

New Energy Quarterly

Circular Economy

April 2025





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Editorial

As the world continues its ambition towards net zero goals, circular economy principles and their integration across industries is becoming a mandatory priority with legislative backing. The concept of the circular economy emphasises the reduction of waste, the thoughtful, and continual use of resources, and the recycling and regeneration of systems. In a renewable energy context, this philosophy is not only about mitigating the environmental impact of energy production but also about improving the lifecycle management of renewable energy infrastructure. By focusing on optimizing the use of resources and minimizing waste, circular economy practices offer an opportunity to drive both environmental and economic value throughout the energy transition.

We are reaching a pivotal moment where numerous renewable energy projects will be approaching the end of their operational life, creating a formidable challenge that will only intensify in the near future. Businesses within the new energy sector must take responsibility for minimizing the impact of their operations on our environment and ensuring that the resources and methods used in generating sustainable energy are as renewable and sustainable as the energy produced. With a growing focus from investors and various stakeholders on long-term sustainability, appropriately addressing the end-of-life management of renewable energy infrastructure is now no longer optional, but imperative. Circular economy focused strategies offer an immediate, actionable way forward, and is a critical philosophy that businesses and organisations in all sectors should prioritise to achieve a truly sustainable, planet-positive future for the generations to come.

In this edition of New Energy Quarterly, we delve into the intersection of circular economy principles and new energy developments and projects. Together, our articles provide a comprehensive look at the critical role of the circular economy in driving sustainability within the energy sector. Shifting from a linear economy to a circular economy requires rethinking how we design, produce and repurpose materials with a holistic, end-to-end perspective, and the insights in this edition underscore the importance of innovation, collaboration, and a long-term vision for a cleaner, more resilient energy future.

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Watt’s Happened at Hamilton Locke



► **Australian Offshore Wind Conference**
Matt Baumgurtel and David Wan attended the Australian Offshore Wind Conference in Melbourne.

Matt Baumgurtel presented on the 5 key constraints facing Australia’s offshore wind industry supply chains.



► **Smart Energy Council drinks**
Marni Riley attended the Smart Energy Council drinks networking event in Brisbane.



► **NEAN Wildfire Energy 12 February 2025**
David O’Carroll hosted the New Energy Associates Network (NEAN) fireside chat with Greg Perkins and Jamie Roodenrys from Wildfire Energy.



► **First Nations & The Energy Transition Forum**
Matt Baumgurtel, Margot King, Ching Yee Tan, Janice Lau, and Ryan Atkinson attended the First Nations & Energy Transition Conference in Perth.

Matt and Margot presented on the topic ‘Navigating the legal landscape of renewable energy projects: implications for indigenous communities’.

Learn more about Matt and Margot’s presentation [here](#) and our key takeaways [here](#).



► **Australian Institute of Energy panel discussion**
The Hamilton Locke New Energy team hosted the Australian Institute of energy’s panel discussion on Affordability, flexibility or efficiency: are electricity tariffs delivering for consumers? (Challenges and responses for networks, retailers and consumers)



► **Hamilton Locke New Energy: Cheers to you!**
The Hamilton Locke New Energy Team hosted the Cheers to you event at Taylor’s Rooftop in Sydney. The event was attended by our teams in Sydney, Brisbane, and Perth, as well as over 70 clients and friends.



► **Energy Infrastructure & Community Engagement Conference**
Matt Baumgurtel, Michael Liu, Christine An, Lachlan Stagoll, and Lily Clements-Markham attended the Energy Infrastructure & Community Engagement Conference in Sydney. Matt presented on the legal aspects of community engagement as a part of renewable energy projects.

Learn more about Matt’s presentation [here](#) and key takeaways from other speakers [here](#).



► **All Energy Australia Conference**
Matt Baumgurtel, Jo Ruitenberg, Marni Riley, William Ryan, Ally Frizelle, and Lachlan Stagoll attended both days of the All Energy Australia Conference in Melbourne.

Matt Baumgurtel and Marni Riley presented on the role of hydrogen as a key component in Australia’s net zero emissions strategy.

Read our key takeaways from: [Day 1](#) and [Day 2](#)



► **Hamilton Locke & Energy Vault annual networking event**
Matt Baumgurtel, Tricia Moloney, Adriaan van der Merwe, David O’Carroll, William Ryan, Perri Robinson, and Chiara Ciulli attended the annual networking event co-hosted by Hamilton Locke and Energy Vault in Melbourne.



► **Asia Pacific Hydrogen Summit and Exhibition**
Marni Riley attended the Asia Pacific Hydrogen Summit and Exhibition in Brisbane.

Market Insights

► On 18 March 2025, the NSW Government introduced the Product Lifecycle Responsibility Bill 2025 to establish a product stewardship framework for brand owners of certain products.

The Bill is a nation leading reform which reflects NSW Government’s commitment to, and growing prioritisation of, the circular economy.

[Read more](#)

► On 15 November 2024, the *Constitution Amendment (SEC) Act 2024* (Vic) came into effect, enshrining the State Electricity Commission in Victoria’s constitution.

[Read more](#)

► On 26 February 2025, the Australian Renewable Energy Agency (ARENA) announced Round 2 of the community batteries program, allocating a further \$46.3 million towards community batteries. After a successful Round 1, which saw \$124.7 million in funding to deploy 318 batteries across all states and the Northern Territory. ARENA aims to fund a further 24 battery projects in this round, with the purpose of lowering energy bills, reducing emissions, and easing the pressure on the electricity grid.

[Read more](#)

► The Queensland Government has announced that from Monday, 3 February 2025, development applications for material change of use for wind farms in Queensland will be impact assessable. The change dramatically increases the risk profile of wind farm projects in Queensland.

[Read more](#)

► The Queensland Government has advised that from Monday, 3 February 2025, the Planning (Wind Farms) Amendment Regulation 2025 (Amendment Regulation) will take effect.

The Amendment Regulation follows the 16 January 2025 Ministerial direction under section 95 of the Planning Act, which instructed the chief executive administering the Act not to decide on three development applications for wind farms that were under assessment for a period of four months.

[Read more](#)

► The National Hydrogen Strategy 2024 (the Strategy), developed by the Federal Government, aims to position Australia as a global leader in hydrogen production and export. The Strategy supports Australia’s transition to net zero and seeks to capitalise on the significant economic opportunity renewable hydrogen presents globally. The road to net zero is challenging, but with strategic investments and innovative policies, Australia has the potential to lead the hydrogen revolution.

[Read more](#)

► On 5 February 2025, Revenue NSW released significantly updated guidance on the application of transfer duty to the grant of call options to purchase land, including: (1) characterising types of options; (2) payments considered to form part of option fees (and therefore dutiable); and (3) when Revenue NSW will consider the use of put and call options to fall within the anti-avoidance provisions.

[Read more](#)

► On the 28 November 2024, the Federal Government has **enacted** the *Future Made in Australia (Guarantee of Origin) Bill 2024 (GO Bill)* along with two supporting bills, in predominantly the same form as originally introduced into Parliament. The passing of the GO Bill marks a pivotal step in Australia’s journey toward a clean energy future. The legislation establishes the voluntary Guarantee of Origin (**GO**) Scheme, which will play a critical role in certifying low-emission products and renewable electricity.

[Read more](#)

► On 20 January 2025, the Albanese Labor Government announced an investment of \$2 billion in Australia’s aluminium industry. Australian aluminium smelters that transition to renewable electricity prior to 2036 may be eligible to receive support in the form of the new Green Aluminium Production Credit.

[Read more](#)

Market Recognition

 ► Hamilton Locke advises Australian Soil Management on its acquisition partnership with Climate Friendly. Read more	 ► Hamilton Locke tops WA Business News' 2024 Corporate Finance Survey. Read more
 ► Hamilton Locke has increased its ranking for Energy in Legal 500. Read more	 ► Hamilton Locke excels in national M&A and ECM rankings. Read more
 ► Hamilton Locke ranks in Chambers and Partners 2025 Asia-Pacific and FinTech Guides. Read more	 ► HPX Group recognised in AFR Fast 100 List for the second consecutive year. Read more
 ► William Ryan named finalists in the 2025 Lawyers Weekly 30 Under 30 Awards for the Projects, Energy and Resources category. Read more	 ► Matt Baumgurtel was recognised by Lexology as a legal influencer. Read more



Watt's Next?

Investing in Renewables

New Starters at Hamilton Locke

Partner James Patto James Nicholls Sophie Uhlhorn Andrea Kennedy Mark Payne Jamie Blair	Graduate Ariana Farahani	Vacation Clerk Tamara Molan Jacob Ferrell Claire Jiang Molly Smith Will Hart Fionn McCabe Jennifer Dabire
Senior Associate Eve Bramley Kylie Zih Yvette Zaayman Christina Hooper	Paralegal Asha Nayer Sophie Nankivell Cory Johnson Ellie Zervos Aarthi Parthiban Anne Pan Lachlan Murrell Lauren Brennan Aceda Rose Ed Ellis	
Lawyer Aleisha Andresen Tuivasa Caitlin Richards Natalie Gillies Danial Cornall Silvana Brcina	Consultant Louise Kelly	



Introducing Matterra

Matterra Consulting: An Overview

We are excited to introduce our new complementary allied business Matterra Consulting which is a specialist sustainability consulting business. Matterra Consulting supports organisations in all aspects of ESG strategy, performance, reporting and compliance whilst navigating the ever-changing regulatory landscape.

With extensive experience across all facets of environmental and social sustainability, Matterra provides support for sustainability compliance and voluntary performance including gap and readiness evaluation, ESG governance and risk management systems, highly skilled technical support for carbon accounting, climate risk assessments, modern slavery assessments and more. Matterra also facilitates investor relations and access to sustainable finance, helping companies meet local and international sustainable investor expectations. Through their services, Matterra helps organisations navigate the shifting sustainability landscape, no matter what stage they are at in their journey, helping both new businesses and established corporates.

Linda Romanovska



Linda Romanovska has joined HPX Group as a Partner heading up Matterra. Linda is a senior expert in ESG, with close to 20 years of experience delivering high-impact work on a wide range of sustainability topics through

policy-making, research and consulting for governments, the private sector and financial institutions. Linda is recognised for her ability to provide a “meet businesses where they are at” approach to a wide array of companies from global multinationals to local start-ups on their sustainability journeys.

Notably, Linda brings the highest level of expertise as a co-author of the key sustainable finance and corporate sustainability regulations and standards for Australia, the European Union, and internationally.

Simplifying ESG for businesses

Matterra understands sustainability can be complex and every aspect requires multiple disciplines and experts to truly stay compliant. Whether it's specialist legal advice ahead of a merger or acquisition, deep expertise on a specific sustainability matter, or assistance with day-to-day ESG workload, Matterra can assemble a tailored and integrated multidisciplinary team that truly understands each client's context, needs and goals.

Matterra ultimately aims to simplify ESG for businesses and set them up for success by being realistic and pragmatic about their sustainability goals and putting in place strategies that are the right fit, and helps discover a real opportunity for businesses to take a long-term view of their ESG commitments as essential to being both a financially healthy and environmentally responsible business.

Please reach out to us if you have any questions or would like to meet the Matterra team. You can also book an introductory call with Linda here: [30 min sustainability conversation with Linda, Matterra](#)

SPOTLIGHT

Kylie Zih



Kylie Zih

Senior Associate

kylie.zih@hamiltonlocke.com.au**What was your journey to becoming a lawyer?**

My parents both have an accounting background so I decided early on that I didn't want to go down that route (much to their disappointment). At school, I enjoyed subjects that involved reading, writing and problem solving so I decided to do a Law degree at UNSW (combined with Commerce).

While studying, I juggled various retail jobs which taught me valuable client management skills and I was fortunate enough to work as a paralegal at Mills Oakley in the Not for Profit / Charities team. That experience gave me my first taste of what it would be like to work at a commercial law firm. But it was during my clerkship and graduate program at Thomson Geer that I discovered my passion for corporate law. For me, I really enjoy getting to the heart of how businesses operate, understanding their commercial drivers and helping them drive their commercial vision to completion.

Tell us about your specialisation (include information on what excites you about current market developments)

I specialise in mergers and acquisitions, capital markets and corporate and commercial transactions. Throughout my career I've developed a broad commercial experience advising both private and listed companies

in Australian and cross-border transactions across the energy, resources, financial markets, technology, commodities and health industries. My expertise includes advising clients on compliance with the Corporations Act and the ASX Listing Rules, and corporate governance.

