinhoe, 'Ireland's energy regulator proposes policy requiring data centers to match load with new power generation' (Web Page, 19 February 2025) <https://www.datacenterdynamics.com/en/news/irelands-energy-regulator-proposes-policy-requiring-data-centers-to-match-load-with-new-power-generation/>.

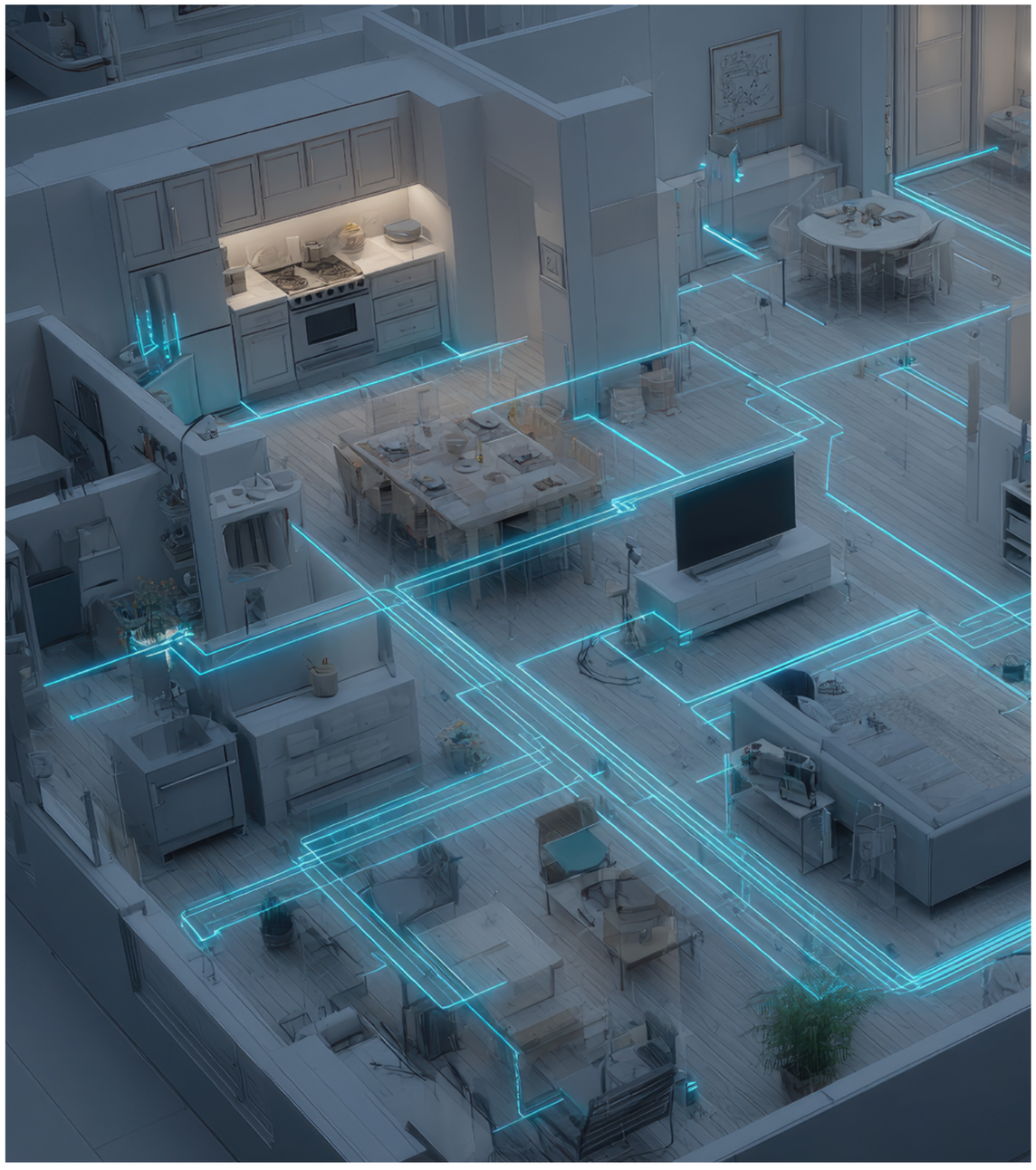
15 Ibid.

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Could AI make your fridge explode? The impact of AI data centres on the grid and your appliances

AI-powered data centres are pushing electricity networks to their limits. But recent lessons from the US, Ireland and even Queensland show that, with the right planning, data centres could support rather than strain the grid.



Artificial Intelligence (**AI**) is driving a global surge in data centre construction and energy demand.[1] Unlike traditional cloud facilities, AI-focused data centres consume vast amounts of electricity and exhibit highly variable power usage patterns.[2] Their rapid growth is raising concerns about grid capacity and power quality.[3] Grid operators and policymakers are now grappling with how to meet the energy needs of AI data centres without compromising reliability for other users.[4]

What are AI data centres?

AI data centres are high-powered facilities that house the technology and systems needed to run AI.[5] They contain ultra-fast computers, high-capacity networks, and special cooling systems to handle the intense processing demands involved in developing and operating AI tools.[6]

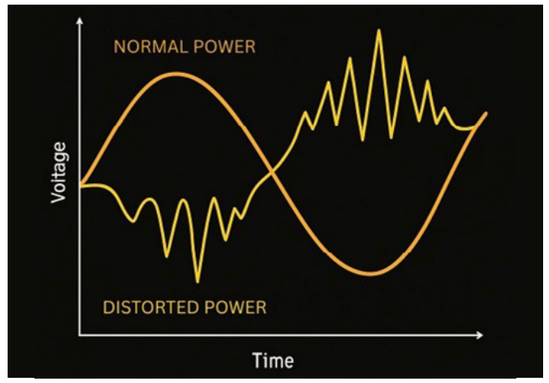
A single facility can host tens of thousands of AI data servers working in unison, with total power consumption reaching into the hundreds of megawatts.[7] In some cases, large AI data centres consume as much electricity as entire cities or small states.[8]

This high energy intensity, driven by constant operation and heavy cooling requirements, makes AI data centres one of the most power-hungry infrastructure ever built. AEMO predicts that by 2050, data centres will account for 12% of NEM demand.[9]

What AI data centres are doing to the grid and your appliances

Have you ever noticed your fridge or dishwasher sounding unusually loud? AI may be the reason.[10] Unlike traditional data centres that draw power at a steady rate, AI data centres, powered by thousands of high-performance chips, consume electricity in short, concentrated bursts, especially during AI model training.[11] These sudden, high-density loads introduce new stresses on the grid, creating uneven and spiky energy usage patterns.[12]

These fluctuations cause what's known as 'bad harmonics', a type of electrical irregularity that occurs when voltage and current waveforms stray from their usual pattern.[13] Although harmonics are rarely perfect (a small amount of distortion under standard grid conditions is normal), studies have shown that areas within 80 kilometres of major AI data centres experience significantly higher levels of grid distortions.[14] This leads to poorer power quality for everyday appliances with electric motors, like refrigerators, washing machines, and air conditioners, leading to potential malfunctions, overheating, and electrical fires.[15]



Output from ChatGPT, Open AI to Zachary Reyes, 24 July 2025

Case study: Data Center Alley

Ashburn, Virginia (often called 'Data Center Alley') hosts the world's largest concentration of data centres.[16] The rapid expansion of AI and cloud data centres in the region has pushed their combined electricity supply capacity to around four gigawatts — exceeding the total data centre capacity in London and Tokyo.[17]

In July 2024, a minor grid fault triggered an automatic emergency response at about 60 data centres in Northern Virginia, simultaneously disconnecting 1,500 MW of load from the grid.[18] This sudden drop of power caused a measurable frequency spike on the Eastern U.S. power system.[19] While no major blackout occurred, the incident highlighted how a concentration of data centres can amplify grid instability.[20]

In response, local authorities have slowed approvals for new facilities until infrastructure upgrades catch up. Grid regulators are also reviewing new rules to prevent future "mass disconnection" events.[21] Meanwhile, community concern is growing as residents face the side effects from the concentration of data centres, including noise, land use pressure, and worsening power quality.[22]

Addressing these challenges

Addressing the impact of AI data centres on electricity grids will require a combination of technology, infrastructure investment, and regulatory reform.[23] The core challenge is not just how much power these centres use, but how unpredictably they use it.[24]

Solving these issues starts with improving how electricity is delivered and managed.[25] Technological solutions such as battery energy storage systems, dynamic voltage regulators, and harmonic filters can help smooth out erratic power flows and reduce the electrical "noise" that damages sensitive equipment.[26]

Case studies: Microsoft and Quinbrook Infrastructure

Ireland has become a hub for data centres and is rapidly expanding its wind power capacity, introducing greater variability into the electricity supply.[27] To address both challenges, Microsoft is transforming its Dublin data centre campus into a grid asset.[28] The facility's large banks of lithium-ion backup batteries (typically reserved for emergency power) have been upgraded and certified to help stabilise the grid.[29]

In a first-of-its-kind arrangement, these batteries will respond to grid signals and discharge electricity when there's a shortfall in wind or other generation.[30] This supports the local transmission operator in maintaining reliable service during fluctuations in renewable output and reduces reliance on fossil-fuelled generators for reserve power.[31] Importantly, it reduces reliance on fossil-fuelled generators for providing reserve power.[32] Microsoft's Dublin project shows one innovative solution: turning data centres' existing battery infrastructure into a buffer for the grid, creating a win-win for both reliability and sustainability.[33]

In South-East Queensland, the "Supernode" project is taking a similar approach on a larger scale. Developer Quinbrook Infrastructure is building an 800 MW/2000 MWh battery energy storage system to support a planned $2.5 billion data centre campus near Brisbane.[34] The mega-battery will ensure a stable power supply for the data centre and also offer dispatchable services to the grid, such as feeding electricity back in during peak periods or emergencies.[35] Stage one is under construction with the final stage (stage four) due to break ground in 2027.[36]

By firming up renewable energy capacity and acting as a safeguard against outages, the Supernode battery is designed to reduce the grid impact of the new data centre.[37] This project reflects a more proactive model: instead of just plugging data centres into the existing grid and hoping it holds, operators are investing in on-site resources to help balance supply and demand.[38]

Balancing the power demands of AI data centres

As artificial intelligence reshapes the digital economy, AI data centres are becoming some of the most demanding elements of modern electricity networks. Their intense and unpredictable power use is placing new pressure on infrastructure, degrading power quality, and affecting household appliances. While often invisible to consumers, these impacts are prompting growing concern.

