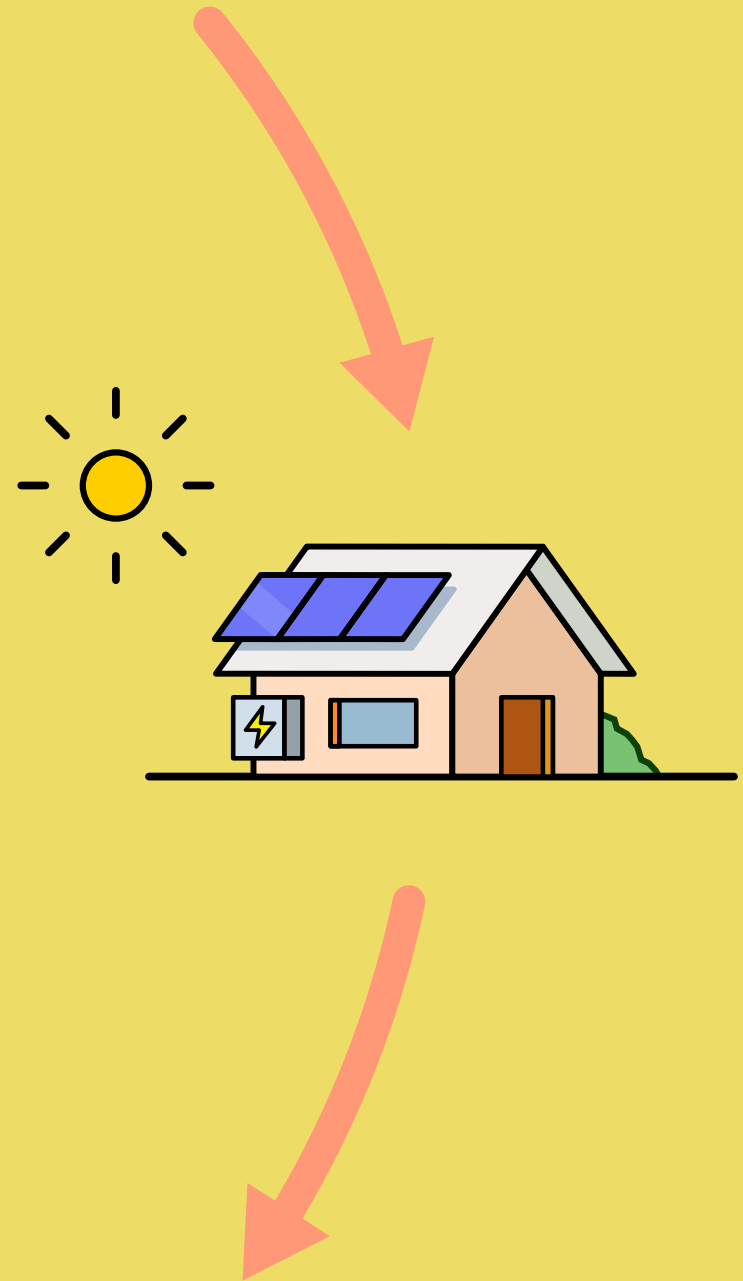


A circular economy for solar PV systems in Australia: Opportunities for re-use



The Challenge

In the next five to ten years a significant number of rooftop solar PV systems will reach end of life in Australia. Unless strategies are put in place to manage the components of these systems once decommissioned, panel waste is estimated to reach between 300,000 and 450,000 tonnes by 2040.

The establishment of a Circular Economy for solar PV systems will: help enable sustainable supply chains by ensuring precious resources used in these systems such as gold, copper and silicon are not wasted; reduce social and environmental impacts associated with mining

of virgin materials required for the renewable energy transition; and avoid a potential hazardous waste problem. There are multiple strategies that will enable this vision, including recycling and re-use of system components, and most importantly, design for durability, longevity and ultimately recycling.

Activating these strategies to support a future circular economy for PV requires technical, economic, and regulatory interventions to support circular business models and grow new markets for second hand panels, components and materials.

The Role of Re-use

This briefing note focuses specifically on how re-use can contribute to the broader vision for a Circular Economy.

- Following circular economy principles, re-use is a higher order recovery pathway than recycling.
- In many cases, solar PV systems are decommissioned prior to failure, meaning re-use is a viable option with the right market support in place.