Now, you might be wondering – why renewables M&A? Good question, I've always had a keen interest in the energy transition and new technologies so when the opportunity came up to combine the two, it felt like a great fit. The renewables sector is growing at an incredible pace, and I'm excited to be working with companies that are shaping the future of energy in Australia.

What are your career highlights?

Apart from joining Hamilton Locke of course, I would say that one of my career highlights has been the work I did at my previous firm with Jet Zero, a leader in the sustainable aviation fuel (SAF) space in Australia. We assisted Jet Zero with its licence of the SAF technology from LanzaJet and a number of fundraisings, including a \$29 million placement to Qantas, Airbus and Idemitsu. I think what Jet Zero is doing in the SAF space is revolutionary and to have assisted their journey so far has been incredibly rewarding.

I've also had the privilege of helping a number of companies achieve an IPO and ASX Listing. Seeing founders and companies reach that milestone, after months or years of blood, sweat and tears, has been a rewarding experience throughout my career.

Why did you join Hamilton Locke?

I was attracted to the market leading New Energy practice at Hamilton Locke. I was excited by the opportunity to work with experts in the New Energy Space and on cutting edge deals that have never been done before. I think also what sets the New Energy team at Hamilton Locke apart is the deep, technical knowledge of the industry that shapes the advice that it provides to clients, alongside the legal expertise.

In terms of Hamilton Locke as a firm, I think what sets Hamilton Locke apart is the culture – the fact that collaboration and the people experience are front of mind in everything that the firm does.

RISING STAR

Lily Clements-Markham



Lily Clements-Markham

Graduate

lily.clementsmarkham@hamiltonlocke.com.au**What are you most proud of in your career to date?**

Transitioning into a graduate role in the New Energy team has been a proud milestone. Being part of a team driving the future of energy allows me to contribute to meaningful projects that align with my values. It is truly inspiring, and I am excited to continue learning and growing in this field.

What do you enjoy about working in the legal industry?

What I enjoy most about working in the legal industry is the constant learning and development. Every day presents new challenges, industries to understand, and evolving regulations to navigate. In the New Energy space, this is especially exciting—technology, policy and market dynamics are always shifting, which means there is always something new to explore.

What do you enjoy most about Hamilton Locke?

What I enjoy most about Hamilton Locke is the people. From day one, I've been surrounded by supportive colleagues who have not only taken a genuine interest in my development but have

also become great friends. The culture here is built on collaboration, mentorship, and a shared passion for the work we do, which makes coming to work every day both rewarding and enjoyable.

In your opinion, how does HPX Group empower communities?

HPX Group empowers communities by championing its people and fostering a culture of collaboration, innovation, and growth. The firm truly walks the walk with initiatives like the Da Vinci Program, which supports personal and professional development. I am excited to get involved and be part of a team that invests in its people, knowing that empowered individuals drive real impact for clients and communities.

Favourite movie and why?

It is tough to pick just one movie, but I am a big fan of true crime series. Mindhunter is probably my favourite — it offers such a fascinating look at the early days of criminal profiling at the FBI and how the term 'serial killer' came about. This has always been an interest of mine — so much so that I studied a dual degree in law and criminology.

Favourite music album

Folklore by Taylor Swift. I think August has been my top listened to song for the last three years. The storytelling, emotion and depth in this album make it one I always come back to, and I love how every listen feels like discovering something new.

What's a place in your hometown that you love visiting?

Being from Cairns in Far North Queensland, I would have to say the reef is my favourite place to visit. I grew up on the water, so nothing makes me happier than spending time out there, whether it is snorkelling, fishing or simply soaking in the sun. When I was home during the Christmas shutdown, I was out there nearly every day, making the most of the perfect conditions. It was absolute magic.

Watt is ARENA Funding?

Program	Summary	Funding available	Closing Date
Hydrogen Headstart Round 2	Hydrogen Headstart Round 2 was announced in the May 2024 Federal Budget. The Program will provide up to \$2 billion of revenue to support large-scale renewable hydrogen production projects. Further information on Hydrogen Headstart Round 2 will be made available in the second half of 2024.	AUD \$2 billion	In development. Applicants can register their interest to get updates on information about Hydrogen Headstart Round 2 when it becomes available.
Battery Breakthrough Initiative	The Battery Breakthrough Initiative was announced in the May 2024 Federal Budget. The program will provide \$523.2 million to promote the development of battery manufacturing capabilities in Australia.	AUD \$523.2 million	In development. Applicants can register their interest to get updates on information about Battery Breakthrough Initiative when it becomes available.
Solar Sunshot	The Solar Sunshot program will support Australia's photovoltaic (PV) manufacturing capabilities. The program 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 program 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. ¹	AUD \$1 billion	Ongoing. Round 1 funding launched in August 2024, with Round 1A Expression of Interest due on 10 December 2024 and Round 1A Full Applications due on 30 April 2025.
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 AUD \$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.	AUD \$400 million	Ongoing.

¹Australian Renewable Energy Agency, Solar Sunshot (Web Page) <<https://arena.gov.au/funding/solar-sunshot/>>.

Program	Summary	Funding available	Closing Date
National Industrial Transformation Program	A range of technology solutions targeting industrial emissions abatement may be supported, from electrification and energy efficiency to fuel switching and zero emissions vehicles. Enabling technologies such as energy storage, demand management and critical infrastructure supporting onsite decarbonisation will also be considered. Projects can range from studies to scale demonstration and deployment.	AUD \$40 million National Industrial Transformation Program	Ongoing.
Regional Microgrids Program (RMP)	The Regional Microgrids Program (RMP) aims to support the development and deployment of renewable energy microgrids across regional Australia that contribute to the Program Outcomes. Funding has been allocated across two Streams under the Program, each with its own Outcomes: 1. 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. 2. 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.	Total AUD \$125 million; - Stream A AUD \$50 million; and - Stream B AUD \$75 million	19 December 2025.
Driving the Nation Program	The Program is focused on accelerating the uptake of Zero Emission Vehicles (ZEVs). ZEVs include Battery Electric Vehicles, Hydrogen Fuel Cell Vehicles and biofuel vehicles. The Program has various focus areas that will be funded (Focus Areas). The current Focus Area for funding is projects which encourage uptake of battery electric vehicles by supporting innovation in the deployment and use of charging infrastructure that accelerates the adoption of managed charging.²	AUD \$500 million	Ongoing.
Clean Energy Innovation Fund (CEIF)	Seeks to fund emerging Australian technologies and businesses to speed the nation's transition to a renewable economy.	Up to \$200 million ³	Ongoing.

²Australian Renewable Energy Agency, 'Driving the Nation Program 2023 Focus Areas' (Report, April 2023) 3 <<https://arena.gov.au/assets/2023/04/driving-the-nation-2023-focus-areas.pdf>>.

³Clean Energy Finance Corporation Investment Mandate Direction 2023 sub-s 16(1).

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A circular future for renewable energy projects

Authors: Matt Baumgurtel, Linda Romanovska, Adriaan van der Merwe, Eamonn Carpenter and Lily Clements-Markham



The circular economy has become one of the central pillars of Environmental, Social, and Governance (**ESG**) strategies.¹ As scrutiny over corporate sustainability claims intensifies, circularity is emerging as a key metric for both investors and regulators in assessing long-term viability. Integrating circular economy principles such as extending asset life, optimising resource efficiency, and designing for repairability and end-of-life recovery, now carries more significant legal, financial and reputational implications.

For the renewable energy transition, circularity is both an opportunity and a challenge. While renewable energy is fundamental to decarbonisation, its reliance on finite raw materials raises concerns about resource depletion and waste accumulation. The lack of structured end-of-life regulations and the clear decommissioning requirements risks has created unintended sustainability gaps. Regulatory frameworks such as the sustainable finance taxonomies (e.g. the Australian or EU ones) are addressing these concerns by embedding Do No Significant Harm (**DNSH**)

criteria into sustainable activity and project classifications, making circularity a mandatory consideration for investments which must align with the taxonomy.² Beyond facilitating access to sustainable finance, adopting circular economy principles within business models has been shown to enhance profitability and create new market opportunities, driving both financial and operational resilience.³

Voluntary reporting standards including the Global Reporting Initiative (**GRI**), the Sustainability Accounting Standards Board (**SASB**) and the Carbon Disclosure Project (**CDP**) are also incorporating circular economy metrics, which influence corporate sustainability disclosure practices. However, for circularity to be meaningfully integrated into the renewables sector, the focus should extend beyond recycling to design innovation, product-as-a-service models and secondary markets for repurposed infrastructure.⁴ Addressing these structural gaps will be crucial in ensuring that renewable energy remains a net-positive contributor to sustainability, both environmentally and economically.

Circularity in renewables: the hidden sustainability challenge

Despite their sustainability benefits, solar, wind and battery storage technologies, just like any other products, have significant lifecycle challenges, from raw material extraction to decommissioning. Without structured circularity measures, renewables risk creating a new wave of environmental liabilities, including resource depletion.⁵ Common pitfalls of renewable energy assets include:

- **Recycled vs. Recyclability**
Many renewable technologies claim circularity, but there is often an overlooked distinction between recycled components and materials, and actual recyclability. Some materials used in renewable energy infrastructure may contain recycled inputs yet lack viable pathways for end-of-life recovery. For example, solar panels may incorporate recycled glass or aluminium, but the high-purity silicon, silver, and rare metals within them remain difficult to extract and reuse efficiently.
- **Lack of Life Cycle Assessments (LCAs)**
Many renewable energy projects lack comprehensive LCAs. Without assessing the full life cycle, from raw material extraction to disposal, companies risk overstating circularity claims, and underestimating environmental impacts. Particularly if critical end-of-life considerations such as recyclability, repurposing and waste management are not factored in. Standardised LCAs are essential for ensuring transparency, improving material efficiency and preventing greenwashing.

These pitfalls increase the risk of greenwashing allegations as circularity is increasingly used as a sustainability metric. But without clear definitions and accountability, circularity risks becoming a marketing tool rather than a meaningful commitment. Projects that highlight recycled materials while ignoring end-of-life challenges, or which lack robust plans for material recovery and reuse, may give the appearance of sustainability without delivering real impact. If renewable energy infrastructure and projects do not integrate genuine circular economy principles, it risks eroding public and investor trust in the sector's environmental claims.

Beyond recycling: circularity strategies for renewables

To align with sustainable investor expectations, such as those driven by the EU (and other) Taxonomies for Sustainable Activities,

renewables must move beyond basic recycling towards a full circular economy approach. This includes:

- **Right to Repair and Longevity** – Designing renewable infrastructure for modular repairs and component level replacements, rather than full asset disposal. The Warranty policies would also need to be adjusted to reflect these developments and not incentivise pre-mature disposal.
- **Product-as-a-Service Models** – Shifting from ownership to leasing models, such as battery leasing programs, to incentivise manufacturers to design longevity and recyclability.
- **Secondary Markets** – Developing pathways for repurposing solar panels, wind turbine components and battery materials into new energy applications or alternative industries.

Regulatory and market incentives

Regulatory frameworks are increasingly embedding circular economy criteria into sustainable finance taxonomies, reinforcing circularity as a requirement of ESG-aligned investment. This shift is a positive and necessary evolution, ensuring that green finance flows toward projects with verifiable sustainability credentials. By establishing clear thresholds and compliance mechanisms, these frameworks drive innovation, efficiency, and long-term resilience in renewable energy investments.

The EU taxonomy: leading the way in circularity standards

The EU Taxonomy for Sustainable Activities is the most advanced regulatory framework integrating circular economy principles into sustainable finance. It provides objective criteria for defining what qualifies as environmentally sustainable economic activity.⁶ Such as:

- **Circular economy as a key environmental objective** – The EU Taxonomy recognises circular economy as one of six climate and environmental goals, incentivising businesses and projects that contribute significantly to resource efficiency, waste reduction and material recovery in their operations.⁷
- **Mandatory DNSH compliance** – Even if a project contributes to climate mitigation, it must still meet circular economy DNSH criteria to qualify for green finance.⁸ This ensures that renewable energy investments also address material other sustainability and lifecycle impacts.