Lessons from Ireland and Queensland demonstrate that, with proper planning, data centres can support rather than strain the grid. By investing in local energy storage, renewable generation, and improved coordination with grid operators, AI data centres can enhance – rather than undermine – system resilience.



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1 Austrade, 'AI and Data Centres' (Web Page) <https://international.austrade.gov.au/en/do-business-with-australia/sectors/technology/ai-and-data-centres>.
2 IBM, 'What Is an AI Data Center?' (Web Page, 21 February 2025) <https://www.ibm.com/think/topics/ai-data-center>.
3 McKinsey & Company, 'AI power: Expanding data center capacity to meet growing demand' (Web Page, 30 October 2024) <https://www.mckinsey.com/industries/technology-media-and-telecommunications/our-insights/ai-power-expanding-data-center-capacity-to-meet-growing-demand>.
4 Digital Realty, 'How AI Is Changing the Data Center Landscape' (Web Page, 12 March 2024) <https://www.digitalrealty.com/resources/articles/data-center-ai>.
5 What is an AI Data Center? (n 2).
6 Ibid.
7 All-About-Industries, 'AI Data Centers Strain the Quality of the Power Grid' (Web Page, 14 January 2025) <https://www.all-about-industries.com/ai-data-centers-strain-the-quality-of-the-power-grid-a-34f3ce06f4ce3ea4c02f4ff04cb3ebad/>.
8 Ibid.
9 Australian Energy Market Operator, AEMO's Updated Forecasting Methodology Targets Rapidly Growing Electricity Loads (Web Page, 26 July 2024) <https://www.aemo.com.au/newsroom/news-updates/aemos-updated-forecasting-methodology-targets-rapidly-growing-electricity-loads>.
10 Wendover Productions, "How AI Is Ruining the Electric Grid" (YouTube, Nebula, 2025) <https://www.youtube.com/watch?v=3__HO-akNC8\>.
11 What is an AI Data Center? (n 2).
12 Bloomberg, 'AI Needs So Much Power, It's Making Yours Worse' (Web Page, 27 December 2024) <https://www.bloomberg.com/graphics/2024-ai-power-home-appliances/>.
13 Ibid; see also Data Center Dynamics, 'AI Data Centres Causing "Distortions" in US Power Grid – Bloomberg' (Web Page, 6 January 2025) <https://www.datacenterdynamics.com/en/news/ai-data-centers-causing-distortions-in-us-power-grid-bloomberg/>.
14 Ibid.
15 Tom's Hardware, 'AI data centers reportedly cause power problems in residential areas – decreased power quality in homes near data centers causes reduced lifespan for electrical appliances' (Web Page, 28 December 2024) <https://www.tomshardware.com/tech-industry/artificial-intelligence/ai-data-centers-reportedly-cause-power-problems-in-residential-areas-decreased-power-quality-in-homes-near-data-centers-causes-reduced-lifespan-for-electrical-appliances>.
16 Lightyear, 'Ashburn colocation: The Data Centre Alley' (Web Page, 12 November 2021) <https://lightyear.ai/blogs/ashburn-colocation-data-center-alley>.
17 Goldman Sachs Research, AI to Drive 165% Increase in Data Center Power Demand by 2030 (Web Page, 4 February 2025) <https://www.goldmansachs.com/insights/articles/ai-to-drive-165-increase-in-data-center-power-demand-by-2030>.
18 Grid Status, 'Byte Blackouts: How large data center loads are surfacing new issues' (Web Page, 18 April 2025) <https://blog.gridstatus.io/byte-blackouts-large-data-center-loads-new-issues-pjm/>.
19 Ibid.
20 Ibid.
21 The Washington Post, 'Data-centre protest sparks community resistance' (Web Page, 5 October 2024) <https://www.washingtonpost.com/technology/2024/10/05/data-center-protest-community-resistance/>.
22 Data Center Knowledge, 'Why communities are protesting data centers – and how the industry can respond' (Web Page, 13 June 2024) <https://www.datacenterknowledge.com/data-center-construction/why-communities-are-protesting-data-centers-and-how-the-industry-can-respond>.
23 Hydrogen Fuel News, 'AI Data Centers Are Placing a Serious Strain on the Power Grid' (Web Page,22 March 2024) <https://www.hydrogenfuelnews.com/ai-data-centers-power-grid/8568880/>.
24 Steve Hanley, 'Demand for Power at Data Centers is Disrupting Harmonics in Nearby Electrical Grids' (Web Page, 30 December 2024) <https://cleantechnica.com/2024/12/30/demand-for-power-at-data-centers-is-disrupting-harmonics-in-nearby-electrical-grids/>.
25 Ibid.
26 Ibid.
27 Microsoft, "Microsoft datacenter batteries to support growth of renewables on the power grid" (Web Page, 7 July 2022) <https://news.microsoft.com/source/features/sustainability/ireland-wind-farm-datacenter-ups/>; Associated Press, 'Ireland embraced the AI boom. Now its data centers are consuming too much of its energy' (AP, 19 December 2024) <https://apnews.com/article/6c0d63cbda3df740cd9bf2829ad62058>.
28 Microsoft (n 27).
29 Ibid.
30 Ibid.
31 Ibid.
32 Ibid.
33 Associated Press (n 27).
34 RenewEconomy, 'Quinbrook seals record finance deal to build huge "Supernode" data centre battery' (Web Page, 22 January 2025) <https://www.reneweconomy.com.au/quinbrook-seals-record-finance-deal-to-build-huge-supernode-data-centre-battery/>; Quinbrook Infrastructure Partners, 'Supernode BESS' (Web Page) <https://www.quinbrook.com/quinbrook-project/supernode-bess/>.
35 Ibid.
36 David Scaysbrook, 'Powering Big Data' (Panel Discussion, Australian Clean Energy Summit, 29 July 2025).
37 RenewEconomy (n 35).
38 Ibid.

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Securing the smart grid: Cybersecurity challenges in Australia's distributed energy future

Part 1: The digitised grid

Introduction

In recent years, Australia has become a world leader in distributed energy resources (**DER**) and consumer energy resources (**CER**)[1], with many households and small businesses generating power through rooftop solar, battery storage and electric vehicles.[2]

At the same time, the growing number of connected devices has expanded the potential entry points for cyberattacks.[3] As operational technology (**OT**) and information technology (**IT**) become more integrated, the grid faces increased exposure to cyberwarfare and ransomware. Hackers may target the grid for financial gain, disruption of critical infrastructure or to access sensitive information. Breaches could interrupt electricity supply, cause widespread blackouts and destabilise essential services such as telecommunications, transport and water systems.

Protecting the grid is therefore a priority. Australia must implement robust IT and OT security measures, enhance its regulatory frameworks, ensure vendors maintain full visibility and control of connected systems and foster cooperation between government, industry and cybersecurity experts to safeguard critical infrastructure.[4]



How has Australia's grid become more digitised?

Across Australia, the energy landscape is undergoing rapid change. Projections indicate that by 2050 almost half of all households and businesses will operate rooftop solar systems, with approximately 61% - 84% of rooftop solar systems expected to be coupled with a battery as uptake increases.[5]

Integrating these variable energy sources into the grid is challenging and can result in grid constraints and power inefficiencies if not done effectively.[6]

Grid digitisation involves integrating information and communication technologies (ICT) and advanced data analytics into the electricity network to improve efficiency, reliability and security.[7]

Notably, Australia's renewable energy industry has been transformed by:

1. **The 'Internet of Things' (IoT)**: In the renewable energy context, is a network of interconnected devices (such as smart meters, solar inverters, wind turbine sensors, batteries and electric vehicle chargers) that collect and exchange real-time data to optimise energy production, storage and use. IoT enables operators to monitor equipment performance, forecast generation, balance supply and demand and detect faults early. At the household level, IoT supports 'smart' energy use by automatically running appliances based on solar output or off-peak times, forming the foundation for technologies like smart grids and energy management systems.[8]
2. **Smart grid technology:** A digitised network that uses data analytics, sensors and automated control systems to manage electricity flows in real time.[9] This allows the grid to respond dynamically to fluctuations in supply and demand, integrate DER more effectively and provide greater visibility for both operators and consumers.
3. **Energy management software (EMS):** Cloud-based systems that monitor and control DER to optimise energy use.[10] In homes, EMS platforms decide when to charge or discharge batteries or draw from the grid to minimise costs.[11] In commercial settings, they provide centralised, real time oversight of energy performance across sites, often integrating with building management systems to manage temperature, ventilation, and lighting.

