

Managing End-of-Life Photovoltaic Systems in Australia: Key Findings from Installer Survey

Institute for Sustainable Futures

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Summary of Key Findings



Almost 30% of decommissioned PV systems are less than 10 years old. Early decommissioning is often owing to faulty PV panels indicating a **high rate of poor quality PV panels being installed.**



More than half (54%) of early decommissioned panels are not replaced under warranty. In part this may be owing to the liquidation or “phoenixing” of companies.



Landfill remains the most common (19%) destination for end of life PV panels



More than 80% of respondents see value in recycling PV systems, whereas only **~ 40% see value in reusing**



A lack of economic drivers for installers coupled with low awareness and access to recycling services are major barriers



Awareness raising along with **financial incentives** will encourage greater participation in reuse and recycling activities

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Introduction

This project aims to gain insights from PV system installers in Australia to better understand decommissioning practices. Through surveys and interviews the research project:

- Obtained new data on the **volume and characteristics of decommissioned PV systems**, including reasons for **early decommissioning**;
- Characterised **current end of life (EOL) management** practices; and,
- Assessed **attitudes and drivers** of PV system installers towards **reuse and recycling**.

The Institute for Sustainable Futures UTS was commissioned to undertake this research as part of a broader project that aims to investigate the feasibility of a whole-of-supply chain solution for managing EOL PV panels and energy storage batteries in Australia. The project is funded by the NSW Environment Protection Authority through the Circular Solar Grants Program.

Findings from the survey and the broader research project support the transition to a circular economy for PV systems in Australia.