Australia's emerging taxonomy: a defining moment for circularity in renewables

Australia is in the process of developing its own sustainable finance taxonomy, and this represents a critical opportunity to align with global better practices.⁹ While DNSH criteria for a circular economy already exist, the absence of a defined (sustainable contribution) definition will create uncertainty for investors and project developers as to the extent circularity is weighted. Despite this, there are numerous potential benefits were the Australian taxonomy to include circularity, including:

- **A safeguard against ESG-washing** – Establishing clear and well-defined circular economy criteria will ensure that only projects genuinely integrating circular economy principles qualify for sustainable finance classification. While the Australian taxonomy remains voluntary, aligning it with global best practices will strengthen investor confidence and market integrity, encouraging greater transparency and accountability.
- **Ensuring renewable energy investments meet global benchmarks** – To remain competitive in international ESG markets, Australia's taxonomy must explicitly address decommissioning, recyclability and lifecycle efficiency in renewables. A strong framework will help attract green capital and position Australia as a leader in sustainable energy finance.

Australia's taxonomy presents a transformative opportunity to future-proof renewable energy investments, ensuring projects not only contribute to decarbonisation but also align with circular economy principles. If implemented effectively, it will strengthen Australia's position in the global green finance landscape, drive industry-wide innovation and set new standards for lifecycle sustainability in the renewables sector.

Emerging solutions

In addition to the recent regulatory developments, Australia is advancing renewable energy material and component recycling, driven by both innovative research and substantial government support. Some recent examples include:

- Researchers at the University of New South Wales (**UNSW**) pioneering a solar panel recycling method capable of separating up to 99 per cent of photovoltaic cell materials from end-of-life solar panels.¹⁰ This breakthrough not only enhances material recovery but also sets the stage for more efficient recycling

processes. In recognition of this progress, the Australian Research Council has allocated \$5 million to establish a dedicated research hub at UNSW, aiming to transform the nation's photovoltaic recycling industry.¹¹

- The NSW Government launching the Circular Solar grants program, a \$10 million initiative designed to manage the anticipated increase in solar panel and battery waste.¹² Projections indicate that NSW will generate between 3,000 to 10,000 tonnes of such waste annually by 2025, escalating to 40,000 to 71,000 tonnes by 2035. This program supports collaborative projects that trial end-of-life solutions for solar panels and battery systems within a circular economy framework.

These continued efforts in industry and innovation will enhance Australia's onshore recycling capabilities alongside the policy measures taking place.

Next steps

Circularity should no longer be an afterthought, it is a regulatory, financial, and strategic necessity for the renewables sector. Without circularity integration, renewable projects risk sustainability shortfalls, greenwashing blame, higher costs, and declining investor confidence.

To avoid these risks, developers, manufacturers, investors, and policymakers should consider:

1. **Renewable energy developers** should embed circularity in project design, ensuring materials, supply chains, and decommissioning strategies align with ESG principles and sustainable finance requirements.
2. **Manufacturers** should shift toward repairable, reusable and repurposable products, supporting longer asset lifespans and secondary market applications, in addition to integrating recycled material content in their products.
3. **Investors** should require verifiable LCAs and taxonomy-aligned disclosures to ensure circularity is genuinely embedded in renewables projects.
4. **Policymakers** should introduce clear extended producer responsibility frameworks and lifecycle accountability regulations, ensuring renewable infrastructure does not become the next waste crisis.

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.

Materra is a sustainability consultancy that helps organisations navigate the shifting sustainability landscape, from mandatory sustainability reporting and compliance to voluntary ambition and performance no matter what stage they are at in their journey. For more information, please contact Linda Romanovska.



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Mandatory corporate ESG financial reporting: Is your business ready?

Authors: Jo Ruitenberg, Kylie Zih and Anne Pan



As of 1 January 2025, many large Australian businesses and financial institutions must prepare annual sustainability reports on mandatory climate-related financial disclosures. This requirement arises from the passing of the *Treasury Laws Amendment (Financial Market Infrastructure and Other Measures) Bill 2024* (Cth) through parliament in September 2024, which amended the *Corporations Act 2001* (Cth) (**Corporations Act**) to introduce these new measures.¹

Further to our previous [Insight](#), this article explores the new mandatory climate-related disclosure requirements, the potential consequences of non-compliance and the steps that we recommend companies take in order to ensure compliance with the new requirements.

Who is required to report under the new legislation?

The entities that are required to produce sustainability reports pursuant to Chapter 2M of the Corporations Act are:

- a. **large proprietary companies:** a company is a large proprietary company if it satisfies two of the following criteria:
 - i. consolidated revenue for a financial year is \$50M or more;
 - ii. value of consolidated gross assets for a financial year is \$25M or more; and
 - iii. company has 100 or more employees;

- b. **asset owners managing funds in excess of \$5 billion;** and
- c. **National Greenhouse and Energy Reporting reporters:** entities with annual emissions reporting obligations under the National Greenhouse and Energy Reporting Scheme and entities registered under the *National Greenhouse and Energy Reporting Act 2007* (Cth).²

Who is not required to report under the new legislation?

There are three main exemptions to the new requirements:

- a. Entities exempt from preparing and lodging financial reports under Chapter 2M of the Corporations Act.
- b. Companies with parent entities submitting consolidated sustainability reports.
- c. Registered not-for-profit organisations and charities.

When does reporting start?

The mandatory climate reporting requirements will be progressively phased in over the next three years across three groups of reporting entities based on the size of the entity as well as its reporting requirements under the National Greenhouse and Energy Reporting Scheme. Entities must report to ASIC, with the first cohort required to prepare annual sustainability reports

for the financial year commencing on or after 1 January 2025, the second commencing on or after 1 July 2026 and the third commencing on or after 1 July 2027.

All reporting entities, including those in the second and third reporting cohorts, should begin preparing for the new climate disclosure regime.

Reporting must occur each financial year by way of a sustainability report, likely contained in the entity’s annual report to be lodged with ASIC. Existing timeframes in respect of submitting annual financial reports also apply to the sustainability report. Refer to the table below for a summary of when the reporting requirement commences.

First annual reporting periods starting on or after	Large entities and their controlled entities meet at least two of three criteria:			NGER Act Reporters	Asset Owners
	Consolidated revenue	EOFY consolidated gross assets	EOFY employees		
1 January 2025	\$500 million or more	\$1 billion or more	500 or more	Above NGER publication threshold	N/A
1 July 2026	\$200 million or more	\$500 million or more	250 or more	All other NGER reporters	\$5 billion assets under management or more
1 July 2027	\$50 million or more	\$25 million or more	100 or more	N/A	N/A

What must the sustainability report contain?

The report must contain a climate statement that addresses the following:³

Climate Statement	• material financial risks and opportunities relating to climate; • any climate related metrics and targets during the financial year required to be disclosed by the Australian Sustainability Reporting Standards, including scope 1, 2 and 3 emissions; • any information about the governance, strategy or risk management by the entity with regard to the metrics mentioned above and targets; and • scenario analyses to demonstrate resilience to climate-related and transition-related changes, if: • the global average temperature “well exceeds 2°C” above pre-industrial levels, or (as provided by the explanatory materials), an increase of 2.5°C or greater; or • the global average temperature increased 1.5°C above pre industrial levels.
Accompanying Notes to the Climate Statement	• relating to the preparation of the climate statement; • required by the Australian Sustainability Reporting Standards; and • required by the Corporations Act.⁴
Director's Declaration	Declaration that the climate statements and the notes comply with the Corporations Act. Please note that: • during the three year transition period, the regime mandates that directors make a declaration which provides that, ‘in their opinion, the entity has taken reasonable steps to ensure the substantive provisions of the sustainability report are in accordance with the Corporations Act’; and • from 1 January 2028, the regime removes the ‘reasonable steps’ threshold and mandates that directors make a declaration which provides that, ‘in their opinion, the substantive provisions in the sustainability report are in accordance with the Corporations Act’.

From 1 July 2030, the sustainability report will also become subject to external audits and assurance requirements.

What are the consequences of non-compliance?

For a three-year period from 1 January 2025 to 31 December 2027, a modified liability regime will provide limited immunity from proceedings for certain climate-related financial disclosures classified as ‘protected statements’. A protected statement is:

- a statement within a sustainability report or an auditor’s report or review of such sustainability reports that is also about any of the following:
 - scope 3 greenhouse gas emissions (including financed emissions);
 - scenario analysis made in those sustainability reports; or
 - a transition plan (within the meaning of the Australian Sustainability Reporting Standards).

This modified liability regime will likely affect proceedings that may be brought for alleged misleading or deceptive conduct, and breaches of directors’ duties. This immunity does not apply if the proceedings are brought by ASIC, or the statements are criminal in nature.⁵ In recognition of this transition period, ASIC has indicated that it will take a “pragmatic and proportionate approach to supervision and enforcement”, prioritising enforcement action against misconduct of a serious nature.⁶

From 2026, ASIC will start undertaking climate-related disclosures surveillance programs which consist of reviewing statements in sustainability reports to determine whether they are incorrect, incomplete or misleading. If so, ASIC may, at their discretion, use their new directions power under s 296E of the Corporations Act to direct an entity to:

- confirm that the statement is correct or complete;
- explain the statement in question;
- provide information or documents that substantiate or support the statement;
- correct, complete or amend the statement; and/or
- publish the corrected, completed or amended statement, or give the statement to specified persons, in accordance with the direction.⁷

It is clear that directors must exercise reasonable care when preparing and approving sustainability reports, or risk facing significant civil penalties.

With the introduction of mandatory climate-related financial disclosures, entities should be increasingly mindful of how they present their statements and whether they are at risk of greenwashing in their sustainability reports. ASIC provides guidelines on how to avoid greenwashing, which was discussed in further detail in our previous [Insight](#).

Is the new legislation still relevant if my company doesn’t fall within the reporting thresholds?

Smaller entities that do not fall within the reporting thresholds may still be indirectly impacted by the new reporting requirements, including with respect to the Scope 3 emissions disclosure requirements. This is because Scope 3 emissions are defined to include upstream and downstream emissions, including financed emissions, that occur in a reporting entity’s supply chain. Consequently, reporting entities may require their suppliers, and entities that they invest in or provide loans to (who may not have reporting obligations directly imposed on them) to provide their emissions data to the reporting entity in order to fulfil that reporting entity’s compliance obligations.

Accordingly, smaller entities should be mindful that they might be required by their business partners to track, quantify and share their emissions data. Reporting entities are required to report Scope 3 emissions from their second reporting year.

Looking forward

As Australia takes a significant leap forward regarding reporting requirements and director responsibilities within the ESG space to match international standards alongside the United Kingdom, European Union, Japan and New Zealand, it is critical for large entities to prepare for mandatory climate reporting by:

- assessing current systems and strategies against the Australian Sustainability Reporting Standards and determining whether they need to be updated and reviewed;

- developing robust due diligence and verification procedures to validate climate-related disclosures and emission data;
- developing accountability structures within the board and executive teams to oversee climate-related financial risks and opportunities; and
- creating a cross-functional team within your company to help coordinate and prepare annual sustainability reports to ensure accurate and consistent reporting.

If you are uncertain whether you will be required to prepare a sustainability report, or any of the requirements within, reach out to Jo Ruitenberg or Matt Baumgurtel.

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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Technological advancement in the recycling of wind, solar and battery assets

Authors: Matt Baumgurtel, Adriaan van der Merwe, Tim McAlpine-Scott and David Wan



Proper management of the lifecycle of renewable generation assets is critical to ensure that the environmental benefits of clean energy are not offset by waste management challenges.

While renewable generation technology has advanced rapidly, the accompanying technology to recycle these systems has not kept pace, which presents technical, environmental and economic challenges.

Challenges in recycling renewable generation systems

The rapid deployment of renewable energy systems has led to a corresponding increase in decommissioned equipment, and this trend will accelerate as more systems reach the end of their operational life. Effectively recycling these materials is essential to prevent environmental degradation and to recover valuable resources.

Wind turbines

Wind turbines are predominantly made up of recyclable metal components, such as steel, aluminium, copper and cast iron, alongside non-metal composite materials such as fibreglass and carbon fibre. Approximately 85–94% of a wind turbine's mass can be recycled in Australia.¹ The composite materials however pose significant recycling challenges.