However, whilst these innovations help bridge the gap between OT and IT, the increased connectivity of devices and systems (which were previously more isolated)[12] also brings new vulnerabilities, fuelling an increase in concerns around data protection and cybersecurity.

The harm with digitisation

How digitisation increases risk

As society's dependence on digitally connected renewable energy infrastructure grows and more automation is introduced to manage the grid's increasing complexities, vulnerability to cyberattacks rises. Each new connection introduces potential weaknesses, increasing the risk of compromised security and large-scale disruption.[13]

The rapid uptake of solar and smart energy appliances in homes and businesses has expanded potential entry points for cyberattacks,[14] with connected devices varying widely in their levels of security.[15]

Because the renewable energy sector underpins both national infrastructure and the broader economy, a single cyber incident or technical failure could disrupt electricity supply, compromise critical infrastructure, weaken grid stability and (in severe cases) destabilise entire regions.[16]

Cyber security experts warn that as systems become more interconnected, cybersecurity becomes even more critical.[17] Our energy networks, and by extension, modern life, depend on secure, uninterrupted access to power.[18]

Consequently, cyber security is not just about protecting digital assets but about safeguarding the stability of the national energy system itself.[19] Continuous monitoring, validation, and authentication across all devices and users are essential to maintaining that security.[20]

Types of threats hackers can carry out

Over the past year, cyberattacks on the energy, transport and telecommunications sector have increased by 30%.[21] In 2023 alone, 90% of the world's largest energy companies suffered a cybersecurity breach.[22]

There are various types of threats to DERs and that may be carried out by hackers, including:

1. **Social engineering attacks:** Hackers use phishing emails, fake websites, or messages to trick employees, installers, or consumers into revealing passwords or system access credentials, potentially allowing unauthorised control of solar inverters, batteries, or management platforms.[23]
2. **Malware-based attacks:** Malicious software such as ransomware or trojans can infiltrate energy management systems or IoT devices, disrupting operations, encrypting control data, or remotely manipulating device settings to destabilise local grids or virtual power plants.[24]
3. **Supply chain compromises:** Attackers may target trusted vendors, installers, or software providers, injecting malware into firmware updates or compromising third-party integrations, to gain indirect access to multiple DER systems simultaneously.[25]

An example of how these threats could affect DER is through smart meters or home energy management systems. If an attacker manipulates DER telemetry or control signals (such as coordinating rapid, periodic changes in battery charge/discharge or photovoltaic output) it could mimic an oscillation attack, destabilising local voltage or frequency. Grid protection systems may then trip automatically, potentially causing localised blackouts or disrupting aggregated DER services like virtual power plants.[26]

As security systems strengthen, cybercriminals are becoming increasingly sophisticated,[27] exploiting gaps between IT and OT (with the latter historically being less developed and protected). With IT and OT now more integrated, companies are adopting software solutions to properly safeguard OT, identify grid bottlenecks and mitigate these emerging cyber risks.[28]



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1 CERs are a subset of DERs and specifically refer to the consumer-owned technologies which generate, store or manage electricity. The primary focus of this article is on DERs.

2 Michael Rothschild, 'Combating the cyber threat to Australia's distributed solar grid ambitions' Australian Information Security Association (Web Page) <https://aisa.org.au/public/Public/News_and_Media/Thought-Leadership-Library/Cyber-threat-to-Australia-s-solar-grid-ambitions.aspx>.

3 Daniel Mercer, 'Australia's electricity grid increasingly vulnerable to hackers via solar panels, smart devices', ABC News (online, 14 March 2022) <https://www.abc.net.au/news/2022-03-14/australia-electricity-grid-vulnerable-hackers-solar-panels-smart/100892044>.

4 Rothschild (n 2).

5 Green Energy Markets, Projections for distributed energy resources – solar PV and stationary energy battery systems (Report, December 2024) 14 chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/https://www.aemo.com.au/-/media/files/major-publications/isp/2025/GEM-2024-Solar-PV-and-Battery-Projections-Report.pdf>.

6 'Role of Smart Grids in Australia's Path to Energy Independence' Smart Lifestyle Australia (Web Page, 11 February 2025) <https://smartlifestyleaustralia.com.au/role-of-smart-grids-in-australias-path-to-energy-independence/>.

7 Power Circle, Digitalization of the Grid (White Paper, November 2022) 2 <chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/https://powercircle.org/digitalization_of_the_grid.pdf>.

8 Jasmin Jessen, 'Top 10 Uses of IoT in Energy', Energy Digital (Web Page, 12 March 2025) <https://energydigital.com/top10/top-10-uses-of-iot-in-energy>; Tanveer Ahmad and Dongdong Zhang, 'Using the internet of things in smart energy systems and networks' (2021) 68 Sustainable Cities and Society.

9 Warren, Smart Grid Technology: Powering Australia's Renewable Energy Future' Sustainable Future Australia (Web Page, 2 April 2025) <https://biomassproducer.com.au/infrastructure-and-grid-integration/smart-grid-technology-powering-australias-renewable-energy-future/>.

10 'How cyber attacks can threaten the energy transition', Twoday (Web Page, 1 September 2025) <https://www.twoday.com/blog/how-cyber-attacks-can-threaten-the-energy-transition>.

11 'Home Energy Management System', Evergen (Web Page) <https://evergen.energy/home-energy-management-systems/>.

12 Warren (n 9).

13 Mercer (n 3).

14 Warren, 'Renewable Energy's Achilles Heel: Why Cybersecurity is Critical for Australia's Green Grid', Sustainable Future Australia (Web Page, 3 April 2025). <https://biomassproducer.com.au/infrastructure-and-grid-integration/renewable-energys-achilles-heel-why-cybersecurity-is-critical-for-australias-green-grid/>.

15 Mercer (n 3)

16 Warren (n 14).

17 Mercer (n 3).

18 Mercer (n 3).

19 Warren (n 14).

20 Richard Bergman, Tony Martin and Emma Hawthorne, 'How cyber security can keep pace with the energy transition', EY (Web Page, 9 October 2023). <https://www.ey.com/en_au/insights/cybersecurity/how-cyber-security-can-keep-pace-with-the-energy-transition>.

21 The Transformation Group, Safeguarding the grid: Cyber Threats in Energy Infrastructure (Report) 2 <chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/https://tranzformd.com.au/documents/16/Safeguarding_the_Grid__Six_Key_Themes_-_TTG_Updated.pdf>.

22 'Securing Renewable Data: Green Energy Sector Cybersecurity Challenges' Beetroot (Web Page, 3 May 2025) < https://beetroot.co/business/securing-renewable-data-green-energy-sector-cybersecurity-challenges/#:~:text=Renewable%20energy%20systems%2C%20from%20wind,millions%20of%20customer%20data%20records.>.

23 'Cybersecurity Challenges in the Renewable Energy Sector', EC-Council University (Web Page, 10 February 2025) <https://www.eccu.edu/blog/cybersecurity-challenges-in-the-renewable-energy-sector/>.

24 See ibid.

25 Twoday (n 10).

26 Falah Alanazi, Jinsub Kim and Eduardo Cotilla-Sanchez, 'Load Oscillating Attacks of Smart Grids: Vulnerability Analysis' (2023) 11 IEEE Access 36538, 36538-36539.

27 CrowdStrike, 2025 Global Threat Report (Report) 2-3 <chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/https://go.crowdstrike.com/rs/281-OBQ-266/images/CrowdStrikeGlobalThreatReport2025.pdf?version=0>.

28 Tom Kline, Unlocking Australia's Green Future: The Critical Rols of New Grid Technology', Climate Tech Partners (Web Page, 28 October 2025) <https://climatetech.partners/unlocking-australias-green-future-the-critical-role-of-new-grid-technology/>.

Securing the smart grid: Cybersecurity challenges in Australia's distributed energy future

Part 2: Cyber resilience and regulation



Current regulatory landscape

Regulatory frameworks and gaps

Australia's current protections for DER are delivered through a combination of the below key sector-led guidance and legislative frameworks.

Two new legal frameworks were recently passed that focus specifically on CERs. Whilst CERs form a substantial component of DERs, the two are not identical, with DERs being broader in scope. Not all measures and protections that apply to CERs will extend to DERs more generally.

1. **Cyber Security Act 2024 (Cth) (Cyber Act):**[29]

   Enacted on 29 Nov ember 2024, the Cyber Act strengthens CER protections by requiring smart energy devices, including inverters and battery systems, to meet minimum cybersecurity standards. It also mandates reporting ransom or extortion incidents within 72 hours and establishes a Cyber Incident Review Board to assess major incidents and issue sector-wide recommendations. These reforms directly target vulnerabilities at the device level and are expected to influence the broader DER ecosystem as smart devices proliferate.

2. **Cyber Security (Security Standards for Smart Devices) Rules 2025 (Cyber Rules):**[30]

   Effective 4 March 2026, the Cyber Rules set a mandatory baseline for consumer-grade internet-connected devices, including CER. Requirements include unique passwords, security contact points, and defined update periods. By addressing common these common vulnerabilities like default passwords and inconsistent updates, the Cyber Rules enhance CER security, privacy, and reliability while indirectly strengthening protections for the wider energy network into which DERs integrate.

