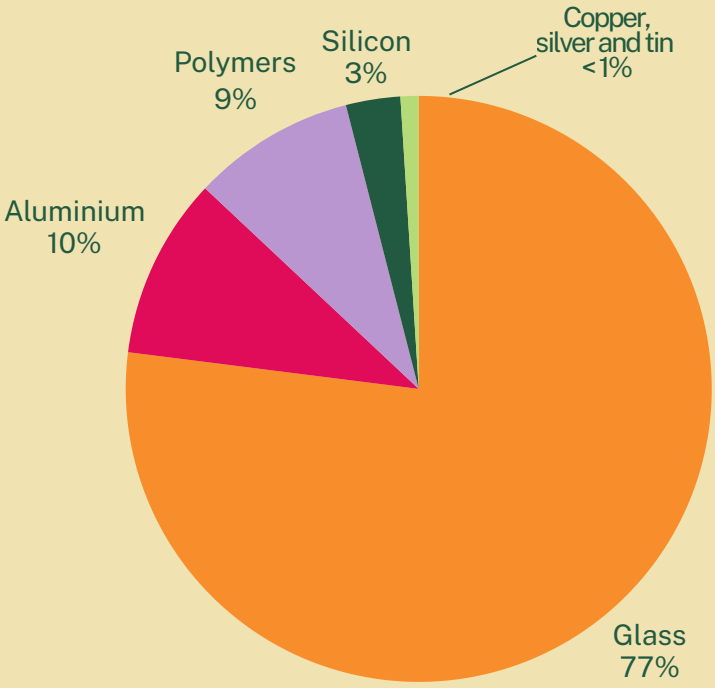
FACT SHEET

Safe and sustainable: debunking myths about solar panels

Solar photovoltaic (PV) technology plays a critical role in Australia's transition to renewable energy. While questions are often raised about solar panel materials, waste, and recyclability, research shows that PV modules have long lifespans, low toxicity, and contain valuable, recoverable materials. Compared with the vast waste streams from fossil fuels, solar panels generate only a fraction of the environmental impact.

95%
of a solar panel is recyclable

Solar panels are made of:



How does solar panel waste compare with other sources?
Recent studies have compared projected solar photovoltaic (PV) module waste with other major waste streams, including municipal waste, coal ash, plastic waste, e-waste, and oily sludge from crude oil production. Even under worst-case assumptions, global PV waste is expected to remain a fraction of the waste produced by fossil fuels. In fact, the world generates as much coal ash in **one month** as is expected from **all PV module waste produced over the next 35 years.**

What is the lifespan of a solar panel?
Large-scale photovoltaic panels are designed to last **25–30 years** and gradually lose efficiency over time. By the end of this period, most panels still generate around 85% of their original capacity, **continuing to produce clean electricity well beyond their nominal design life**. Advances in cell design and encapsulation materials are extending this lifespan even further, reducing replacement frequency and total waste volumes.

Are solar panels recyclable?
Yes — PV panels are mostly made from recyclable materials like aluminium, glass, silicon, and metals such as silver and copper. About 95% of a panel's materials can be recovered, though in Australia currently only around 17% (mainly frames and junction boxes) is recycled locally. Expanding domestic recycling would reduce exports and support a circular economy. As domestic recycling capacity grows, Australia has an opportunity to develop local PV waste management and resource recovery industries, reducing dependence on exports and supporting circular economy goals.

Are there any Australian facilities recycling solar PV modules?
There are now several solar PV recycling facilities that work to recycle end-of-life solar PV modules. This includes all associated materials such as cables, inverters, mounting structures and optimisers while using no chemicals.

Are there health or environmental concerns?
The International Energy Agency (IEA) confirms that commercially produced PV modules pose no significant human or environmental health risks. The only trace concern is the small amount of lead used in solder to connect cells. However, manufacturers are increasingly shifting toward lead-free solder and more sustainable manufacturing processes.
Compared with fossil fuels, solar PV systems produce negligible emissions and toxic waste during operation and at end of life.