Currently, there are limited commercially feasible end-of-life options to dispose of composite materials. These materials are difficult to recycle, as the polymers used are 'cross-linked' in an irreversible process to achieve durability and strength while maintaining a lightweight.² As there is no widespread method for recycling fibreglass, a significant portion of turbine blades end up in landfills.³

As of 2023, 31 Australian wind farms are over 15 years old, with 599 wind turbines approaching the end of their design life.⁴ By 2034, an estimated 15,000 tonnes of blade composite waste will have been created in Australia due to decommissioning.⁵ As more turbines reach the end of their lifespan, prompt action needs to be taken to develop effective recycling strategies and infrastructure.

The most common recycling method for wind turbine blades is mechanical grinding, whereby composite materials are ground into short fibres and ground matrix (powder). Although this method is cost-effective and less energy-intensive than other technologies, the end product is less valuable than the original material.⁶

The shredded material is used as filler or reinforcement in construction, such as decking panels, light poles, and cement. Low market demand however prevents this process from being a sustainable recycling option.⁷

Solar panels

Australia has one of the highest global rates of per capita rooftop solar installations. This success is however accompanied by a looming waste management issue. While more than 85% of a solar photovoltaic (PV) module is made of recyclable materials (like aluminium and glass), solar panel recycling is currently not cost-effective or widely adopted.⁸

As of August 2023, only 17% of solar panel components, primarily aluminium frames and junction boxes, are recycled in Australia.⁹ The remaining 83%, including glass, silicon, and polymer back sheets, are not recyclable within the country and are often treated as waste.¹⁰ Our previous article: [Australia's Solar Panel Recycling Challenge and Market Outlook](#) further discusses the challenges and barriers in Australia's solar panel recycling.

With over 1.2 million solar panels estimated to be decommissioned in Queensland alone in 2025, existing facilities are struggling to keep pace. Pan Pacific Recycling in Brisbane, Queensland's first solar panel recycling plant, started operation in 2024 and currently processes 30,000 panels a year.¹¹ Though the plant aims to scale up to processing 240,000 panels a year,¹² it is still only a small portion of the discarded solar panels – only 20% in Queensland in 2025.

Battery energy storage systems (BESS)

The increased adoption of BESS, particularly lithium-ion batteries (**LIB**), underlies the energy transition by enabling the storage of intermittent renewable generation. The recycling of these batteries are however fraught with challenges, such as energy-intensive processes and the management of hazardous materials.

Major challenges in recycling LIBs stem from the diversity in their chemical compositions and designs,¹³ resulting in the cost of recycling being higher than mining new materials.¹⁴

The Australian battery recycling rate was around 10% by 2021,¹⁵ indicating a significant gap in managing end-of-life batteries. There is very little Australian capacity for processing LIBs, with the result that large volumes are stored in warehouses and scrap yards, creating a fire risk and potential environmental contamination.¹⁶

Technology advancement and future opportunities

Fortunately, as renewable energy technologies evolve, so do the methods for managing their end-of-life materials.

Wind turbines

Wind turbines are increasingly recyclable, due to advancements in recycling technologies and the evolution of manufacturing materials. For example, Siemens Gamesa is committed to producing 100% recyclable wind blades by 2040,¹⁷ with the first recyclable wind turbine blade, using a new resin material, installed for commercial offshore use in 2021 at Kaskasi off the German coast.¹⁸

Vestas is developing a chemical process to break down epoxy resin in old turbine blades into reusable base materials.¹⁹ Another pilot-scale method, high-voltage pulse fragmentation, uses electricity to separate fibres from composite materials. This process yields cleaner, longer fibres than traditional mechanical methods.²⁰

In Australia, the Australian Government awarded a \$3 million grant to Industrial Property Maintenance through the Cooperative Research Centres Projects (**CRC-P**) initiatives in 2023. This will be used to develop a new processing treatment and a pilot recycling facility for wind turbine blades.²¹

Solar

The major challenge in PV recycling is the durable seal that protects solar cells and ensures the solar panel's longevity. This seal, made of polymer sheets laminated between glass panes, is difficult to separate and complicates the recycling process.²²

In the U.S., the Department of Energy is funding projects to reduce waste from solar modules from when they are being made. One approach uses sealants that can be dissolved without damaging other panel materials,²³ which makes it easier to deconstruct solar panels. Meanwhile, the U.S. National Renewable Energy Lab is developing a better way to seal the solar modules. Using a femtosecond laser, the researchers welded together solar panel glass without the use of polymers. These glass-to-glass precision welds are durable enough for outdoor use and offer better protection against corrosive moisture.²⁴

BESS

The widespread adoption of LIBs raises concerns regarding their environmental impact and the scarcity of critical resources. While conventional recycling methods present environmental and efficiency challenges, new electrochemical techniques show considerable promise in terms of enhancing selectivity, reducing energy

consumption and minimising the production of secondary waste.²⁵ These methods are being developed to be waste-free and requires minimal chemical consumptions or energy inputs, while achieving high lithium recovery efficiencies of up to 97%.²⁶ Although not yet commercialised, the future looks promising.

Looking ahead

Embracing a circular economy, where materials are reused and recycled, can significantly reduce environmental impacts and create economic value. Australia’s [Circular Economy Framework](#) supports this, especially by listing minerals beneficiation as one of the priorities, aiming to extract valuable minerals from waste and renewable technologies (such as batteries and solar PV).²⁷

While challenges remain, recycling of renewable generation assets can be advanced through the harmonisation of regulation and financial support for research. Australia’s regulatory and financial initiatives will promote stronger industry collaboration and encourage industry investment, which eventually foster infrastructure improvements for sustainable waste management.

These interventions will support recycling, and contribute to the creation of a circular economy for renewable generation assets.

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Built to last, but not forever: the future of decommissioning renewable energy projects

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A growing number of renewable energy projects across Australia are presenting challenges for existing national waste management and decommissioning systems. What does the future hold for these retiring renewables?

Need to know

- New energy facilities such as wind farms, solar PV projects, and battery energy storage systems require decommissioning processes to facilitate a circular project life cycle.
- While there is no national legislative basis for decommissioning renewable energy facilities in Australia, guidelines have been released at both federal and state levels, shifting the onus onto developers at the planning stage to consider and appropriately budget for the decommissioning of their sites.
- The process of decommissioning differs greatly for each type of renewable technology, with each presenting their own challenges and solutions.
- It is expected that in 2025 and beyond, government and industry stakeholders will increasingly regulate the process of decommissioning renewable energy projects and begin to standardise such processes across the energy industry.

As more renewable energy assets reach their end-of-life stage, it's important to consider what comes next. At the end of an asset's operational life, the owner is generally required to remove the asset, including any requisite materials, and remediate the land to its original state or a state that is appropriate for future use. This is a process known as '[decommissioning](#)'.

The ever-increasing amount of new energy facilities such as wind farms, solar panels, and battery energy storage systems (BESS) necessitates accessible and centralised decommissioning processes to facilitate a circular project life cycle. In fact, the share of electricity generated by renewable sources is forecast to rise from 10.5% in 2010 to 46% in 2030, demonstrating the necessity of waste management systems to scale accordingly.¹ The retiring of renewable infrastructure, recycling of assets and remediation of sites therefore constitute an important process within the project life cycle, ultimately restoring the utility of the land and reducing the use of new materials in the production of new assets.

Current process for decommissioning renewable facilities

While there is no national legislative basis for decommissioning renewable energy facilities in Australia, guidelines have been released at both federal and state levels. The Australian Energy and Infrastructure Commissioner (AEIC) released a guideline, '[Considerations for Landholders before entering into Commercial Agreements](#)', in January 2023 which recommended that matters relating to the retirement of renewable projects should be addressed in the lease agreement. The guideline shifts the onus onto developers at the planning stage to consider and appropriately budget for the decommissioning of their sites.²

At a state level, the NSW government released [guidelines for renewable energy projects in November 2024 \(NSW Guidelines\)](#). The NSW Guidelines affirms the government's intention to impose conditions on all wind and solar energy projects to be decommissioned at end-

of-life, reaffirming the onus of decommissioning infrastructure as on the developer, and contains a decommissioning calculator to facilitate informed investment decisions.

The Victorian Environmental Protection Authority (EPA) is granted legislative powers under section 54(2)(j) of the [Environment Protection Act 2017](#) to impose conditions on the cessation of permitted projects. The EPA has imposed conditions on operating licenses to prepare and maintain a decommissioning plan throughout the course of the project life cycle – aligning with the AEIC guidelines in respect of Victorian projects.

These recommendations contrast with international regulations that are more proactive in addressing renewable industry waste. For example, Italy introduced Legislative Decree No. 49, instituting obligations for the decommissioning of solar projects.³ Italian developers possess an extended producer responsibility for waste electrical equipment, requiring evidence of financing for the decommissioning process and organisation for the collection, treatment, recovery and disposal of equipment.⁴ The decree also creates a national register for producers which lists regular reporting of quantities of electronic waste material placed on the market for recycling and collection.⁵

This example posits the question as to whether Australia, as a growing renewable energy powerhouse, should develop more stringent regulations that require developers to consider and accommodate the local environment, with consequences which reflect, and are proportionate to, the importance of decommissioning.

Currently, the process of decommissioning differs for each type of renewable technology.

Wind turbines

The NSW Guidelines provide that development consent will be granted on the condition that the developer will decommission and rehabilitate the project site.⁶ Accordingly, projects that require a development consent must address the issues associated with decommissioning a site within their application, considering dust and noise generation, increased traffic or traffic disruptions and risks to land viability, amongst others.⁷

However, not all aspects of a wind energy proposal will need development consent. For example, wind monitoring systems, that would be used to determine the feasibility of a wind resource, do not require planning consent under the Transport and Infrastructure State Environmental Planning Policy.⁸

This eases some procedural burden and regulatory delay by eliminating the consent required for initial testing of a sites prospects; though conversely, this means these initial testing procedures may not be subject to specific decommissioning requirements.

On 4 February 2025, the new Queensland [State code 23: Wind farm development](#) took effect. Development applications for development permits for wind farms are assessable against the code. The code essentially requires a development application to be supported by a decommissioning report and plans. The conditions of any approval will include conditions requiring proponents to:

- prepare and lodge an End of Construction Decommissioning Management Plan prior to the finalisation of construction of the wind farm;
- prepare and lodge an End of Operation Decommissioning Plan six months prior to the ceasing of a wind farms' operations; and
- provide financial security that will ensure timely compliance of decommissioning at the end of construction and at the end of operations – at no cost to the landowners or the government.⁹

Whilst much of the decommissioning process will be specific to each project site and dealt with on a case-by-case basis in the landholder agreement, the primary options are typically:

- replacing the wind turbines with new technology (subject to landholder agreements, planning approvals and the condition of the equipment); or
- decommissioning the project in part or in full.

In circumstances of replacement, a new development consent may be required, resulting in a revised decommissioning process to be proposed in respect of the replacement technology. However, if it is a mere refurbishment of the turbine to its original operating capacity, this will not typically require a new application as ongoing maintenance is often permissible within the terms of an existing contract.

Alternatively, if a developer wishes to cease operation of a wind project, decommissioning will follow the reverse order of installation.¹⁰ This includes dismantling the turbine and its components, removing the above-ground ancillary infrastructure and restoring the site, with particular consideration to ecologically sensitive zones, to its final agreed land usage within 18 months of operations ceasing.¹¹ Below ground cabling, conduits and transmission infrastructure may be retained on-site to support the ongoing use of the land for residential or agricultural purposes.¹²

Solar panels

The decommissioning of solar projects follows a similar process to wind turbines, including the distinction between replacing or refurbishing a site or ceasing operations, following the reverse order of installation and allowing ancillary transmission infrastructure to remain in situ.

Indeed, the NSW Guidelines utilise much of the same language to describe the obligations of developers for both wind and solar projects.¹³ However, whilst wind turbines are notoriously difficult to recycle, solar panels have many avenues by which they may be reused as panels elsewhere or broken down for collection of requisite materials. To read more about solar panel recycling please see our [previous article](#), ‘Australia’s Solar Panel Recycling Challenge and Market Outlook’.

An important note for landholders who may be considering the development of renewable projects on their land, regardless of the type of technology, is that the development consent applies only to the land and not to a particular company or developer. Thus, whilst the obligation of decommissioning and rehabilitation is initially on the developer, the obligation may fall on the landholder if the developing company becomes insolvent. The landholder should have a clear understanding of a developer’s plans to manage the decommissioning phase and may request assurances as to funding for the process, including ongoing evidence of financial capacity.