The above CER-specific frameworks sit alongside the following broader DER-relevant mechanisms:

1. **Updates to the National Electricity Rules (NER)**

   In December 2024, the Australian Energy Market Commission introduced a rule clarifying the Australian Energy market Operator's (AEMO) cybersecurity role, formalising four functions: coordinating incidents, supporting preparedness via AESCSF and exercises, advising government and industry on risks, and sharing critical cybersecurity information with market participants.[31]

2. **Australian Energy Sector Cyber Security Framework (AESCSF)**

   The AESCSF is a cyber security framework developed and tailored to the Australian energy sector, enabling market and non-market participants (including DER participants), to assess, evaluate, prioritise, and improve their cyber security capability and maturity.[32]

   The AESCSF Lite Framework provides a customised approach for smaller, emerging, or resource-constrained organisations, including those operating within the DER ecosystem.[33] These organisations play a vital role in the broader energy landscape and are increasingly interconnected with critical energy systems. The framework is deliberately designed to be agnostic to organisational size, scale, or maturity, making it more suited for DER participants that may lack dedicated cybersecurity teams or fully developed security programmes.[34]

3. **Security of Critical Infrastructure Act 2018 (SOCI Act)**

   The amended SOCI Act broadened its scope to include the energy sector, introducing stringent cybersecurity standards and incident reporting obligations for energy providers. Under the SOCI Act, owners and operators of 'critical infrastructure' face fines and penalties if they fail to meet prescribed security requirements.[35]

However, despite these frameworks, DER presents unique vulnerabilities. Except for the Cyber Act and Cyber Rules (which are more relevant for CERs), most of the above frameworks[36] largely focus on aggregated or centrally registered assets, leaving gaps for behind-the-meter DER. Key observations made by industry stakeholders include:

1. The SOCI Act excludes generators with a capacity under 30 MW and lacks a clear classification for DER aggregators (which may control capacities above this threshold), creating uncertainty about which obligations apply to original equipment manufacturers (**OEMs**).[37]
2. Some distribution network service providers (**DNSPs**) have introduced their own guidelines for how SOCI Act requirements apply to DER and OEMs, but SMA and the Smart Energy Council note this can lead to inconsistencies and potential misunderstandings across jurisdictions.[38]
3. The AESCSF does not cover device-level standards for products such as inverters, and the new NER, which formalised AEMO's cybersecurity role, does not give AEMO authority to mandate participation, leaving OEMs guided by generators' requirements, which may include SOCI Act obligations.[39]

Although cyber regulation and policies exist, it can be difficult for consumers to find out how these requirements are enforced and reported.[40] Stakeholders have called for a national, DER cybersecurity strategy, clearer guidance from market bodies and governments on DER security, and the introduction of mandatory standards for DER systems.[41] Whilst stakeholders have welcomed the emerging CER-specific protections, it is noted that these measures are still in early stages[42] and further clarity is needed from market bodies and governments on the practical application of these requirements.[43]

Current technology and gaps

Australia's DER systems employ multiple layers of cybersecurity to protect renewable energy assets.[44]

At a high level, operators use encrypted communications, multi-factor authentication, network segmentation, automated threat detection, and AI driven anomaly monitoring, often supported by 24/7 Security Operations Centres. Frameworks such as the AESCSF help DER providers conduct risk checks, vet vendors, and plan incident responses.[45] Device-level systems, such as microgrid controllers and inverters, use layered security including firewalls, encryption, and intrusion detection.[46] Initiatives like South Australia's Virtual Power Plant security framework provide real-time monitoring and active protection across DER networks.[47]

Despite these measures, DER systems remain vulnerable to attack. Internet-connected inverters, batteries, and other DER devices are still exposed to data attacks, operational disruption, or grid instability,[48] increasing the volume of sensitive data at risk.[49] Diverse technologies, multiple stakeholders, and mixed old and new systems makes consistent protection challenging.[50] Stand-alone security solutions often fail to detect risks across interconnected DER assets, while operators and utilities may lack access to sufficient operational data to respond quickly, leaving gaps similar to those seen in consumer-grade smart devices.

Future directions for DER cybersecurity

Preventing attacks is not the responsibility of a single group. Close cooperation between all industry players is essential to building a robust defence,[51] ensuring the responsibility for protection does not fall entirely on households and small businesses. For owners of DER, practical steps such as maintaining a secure home Wi-Fi network and using strong, unique passwords can provide an added layer of protection.[52]

The industry should consider the following initiatives to strengthen DER cybersecurity:

1. **Close regulatory gaps and harmonise frameworks:** Address the SOCI Act's 30 MW threshold and implement a national strategy to align requirements across jurisdictions and DNSPs.[53]
2. **Introduce mandatory device-level standards across all DERs:** Require mandatory security standards across all DERs (rather than only focusing on regulation at the CER level and relying on voluntary frameworks for broader DERs) for inverters, smart meters, and communications gateways, including proactive safeguards, vulnerability testing,[54] secure procurement, multi-factor authentication, network segmentation, and timely intelligence sharing with AEMO and regulators.[55]
3. **Ensure supply chain accountability:** Provide clear guidance on how cybersecurity obligations flow through the DER supply chain, from OEMs to service providers to end users, recognising that overall security is only as strong as the weakest link, with IoT and AI creating additional risks.[56]
4. **Enhance AEMO resourcing and preparedness:** Expand AEMO's role in risk assessment, threat intelligence dissemination, and proactive guidance to improve DER resilience.[57]
5. **Adopt a prescriptive regulatory approach:** Stronger and more integrated regulatory measures are needed to address the current fragmented framework and better safeguard Australia's evolving energy ecosystem.[58]

Conclusion

Australia's shift to a decentralised, digitally connected energy grid has made it a global leader in DER, delivering sustainability, efficiency, and energy independence. However, increased IT/OT integration has expanded the cyberattack surface, where vulnerabilities in one area can have widespread effects.

Mitigating these risks requires a coordinated approach: strengthening IT and OT protections, maintaining visibility and control over infrastructure, and regularly testing and updating cybersecurity measures. Collaboration between government, industry, specialists, and consumers ensures shared responsibility. By combining technological safeguards with coordinated policy and active risk management, Australia can grow its clean energy capabilities while protecting critical infrastructure from emerging cyber threats.

The Hamilton Locke team advises across the energy project life cycle – from project development, grid connection, financing, and construction, including the buying and selling of development and operating projects. For more information, please contact Matt Baumgurtel.