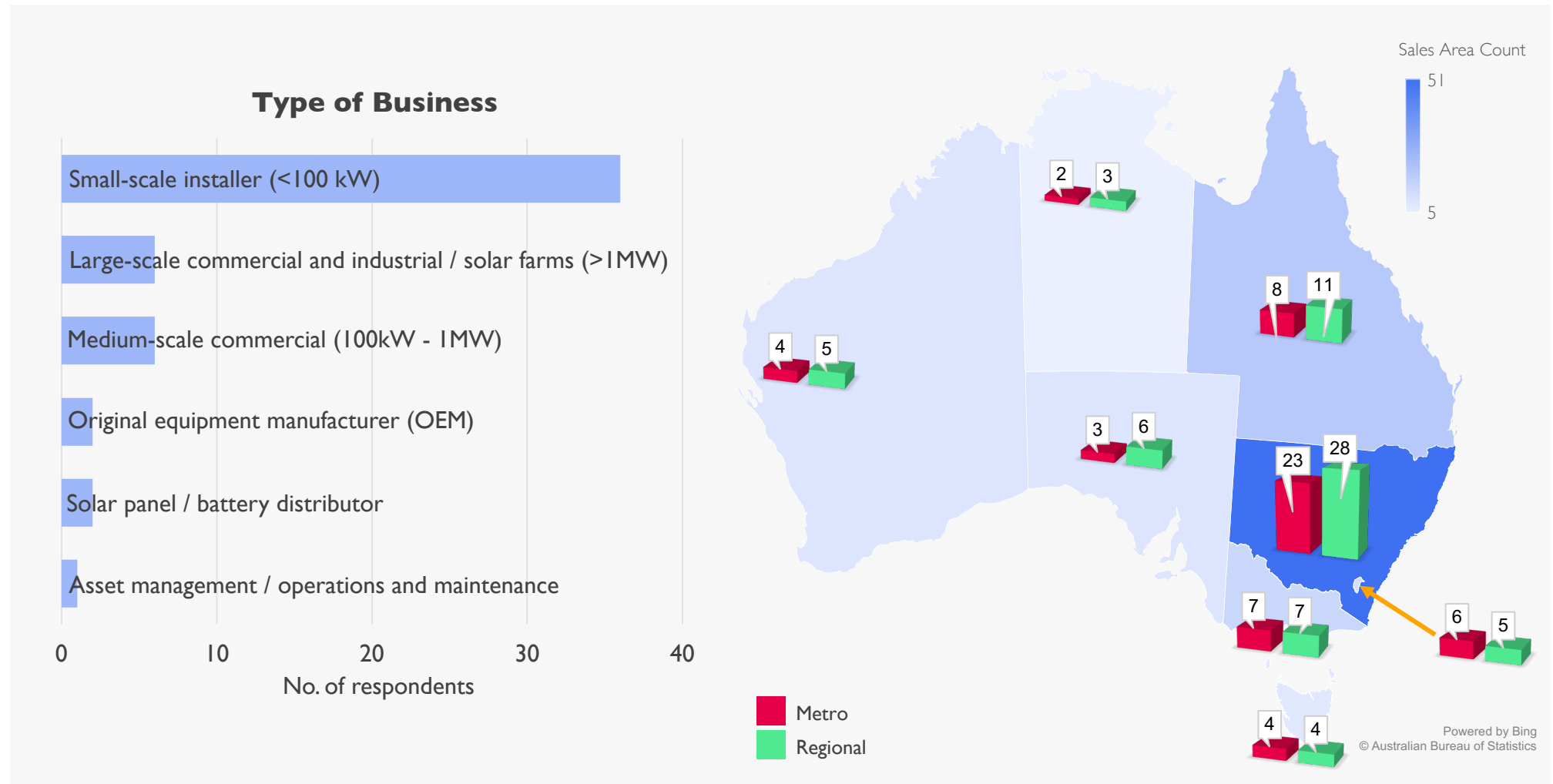


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Respondent overview

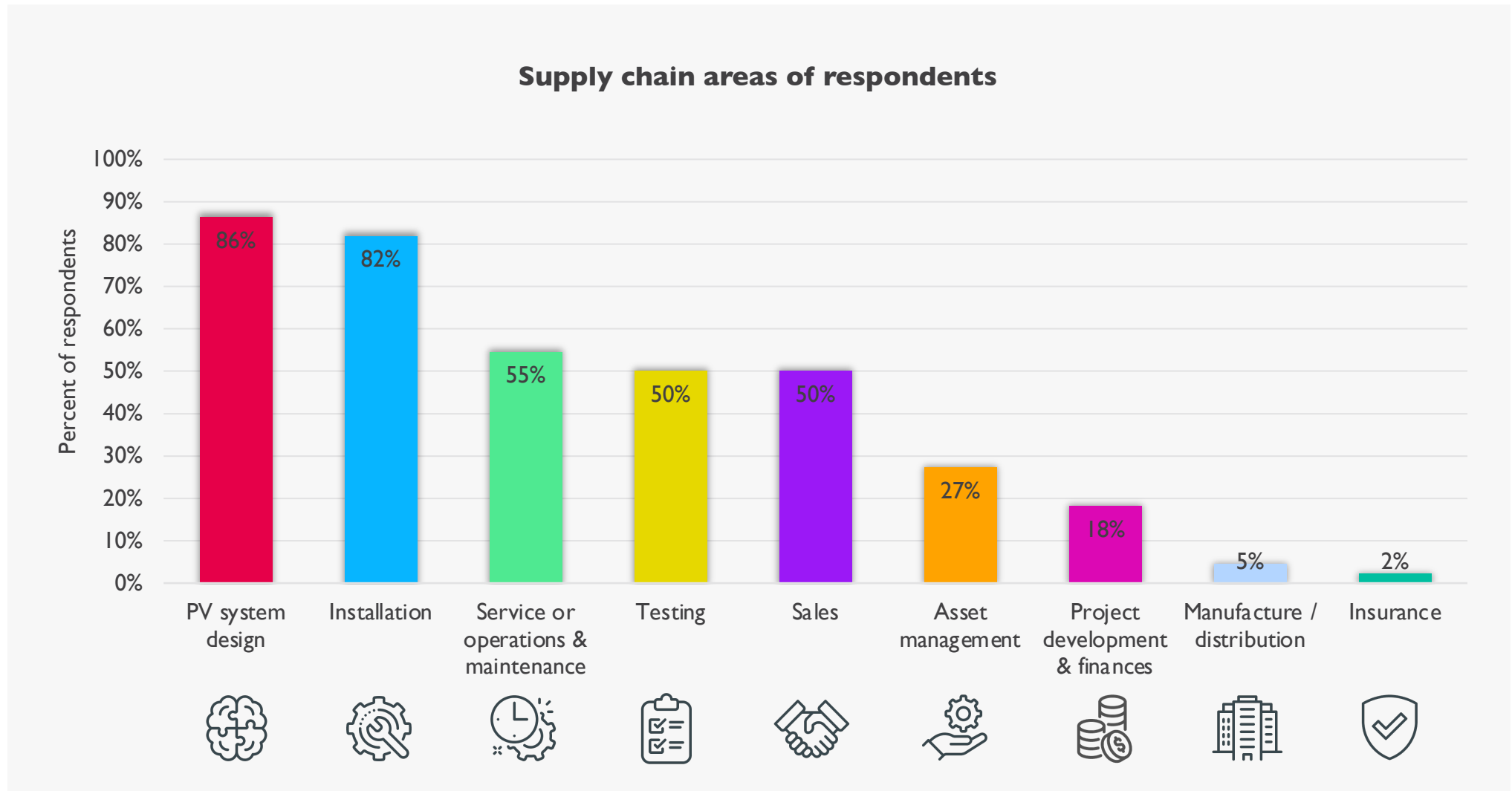
Characteristics of survey respondents

44 complete responses, mostly (82%) small-scale installers (<100 kW) based in NSW, including 23 installers in metro areas and 28 in regional areas



Q: Which of these categories best describes the majority of your work as an organisation? What regions do you operate in?