Batteries

The use of BESS in both solar and wind farms is becoming increasingly important as a means of stabilising the grid and securing consistent energy supply, even at times of low renewable energy production.¹⁴

The NSW Guidelines address the role of BESS through the lens of solar or wind recommendations – thereby binding the developer to undertake the requisite decommissioning process, inclusive of BESS.¹⁵ Yet, batteries often have differing procedures to the normal decommissioning process, such as the initial stage to de-energise the battery, so as to avoid electrical risk when disassembling,¹⁶ which may require additional regulatory guidance.

To this end, the [National Waste Policy Action Plan \(2024\)](#) seeks to amend waste management practices in Australia by coordinating a national approach to battery disposal and recycling, setting a recovery target of 80% for all waste by 2030. The plan came as a continuation of the Labor government’s [National Battery Strategy](#) that directs funding in the 2024-25 May Budget

and Future Made in Australia Innovation Fund toward strengthening battery manufacturing capabilities nationwide.

Thus, whilst the federal government ramps up domestic battery production, the complimentary waste management plan seeks to address the socio-environmental complications associated with increased battery manufacturing.

Battery recycling is also an essential aspect of decommissioning a BESS project, particularly as it pertains to the realisation of a circular economy, as the raw materials used in these batteries can be reused in a multitude of ways. For example, heavy metals recovered from batteries, such as cadmium, can be reused in new alloys, electroplating, solar cells, or remade into another battery.¹⁷

Considering the rise of the renewable energy market, both state and federal governments have increased their attention toward recycling efforts – for instance, the [national Recycling Modernisation Fund](#) was created to invest over \$1 billion in recycling infrastructure, whilst contributing to the circular economy through continued use of decommissioned site components as new project materials.

However, despite the initial mass-investment in battery recycling technology, the current viability of such practices remains under threat from cheap and efficient battery cells that have flooded the market, relegating the reuse of old cells to a secondary concern.¹⁸

Ocean energy infrastructure

The [Offshore Electricity Infrastructure Act 2021 \(OEI Act\)](#) establishes a regulatory framework for the construction, installation, operation, and decommissioning of offshore electricity infrastructure, inclusive of both renewable and non-renewable energy projects. Under the OEI Act, a developer must prepare a management plan for approval by the offshore infrastructure regulator.

The management plan is a legally enforceable document that, amongst other things, sets out a proposed decommissioning plan when the project reaches its end-of-life phase. The developer must provide financial securities to the Commonwealth which covers the costs associated with decommissioning infrastructure, removing property and remediating the licensed area. Failure to provide the required security amount is an offence under the OEI Act.¹⁹

Offshore energy regulation illustrates the difficulty of onshore decommissioning processes as each state government has implemented a different standard procedure for a project’s cessation, whereas offshore

energy projects are regulated by a single OEI Act. Greater harmonisation of these regimes may be beneficial to promote an efficient decommissioning process essential for a circular economy.

Complimentary to the OEI Act is [Australia’s Offshore Resources Decommissioning Roadmap](#), released in December 2024, which commits to developing a regulatory directorate to govern the decommissioning of offshore energy projects. This directorate is created in recognition of how expensive and laborious the current process of offshore decommissioning is, seeking to create a more streamlined procedure whilst minimising the marine impacts of a project.

Looking to 2025 and beyond

The increasing number of new energy infrastructure correlates with an increase in ‘orphaned projects’ that could burden taxpayers with the cost of decommissioning private developments. In 2025 and beyond it is likely that even more stringent and specific regulatory or legislative guidance will be promulgated, leading to an expansion of the Australian decommissioning and recycling industry.

International regulations may provide guidance as to how Australia can progress further – such as sharing financial responsibilities for project decommissioning as a condition of buying into or developing a project in circumstances of multiple parties, as is standard, but not compulsory, in the UK.²⁰ Moreover, the principles of a circular economy, as a growing national and international trend, will only contribute more to the need for clear regulation of renewable waste management and disposal.

The NSW Guidelines provide an insight into the future of decommissioning regulation, with a focus on standardising the decommissioning of projects across the Australian energy industry. For example, requiring financial assurances at the planning stage that consider, and ultimately fund, a project’s disassembly.²¹

Whilst this is legislatively enshrined when considering offshore energy projects, or traditional fossil fuel energy developments, it is not yet a widespread requirement for renewable energy companies to address decommissioning at an initial planning stage – this may be an area for regulatory intervention within the coming years.

Ultimately, it is expected that in 2025 and beyond, government and industry stakeholders will increasingly regulate the process of decommissioning renewable energy projects and begin to standardise such processes across the energy industry.

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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Brightening the field: how Australia can repurpose unproductive landfills into solar powerhouses

Authors: Amelia Prokuda, Anna Mouat and Suwathie Rajeswaran



Decommissioned landfills present both environmental and economic challenges, but they also offer a golden opportunity to transform waste sites into valuable, green energy-generating assets. With landfill solar projects gaining momentum globally, we examine whether Australia is fully harnessing this opportunity, and the steps needed to realise the benefits.

Why landfills are ideal for solar farms

Many closed landfills are unsuitable for commercial or residential development due to contamination risks and subsidence concerns.¹ Additionally, the sites require long-term monitoring and maintenance, placing a financial burden on local councils and State governments.² Solar energy presents a sustainable solution.³

Unlike other infrastructure projects, solar panels can be mounted in a way that does not require deep excavation, preserving the integrity of landfill sites.⁴ Furthermore, landfills usually already have the necessary infrastructure built at the site, such as access roads, stormwater management systems, security fences and electricity connection systems, reducing establishment costs.⁵ They are also usually broad tracts of land with little to no shading, making them ideal locations for generating solar energy.⁶

Additionally, landfill solar farms are uniquely positioned to face minimal land-use conflicts and community opposition. Any large-scale renewable energy project relies on community support, without which development can face significant delays or even cancellation. For example, farmers have raised concerns that large-scale solar developments may encroach on high quality agricultural land, jeopardising food production.⁷ With their expansive surface areas, landfills are well-suited to large-scale solar installations, helping to convert otherwise dormant spaces into productive energy hubs and offering a ‘win-win’ approach.⁸

Landfill solar farms also reap significant socio-economic benefits. Landfill solar farms contribute to environmental sustainability, creating renewable energy parks that support decarbonisation efforts. Economically, they help offset post-closure maintenance costs for councils while utilising land that has limited commercial value.⁹

Repurposing landfills for sustainable uses can also advance environmental justice by creating jobs and helping revitalise communities.¹⁰ This approach fosters a circular economy, giving new life to land that would otherwise remain unused.

Landfill solar development in Australia

The [Albury Landfill Solar Farm](#), launched in 2019, is considered to be one of the pioneering projects of this kind in Australia. This project saw the installation of a 1.1MW (AC) solar PV system, consisting of 4,000 solar panels on a capped

landfill site. The solar panels generate emissions-free energy to power about 430 homes as well as an electric vehicle super-charger providing the community with clean energy to charge their electric cars. It was a collaboration between Albury, LMS Energy and Joule Energy, showcasing the potential for landfill solar farms to be both technically viable and beneficial to local communities.

Despite these promising initiatives, a 2019 feasibility study by the Australian Renewable Energy Agency (**ARENA**) found that without substantial cost reductions and financial incentives, landfill solar projects in Australia were unlikely to be viable.¹¹ In order to fully capitalise on the vast potential of large-scale landfill solar projects, Australia must overcome key engineering and operational challenges through innovative solutions and strategic mitigation efforts.

The challenges include:

1. The costs of developing solar infrastructure on landfill sites which are significantly higher than on undeveloped land due to the need for specialised solutions.¹²
2. The need for innovative engineering methods such as ballasted mounting systems that don’t disturb the ground,¹³ as traditional mounting structures that require deep foundations could breach the landfill cap and create contamination risks.¹⁴
3. Additional engineering risks caused by the hazardous gases that landfill sites emit.¹⁵
4. Regulatory hurdles and complex grid interconnection requirements that contribute to delays and feasibility concerns.

The United States: leading the way in landfill solar innovation

The US has made significant strides in landfill solar development, demonstrating how these challenges can be effectively addressed. Over 10,000 closed landfills across the US have been identified as potential renewable energy sites,¹⁶ and landfill solar projects have grown by 80% in the past five years.¹⁷ In 2021 alone, over 20 major projects were announced, adding more than 200 MW of solar capacity.¹⁸ As of 2023, the US had approximately 2.6 GW of landfill solar capacity, with projections estimating a 25-fold increase.¹⁹

Government incentives have played a crucial role, with the 2022 Inflation Reduction Act offering a tax credit up to 10% for projects built in energy communities, which includes communities with former coal mines and brownfields.²⁰

Many states also have incentives and policies supporting landfill solar developments. States including New Jersey and Massachusetts have successfully implemented technical assistance programs and financial incentives to make solar more attractive to developers.²¹ As a result of these programs, Massachusetts has emerged as a national leader in utility-scale landfill solar development.²²

Engineering advancements have also contributed to the viability of landfill solar projects in the US. For example, Terrasmart, a leading provider of commercial to utility scale solar ground mounts, have optimised tilt and ballast designs as a means of reducing costs while maintaining landfill integrity.²³

These innovations have made landfill solar more financially feasible and technically manageable, demonstrating that with the right investment and policy support, landfill solar can be scalable and effective renewable energy solution.

Lessons for Australia: policy, investment and innovation

For Australia to fully unlock the potential of landfill solar, it must address the key challenges identified through targeted policies and financial incentives. Investment in specialised landfill solar engineering expertise will be crucial in overcoming technical barriers and reducing costs.

The Australian Government should consider introducing tax credits, grants, streamlined regulatory processes and other incentives to encourage landfill solar adoption. Furthermore, research into engineering solutions, tailored specifically to Australian conditions should help mitigate risks associated with hazardous materials and mounting constraints.

With the introduction of effective policy frameworks, continued technological advancements and increased investment, Australia has the opportunity to transform its closed landfills into productive renewable energy assets. A strategic approach to landfill solar development could help bridge the gap between waste management and clean energy generation, with the aim of fostering a more sustainable and economically viable future.



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Closing the loop on organic waste and fueling the future with biogas