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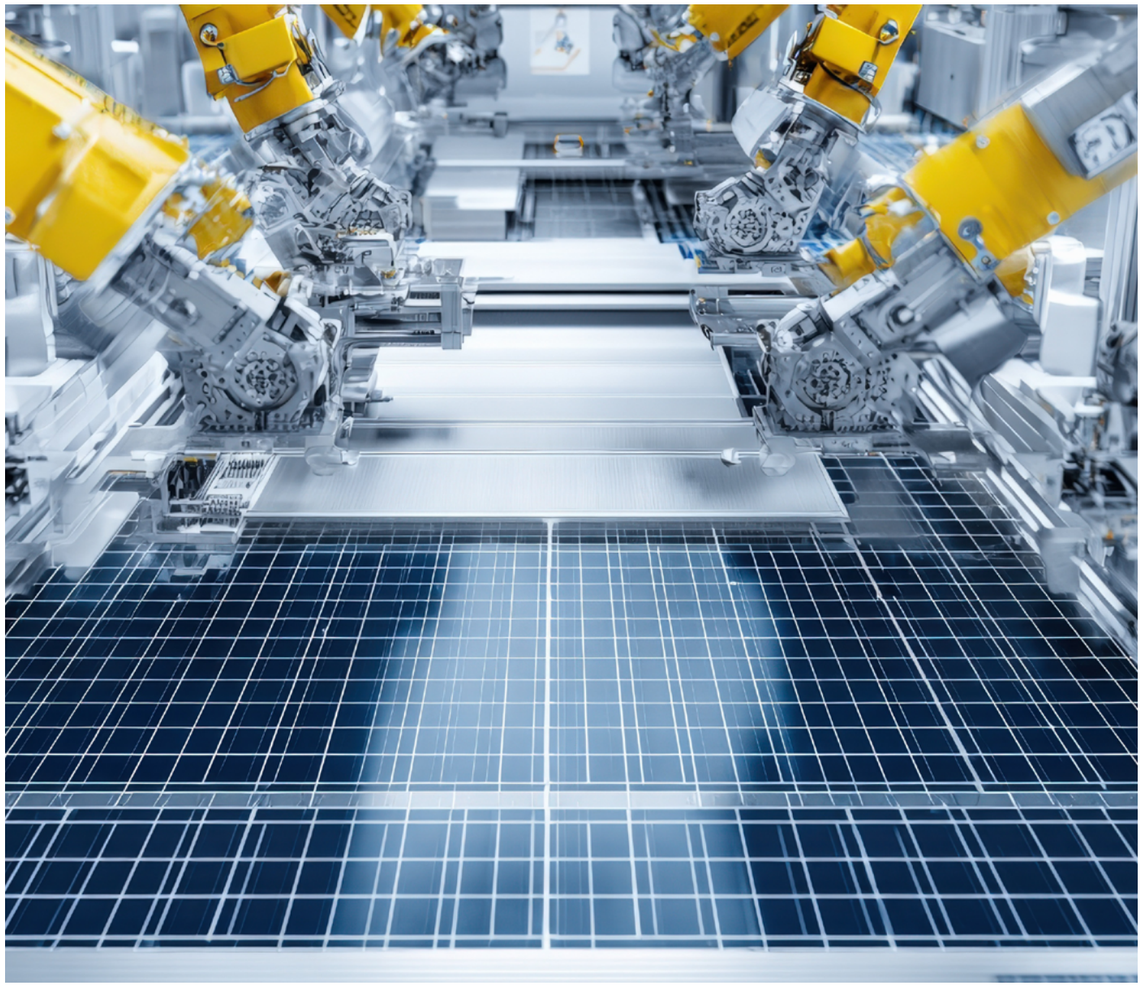
29 Department of Home Affairs, 'Cyber Security (Security Standards for Smart Devices) Explanatory Document' (Explanatory Document, 2024) <chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/https://www.cisc.gov.au/resources-subsite/Documents/cyber-security-security-standards-for-smart-devices-explanatory-document.pdf>.
30 See Ibid.
31 Australian Energy Market Commission, 'National Electricity Amendment (Cyber security roles and responsibilities) Rule 2024 (Final Determination, December 2024) 32 <https://www.aemc.gov.au/sites/default/files/2024-12/ERC0388%20Cyber%20Security%20roles%20and%20responsibilities%20Final%20Determination%20%281%29.pdf>.
32 Australian Energy Market Operator, 'AESCSF 2025 Distributed & Consumer Energy Resources Guidance' (Guidance Material, 2025) 4 <https://www.aemo.com.au/-/media/files/initiatives/cyber-security/aescsf/guidance-materials/aescsf-2025-distributed--consumer-energy-resources-guidance.pdf?rev=402bfdcf-8fb2-4ed3-998a-9a3a6c247128&sc_lang=en>.
33 See Ibid 5-7.
34 Australian Energy Market Operator (n 32) 7.
35 Australian Energy Market Commission (n 31).
36 Department of Climate Change, Energy, the Environment and Water, 'National Consumer Energy Resources Roadmap' (Report, July 2024) <https://www.energy.gov.au/sites/default/files/2024-07/national-consumer-energy-resources-roadmap.pdf>.
37 Australian Energy Market Operator (n 32).
38 Australian Energy Market Operator (n 32).
39 Australian Energy Market Operator (n 32).
40 SolarEdge, 'Submission to the 2023-2030 Australian Cyber Security Strategy' (Submission, 29 August 2025) 2 <https://www.homeaffairs.gov.au/how-to-engage-us-subsite/files/2023-2030-australian-cyber-security-strategy/SolarEdge-Submission.pdf>.
41 Department of Climate Change, Energy, the Environment and Water (n 36).
42 SolarEdge (n 40).
43 Department of Climate Change, Energy, the Environment and Water, 'National Consumer Energy Resources (CER) Roadmap Implementation Plan Update' (Report, August 2025) 20 <https://www.energy.gov.au/sites/default/files/2025-08/National%20Consumer%20Energy%20Resources%20%28CER%29%20Roadmap%20Implementation%20Plan%20Update%20August%202025.pdf>.
44 Warren (n 14).
45 Warren (n 14).
46 Juanwei Chen et al,' Cybersecurity of distributed energy resource systems in the smart grid: A survey' (2025) 383 Applied Energy.
47 Warren (n 14).
48 Juanwei Chen et al (n 46).
49 Juanwei Chen et al (n 46).
50 Juanwei Chen et al (n 46).
51 'OT Security: Recent Attacks Expose Risks for Australia's Critical Infrastructure' KineticIt, (Web Page, 15 October 2024) <https://kineticit.com.au/article/ot-security-recent-attacks-expose-risks-for-australias-infrastructure/>.
52 Dor Son Tan, 'Energy System Cybersecurity for an Uncertain World', Energy Networks Australia (Web Page, 20 April 2023) <https://www.energynetworks.com.au/news/energy-insider/2023-energy-insider/energy-system-cybersecurity-for-an-uncertain-world/>.
53 Australian Energy Market Commission (n 31).
54 Bella Peacock, ''Really Serious' Problems Cybersecurity Breaches Pose in Australia's DER Future', PV Magazine Australia (Webpage, 27 June 2023) <https://www.pv-magazine-australia.com/2023/06/27/really-serious-problems-cybersecurity-breaches-pose-in-australias-der-future/>.
55 Australian Energy Market Commission (n 31).
56 Australian Energy Market Commission (n 31).
57 Australian Energy Market Commission (n 31).
58 Australian Energy Market Commission (n 31).

Reducing risk, boosting scale: The role of robotics in renewable energy projects

The increasing use of robotics in renewable energy construction and infrastructure reflects a broader global trend that is driven by rapid advancements in artificial intelligence (AI), robotics and automation.[1] As AI continues to evolve, the use of robotics and maximising automation has shifted from a productivity-enhancing convenience to a strategic necessity in Australia's clean energy transition.[2]

Using robotics to meet net-zero targets

Achieving net zero by 2050 requires over 800 GW of solar to be installed annually by the early 2030s. Human labour alone cannot deliver at this pace, with inefficiencies, fatigue and weather risks creating costly delays. Robotic manufacturers and installers offer scalable solutions that reduce reliance on large workforces and provide predictable scheduling. Shanghai's Leapting Technology has demonstrated this potential, with its robot installing 480 panels per day; three to five times faster than a human crew.[3] The adoption of a robotic workforce for such installation-based tasks has multiple benefits.



1. Overcoming human risks and limitations

Construction remains one of the most hazardous industries in Australia, with large-scale solar projects posing WHS risks such as strain injuries, falls, heat stress, and weather exposure.[4] Further, traditional safety controls have limits, creating a need for new solutions.

Robotics provide a safer alternative by handling heavy, repetitive and high-risk tasks without fatigue, while workers transition to lower-risk supervisory or technical roles. This improves safety outcomes, supports WHS compliance, reduces insurance costs and enhances project delivery, particularly in large-scale developments.[5]

2. Improving project cost efficiency

Utility-scale solar projects are often built in remote regions, where transporting and housing workers and providing basic amenities adds major logistical and cost pressures. Hidden labour costs such as compensation claims, higher insurance premiums and downtime from injuries, or staff relocation costs create additional financial burdens for project proponents.

Robotics reduce these burdens by limiting workforce requirements, cutting reliance on temporary infrastructure, and enabling smaller support crews.[6] This leaner approach lowers transport, accommodation and support costs, with ARENA projecting that automation could help drive large-scale solar costs down to $20/MWh.[7]

3. Offsetting labour and skill shortages

The energy transition will require up to 17,400 additional critical energy workers by 2030 and 37,600 by 2050.[8] However, Australia faces acute labour shortages in trades and construction, particularly in regional areas. This threatens project viability and the safety and quality of installations.

Robotics offer a practical solution. Systems like Leapting's robot can perform the work of four human installers in a fraction of the time, reducing reliance on large on-site workforces and accelerating installation timelines.[9] By bridging labour gaps, robotics can provide the manufacturing and installation capacity required for net-zero by 2050.

4. Curbing project delays and cost overruns[10]

Delays and cost overruns in large-scale renewables undermine timely project delivery. New solar farms may face up to one-third curtailment by 2027, while AEMO has confirmed a two-year delay to the VNI West interconnector. If you would like to read more about the risks of energy curtailment, see our article on the subject here.

By reducing delays and budget blowouts, robotics lower project risk, strengthen investor confidence and support critical grid and funding milestones.

Examples in practice

ARENA is funding robotic deployment through initiatives such as the $2.66m Australian Robotic Piling Deployment for Large Scale Solar program[11] and the Solar ScaleUp Challenge,[12] aimed at commercialising technologies that reduce labour reliance, improve safety and accelerate installation.

1. Leapting Technology and Culcairn Solar Farm (NSW)[13]

At the Culcairn Solar Farm, Leapting's autonomous robot installed nearly 10,000 panels in ten weeks,[14] 25% faster and 30% cheaper than manual crews while removing workers from high-risk tasks.[15] Leapting plans to scale this work by installing up to 500,000 panels, as of May 2025 -signalling that robotic installation could soon become standard practice in Australia.[16]

2. LUMI robot[17]

ARENA recently contributed funding of $4.9 million to deploy Luminous Robotics' 'LUMI'; an AI-powered autonomous, tracked robotic system at two major utility-scale sites in NSW and Victoria. Luminous Robotics aims to operate at twice the speed of conventional crews, install approximately 3.5 MW per week with minimal oversight, and lower project costs by up to 6.2%.

Looking ahead: challenges and opportunities

Robotics is not yet a standalone solution. They perform best on level, open sites and cannot handle tasks like wiring or troubleshooting, meaning rooftop and complex projects still depend on human labour.[18] Robotic installation is also largely governed by existing legal and regulatory frameworks. However, there are certain gaps that raise significant issues, especially as robotic systems become more autonomous and widely used:

1. WHS compliance

Existing WHS laws have been designed for human workers. It is unclear how risk assessments, incident reporting, and duty of care obligations will apply when robots enter the site, especially if the robot malfunctions or causes injury.[19]

2. Product liability and duty of care

In cases of product defects, malfunction, or human oversight, it is unclear whether the developer, robotics manufacturer or contractor should bear responsibility for product liability and tort-based negligence, particularly because automated machines act independently.[20] Proponents may consider this risk in negotiating their development agreements.