Solar PV systems are long-lasting, largely recyclable, and low-toxicity, offering one of the most environmentally sustainable energy technologies available. While managing end-of-life panels is an emerging challenge, it also presents a significant opportunity for Australia to lead in renewable resource recovery, create green jobs, and close the loop in the clean energy supply chain.

Sources

- Fact sheet -Safe and sustainable: debunking myths about solar panels | Clean Energy Council | August 2025: https://cleanenergycouncil.org.au/for-consumers/fact-sheets
- Source (p1376): Unfounded concerns about photovoltaic module toxicity and waste are slowing decarbonization | Nature Physics

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FACT SHEET

Recycling and decommissioning: Solar and Battery technologies

Clean energy technologies, including wind turbines, solar photovoltaic panels and batteries, are essential for Australia's transition towards net zero. However, the renewable energy transition poses questions around recycling, waste management and decommissioning of large-scale renewable energy projects and household solar panels and batteries. The clean energy industry takes these issues very seriously and is constantly innovating to improve management of the resources used for clean energy technology and infrastructure.

What is decommissioning?
Decommissioning means wind turbines, site offices and any other infrastructure is removed from a site1. Disturbed areas and foundation pads are then covered and revegetated if necessary, allowing land to return to its former use. Sometimes, components of a project continue to service a functional purpose and will remain in place, following agreement from the landowner – for example, access tracks and fencing.

Who is responsible for decommissioning clean energy infrastructure?
The project owner is responsible for decommissioning. Requirements for decommissioning projects, such as land rehabilitation, are set out in the landowner contracts and planning and environmental approvals of the specific project.

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Can materials from large scale renewable energy projects be recycled?
Clean energy technology and infrastructure can be recycled and decommissioned to lower the environmental impact of the projects and present economic opportunities to reduce the consumption of critical materials. This can be done by recycling metals and other valuable resources or repairing and upgrading equipment to be utilised elsewhere.

Is there a time limit on decommissioning clean energy infrastructure?
Project contracts and approvals generally contain clauses around the amount of time between end-of-life of the infrastructure and decommissioning, including the expectations around rehabilitating the land and project site. If a clean energy project is sold, the new owner will take on the requirements and responsibilities contained in contracts with landowners and in planning and environmental approvals.

What happens if an asset becomes stranded and the owner can't afford to decommission it?
The risk of assets becoming stranded for clean energy projects is low since the resource (e.g. wind, sun) will continue to be available and is likely worth continued investment. Clean energy projects in this way are different to mining. In mining, a resource can be depleted, meaning the site has less value.

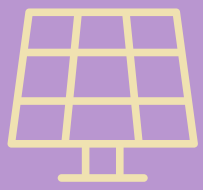
When does a project owner put aside finances for decommissioning?
The required finance for decommissioning can be generated in just a few years of operation, so in most cases financial assurance will take place around 3-5 years before end of life. The industry is currently investigating ways to give greater confidence (including financial products such as bonds) to community stakeholders who may be concerned about stranded assets.

Does clean energy infrastructure use a lot of raw materials?
Deployment, maintenance and replacement of clean energy infrastructure requires significant resources, including critical raw materials. As clean energy infrastructure is being built, the industry can prevent future loss of valuable resources to landfill by ensuring materials are recycled for future infrastructure and technology needs.

Can recycled materials be used in the manufacturing of clean energy technology?
By using recycled materials, we can reduce the use of raw materials in new energy-generating products and in other manufacturing sectors. Global competition for materials essential to the renewable energy transition is projected to increase in coming years. Use of recovered and recycled materials, including critical minerals that can be extracted from end-of-life renewables and electronics, can help meet these demands.

Solar

95%
of a solar panel is recyclable



25-30 years
average lifespan of large-scale photovoltaic solar panels

What is the lifespan of a solar panel?
Large-scale photovoltaic (PV) solar panels generally have a lifespan of 25 to 30 years and will naturally degrade or lose efficiency over time.

