SUBMISSION

Submission to the Standing Committee on Climate Change, Energy, Environment and Water

Submission to the Inquiry into Solar Panel Reuse and Recycling in Australia

30 March 2026

While waste from solar panels is a relatively small issue compared with managing waste from some other forms of energy generation, recycling directly reduces domestic waste-to-landfill streams and could enable long-term potential benefits across multiple environmental, technological, and strategic imperatives. The Australian Government has an opportunity to coordinate its approach to end-of-lifecycle solar panel management while this potential industry is still in its infancy, not only reducing waste but allow for critical minerals to be reused. This submission focuses on the inquiry's Terms of Reference concerning potential benefits of resource recovery from solar panels, the state of technology and markets for solar panel recycling, barriers to recycling solar panels at scale and policy options to overcome these challenges.

ATSE makes the following recommendations:

Recommendation 1: Integrate solar panel recycling into the Critical Minerals Strategy.

Recommendation 2: Emphasise government support beyond the National Solar Panel Recycling Pilot Program as contingent on facilities' capacity to demonstrate independent sustainability and operational integrity.

Recommendation 3: Establish a solar panel product stewardship scheme.

Recommendation 4: Scale up successful programs to increase the STEM (science, technology, engineering and mathematics) skilled workforce to support the viability of the solar recycling industry.

Recommendation 5: Institute embedded design-for-recyclability standards for imports.

Recommendation 6: Create a national material inventory and traceability framework for solar panel fabrication.

Unlocking opportunities in solar panel recycling

Australia remains a global leader in solar panel deployment and integration (ACAP 2024). Consistent annual growth in small-scale residential installations, coupled with an increase of large-scale projects, has led to a total of 4.3 million rooftop solar PV installations operating in Australia as of December 2025 (Clean Energy Council 2025). This growth in solar generation capacity remains a critical part of Australia's efforts to meet its 2030 emissions reduction obligations (DCCEEW, 2025). By 2029-2030, Australia's domestic solar PV energy capacity is projected to exceed the required amount by 1GW (AEMO 2024, CEC 2025).

As ATSE has previously recognised, the mass installation of solar panels has resulted in an emerging waste stream (ATSE 2020). End-of-lifecycle solar panel waste is projected to exceed 100,000 tonnes annually by 2030-35, an 18-fold increase in PV waste since 2019 (ACAP 2024, Productivity Commission 2025). Australian residential solar panel installations, being the first type of at-scale installations to occur in Australia, have only just begun to reach the end of their lifecycle. As a result, the waste from these installations currently represents the majority of potential feedstock for solar recycling facilities (ACAP 2024). This proportion is projected to shift as larger amounts of (more recently installed) commercial, industrial and utility-scale systems reach the end of their lifecycle. (ISF 2020) Around four-fifths of residential systems will reach end of their lifecycle before utility-scale systems, with waste from large-scale systems projected to grow from 2030 onwards (ACAP 2024).

The projected increase in the retirement of large-scale solar installations also presents an opportunity to develop domestic capacity for sustainable, economically beneficial forms of critical mineral recovery, as outlined in ATSE's recent submission to the inquiry into factors shaping social licence and economic development outcomes in critical minerals projects across Australia (ATSE 2026). As this submission notes, advanced resource recovery technologies are increasingly available in Australia. However, their widespread, industrial-scale deployment is not yet to be proven economically feasible (ATSE 2026). While approximately 95% of a solar panel's materials could be recycled based on available technologies (CEC, 2025), as of August 2023, Australia only recycles approximately 17% of solar panel componentry (the aluminium frame and junction boxes). The remaining 83% of materials (glass, silicon and polymer back sheeting) are treated as waste, due to a lack of capacity to cost-effectively recycle these materials domestically (Baumgurtel and van der Merwe 2024). While the aluminium and copper componentry of solar panels is relatively accessible to recover, glass and silicon require more advanced recycling technologies and processes (Smart Energy Council 2026).