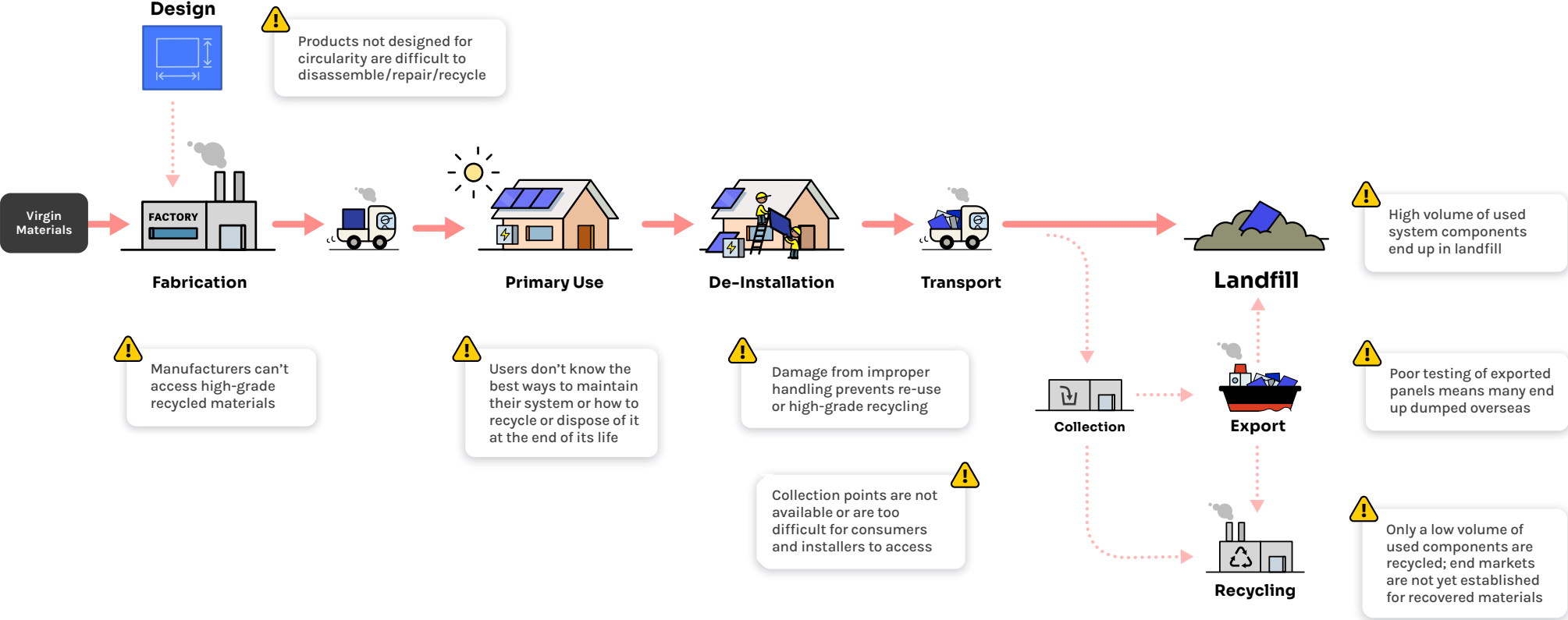
While many PV panels that will be decommissioned in the near future may not be suitable for re-use because they fail to comply with current standards, there will be opportunities to re-use panels that meet current standards when they are eventually decommissioned. Although recycling may remain the best option for many older or

damaged panels, it is important that the circular economy for PV systems in Australia does not become “locked-in” to recycling as the only end-of-life pathway and lose the potential for higher order recovery afforded by refurbishment, re-use as well as more advanced recycling technologies.

This document summarises the potential re-use pathways in a circular economy for rooftop solar PV systems in Australia. It highlights the opportunities and indicates the types of support that may assist in strengthening re-use pathways and end markets.

- There are existing markets for re-use in Australia and internationally, however they remain underdeveloped and have a number of issues that must be addressed for them to become viable at scale.

The Current Linear System



Factors currently affecting reusability of system components

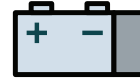
PV Panels



- ➖ Damage due to low panel quality, wear while in use or rough handling in transport
- ➖ Uncertainty around evolving quality and safety standards
- ➖ Lack of incentives to drive re-use as a priority

🔒 High volume of early decommissions due to failure of other system components or system upgrades

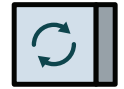
Energy Storage Systems (batteries)



- ➖ Limited research into the capacity of decommissioned energy storage systems to be refurbished and re-used due to insufficient volumes.
- ➖ Different efficiency levels, faults and damage to batteries.
- ➖ Design variability affecting compatibility and scalability of operations
- ➖ Uncertainty around evolving quality and safety standards
- ➖ Lack of incentives to prioritise re-use