Respondents are involved primarily within the PV system design and installation of the PV systems



Q: What part of the supply chain are you involved in? Tick all that apply.

02

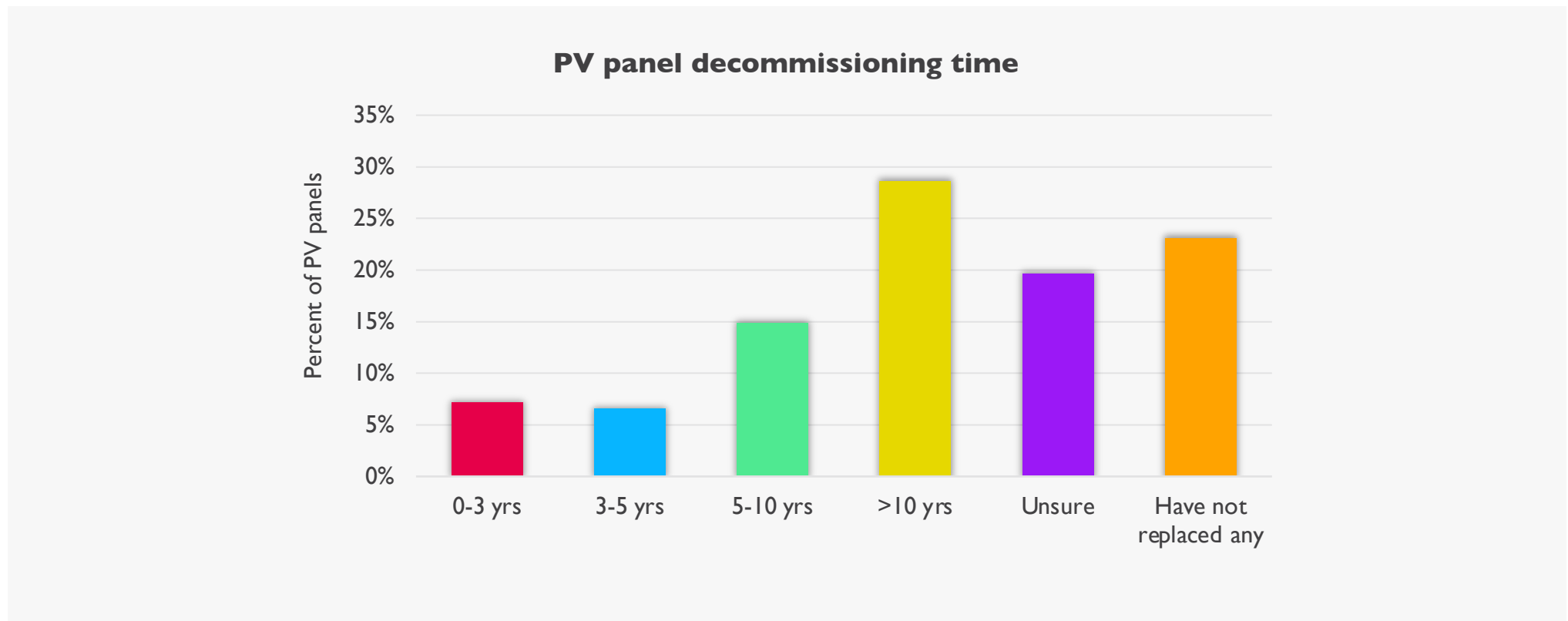
Characterising decommissioning behaviour

When, why and how existing PV systems are being decommissioned and replaced

About 30% of decommissioned PV panels are less than 10 years old

A significant proportion of PV panels decommissioned by the installers surveyed are decommissioned early. Early decommissioning is undesirable when PV panels have high levels of remaining efficiency. In the absence of established reuse and recycling industries these systems are ending up in landfill.

Only four installers surveyed reported replacing energy storage batteries, which is unsurprising given current low rates of deployment in NSW.