3. Industrial relations and workforce displacement

Currently, there is no legislation that governs workforce rights in relation to robotics. This may cause uncertainties around workforce displacement, enterprise bargaining agreements, and upskilling obligations.[21] Further, the social licensing cost of displacing entire workforces will be a critical juncture to be overcome in the wider scale adoption of robotics.

4. Data privacy and cybersecurity

Advanced robotics systems often collect and transmit large volumes of operational data. Where these systems are remotely monitored or cloud-integrated, there may be exposure to cybersecurity risks, confidentiality and other breaches under the Privacy Act 1988 (Cth).

While robotics are not a perfect solution, they have demonstrated capability to enhance efficiency, reduce WHS risk and accelerate project development and delivery, positioning them as a key enabler in Australia's pursuit of achieving net-zero emissions.

The Hamilton Locke team will interview Alan Fenelon from Solar Energy Robotics, one of two solar automation companies in Australia. Please see our Expert Insights section for the upcoming publication.

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1 Michael Bernard, 'Meet the Robot Replacing Four Workers at a Time on Solar Projects', CleanTechnica (Online Article, 25 April 2025) <https://cleantechnica.com/2025/04/25/meet-the-robot-replacing-four-workers-at-a-time-on-solar-projects/>.

2 Ibid.

3 Ibid.

4 Frank Oudheusden and Chris Needham, 'How Robotics is Reshaping Solar Module Installation', PV Magazine, (Online Article, 29 April 2025) <https://www.pv-magazine-australia.com/2025/04/29/how-robotics-is-reshaping-solar-module-installation/>.

5 Bernard (n 1).

6 Oudheusden and Needham (n 4).

7 Giles Parkinson, 'More Confident Than Ever: Australia Set for Stunning Low Price for Solar, with Help of Robots and AI', Renew Economy (Online Article, 23 May 2025) <https://reneweconomy.com.au/more-confident-than-ever-australia-set-for-stunning-low-cost-for-solar-with-help-of-robots-and-ai/>.

8 Tom Monaghan, 'Australia's Workforce Shortage: A Potential Obstacle on the Road to Net Zero', Australian Energy Council (Online Article, 25 July 2025) <https://www.energycouncil.com.au/analysis/australia-s-workforce-shortage-a-potential-obstacle-on-the-road-to-net-zero/>.

9 Bernard (n 1).

10 Ryan Cropp, 'Solar Farms Forced to 'Switch Off' Due to Energy Grid Logjam', Australian Financial Review (online, 11 July 2025) <https://www.afr.com/policy/energy-and-climate/solar-farms-forced-to-switch-off-due-to-energy-grid-logjam-20250710-p5mdw5>.

11 'Australian Robotic Piling Deployment for Large Scale Solar', Australian Renewable Energy Agency (Web Page) <https://arena.gov.au/projects/australian-robotic-piling-deployment-for-large-scale-solar/>.

12 'LUMI Robots ScaleUp Solar Deployment with Advanced Automation', Australian Renewable Energy Agency (Web Page, 2 July 2025) <https://arena.gov.au/news/lumi-robots-scaleup-solar-deployment-with-advanced-automation/>.

13 Bernard (n 1).

14 David Carroll, 'Leapting Robot Completes Install of 10,000 PV Modules', PV Magazine (Online Article, 23 April 2025) <https://www.pv-magazine-australia.com/2025/04/23/leapting-robot-completes-install-of-10000-pv-modules/>.

15 Bernard (n 1); 'Guide to managing the Risks of Rooftop Solar Installation Work', Safe Work Australia (Guidance Material, August 2024) <https://www.safeworkaustralia.gov.au/sites/default/files/2024-11/final_-_guide_to_managing_the_risks_of_rooftop_solar_installation_0_002.pdf>.

16 Carroll (n 14).

17 'LUMI Robots ScaleUp Solar Deployment with Advanced Automation' (n 17).

18 Blathnaid O'Dea, 'Labour Shortages and Safety Prompt Developer Interest in Robot Workers', PV Magazine (Online Article, 28 March 2025) <https://www.pv-magazine-australia.com/2025/03/28/labour-shortages-and-safety-prompt-developer-interest-in-robot-workers/>; Bernard (n 1).

19 Work Health and Safety Act 2011 (Cth).

20 Competition and Consumer Act 2010 (Cth) sch 2 ('Australian Consumer Law').

21 Fair Work Act 2009 (Cth).

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The Perovskite breakthrough: Unlocking high-efficiency solar panels



High-Efficiency Solar, Low-Efficiency System: Why Reform Must Precede Perovskites

Australia is a world leader in solar generation, with unmatched access to sunlight and a significant pipeline of renewable energy projects. But the pace of technological advancement is now outstripping the capacity of Australia's energy system to accommodate it. Curtailment is rising, transmission is delayed, and grid constraints are dampening the return on new investment. As new solar technologies like perovskites promise step-change efficiency gains, the risk is that Australia will not be ready to capture their value. The promise of next-generation solar depends on fixing the physical and commercial limits of the National Electricity Market (**NEM**) that governs how solar is used.

The curtailment problem

Curtailment occurs when network capacity is insufficient to transport electricity from generation sites to demand centres, particularly in areas not originally designed to host large-scale renewable projects. According to the Australian Energy Market Operator (**AEMO**), new solar farms in Victoria and South Australia could be forced to curtail up to 65 percent of their generation by 2027 due to delays in transmission infrastructure.[1] AEMO's forecasts apply to hypothetical 300 megawatt solar projects and reflect growing grid congestion across the NEM.

This mismatch between generation and transmission capacity arises from the way the NEM's transmission framework operates. Under the current open access regime, generators have the right to connect to the grid but no guaranteed right to export electricity. Transmission network service providers (**TNSPs**) are primarily obligated to invest to meet reliability standards for consumers and not to provide firm access for generators. As a result, the cost of expanding shared transmission infrastructure is recovered from consumers, and there is no commercial incentive for TNSPs to build capacity solely to accommodate additional generation. While generator-funded augmentations are permitted, they do not confer guaranteed access or dispatch rights, which limits their commercial appeal.

In practice, this means that generation is being added in locations with strong solar or wind resources, but the supporting transmission infrastructure often lags. Until transmission is built out and storage scaled, building more solar adds limited value if the grid cannot absorb the additional output. In many cases, additional generation will face the same bottlenecks, delivering diminishing returns and delaying the decarbonisation objectives these projects are intended to support.

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Why silicon dominated solar for decades

For over 40 years, silicon photovoltaic technology has been the backbone of global solar deployment. Silicon is abundant, stable, and benefits from decades of sustained investment in research, manufacturing, and supply chain development. It also aligns with the expectations of conservative project finance. Silicon panels are bankable and backed by long-term warranties.

Silicon performs well in high-irradiance conditions and maintains reasonable stability over 25 to 30 years.[2] It has benefited from scale as production volumes increased, costs dropped dramatically and making silicon panels more affordable than ever.

However, silicon has several limitations. Its theoretical efficiency limit is approximately 29%, and most commercial panels operate below 24%.[3] Improvements are becoming marginal and expensive. The panels are also rigid, heavy, and require high-temperature manufacturing, which contributes to higher embodied carbon. Silicon's dominance came from technical maturity and commercial certainty, but new technologies like perovskites may overcome these limits.

The promise of perovskite technology

Perovskites offer a fundamentally different pathway. Perovskites are a family of crystalline compounds. It can absorb light across a broader range of the solar spectrum than silicon. When paired with silicon in tandem cells, perovskites boost overall efficiency by capturing energy that would otherwise be lost.

Beyond efficiency, perovskite layers can be manufactured at low temperatures by using potentially cheaper, solution-based processes. Their lightweight and flexible nature opens new opportunities in niche situations such as on curved surfaces, floating solar, portable systems, and even integration with windows or building materials.

Pilot projects, like MicroQuanta's 8.6 MW perovskite PV farm in China, are demonstrating the commercial viability of the technology.[4] It features over 95,000 perovskite modules specifically designed for humid, low-light conditions. This demonstrates one of the key advantages of perovskite technology over traditional silicon, particularly in regions with less favourable sunlight. However, while perovskites are advancing rapidly, they still face major challenges that need to be addressed before they can be adopted at utility scale.

The hurdles of perovskite

Despite these developments, perovskites are not yet ready for widespread commercial use. The technology faces several key challenges:

a. **Durability**: A recent four-year outdoor study in Germany showed that perovskite cells experienced significant seasonal performance variation, with up to 30% efficiency loss in winter.[5] This raises concerns about how well the technology will perform over the 20 to 30-year lifespan typically expected of utility-scale solar assets.

b. **Toxicity**: Most high-efficiency perovskites contain lead, raising issues for recycling, regulatory approval, and ESG compliance.[6] While research into lead-free alternatives is ongoing, commercially viable substitutes have not yet matched the performance of lead-based cells.

c. **Scalability**: While several companies, particularly in China are beginning to scale up perovskite production, no manufacturer has yet achieved the multi gigawatt-scale output seen with silicon.[7] Transitioning from pilot lines to reliable, high-volume manufacturing still faces challenges in cost, yield, and long-term performance.

d. **Bankability**: Project financiers and insurers require performance guarantees, robust warranties, and a clear supply chain. All these factors are missing from perovskite currently. Until these elements are in place, the technology will struggle to compete with mature and de-risked crystalline silicon.