Are solar panels recyclable?
Photovoltaic solar panels consist of 95% recyclable materials, including aluminium, glass, silicon, silver, copper, indium and germanium. Materials like glass, aluminium frame, copper and junction box can be separated and repurposed. For example, the glass is being turned into asphalt and other elements shredded and added to building materials.

What parts of a solar panel can be recycled?
The panel's aluminium frame and junction/terminal box, which houses the electrical connections, are the most common components to be recycled.

How much solar panel waste will need recycling locally?
The cumulative volume of end-of-life solar panels in Australia is expected to reach 1 million tonnes by 2035 and the total material value from end-of-life solar panels is projected to surpass $1 billion.

The challenge right now is a lack of facilities in Australia that recycle solar panel recycling facilities in Australia to maximise the amount of materials being repurposed. A national approach to recycling solar panels is currently being developed, with the involvement of federal and state governments, industry and business so that capacity can better meet demand.

What are the environmental benefits of recycling PV solar panels?
The environmental benefits of recycling PV panels include the avoidance of global warming potential, ecotoxicity impacts and savings on water and energy. PV recycling can avoid the emission of up to 1.2 tonnes of carbon dioxide equivalent emissions for every tonne recycled.

What are the financial benefits of recycling PV solar panels?
Australia is potentially set to dispose of 34.6 GW worth of fully serviceable solar panels by 2045, which is the equivalent of all the solar panels installed in Australia today (August 2024). That provides an estimated economic value of $167 billion. Reusing these panels for continued renewable energy production could increase Australia's installed capacity by up to 17 per cent by 2035.

Battery

What are lithium-ion batteries?
Lithium-ion batteries are the predominant commercial form of rechargeable batteries, commonly used in consumer electronic electronics and electric transportation, including electric vehicles (EVs). Most plug-in hybrids and all EVs use lithium-ion batteries.

Can lithium-ion batteries be recycled?
Lithium-ion batteries are a source of many valuable materials. If recycled, potentially 100 per cent of battery components can be recovered for alternative use or may even be turned into new batteries.
Recycling typically involves collecting end-of-life batteries, extracting critical minerals, and repurposing them for new battery production.

100%
of a lithium-ion battery has the ability to be recycled

This method significantly cuts greenhouse gas emissions and energy consumption compared to traditional mining.

Beyond reducing environmental harm, battery recycling also strengthens supply chains by creating a circular economy where materials are continually reused rather than discarded.

Are batteries made of critical minerals?
Critical minerals are essential for manufacturing batteries, electric vehicles, solar panels and wind turbines. The demand for critical minerals for batteries is expected to grow rapidly by 2030, with manganese, lithium, graphite and nickel increasing at least sixfold, and cobalt more than tripling.

What are critical minerals?
Critical minerals are metallic or non-metallic elements found in the earth that are crucial for modern technologies, economies and national security.

Is there a large amount of lithium-ion battery waste?
Lithium-ion battery waste is growing by 20 per cent annually and could exceed 136,000 tonnes by 2036.
As demand for renewable energy grows, governments are enforcing stricter regulations on battery recycling. The European Union, for example, mandates that at least 70% of lithium from spent batteries must be recycled by 2030.