End-of-lifecycle solar panels also contain small amounts of other critical minerals. In the long term, supporting mineral recovery innovations can prove both economical and strategically beneficial for

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Australia. For example, small amounts of high-purity silver are contained in end-of-lifecycle solar panels. Researchers at the University of Newcastle have recently developed a process for reclaiming silver from solar PV silicon wafers through a froth floatation method, avoiding the conventional use of acid-based leaching in silver recovery. (UoN 2025). Assuming a consistently high-volume feedstock, minerals like silver, when recycled and reclaimed at a large enough scale, are valuable and reusable strategic resources.

On average, the contents comprising a typical 20-kilogram solar PV panel has an estimated material value of around A$20–$30, with the cumulative recoverable value from Australia's end-of-life panels projected to exceed A$1 billion by 2035 (ACAP 2024). Australia's domestic capacity for mineral reuse also has significant implications for resource sovereignty noting increasing global supply chain precarity.

Understanding Australia's facilities for mineral recovery as part of our critical minerals strategy changes both the investment case and the responsible government stakeholders. Recycling and reprocessing are both noted as a possibility in the Critical Minerals Strategy 2023–2030 (DISR 2023). Noting that this Strategy is due for review in 2026, there is an opportunity to consider solar panel recycling and supporting government actions in more detail for its next iteration. For example, the Australian Government could explore co-funding mechanisms for critical mineral recovery facilities and technologies, in collaboration with state governments, industry and Australian research institutions, to support development of this industry.

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Scaffolding development of the solar recycling industry

Australia's lack of domestic recycling capacity for high-value materials may indicate that the private sector currently faces too much uncertainty to invest in advanced recovery technology and facilities. This is illustrated by Sircel, one of Australia's biggest solar panel recycling firms, going into voluntary administration last year amid long-term revenue uncertainty (Sircel 2025). This example demonstrates the risk faced by early movers in the private sector when recycling capacity is built in advance of feedstock certainty, highlighting the need for government support to establish and secure a countries' baseline domestic capacity before industry can scale up activity.

The Federal Government has leveraged its ability to kickstart advanced domestic recycling facilities through establishing a three-year National Solar Panel Recycling Pilot Program. Citing the Productivity Commission's report into Australia's circular economy, this program, estimated to start in mid-2026, aims to develop a sustainable national solution for recycling end-of-life solar panels (Productivity Commission, 2025; DCCEEW 2026). This program demonstrates foresight by establishing facilities in advance of projected significant increases in solar panel feedstock from retired installations in coming years. Any continued government support beyond this three-year program could aim to ensure that domestic recycling facilities are able to self-sustain upon scaling up their activity. In flagging its expectations, the Australian Government would signal to the private sector a willingness to invest in facilities' baseline capacity while establishing longer-term expectations of achieving independent operational integrity. This approach to strategic government investment, aimed to consolidate Australian industrial capacity while boosting private sector confidence, aligns strongly with Federal government's 'Future Made in Australia' strategy (Australian Government, 2024).

ATSE recommends that the next step would be to establish a solar panel product stewardship scheme. The need to shift to circular economy principles across a range of products was highlighted in ATSE's *Towards a Waste-Free Future* report (ATSE, 2020). The report notes the importance of both designing products for recovery and implementing product stewardship schemes. Product stewardship requirements shift a degree of cost and responsibility to manufacturers, importers, and end-users. Currently there is no framework around product stewardship for solar panels. The establishment of a national product stewardship scheme for small-scale solar panel systems has been identified as an urgent need by the Productivity Commission's Circular Economy Inquiry Report (2025). Their report highlights that a national product stewardship scheme for small-scale solar PV would have a net economic benefit of $7.3 billion. The National Solar Panel Recycling Pilot Program will provide initial proof-of-concept and provide data about demand for a product stewardship scheme. Should this Pilot prove successful, ATSE recommends the establishment of an ongoing product stewardship scheme that would reduce the volume of components going to landfill, provide certainty of feedstock for the recycling industry, and enable households to access a clear and easy pathway for disposal for end-of-life solar PVs.