Solar efficiency vs Australia's grid bottleneck

Even if durability, scalability and bankability hurdles are resolved, perovskite technology won't solve the structural limitations facing solar deployment in Australia. Higher-efficiency panels may generate more electricity from the same land area, but they do not address the core issue, in that much of this additional energy still cannot be exported to the grid.

Until transmission is delivered, storage is better integrated, and curtailment risks are priced or mitigated, the benefits of deploying perovskites at scale may be muted. Simply put, adding more efficient panels won't add value if the energy still has nowhere to go. Until then, Australia's solar ceiling will be defined by policy and infrastructure reform rather than the science.

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The path forward: reform first and technology second

Perovskite solar cells represent a major advance in photovoltaic science. With further development, they could significantly improve Australia's solar output per hectare, per dollar, and per tonne of embedded carbon. Realising that potential will depend on the policy and infrastructure decisions made today.

Unlocking their potential will require:

a. Faster delivery of delayed transmission projects. Unlocking high-efficiency solar technologies depends on resolving the infrastructure bottlenecks that are currently limiting output from existing projects. Without transmission, new generation adds to congestion.

b. Scaling of storage, including behind-the-meter and utility-scale batteries. Storage can absorb excess solar output during peak generation and release it when demand or transmission capacity allows, reducing curtailment and increasing the system value of every megawatt generated.

c. Clear end-of-life and product stewardship pathways, particularly for lead-based modules. Regulatory certainty around recycling and disposal is essential to ensure ESG compliance and to support widespread adoption, especially where toxic materials are involved.

d. Emerging technologies like perovskites often require initial backing, whether through government procurement, underwriting schemes or demonstration grants to overcome early-stage risk and build the track record needed to attract broader market adoption.

The market is not yet large enough to support full commercial rollout, but they offer a proving ground for the technology while system-wide constraints are addressed. Meanwhile, domestic R&D efforts are helping to lay the groundwork for future adoption. A $10.7 million ARENA-backed program led by the University of Sydney and SunDrive is focused on developing high-efficiency tandem perovskite-silicon cells using scalable, low-temperature manufacturing.[8]

Conclusion

Perovskites represent one of the most exciting frontiers in solar innovation. It has the potential to boost energy yield, reduce manufacturing emissions, and unlock new applications. But their success in Australia will hinge on factors beyond material science. Without the grid capacity, market design, and investment frameworks to support their deployment, higher-efficiency panels may simply face the same roadblocks as existing technologies. If we build a system that can absorb the energy we generate, perovskites and other clean tech innovations will have a clearer path to support the energy transition.



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1 Australian Energy Market Operator, 2025 Enhanced Locational Information (ELI) Report (Report, July 2025).
2 Advancements in photovoltaic technology: A comprehensive review of recent advances and future prospects, (Web Page, 2025) https://www.sciencedirect.com/science/article/pii/S2590174525000844
3 Solar Calculator, 'Solar panel efficiency' (Web Page, 2025) <https://solarcalculator.com.au/solar-panel-efficiency/>.
4 Vincent Shaw, 'Chinese developer switches on world's largest perovskite-based PV plant' (Web Page, 9 December 2024) https://www.pv-magazine.com/2024/12/09/chinese-developer-switches-on-worlds-largest-perovskite-based-pv-plant/.
5 Emiliano Bellini, 'Four-year outdoor testing shows perovskite cells suffer from high seasonality' (Web Page, 11 July 2025) https://www.pv-magazine-australia.com/2025/07/11/four-year-outdoor-testing-shows-perovskite-cells-suffer-from-high-seasonality/.
6 Christa E. Torrence et al., Environmental and health risks of perovskite solar modules: Case for better test standards and risk mitigation solutions (Report, 20 January 2023).
7 Vincent Shaw, 'Chinese PV Industry Brief: UtmoLight starts perovskite module production' (Web Page, 7 February 2025) https://www.pv-magazine.com/2025/02/07/chinese-pv-industry-brief-utmolight-begins-perosvkite-solar-module-production-at-gw-scale-facility/.
8 Australian Renewable Energy Agency, 'Commercialising Si Perovskite Tandem in Australia' (Web Page, 16 March 2023) https://arena.gov.au/projects/commercialising-si-perovskite-tandem-in-australia/.

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Expert insights

Automation of solar installation and maintenance with Alan Fenelon, Chief Executive Officer of Solar Energy Robotics

In this edition of New Energy Expert Insights, we sat down with Alan Fenelon, Chief Executive Officer of Solar Energy Robotics, to discuss the automation of solar installation and maintenance.

Solar Energy Robotics

Solar Energy Robotics (SER) is an Australian company delivering advanced robotic solutions for the solar energy sector. SER designs and manufactures specialist robotic systems in-house where unique local needs demand innovation. SER is also the Australian partner for Sunpure Technology, a partnership focused on introducing and supporting utility-scale install and cleaning solutions to Australia.

This dual capability makes SER unique in Australia – able to innovate locally, leverage global best-in-class systems, and deliver end-to-end robotic solutions that give utility-scale solar projects a decisive competitive edge.

Alan Fenelon is the Chief Executive Officer at SER. He brings more than twenty-five years of experience in mining technology and renewable energy.

What Are You Seeing in the Australian Solar Robotic Market?

Australia's solar robotic market is nascent. There are no existing solar farms in Australia that currently use robotic cleaning. In part, this is due to an underappreciation of the impact of soiling on projects. Unlike their international counterparts, most Australian developers do not collect data on soiling. As a result, Australian developers do not fully understand the impact of soiling on operational efficiency and so do not consider incorporating robotic technology into the project during the planning phase. More simply put, nobody requests autonomous cleaners to be 'designed in', therefore they never are. And a retrofit is always a compromise.

"I think the big variable in there is that no one is really looking at soiling data"

SER endeavours to target this persistent gap in Australia's market by introducing a localised and fit for purpose robotic solution. The technology itself is highly mature and reliable, and robotic solar cleaning solutions have been available globally for nearly a decade. From a hardware and software standpoint, these systems are scalable, cost effective and field proven. The real issue with maturity lies within the Australian market. The barrier isn't technological; the barrier lies in the lack of consideration given to integrating automation during the design and development phases of solar projects.

SER is actively working to shift this mindset, advocating for cleaning systems to be considered in the project planning phase.

What Role do you see Solar Energy Robotics playing in shaping Australia's Solar Robotic Market?

SER has two strands of business. On the one hand it develops and manufactures solutions end-to-end that target specific operational gaps in the local market where competition is scarce. On the other hand, SER partners with market leaders Sunpure Technology for the volume-based utility scale solar energy market.

All SER's range of autonomous cleaners offered are waterless and self-sufficient. They are designed to be permanently installed on site in most cases. In its own product suite, SER adopts the concept of a literal and metaphorical 'chassis', one that is configured to various use cases without having to redesign anything from scratch. It makes for more effective client support too.

Due to its relationship with Sunpure Technology, SER is now placed to also offer module installation robots as a wet rental and or outright purchase. Automation of this task has the ability to reduce over half of the investment and duration associated with module installs. It's also more accurate and much safer because there is almost zero manual handling.



Why would a developer use a robot over a human?

Robots provide logistical and financial benefits to developers.

From an operations and maintenance (O&M) and Life of Farm perspective, robotic cleaners boost performance and daily yield by ensuring soiling does not occur on solar panels. Soiling is the accumulation of particles and debris on the surface of solar panels, which reduces the energy production of the panels. By installing robotics into a project (a one-off installation), the developer avoids the ongoing complexities of traditional labour (for example, workplace health and safety risks and training requirements). Further, as robotics technology can be designed into a project during the planning phase, developers have a unique opportunity to better design solar farms to maximise operational efficiency in ways not possible with human labour forces.

Financially, robotic cleaning significantly reduces labour dependency and capital costs, providing developers with an accurate, upfront investment that leads to long-term savings across the entire operation and maintenance of a project. For example, individual robots can clean semi uninterrupted solar rows up to 2 kilometres, offering a level of efficiency unmatched by traditional labour.

How do you anticipate the role of human workers changing as automation becomes more prevalent in the solar industry?

Although automation will impact certain workforces, it will also encourage skills to be reallocated across the new energy industry. In the specific case of solar cleaning and installation, there is already a shortage of labour, and so the impact is fairly localised. However, when automation moves beyond solar cleaning into broader operations and maintenance activities (where there is a larger workforce), the impact will be more noticeable. The answer may be to transition that workforce into new roles focused on managing, maintaining, and optimising robotic systems.

Are there any technical limitations or challenges that automated systems face in solar maintenance, and how are these being addressed?

The biggest limitation for robotic cleaning solutions is deployment onto already designed and operating solar farms. Retrofitting automation into existing layouts, especially when those layouts have not been designed with robotics in mind, is technically nuanced, costly and compromise heavy.

In design stages, there are virtually no limitations on implementation. It simply requires intentional design choices to accommodate robotic technology. A sympathetic design sees longer, less interrupted arrays. Footprint permitting, it might be as simple as relocating inverters and some services to achieve this. When 'designed in' the cost tends to be less than 1% of the capital cost of the project overall. The client has a zero impact, technology solution for the least investment.