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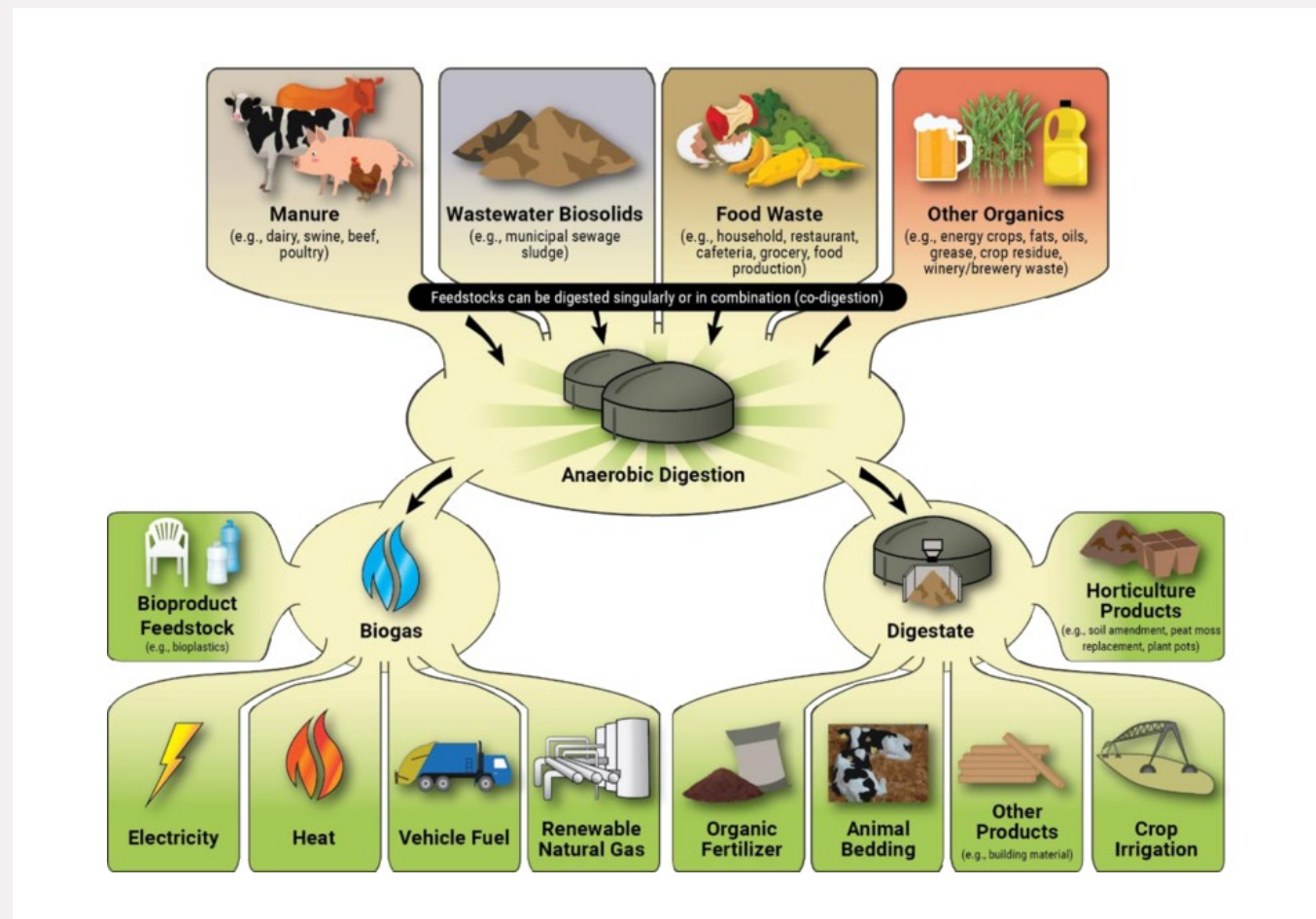
The nutrient cycle of agriculture, where farmers recycle organic waste into fertiliser or feed, is perhaps the most ancient circular economy of all. However, with the agriculture sector accounting for approximately 18% of Australia's emissions¹, the need for innovative and scalable solutions to reduce its greenhouse gas emissions is more imperative than ever.

One such solution lies in the use of anaerobic digestion, which converts biomass into biogas.² Biomass refers to organic materials that come from various sources, including the remnants from agricultural activities, the food industry, forestry operations and waste management systems.³ Biogas is a type of fuel made from the conversion of biomass through the anaerobic digestion process.⁴ Biogas is able to be utilised in the generation of electricity, steam and heat⁵ and can also be upgraded into 'renewable natural gas' (RNG) for injection into natural gas networks or to

fuel vehicles.⁶ The transformation of biomass into biogas has the potential to create self-sustaining, closed-loop farming systems to promote a more circular economy.

What is anaerobic digestion?

The word anaerobic means 'without oxygen'.⁷ Hence, anaerobic digestion is carried out in an oxygen-free sealed digester, whereby microorganisms break down biomass and convert it into biogas.⁸ Biogas is composed of 50 to 75 per cent methane, as well as carbon dioxide (CO₂), hydrogen sulphide (H₂S), water vapour and inconsequential amounts of other gases.⁹ The captured biogas can then be used as a fuel on-site for such purposes as producing heat or generating electricity (including to power the anaerobic digester itself).¹⁰ The anaerobic digestion process is illustrated in the diagram below.



Source: U.S. Environmental Protection Agency¹¹

Upgrading biogas into 'renewable natural gas' (RNG)

While the captured biogas from the anaerobic digestion process can be used to generate electricity, steam and heat, it can also be purified and upgraded into RNG.¹² This is done by removing the low-value components of CO₂, water vapour, H₂S and other trace gases.¹³ RNG is typically composed of 96 to 98 per cent methane.¹⁴ The uses for RNG include being injected into existing gas distribution networks and as a replacement for natural gas (such as in electricity generation, cooking and heating)¹⁵ or being converted into either compressed natural gas or liquified natural gas to be used as a vehicle fuel.¹⁶

Biogas upgrading – a better alternative to biogas flaring

In May 2023, the RACE for 2030 Opportunity Assessment reported that approximately 40% of anaerobic digestion facilities in Australia were flaring their biogas rather than using it.¹⁷ Flaring the biogas converts it into carbon dioxide,¹⁸ which is reported, over a 20-year period, to be 80 times less harmful to global warming than methane.¹⁹ However, carbon dioxide is still a greenhouse gas.²⁰

Flaring is therefore a tragic waste of biogas that, as outlined above, has a multitude of potential useful applications.

Biogas upgrading in Australia and certification schemes

The RACE for 2030 Opportunity Assessment also found, as of March 2019, that while Australia had over 200 operating anaerobic digestion facilities, there was not a single operating commercial biogas upgrading plant (RNG Plant).²¹ The Jemena Malabar Biomethane Facility became the first Australian project to upgrade anaerobic digestion-generated biogas into RNG and inject it into a gas network.²² The project is also reported to be the first biomethane facility in Australia to register under GreenPower's renewable gas certification scheme.²³ Additionally, to offset the electricity consumed in producing RNG, the project generates Large-Scale Generation Certificates.²⁴

Whether anaerobic digestion facilities and RNG Plants will be eligible for registration under various Federal or State schemes (including those noted above) will depend on the specifications and details of the individual project. Such schemes may provide financial incentives for the development and operation of these types of projects.



Barriers to developing RNG Plants

The shortage of RNG Plants in Australia may partially be due to gaps in domestic knowledge in the design, operation and maintenance of the anaerobic digestion systems, which differ in complexity.²⁵ There is also the necessity of feedstock security which, except if the project developer produces the feedstock itself, cannot be guaranteed unless RNG Plants have entered long-term arrangements with feedstock suppliers.²⁶

In an effort to overcome these issues, project developers and feedstock suppliers may choose to enter into arrangements to jointly develop RNG Plants. One example of such an arrangement is the renewable fuels joint venture between Apeiron Bioenergy, who will provide know-how on feedstock collection, and Jet Zero Australia, who will concentrate on investing in processing and refining of non-edible crops.²⁷

It's time to act

Biogas represents a powerful, yet underutilised, solution to some of the agricultural industry's most pressing environmental challenges. Through the use of anaerobic digestion and the upgrading of biogas to RNG, the potential for a circular economy in the agricultural sector is within reach. Harnessing the full potential of biogas is not just an opportunity for cleaner energy – it is a key step towards a more sustainable, self-sufficient agricultural system that can help mitigate climate change and fuel the future.²⁸



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Unlocking the potential of tailings: a hidden resource in plain sight

Authors: Matt Baumgurtel, David O’Carroll, Eamonn Carpenter, Ellie Zervos and Aarthi Parthiban



Tailings, a by-product from the processing and extraction of raw minerals and metals from mined ore, are being re-examined as a potentially commercially viable resource for products like batteries and other electronics. We take a look at the evolution of the tailings industry and how EnviroGold Global is employing an innovative new process called the NVRO Process to support profitable, sustainable and responsible mining practices.

Historically, many mines were abandoned without proper reclamation, leaving a host of environmental issues in their wake, tailings among them.¹ Today, billions of tonnes of tailings are produced globally each year.² Reprocessing tailings represents a potential maturing of the industry, as it not only recovers valuable minerals but also reduces environmental harm. With growing pressure from stakeholders for responsible environmental practices, mining companies are increasingly prioritising tailings reprocessing as part of their ESG strategies.

There has been no agreed best approach to handling tailings. In the past, tailings were simply discharged into nearby water sources, a practice which continues in areas with steep, unstable terrain, like the Ok Tedi and Grasberg mines.³ By the 1900s, the negative impacts of uncontrolled tailings disposal including irrigation ditch blockages and downstream contamination became evident, causing greater conflicts

with agricultural land use.⁴ Even tailings dams, purpose-built storage dams, were prone to chemical leakages, structural instability and high operating costs.

Barriers to reprocessing tailings

Reprocessing tailings in the past was not commercially appealing or viable. Extraction methods were inefficient, and the high variance in material concentrations and presence of chemical additives made it difficult to recover valuable materials.⁵

However, growing ESG pressures taking the focus off pure profit, and technological advancements like flotation, advanced gravity separation, high-intensity magnetic separation, leaching, roasting, and sensor-based sorting are changing how the sector views tailings.⁶

Case study: how EnviroGold Global is tackling environmental challenges with innovative solutions

Chemical leaching involves treating mined ore using a chemical agent (like nitric acid). The chemical agent converts the valuable minerals to a soluble form which can be extracted, while the undesired residual materials remain insoluble.

[EnviroGold Global](#) is a company targeting the treatment of sulphidic tailings, which are the cause of acid mine drainage and related environmental risks, by employing its proprietary NVRO Process. The NVRO Process uses a weak acid catalyst at atmospheric pressure and low exothermically generated temperatures to generate a self-sustaining chain reaction which chemically alters the sulphide bonds liberating the metal and making the acid generating sulphur available for neutralisation.

This process is more efficient than other common methods for tailings retreatment with lower capital and operating costs due to the fact that it does not require high pressure, high temperature or specialised equipment. Its residence time is shorter than other technologies which means that the size of the equipment can be scaled down compared to other technologies.

The NVRO Process is metal agnostic and can be used to reprocess sulphidic tailings and smelter byproducts to recover contained metals including

precious and non-precious metals, strategic metals and rare earth metals.⁷ The exothermic reaction chemically alters the sulphides allowing the metals to be released for recovery by conventional methods, with a highly successful recovery rate of over 90% for targeted metals.⁸ As the water and leach solution is recycled through the system at very low temperatures to regenerate the catalysts in the reaction, the process is highly sustainable.⁹

In May 2024, EnviroGold Global announced that it had entered into an agreement to purchase an integrated metal processing plant developed at the CSIRO Australian Minerals Research Centre. As part of its customer engagement process, NVRO customer tailings are transported to the demonstration facility and processed using the NVRO Process. This demonstration plant accelerates the feasibility process and aids in the controlling of study costs.

After extraction of the metal, the tailings have a reduced environmental risk profile which can be further neutralised according to client specifications. The goal of the process will be to produce inert, dry stackable tailings (filtered sand like material) which can be laid down, compacted and planted with native soils and vegetation as part of environmental rehabilitation. Adopting this practice will mean a decrease in the need for tailings dams which require extensive maintenance due to the chemical and metal content in conventional tailings. This is poised to benefit developing mining countries facing water scarcity issues.¹⁰

EnviroGold Global’s pilot test of its technology in 2021 for the Hellyer Gold Mine successfully processed 500 kg of tailings.¹¹ Following demand from multiple mines to trial the technology EnviroGold Global has developed a pipeline of interested customers.

The NVRO Process offers a commercially viable solution due to its low capital and operating costs, as well as its scalable, modular design.¹² In January 2025, EnviroGold Global signed an MOU with Fraser Alexander, a global leader in mine tailings management and processing, to collaborate on deploying the technology across three tailings storage facilities.¹³ This is a significant step towards proving the potential of its clean leach process.

EnviroGold Global CEO, David Cam states, “*EnviroGold’s continued momentum underscores its commitment to responsible growth and operational excellence. The company is accelerating the development of its Strategic Relationships and customer engagement, further reinforcing its first mover advantage and leadership position in the green mining and resource recovery sector.*”

Next steps

As metal reserves decrease, the need for innovative solutions to remediate tailings becomes more pronounced. Amongst growing resource scarcity, EnviroGold Global’s technology highlights the ability to view tailings as a valuable source for both the metals and agricultural industry.

The NVRO Clean Leach process also contributes to mining companies satisfying their ESG obligations by preventing leaching into waterways, causing environmental harm. The anticipated commercialisation of the technology shows significant and promising advancement towards sustainable mining. Further innovation in other stages of the mining process will help to reduce the environmental footprint of the mining industry.¹⁴

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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Renewable energy policy moves towards circularity

Authors: Matt Baumgurtel, Kusum KC and Anne Pan

The renewable energy industry currently operates within the traditional linear economy model characterised by a “take-make-dispose” approach. This approach not only contributes to waste but also undermines the sustainability principles at the heart of the energy transition.

A circular economy, by contrast, prioritises resource efficiency, reuse, and recycling, ensuring that materials such as solar panels, wind turbine blades, and lithium-ion batteries are repurposed rather than disposed of, extending their lifecycle and reducing environmental impact.