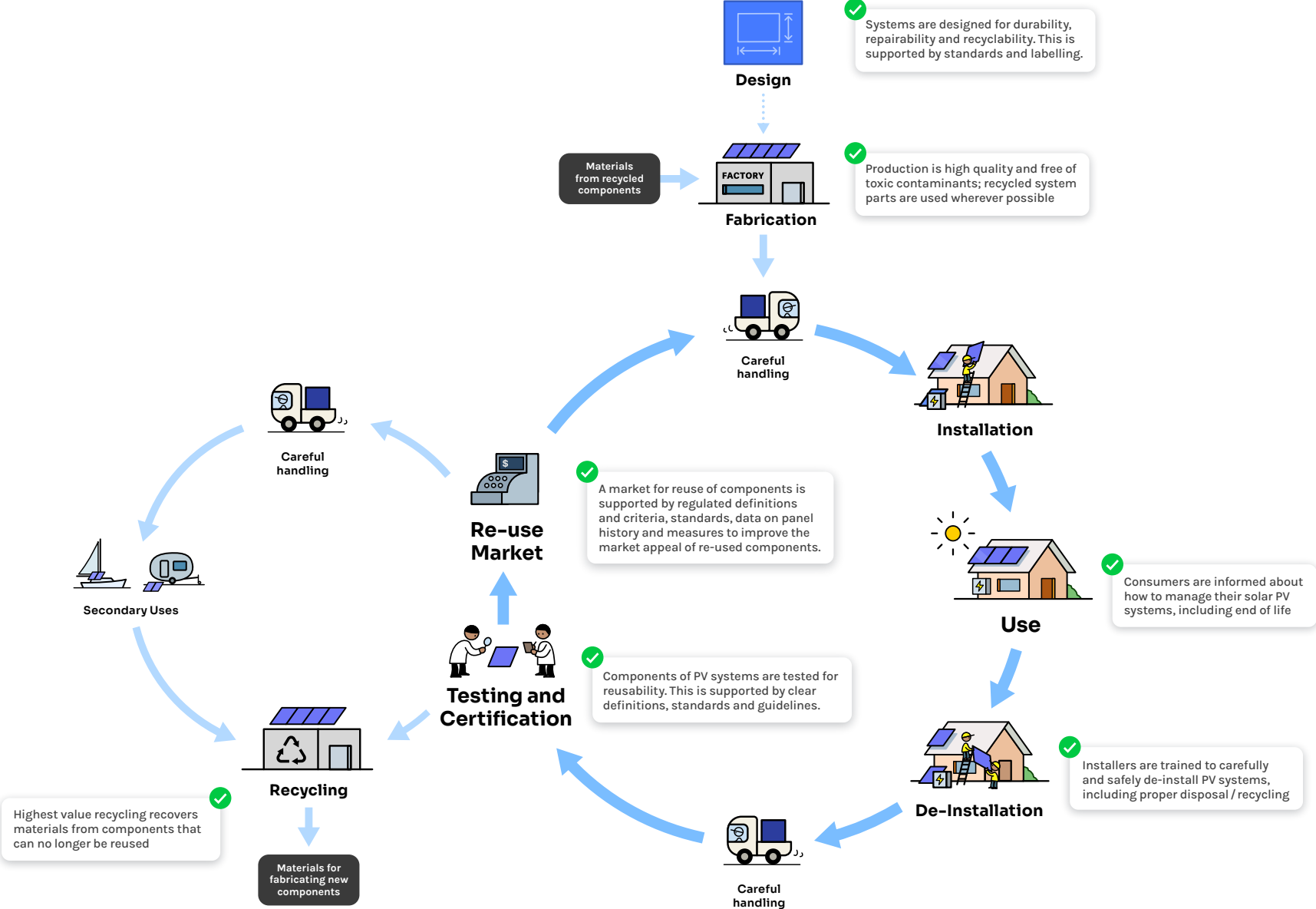
🔒 Potential for energy storage systems from Electric Vehicles to be re-used in solar PV Systems system upgrades

Inverters



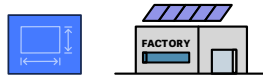
- ➖ Concern that older generation inverters may not meet the current standards.

A Future Circular System



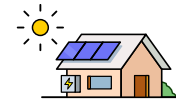
How to enable a circular system

Design & Fabrication



- ✓ Pursue circular design opportunities enabling repair, refurbishment, re-use and recycling
- ✓ Develop, pilot, and implement PV system repairability and durability labelling, standards, and a national repairability index.
- ✓ Provide incentives and clear pathways for use of recycled materials
- ✓ Ensure clear labelling of battery chemistries and instructions for disassembly to enable repair, refurbishment, re-use and recycling.

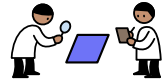
Use (and Re-use)



- ✓ Education for customers and installers about optimal system management and end of life pathways
- ✓ Predictive technologies that better estimate battery State of Health (SoH) and Remaining Useful Life (RUL).
- ✓ Provide financial incentives to potential customers looking to purchase properly tested, repaired, and refurbished PV systems.
- ✓ Make the existing ownership history data recorded more accessible to customers and industries.
- ✓ Integrate repair or refurbishment history into the database for second-hand PV system markets.
- ✓ Require second-hand PV system market to disclose information that demonstrates performance, quality, and safety of these components
- ✓ Trial different market segmentations for re-use of PV systems to understand their profitability and feasibility.
- ✓ Provide shorter-term and limited product warranties to build customer trust in purchasing second-hand PV systems.
- ✓ Automate processing capability for repair and refurbishment of PV systems to provide greater economic feasibility.

How to enable a circular system

Testing and Certification



- ✓ Develop clear definitions and criteria for reusable PV systems
- ✓ Develop technical guidelines for performance and safety testing for repaired and/or refurbished second hand PV systems
- ✓ Ensure technical guidelines are reflected in regulated product stewardship approach
- ✓ Ensure greater technological capability and efficiency in field testing methods of PV panels.

Handling and Transport



- ✓ Develop guidelines and training for safe handling and transport of decommissioned PV systems.

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www.uts.edu.au/isf/explore-research/projects/circular-economy-photovoltaic-pv-systems



epa.nsw.gov.au



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