They achieve Every Panel Every Day (EPED) cleaning with zero associated effort and thus derisk the Life of Farm in soiling terms; achieving a highly predictable 0.5% soiling loss versus the anomalous and much higher losses when it's left to nature and some intermittent cleaning.

In reflecting the 0.5%, highly predictable and de-risked soiling losses, the even more obvious upside is that the optimised farm does not have to be as large. Think of the ~20% reduction of savings achieved if you could deliver the same, consistent energy from a smaller footprint. Less trackers, less panels, fewer inverters, shorter projects with fewer people and less real estate.

The Future

a) What are the most promising technological advancements in the automation of solar panel maintenance?

The most promising technological advancements are developing a robotic system that can, while carrying out cleaning, monitor the condition of the installed solar panels. There is a clear synergy in condition monitoring while solar panels are being cleaned and maintained. The next step in the industry is to combine the benefits of solar cleaning with continuous, ongoing solar monitoring.

b) What excites you most about the future of solar and automation?

The most exciting part about the future of solar and automation is the huge potential for innovation. The benefit of having no active installations in Australia is that every installation is a step into the future. The sheer number of potential installations leaves an enticing space for the deployment of new robotics technology.

Other than that, the future hopefully holds increased installations of solar robotic cleaners, which ultimately boosts Australia into a cleaner, more sustainable and more efficient future.



Expert insights

How project managers are powering Australia's renewable transition with William Ryan, Chief Executive Officer of Project Management Planet

In this edition of New Energy Expert Insights, we sat down with William Ryan, Chief Executive Officer of Project Management Planet, to discuss the state of renewable energy project management and training in Australia.

Project Management Planet is Australia and New Zealand's leading project management education and training provider. They provide project, programme and portfolio management training for professionals in the renewable, construction, IT, healthcare and professional services sectors. In addition to supporting experienced project managers to enhance their skills and achieve industry-recognised certification, Project Management Planet also provides training and placement pathways for those career-changing into project management.

William Ryan is the Chief Executive Officer at Project Management Planet. He brings experience from both government and private sector project teams across Australia's renewable energy, construction, and transport industries.



How does project management in the renewable energy sector differ from other sectors?

Project management in the renewable energy sector differs from other sectors in several key ways. Firstly, renewable energy projects often operate at the intersection of multiple disciplines – engineering, construction, environmental science, community engagement, and finance. This makes project management inherently more cross-functional than in other sectors. Project managers must coordinate diverse technical teams and manage interfaces between civil, electrical, environmental, and digital systems – all while ensuring compliance with stringent safety and regulatory standards.

Secondly, project managers in the renewable energy sector must navigate rapidly evolving technologies and policy frameworks. From grid-scale batteries and green hydrogen to offshore wind and transmission upgrades, project timelines must adapt to shifting government incentives, changing regulatory settings, and emerging sustainability requirements. This requires strong adaptive planning and agile management approaches, rather than rigid linear methodologies commonly used in construction and traditional energy projects.

Finally, the sector's urgency – driven by Australia's net-zero targets – means project managers are under pressure to deliver faster, at greater scale, and in new locations. This demands a future-focused skill set: digital literacy (for example, data-driven project control and understanding), sustainability reporting, and a deep understanding of environmental, social, and governance (ESG) principles.

How do project managers secure social licence for renewable energy projects?

The renewable energy sector has a unique stakeholder landscape. Unlike traditional infrastructure or construction projects, renewable energy developments are often situated in regional or rural communities and depend heavily on community support to proceed.

Project managers play a vital role in securing social licence for renewable energy projects by ensuring genuine, transparent, and long-term engagement with local communities. Successful project managers in this sector are not just delivery specialists – they are also negotiators, communicators, and trust-builders. This makes social licence management and transparent communication a central part of the project manager's role.

There is also a significant opportunity to share benefits through project management training. While renewable energy developers increasingly provide trade-based training to secure social license, this could be expanded to include upskilling community members in project management. These skills are transferable to other sectors, allowing locals to not only contribute to project delivery but also lead initiatives such as small businesses or social programs, long after the project is completed.

Is Australia ready — from a project management skills and training perspective — for the renewable energy revolution?

Project management training in Australia's renewable energy transition is emerging but underdeveloped. Key challenges include limited scale, slow rollout, regional access issues, and shortages of trainers and facilities.

Excluding rooftop solar, the renewable energy transition is largely happening in regional areas, but most training centres are located in major cities. We can't expect workers interested in retraining or upskilling as project managers to take time away from their work and families to travel to these training centres. To address this challenge, one of Project Management Planet's key offerings is online and self-paced professional certificates for mid-career professionals. Self-paced training can be undertaken remotely and so it addresses regional and trainer shortages while maintaining the same quality (and certification outcomes) as in-person programs.

Another challenge in Australia's renewable energy transition is that it relies heavily on workers moving from the construction and traditional energy sectors. However, these sectors are also facing a critical shortage of project managers. For example, since 2021, Jobs and Skills Australia has reported a severe shortage of construction project managers in every state and territory. It is difficult to encourage these professionals to upskill for renewable energy projects when attractive opportunities remain in their current sectors.

Of course, the project management skills shortage also reflects broader renewable energy skills shortages. In September this year, Powering Skills Organisation predicted a 42,000 shortfall of renewable energy trade workers by 2030, citing training bottlenecks and a 40% decline in training over the past decade. Without rapid expansion of training – particularly retraining – initiatives, workforce bottlenecks could slow renewable deployment and net-zero progress. This is a significant challenge for industry and government (and a great opportunity for certified professionals!).

Is the government doing enough to support retraining and upskilling of renewable energy project managers?

Australia's government has made meaningful progress in supporting renewable energy workforce development, but is not doing enough to address the specific retraining and upskilling needs of project managers.

Federal initiatives such as the $91 million 'Skilling the Clean Energy Workforce' program (2024-25 Budget) demonstrate recognition of the renewable energy transition's workforce demands. State programs, such as Victoria's Renewable Hydrogen Worker Training Centre and the Wind Worker Training Centre, will also play an important role in building the renewable energy workforce. However, funding and policy focus prioritises trades, apprenticeships, and technical roles – not project managers who are responsible for overall project delivery.

Government funding for project management is mostly limited to foundational level training (for example, financial support for diplomas and Cert IVs in project management). This training is suitable if you have just finished school, but is too basic for mid-career project professionals who will deliver large-scale wind, solar, and BESS projects. There's a real need for government support to incentivise mid-career project professionals to transition from construction and traditional energy into renewable energy. Government subsidisation of professional certificates (PRINCE2, Agile, Project Management Institute courses), which are more advanced and teach practical, day-to-day project management skills, is necessary for Australia to meet the 2030 and 2050 renewable energy targets.



What excites you about the future of renewable energy project management?

What excites me most is the pace of innovation and the opportunity for project managers to redefine how complex infrastructure is delivered. We're entering a period where digital transformation, sustainability, and community outcomes are no longer separate objectives – they're integrated into every phase of a project. Project managers are at the centre of this shift. We're seeing rapid adoption of digital project controls, the emergence of AI-driven scheduling, and real-time data analytics that can predict risks and optimise performance. These tools don't just make projects more efficient; they create transparency and accountability across stakeholders – from financiers to local communities.

I'm also inspired by the new generation of project professionals coming through. Many are purpose-driven and deeply motivated by climate impact. They're not just managing budgets and timelines; they're helping to build Australia's renewable energy future. At Project Management Planet, we're proud to help lower some of the barriers to entering the project management profession and to support this next generation as they lead the renewable energy revolution.

NEAN

New Energy Associates Network (NEAN): Fireside chat on the revenue landscape for battery energy storage systems with Marija Petkovic from Energy Synapse



NEAN is a network for New Energy Industry professionals from graduate to senior associate level, aimed at building connections and sharing industry knowledge among members. NEAN seeks to foster and grow relationships between industry stakeholders at the earlier stages of their careers.

On 22 October 2025, the New Energy Associates Network hosted its latest fireside chat at Hamilton Locke's office. The discussion centred on revenue optimisation strategies for energy storage projects, exploring how developers can maximise economic returns through revenue stacking whilst balancing the trade-offs between contracted certainty and merchant flexibility.

Marija Petkovic from Energy Synapse addressed the current market's aversion to technology risk, observing that whilst the race for dominant long-duration storage technology remains wide open, pumped hydro—despite being the most mature option—carries its own uncertainties as demonstrated by projects like Snowy 2.0. Discussion also covered government support mechanisms, with the view that schemes should be considered worst-case support rather than primary revenue drivers, and particular attention given to the Long-Term Energy Service Agreement (LTESA) framework which is encouraging eight-hour battery deployment in New South Wales.

The conversation highlighted the significant transition ahead for Australia's energy market, with substantial coal generation to exit the system alongside rapidly growing demand from AI, data centres and electric vehicles. A key focus was the critical decision between merchant and contracted revenue models, with participants noting that storage duration beyond four hours creates uncertainty around actual utilisation rates.

We were delighted to see so many professionals interested in the development of energy storage solutions and look forward to the next NEAN event!

Want to be added to the mailing list for the next NEAN event?

Please reach out to David O'Carroll.

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