Achieving this shift, however, requires more than just industry goodwill — it demands strong policy frameworks and governance mechanisms to support innovation, investment, and infrastructure for circularity.

Recognising this, the Australian Government took a significant step in 2024 by launching [Australia's Circular Economy Framework](#) (the ‘**Framework**’) with the ambitious goal of doubling circularity by 2035.

Current policies on circular economy

As of 10 February 2025, the following policies and regulations are currently in place across States and Territories to support the transition to a circular economy:

New South Wales	Circular Economy Policy (2019) Renewable Energy Planning Framework (2024)
Queensland	Waste Management and Resource Recovery Strategy (2019)
Victoria	Recycling Victoria: A New Economy (2020)
Western Australia	Waste Avoidance and Resource Recovery Strategy 2030 (2024)
South Australia	South Australia's Waste Strategy 2020-2025
Tasmania	Draft Waste Action Plan (2019)
Australian Capital Territory	Circular Economy Act 2023
Northern Territory	Circular Economy Strategy 2022-2027

The national Framework sits above and consolidates the underlying objectives of the various policies and frameworks. The three key targets of the national Framework are:

1. to reduce Australia's per capita material footprint by 10%;
2. lift material productivity by 30%; and
3. safely recover 80% of resources by 2035.

At the national level, there are also several investment instruments that support a circular economy including the \$7 billion Northern Australia Infrastructure Facility launched in July 2016 and the \$15 billion National Reconstruction Fund launched in November 2023.

As it stands, despite housing 0.33% of the global population,¹ Australia generates 4.5% of global emissions, of which 80% comes from fossil fuel exports.² Australia's circularity rate is just 4.6%, falling below the global average of 7.2%. Australia also has the highest material footprint per capita among G20 nations and generates only \$1.20 USD in economic output per kilogram of materials consumed—significantly lower than the OECD average of \$2.50 USD. By doubling circularity, Australia has the potential to realise a net economic benefit of \$26 billion in GDP by 2035.



The framework and the renewable energy industry

By the time Australia introduced the Framework, three-quarters of G20 countries had already established national circular economy strategies. The Framework was designed to align with emerging global supply chain priorities to enhance the competitiveness of Australian exports.

CSIRO identified mining, construction, manufacturing, agriculture and resource recovery as the five key industries with the most potential to advance circularity in Australia.³ The renewable energy sector touches on all these industries and plays a key role in the transition serving as both an indicator of the transition and a driver of circularity through the recycling and repurposing of critical materials. In addition to critical minerals, there is also opportunity for Australia to export green steel and other sustainable materials.

Critical minerals

Critical minerals are essential for producing renewable energy technologies, and demand is expected to exceed supply over time. Given the parallel pursuit of net zero targets, there has been an accelerated increase in the adoption of renewable energy technologies, including in Australia. This led the government to develop and launch the Critical Minerals Strategy 2023–2030 in 2022, which also prioritises circularity and

highlights the need to develop downstream processing capabilities.

The end-of-life management of renewable energy technologies (such as batteries and solar photovoltaics) must involve the recovery and reuse of valuable materials and minerals to give Australia a competitive advantage in the resources industry. This requires investment in innovation and infrastructure to develop new methods to extract valuable minerals from waste and renewable technologies.

Leveraging best practices to advance Australia's circular economy

Given that Australia currently lags behind other advanced economies in promoting circularity, Australia has a unique opportunity to combine the traditional ecological knowledge of First Nations Peoples with the strategies of other global economies to create a more sustainable and competitive circular economy.

Consultations with First Nations People

The Australian Government should consult with First Nations communities who have long implemented knowledge systems that embody circular economy principles, such as “caring for Country, minimising waste and ensuring the natural environment thrives for future generations”. The First Nations Peoples traditional

knowledge of sustainable practices offers valuable insights into a circular economy that emphasises respect for the environment, long-term planning, and holistic approaches to resource use.

European Union (EU)

The EU is a global leader in establishing a circular economy, with a circularity rate of 11.5%. One of their most successful schemes is the ‘Extended producer responsibility scheme’, which mandates all electrical goods producers in the EU to cover the costs of recycling their products. This approach incentivised producers to maximise product life cycles, in turn reducing waste and providing consumers with better quality goods.

Alongside this, the EU recognised the significant role of renewable technology in achieving circularity, and rapidly expanded the industry and actively reduced the use of fossil fuels. This shift contributed to a significant 8% reduction in greenhouse gas emissions in 2023.⁴

Taiwan

Similarly, Taiwan invested in comprehensive renewable energy distribution programs which included detailed maps of wind, photovoltaic and hydroelectricity energy resources which has led to substantial developments in the renewable energy sector.

In 1997, Taiwan introduced a ‘4-in-1 Recycling Program’, which required manufacturers and importers to pay fees that subsidised recycling. This initiative led to a dramatic reduction in municipal solid waste, from 1.14 kg per person per day in 1997 to just 0.4 kg in 2011.

The above case studies demonstrate the effectiveness of integrating circular economy principles with renewable energy advancements to promote sustainability, develop durable goods and reduce waste.

Moving forward

As the Framework is relatively new, it is essential that its implementation is closely monitored to assess its effectiveness and adapted as required. As policymakers are aware, businesses and industry stakeholders are more likely to comply when compliance is straightforward. Therefore, it is essential for federal and state governments to continue to harmonise policies and regulations across the renewable energy sector, and more broadly, to encourage greater participation and facilitate a more effective transition to a circular economy.

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New Energy Expert Insights

MIHG Technology and the Future of Waste-to-Energy Solutions with Wildfire Energy

Authors: Matt Baumgurtel, David O'Carroll and Lily Clements-Markham



In this edition of New Energy Expert Insights, we sat down with Jamie Roodenrys, General Manager of Commercial and Strategic Partnerships, and Greg Perkins, Chief Executive Officer of Wildfire Energy, to discuss their proprietary Moving Injection Horizontal Gasification (MIHG) technology and its transformative potential for waste-to-energy solutions.

[Wildfire Energy](#) is an Australian cleantech early-stage company focused on developing and deploying MIHG, an innovative gasification technology, to convert landfill-bound waste into sustainable fuels and renewable energy products.

How does MIHG technology work and how does it differentiate itself from other waste-to-energy technologies?

MIHG technology offers a distinctive alternative to conventional waste-to-energy systems, such as incineration, which involves combusting waste to generate heat and produce electricity.

Unlike incineration, MIHG utilises gasification, where waste is subjected to high temperatures in a controlled oxygen environment. This produces syngas, which is composed predominantly of carbon monoxide and hydrogen. This syngas can then be converted into various energy products, including hydrogen, methanol, biofuels and renewable diesel, highlighting the versatility of MIHG.

A key differentiator of MIHG is its innovative reactor design. Rather than moving the waste through the reactor, MIHG shifts the reaction zone through the waste. This approach

optimises operational efficiency and enables smaller-scale, distributed energy generation, effectively servicing population centres as small as 25,000 people.

Moreover, MIHG is particularly adept at managing diverse waste feedstocks, including those with varying physical properties and contaminants. The technology's ability to handle such variability is a significant strength, as it eliminates the need for extensive pre-treatment and complex feeding mechanisms.

What types of waste are targeted for processing, and what are the associated economic and environmental benefits?

The focus is waste that is destined for landfill, which aligns with existing policy frameworks and economic incentives supporting waste-to-energy projects.

Governments across Australia have implemented waste levies that impose costs on waste disposal, creating a financial incentive to divert waste from landfills. These levies encourage increased recycling and support the development of waste-to-energy technologies to process post-recycling residual waste streams.

Targeting waste with negative economic value – that is, waste that incurs disposal costs – allows for the generation of significant revenue from accepting and processing this material. This revenue is essential for the financial viability of smaller-scale projects, ensuring the sustainability of the business model.

Currently, the recovery of waste from existing landfills presents technical and economic challenges, making it less feasible. However, from an environmental standpoint, diverting waste is crucial to avoid significant methane emissions that landfills are unable to effectively capture.

While the quantity of methane emitted by individual landfills varies, on average there is approximately one tonne of CO₂eq emissions for every tonne of waste placed into landfills.

“By processing this waste with our MIHG technology, methane emissions are avoided, and a beneficial source of renewable energy is generated.”

Australian Carbon Credits Units are earned by avoiding methane emissions from landfills.

What are the main outputs and to what degree can you tailor that output?

In the MIHG process, the primary product of gasification is syngas, a mixture of gases mainly composed of carbon monoxide and hydrogen, along with smaller amounts of methane and higher hydrocarbons. This syngas is generated through the thermal conversion of waste. The raw syngas contains contaminants from the waste such as sulfur, chlorine, and heavy metals.

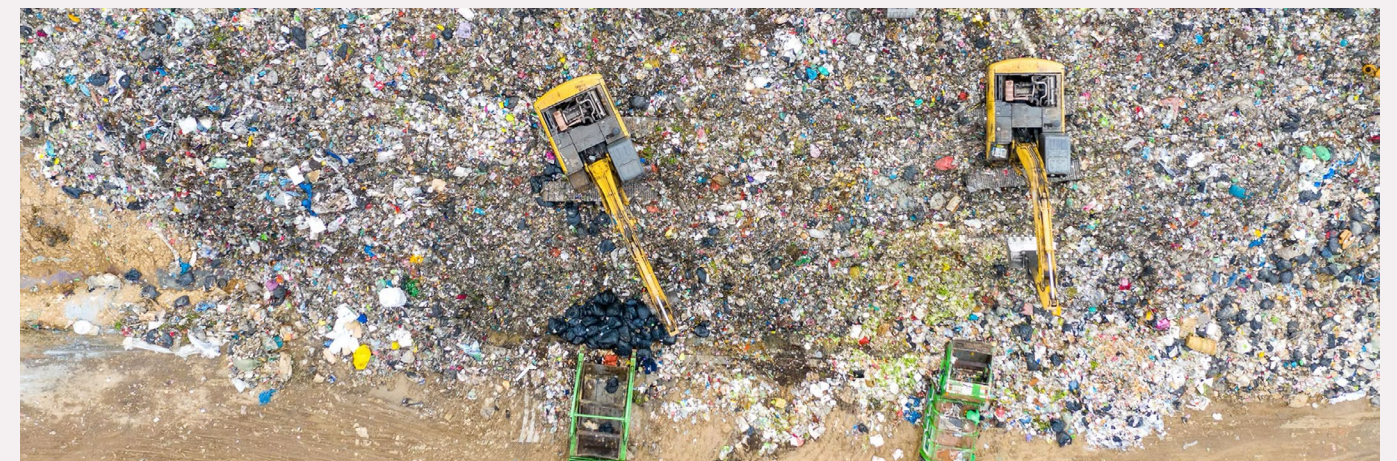
These need to be effectively managed for two reasons:

- 1. Equipment integrity:** Contaminants can damage the equipment used in subsequent stages of processing the gas and converting it to a final product, such as electricity. Removing these impurities ensures the longevity and efficiency of the plant equipment.
- 2. Regulatory compliance:** To meet environmental standards and air quality regulations, it is essential to clean the syngas of harmful substances.

For gas cleaning, proven, off-the-shelf technologies are employed, which have been effective in the energy sector for decades. While these technologies are not proprietary, their selection and implementation are guided by extensive expertise.

After purification, the syngas can be converted into various products, depending on the intended output. The complexity of this conversion varies:

- a. Electricity:** Generating electricity is the most straightforward application. Gas engines, similar to those used in landfill gas applications, are employed with minor modifications. These engines can also produce heat, which can be utilised for various industrial processes.
- 2. Hydrogen:** Hydrogen production utilises equipment traditionally used for hydrogen generation from natural gas. This equipment is adapted to concentrate and separate hydrogen from the syngas, enabling the production of carbon negative ‘green’ hydrogen from waste.



3. Renewable diesel, chemicals or methanol:
Producing liquid biofuels such as renewable diesel or chemicals involves advanced processing. Specialised catalysts are used to synthesise these liquids from purified syngas. This stage requires extensive purification because the catalysts are sensitive to contaminants.

What is done with the residual product from the first stage of the gasification process?

In the gasification process, the primary residual product is known as slag. This byproduct resembles the output from a blast furnace and is essentially a rocky aggregate. During gasification, materials that do not convert into gas – such as ceramics, metals, glass, and other inert substances – accumulate as slag. Despite the reactor’s high temperatures of up to 1500°C, these materials cannot be converted into gas and are classified as inert.