Sources

- Fact sheet - Recycling the future: sustainable solutions for renewable energy technologies | Clean Energy Council | August 2025: https://cleanenergycouncil.org.au/for-consumers/fact-sheets
- Recycling, decommissioning and clean energy
- Decommissioning: https://www.cleanenergycouncil.org.au/advocacy-initiatives/community-engagement/decommissioning#:
- ~:text=Decommissioning%20means%20that%20the%20wind,returned%20to%20its%20former%20use.
- PV Industries: https://www.pvindustries.com.au/
- Sustainability Victoria: https://www.sustainability.vic.gov.au/news/news-articles/from-trial-to-reality-recycled-glass-and-plastic-in-asphalt-roads
- UNSW: https://www.unsw.edu.au/newsroom/news/2023/06/Repair-reuse-and-recycle-dealing-solar-panels-end-their-useful-life
- Solar recycling: Solar Panel Recycling in Australia | Canstar Blue
- Sustainabilty Victoria https://www.sustainability.vic.gov.au/circular-economy/product-stewardship/national-approach-to-manage-solar-panel-inverter-and-battery-lifecycles
- PV recycling benefits: High yield, low cost, environmentally friendly process to recycle silicon solar panels: Technical, economic and environmental feasibility assessment - ScienceDirect
- PV recycling benefits: High yield, low cost, environmentally friendly process to recycle silicon solar panels: Technical, economic and environmental feasibility assessment - ScienceDirect
- Recycling lithium-ion batteries cuts emissions and strengthens supply chain | ScienceDaily: https://www.sciencedaily.com/releases/2025/01/250131194431.htm
- Critical minerals: What are critical minerals and why are we mining them in Queensland? | State Development and Infrastructure
- Lithium-ion battery waste: https://www.csiro.au/en/research/technology-space/energy/energy-in-the-circular-economy/battery-recycling

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FACT SHEET

Fire-resilient renewable energy: minimising bushfire risk

Eliminating the risk of fire is considered in every stage of developing renewable energy projects. This includes during early site selection as part of the initial planning phase, developing emergency response plans, providing emergency vehicle access, managing vegetation, creating fire breaks, water storage, building access roads, training staff, active monitoring and coordinating with local fire brigades.

What's the most effective way to reduce risk from fire?
Incorporating safety risk management in the early design of clean energy facilities is the most effective way to reduce the potential for fires occurring or being damaged by a bushfire. This risk is assessed in the planning for facilities across every state and territory in Australia.

How are clean energy projects assessed for fire risks?
Clean energy projects are thoroughly assessed for fire hazards with investment toward mitigation strategies to reduce fire risk a priority. Most commonly projects are assessed against the Design Guidelines and Model Requirements for Renewable Energy Facilities1 which has been developed by Victoria's Country Fire Authority (CFA) and implemented by other states and territories.

Why does fire risk need to be managed at clean energy facilities?
The purpose of identifying and managing fire risk at renewable energy facilities is to protect the community, personnel, fire crews and the renewable energy asset itself.

Are state fire authorities consulted on projects and plans?
Planning legislation in every jurisdiction outlines that the relevant fire authority must be consulted and given the opportunity to make recommendations on management plans and mitigation measures. This is mutually beneficial as it ensures expert insights are incorporated into the design and operation of the facility.

How do renewable energy projects coordinate with local brigades?
It's important that renewable energy facilities engage with local brigades to ensure risk management or fire management plans can be effectively operationalised. The plans allow local emergency responders to familiarise themselves with the facility layout, including location of water resources available onsite and after-hours site contacts for energy isolations if necessary. To support this, renewable energy projects host local fire brigades and offer familiarisation visits through their facilities.

All renewable energy projects are designed to reduce the risk of fire. They are subject to thorough planning assessments and must adhere to rigorous standards.

What is included in fire mitigation plans?
Projects develop multiple plans to minimise risk. Plans are developed in accordance with Country Fire Authority (CFA) guidelines and are reviewed regularly and updated as required. Plans usually provide a detailed description of the facility, including location, size and types of clean energy technologies used. Plans will also detail emergency vehicle access, firefighting water supply, fire break widths, separation distance and ignition sources. The plans provide evacuation routes, assembly points and procedures for personnel, as well as how to communicate during an emergency, including internal communication and coordination with external emergency services.

Three of the most common plans include:

- An overarching Emergency Management Plan that outlines a company's obligations to prevent, prepare and respond to any emergencies that may impact the site, such as fires.
- A Fire Management Plan, which needs to be approved by the local fire authority in each state, which includes procedures for dealing with fire on site and the water required to be kept on site for that specific purpose.
- A Risk Management Plan that has identified hazards and the strategies to be applied to lower the risks (e.g. grass cutting and removal of vegetation within the 10-metre fire break).