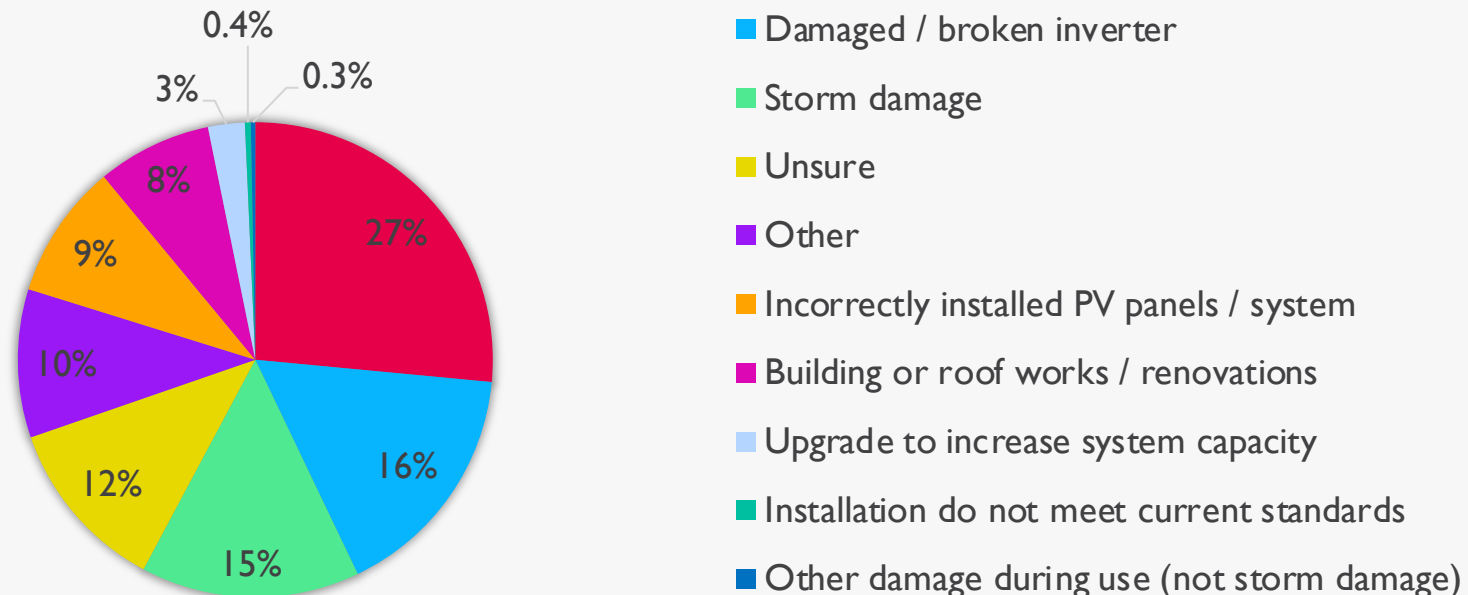
Question(s): Please estimate the percentage of solar panels that need to be replaced (for any reason) within the below timeframes.

Faulty PV panels (27%) and damaged or broken inverters (16%) are the most common reasons for PV system decommissioning and replacement.

The high frequency of early decommissioning owing to faulty PV panels (e.g., owing to delamination or water ingress) indicates that low quality panels are being installed. Upgrade to increase system capacity as a reason for replacement is low as the reason preceding this is due to several faulty or damaged PV panels or broken inverters.

The relatively short lifetime of inverters compared to PV panels (about half that of PV panels) is also a major factor contributing to early decommissioning of PV systems.