Additionally, the effectiveness of any product stewardship scheme will be largely dependent on skilled workforce capacity. This is specifically mentioned in relation to product stewardship schemes in ATSE's

report, *Towards a Waste Free Future.* (ATSE 2020) Australia's technical skill shortages impact our access to the relevant expertise in mining, critical minerals recovery, and electrical engineering, among others (CEC 2023, ATSE 2026). Skills shortages, particularly in STEM (science, technology, engineering and mathematics) disciplines have been a persistent limitation across numerous sectors (ATSE 2022). Similarly, this shortage will bottleneck Australia's potential to develop and maintain solar PV recovery facilities and place additional demands on the skilled workforce (Smart Energy Council 2025). Targeted investment in upskilling programs will bolster Australia's domestic industrial capacity for resource recovery as well as across other sectors requiring STEM skills. Scaling up proven programs to build up the STEM-skilled workforce, such as ATSE's *Elevate: Boosting diversity in STEM* scholarship program, is one mechanism to address these shortages.

Recommendation 2: Emphasise government support beyond the National Solar Panel Recycling Pilot Program as contingent on facilities' capacity to demonstrate independent sustainability and operational integrity. **Recommendation 3:** Establish a solar panel product stewardship scheme.

Recommendation 4: Scale up successful programs to increase the STEM (science, technology, engineering and mathematics) skilled workforce to support the viability of the solar recycling industry.

Designing for recyclability of solar panels

Requiring design-for-recyclability standards for solar PVs, including imported products, would improve the economic viability of recycling. Australia's heavy reliance on imported modules means that waste outcomes are currently dictated by international designs prioritising durability over ease of disassembly. ATSE recommends requiring "smart design" principles for imported solar panels, primarily aimed at maximising the recyclability of these panels within domestic facilities. This could include requirements for modular construction, or standardised material labelling. The International Energy Agency's design-for-recyclability guidelines for solar PV module design could be used as a starting point for standards development for Australia (International Energy Agency 2021).

In addition to recycling household solar PVs, there will be a future need to manage waste from decommissioned utility-scale solar installation projects. Australia's first wave of utility-scale solar installations is scheduled to reach the end of their life within the next decade. In the circumstance that developers become insolvent or abandon projects before decommissioning, there is a risk of leaving orphaned assets. The challenges from decommissioning utility-scale solar projects mirror some decommissioning challenges from other energy sources. ATSE's report on Offshore Oil and Gas Decommissioning highlights the difficulty in estimating and recovering decommissioning costs, which can result in governments having to intervene and bear costs to ensure decommissioning is complete (ATSE, 2024). However, for solar PV decommissioning, there is the additional incentive of recovering valuable critical minerals. This suggests a potential market-based solution for managing and budgeting for decommissioning solar farms.

To support product stewardship requirements across domestic and utility-scale solar PV recycling, ATSE recommends that the Australian Government, in collaboration with state governments, establishes a national material inventory and traceability framework for solar panel fabrication. This could serve as a transparent accounting system designed to track the volumes, flows, and resulting material value of imported and domestic PV technology in Australia. This would ultimately allow recyclers to identify and recover these materials at their highest value, rather than treating them as low-grade waste or landfilling them. Importantly, this would also bolster private sector clarity regarding potential return on investment in facilities. This traceability framework could be incorporated into the National Solar Panel Recycling Pilot to provide the initial data that would support design of an appropriate long-term stewardship scheme.

Recommendation 5: Institute embedded design-for-recyclability standards for imports.

Recommendation 6: Create a national material inventory and traceability framework for solar panel fabrication.

ATSE thanks the Standing Committee on Climate Change, Energy, Environment and Water for the opportunity respond to the inquiry into Solar Panel Reuse and Recycling in Australia. For further information, please contact academypolicyteam@atse.org.au.