Precautionary design measures

Standards and regulations

All our BESS projects and sites must meet:

- Fire Safety and Emergency Management Guidelines: All current national and sate requirements for designing, constructing, and operating new renewable energy facilities, with specific focus on BESS fire risks.
- Non-Combustible Systems and Surfaces: Utilising fire protection systems and non-combustible surfaces that comply with relevant standards for "open-air" or "containerised" storage configurations as per AS24191.1 Fire hydrant Installations, part 1: System Design, Installation and Commissioning.
- Electrical Safety Standards: Comply with all Australian Standard requirements for the safe installation and commissioning of battery systems, including the integration of safety systems with power conversion equipment
- Dangerous Goods Requirements: Regulations and approved codes of practice for the storage and handling of dangerous goods (including batteries) and hazardous materials.
- Legal Obligations: State and national legislation that outlines the obligations for an owner and operator of a complex electrical installation, ensuring compliance with relevant state Electrical and workplace Health and Safety Acts and Regulations.

Physical protections

All our BESS projects and sites are designed with:

- Fire Spread Mitigation: Non-combustible surfaces to prevent thermal runaway and ground fire spread.
- Fire Breaks & Access: Perimeter roads or clear fire breaks set back the required distance from BESS units.
- Emergency Access: Roads designed to accommodate fire trucks and other emergency vehicles.
- Fire Separation: Adequate spacing between battery units, containers, and infrastructure to prevent cascading fires.
- Firefighting Infrastructure: Reliable water supply or suppression systems available on site.
- Run-off Management: Retention or filtration systems to prevent contamination from fire water, meeting council and environmental requirements.
- Emergency Facilities & Procedures: Evacuation areas, first aid facilities, and tested emergency procedures.
- Information for Responders: Emergency info containers at entry points with site layout, hazards, and shutdown procedures.

Our battery manufacturers must:

- prove compliance with the Standard for Energy Storage Systems and Equipment (UL 9540)
- provide proof of product testing in accordance with the Standard for Test Method for Evaluating Thermal Runaway Fire Propagation in Battery Energy Storage Systems (UL 9540A).

Our batteries and enclosures must:

- incorporate a battery management system to enable early warning of faults, which includes a complex system of sensors monitoring all aspects of the device and indicate operational issues or faults
- have inbuilt thermal runaway mitigation measures
- have thermal monitoring systems
- have inbuilt warning detection systems
- have an automatic shut down and isolation system
- have cooling systems built into battery containers
- be designed to control a thermal runaway event to mitigate the risk of explosion and the spread of fire from one unit to another
- have pre-installation manufacturing testing
- come with a comprehensive service schedule
- be dustproof, waterproof and made from steel.

Safe operations

Once the BESS is operational, we will continue to ensure fire risk is minimised in the facility through:

- 24-hour monitoring of the site in line with our site safety operating procedures
- active alarm systems linked to our Security Control Room with access to real time CCTV
- fire breaks and roads maintained
- regular battery servicing as per manufacturer specifications
- routine waste management services including removal of combustible materials
- maintenance undertaken in line with relevant Australian Standards and manufacturers requirements for all infrastructure, equipment and vehicles at the facility
- regular site inspections to ensure the facility is clear of vegetation and grasses
- annual review of the emergency management plan
- emergency management exercises to test our emergency response plans and practice emergency readiness
- ongoing safety training for personnel and responsibilities outlined during emergencies
- personal protective equipment, first-aid and shower facilities available and maintained on-site
- ‘hot work’ activities performed under ‘hot work permits’ systems and risk management processes
- fire protection measures maintained on a continuing basis for the life of the permit, to the satisfaction of the fire authority.

Sources

- Fact sheet - Fire-resilient renewable energy: minimising bushfire risk | Clean Energy Council | August 2025: https://cleanenergycouncil.org.au/for-consumers/fact-sheets
- Renewable Energy Fire Safety | CFA (Country Fire Authority)

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