The slag forms a molten liquid that drips to the bottom of the reactor. As it cools, it solidifies into a rocky aggregate with sizes ranging from a golf ball to a softball. This material is brittle, making it relatively easy to crush.

The inert nature of the slag, coupled with its high-temperature processing, makes it suitable for reuse in construction. It can be employed as aggregate in road base, concrete and other construction materials, providing a valuable

alternative to traditional materials. The slag represents about 10-15% of the total volume processed, and its reuse helps reduce the demand for more resource-intensive materials.

The other byproduct of the reactor is biochar which can be removed as a separate product or reintroduced into the reactor and converted completely to syngas. Biochar, which is mostly carbon, has a range of applications. It is particularly useful for capturing carbon as a solid which is much more cost effective than capturing CO2 and finding a use or suitable storage site. Biochar from processing biomass can be used as soil conditioner and incorporated into building products. Wildfire Energy is currently investigating the best end use applications of biochar derived from wastes.

What energy input is required, and where does it come from?

The primary energy source for the process is derived from the waste itself. In the gasification reactor, waste is subjected to a controlled environment with low oxygen content. Oxygen is then injected, and the system is heated, allowing the waste to release its energy as a gas. The energy content of the waste typically ranges from 10 to 20 megajoules per kilogram, which is approximately one-third to one-half of the energy value of coal. This indicates that waste holds substantial energy potential.

Initially, a small amount of external electricity is required to start the system, such as powering lights and initiating operations. However, once the process is underway, the facility becomes a net exporter of electricity. The facility generates sufficient power to operate independently, relying on the energy released from the waste.

“In addition to producing electricity, the MIHG process can generate significant volumes of hydrogen which can be easily extracted and concentrated to power fuel cell vehicles.”

During hydrogen concentration, the non-hydrogen gases are separated from the syngas, including methane, carbon monoxide, and carbon dioxide. These byproduct gases, known as tail gas, can be utilised in generators to produce additional electricity, ensuring that the plant remains self-sufficient.

What are the operational costs associated with the plant, and what economic benefits does it bring to local communities?

Operational costs for the plant primarily include labour, maintenance, and the procurement of necessary consumables and materials. Managing solid waste requires a workforce to handle waste, transportation, and reactor operation. This includes overseeing plant operations and maintaining equipment, which entails both fixed and variable costs for repairs and replacements.

Specifically, labour costs are significant, given the need for skilled personnel to operate and maintain the waste processing and power generation components of the plant. In addition to traditional waste management roles, the plant’s power generation aspect demands well-qualified professionals with technical expertise.

For example, a Wildfire Energy project currently advancing in regional Queensland is expected to create between 12 and 18 full-time jobs. These roles will encompass both waste management and power station operations, requiring a mix of manual and technical skills. The plant’s capital investment is estimated at \$50-60 million, and it is projected to generate approximately \$20 million in annual revenue. This revenue will benefit the local economy by creating jobs and supporting community development.

Local governments have shown support for such projects because they not only reduce carbon emissions and divert waste from landfills but also stimulate economic growth by providing valuable employment opportunities. Moreover, MIHG technology addresses a significant gap in

the energy-to-waste sector by providing valuable solutions for smaller towns and cities with populations of 25,000-200,000. Unlike existing waste-to-energy technologies that are typically feasible only in larger metropolitan areas, MIHG technology allows for deployment in smaller communities, thereby enhancing its overall impact and accessibility.

How is the customer base evolving, and what types of customers and products are being targeted?

As the technology matures, the customer base is expected to evolve. Initially, the focus was on early adopters, such as multinational corporations with significant waste management needs or a keen interest in new technologies to reduce carbon emissions. These early-stage customers are often seeking solutions to their waste issues or aiming to produce lower-cost hydrogen.

For instance, many corporations are interested in affordable hydrogen production. By leveraging waste disposal costs through waste levies, the MIHG technology can achieve a levelised cost of around \$1 to \$2 per kilogram of hydrogen. This cost aligns with the Australian Government’s 2030 target for hydrogen pricing. Current hydrogen projects based on electrolysis face challenges due to high power prices, making this cost-effective hydrogen production method particularly attractive.

In addition to hydrogen, sustainable fuels are another key focus area. The hydrogen industry, while promising, still faces hurdles related to distribution and infrastructure. In contrast, sustainable fuels are drop-in ready and therefore offer more immediate applications. For example, sustainable aviation fuel can be used in aircraft today, and renewable diesel can replace fossil diesel in existing truck fleets.

Although producing these fuels involves a more complex value chain with a high capital intensity, there is significant interest and potential in this area. Future announcements are anticipated as efforts in sustainable fuels continue to gain traction.

How does the approach to smaller scale waste-to-energy projects address community concerns and regulatory challenges?

Wildfire Energy’s approach to smaller scale waste-to-energy projects focuses on addressing waste management issues at a community level while producing high value products.



These projects are designed to mitigate local waste problems rather than imposing solutions on broader regions, which helps to build community support and minimise resistance.

A key aspect of this model is its alignment with the principle of local waste management. By targeting communities to manage their own waste, the approach reduces concerns about disproportionate burdens on particular communities and social license issues. Communities are more likely to support and engage with projects when they perceive that they are solving their own waste problems, rather than being responsible for the waste of others.

Regulatory and site-specific factors are also carefully considered. Projects can be strategically located at greenfield industrial parks, existing landfills or waste transfer stations to minimise potential objections and regulatory hurdles.

In the early stages of project development, a ‘heat map’ approach is used to identify optimal locations based on regulatory conditions and community acceptance. This ensures that projects are implemented in areas where they can be commercially viable, operate smoothly and gain the necessary support.

The approach emphasises careful site selection and community involvement, aiming to reduce friction and foster positive relationships with local stakeholders.

How has government support and venture capital contributed to the development and expansion of your waste-to-energy projects?

The development and expansion of waste-to-energy projects have received substantial support from both state and federal governments in Australia. Significant grants and competitive funding have been secured by Wildfire Energy from entities such as the Queensland Government and the Australian Federal Government, demonstrating strong governmental backing for these initiatives.

Transitioning from pilot plants, which typically involve moderate costs, to full scale commercial plants requires considerable investment. For instance, while a pilot plant may cost a few million dollars, scaling up to a commercial facility can exceed \$20 million. Although there is robust support for first-of-a-kind plants and renewable energy technologies from organisations like

the Australian Renewable Energy Agency, challenges remain. Current funding programs often focus on achieving renewable energy targets rather than supporting new, innovative technologies developed domestically. This can create a gap in support for indigenous innovation versus the adoption of established overseas technologies.

In addition to government support, venture capital has played a crucial role in the growth of Wildfire Energy. Initial investments helped scale the technology from a small pilot plant to a more advanced setup. The involvement of a lead investor from a Japanese corporation is paving the way for further expansion and development of larger plants. This backing not only supports domestic growth but also facilitates international expansion, with ongoing efforts to identify attractive opportunities and supportive government policies in Europe, Asia and North America.

The Australian Government’s international trade and investment bodies, such as AUSTRADE and Trade and Investment Queensland, have also been instrumental. They have provided valuable connections and promoted our innovative Australian technologies globally. Their support includes facilitating introductions to potential investors and projects, which helps amplify the impact of these technologies and fosters revenue growth both domestically and internationally.

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New Energy Associates Network (NEAN): Fireside Chat on Sustainable Fuels with Wildfire Energy

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 12 February, the New Energy Associates Network (**NEAN**) hosted its latest fireside chat at Hamilton Locke’s new office in Brisbane. David O’Carroll, Senior Associate sat down with Greg Perkins, CEO and Jamie Roodenrys, General manager of Commercial and Strategic Partnerships, from Wildfire Energy to discuss the future of sustainable fuels and Wildfire Energy’s patented Moving Injection Horizontal Gasification (**MIHG**) technology.

MIHG technology repurposes heterogeneous waste into sustainable fuels like hydrogen, biochar and electricity to create sustainable waste-to-energy solutions.

The discussion revolved around MIHG technology’s application to the waste to-energy industry, how developing technologies can contribute to the circular economy and the social licensing concerns of new energy projects. Wildfire Energy also discussed their experience with gauging community support, i.e. that a social license is more likely to be granted where communities perceive that the project is solving their own waste problems, rather than being responsible for the waste of others.



The conversation also focussed on the regulatory landscape and market opportunities for waste-to-energy projects across Australia. In Queensland, councils are incentivised to collaborate with Wildfire Energy and are leading project development. In contrast, other states present greater regulatory challenges, making it more difficult for startups to innovate and scale.

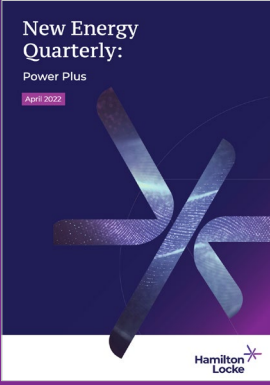
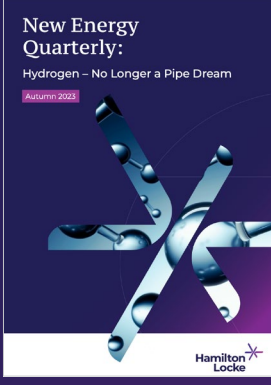
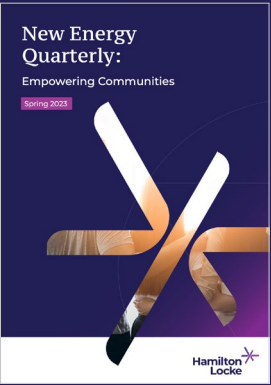
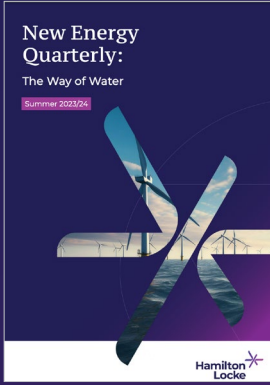
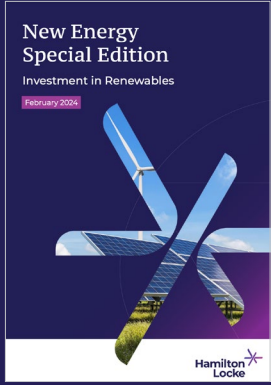
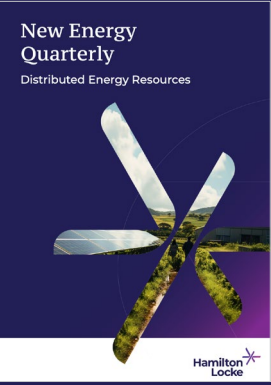
We were delighted to see so many professionals interested in the development of new energy technologies and look forward to the next NEAN event!

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

Please reach out to David O'Carroll.



New Energy Quarterlies



Expert Insights



Developments in the Australian Hydrogen market – Jean-Louis Salinas (Siemens Energy)



Digital Power with Guy Dickinson from BetaCarbon



The Global Energy Crisis and Hydrogen's Opportunity



Energy Storage in Australia with GRS and E22



The Truth about Blue Hydrogen – a Necessity in the Energy Transition?



Unlocking Energy Storage Potential with Lucas Sadler of Energy Vault



Is C&I Solar the next big generator?



Floating Floatovoltaics with Ross Warby and Craig Jones



How to Revenue Stack your Battery – New Energy Expert Insights with Marija Petkovic of Energy Synapse



Andrew Dyer's experiences with community engagement during the energy transition



Is C&I Solar the next big generator? A discussion with Asif Hussain, David Xu, Myles Carrucan, Anthony Headlam, John Sheehy and Rodrigo Arias



Investment outlook for the renewable energy sector with Rodrigo Arias Lopez of Pottinger



SMS: The Early Bidder Catches the Worm with Quintas Energy



Distributed Energy Resources with Myles Carrucan – Green Peak Energy



SMS: The Early Bidder Catches the Worm with Fluence Digital



Marine Ecology and Australian Offshore Wind Farms with Dr Rachel Przeslawski



Harvesting the Sun – Distributed Energy Resources and Agrivoltaics with Dr Madeline Taylor of Macquarie University.



Community Engagement for Better New Energy Projects with Amy Kean and Luke Osborne – Stride Renewables