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References

ACAP (2024) *Scoping Study: Solar Panel End-of-Life Management in Australia*. https://www.acap.org.au/post/solar-panel-recycling-end-of-life-management-scoping-study

AEMO (2024) *Appendix 2. Generation and Storage Development - Appendix to the 2024 Integrated System Plan for the National Electricity Market*.https://www.aemo.com.au/-/media/files/major-publications/isp/2024/appendices/a2-generation-and-storage-development-opportunities.pdf?la=en

ATSE (2020) *Towards a Waste-Free Future.* https://atse.org.au/media/1jligyqm/atse-towards-a-waste-free-future-report-low-res.pdf

ATSE (2022) *Our STEM Skilled Future.* https://www.atse.org.au/media/aaej5idk/atse-education-report-our-stem-skilled-future.pdf

ATSE (2024) *Offshore oil and gas decommissioning – Technologies.* https://www.atse.org.au/what-we-do/strategic-advice/offshore-oil-and-gas-decommissioning-technologies

ATSE. (2026). *Submission to the inquiry into factors shaping social licence and economic development outcomes in critical minerals projects across Australia.* sbm-2026-02-27-inquiry-into-outcomes-in-critical-minerals-projects-final.pdf

Australian Government (2024) *A Future Made in Australia.* https://archive.budget.gov.au/2024-25/factsheets/download/factsheet-fmia.pdf

Baumgurtel and Van Der Merwe (2024) *Australia's Solar Panel Recycling Challenge and Market Outlook.* https://hamiltonlocke.com.au/australias-solar-panel-recycling-challenge-and-market-outlook/

CEC (2023) *Skilling the Energy Transition.* https://cleanenergycouncil.org.au/news-resources/skilling-the-energy-transition

CEC (2025) *Rooftop Solar and Storage Report – July-December 2025.* https://cleanenergycouncil.org.au/getmedia/16ed1cff-8ddb-423a-b3ad-3f9fa8e4d594/rooftop-solar-and-storage-biannual-report_july-december-2025.pdf

CEC (2025a) *Recycling the future: sustainable solutions for renewable energy technologies.* https://cleanenergycouncil.org.au/for-consumers/fact-sheets/recycling-get-the-facts/recyling-wind-turbines-solar-panels-batteries

DCCEEW (2025) *Australia's Net Zero Plan.* https://www.dcceew.gov.au/sites/default/files/documents/net-zero-report.pdf

DCCEEW (2026) *Joint media release: Labor pilots national solar panel recycling program.* https://minister.dcceew.gov.au/bowen/media-releases/joint-media-release-labor-pilots-national-solar-panel-recycling-program

DISR (2023) *Critical Minerals Strategy 2023-2030.* https://www.industry.gov.au/publications/critical-minerals-strategy-2023-2030

International Energy Agency (2021) *PV Module Design for Recycling Guidelines.* https://iea-pvps.org/key-topics/pv-module-design-for-recycling-guidelines/

Productivity Commission (2025) *Australia's circular economy: unlocking the opportunities*. https://assets.pc.gov.au/2025-10/circular-economy.pdf?VersionId=kzNYni.c_7M8UjMSOx3bhMmrRnJ.fWXa

ISF (2020) *Scoping study for photovoltaic panel and battery system reuse and recycling fund.* https://www.epa.nsw.gov.au/sites/default/files/isf-solar-pv-and-battery-recycling-report.pdf

Sircel (2025) *Update: Sircel Operations.* https://sircel.com/2025/11/17/update-sircel-operations/

Smart Energy Council (2025) *Solar Module Recycling.* https://smartenergy.org.au/wp-content/uploads/2025/12/Solar-Module-Recycling-2025.pdf

Smart Energy Council (2026) *Silicon in Solar Panels*. https://smartenergy.org.au/wp-content/uploads/2026/03/Silicon-in-Solar-Panels-1.pdf

UoN (2025) *Scientists find a fast, new way to recover high-grade silver from end-of-life solar panels.* https://www.newcastle.edu.au/news/2025/12/scientists-find-a-fast-new-way-to-recover-high-grade-silver-from-end-of-life-solar-panels

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