Reasons for replacement

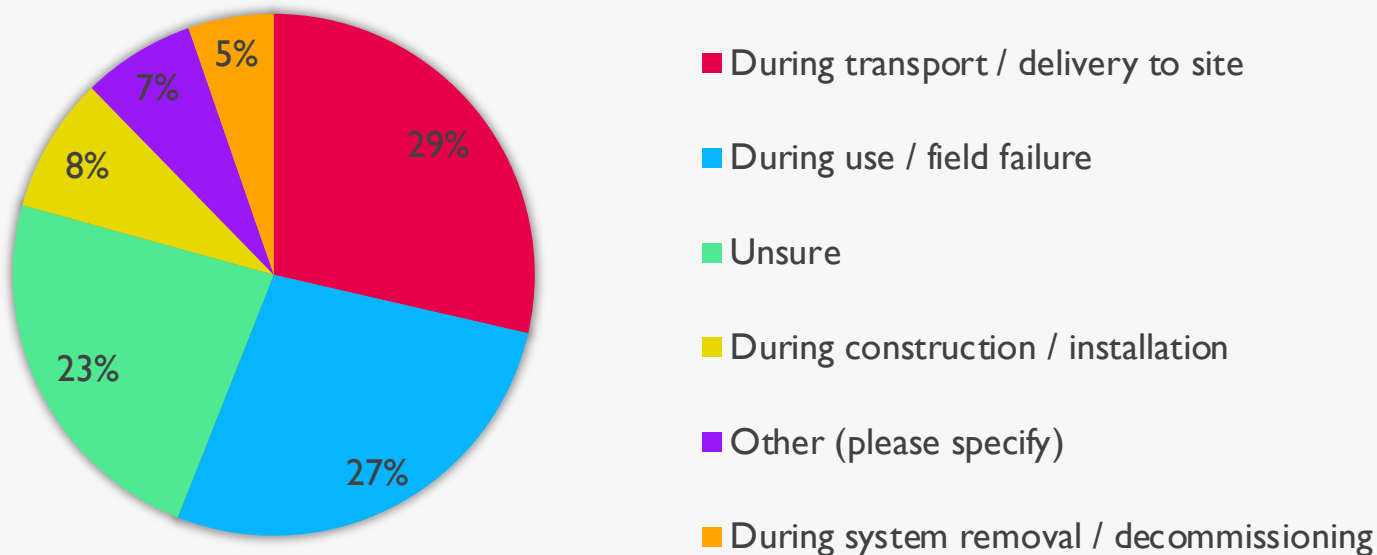


Question(s): What are the reason(s) for solar panel/system upgrades or replacements?

The largest proportion of PV panel damage occurs during transport or delivery to site (from OEM or distributor) and construction / installation (37%); damage during use / field failure (27%) is also significant

Survey responses indicate that the period during transport from the OEM or distributor, and damage during construction or installation, are the most significant contributors to PV panel waste generation. Damage that occurs in use (e.g., owing to storm damage or system fault) is also a significant contributor to PV panel waste generation.

Causes of damage

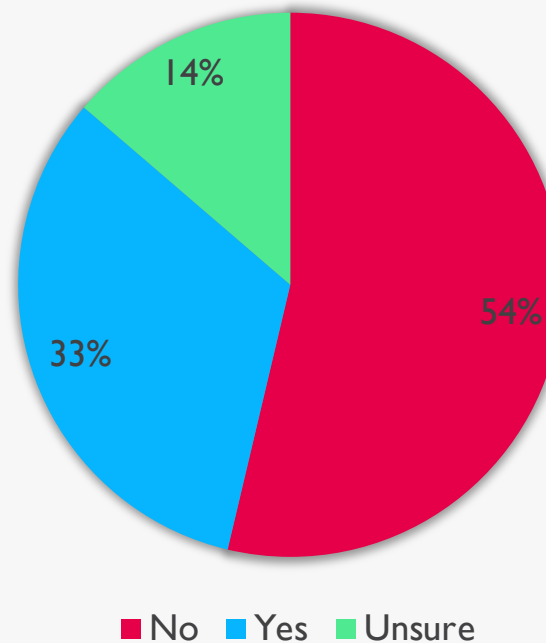


Question(s): What percentage of solar panel damage occurs in the below stages?

Of those respondents who are making warranty claims, over half of these (54%) claims were not honoured.

The high number of replacements without warranty could be owing to the liquidation or “phoenixing” of companies so customers are unable to make warranty claims, but also PV panels that are out of warranty.

Were solar panels replaced under warranty?



Question(s): Have you had to make any warranty claims to the manufacturer for damaged or faulty solar panels? What percentage of solar panels you needed to replace, are replaced under warranty?

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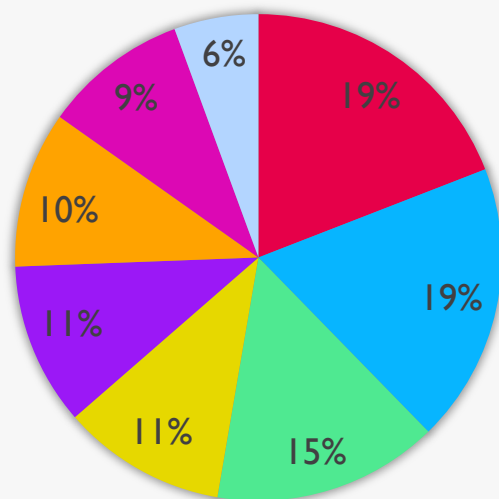
End-of-life management practices

Material recovery and disposal

About 30% of decommissioned PV panels are currently disposed in landfill or stockpiled

The survey responses revealed a diversity of EOL destinations for decommissioned PV panels. While disposal to landfill and providing PV panels to a specialist recycler were the main EOL options according to survey respondents we expect the number of solar installers taking PV panels to specialist recyclers may be overestimated owing to the recruitment of respondents through a distributor business that has a relationship with PV Industries. Furthermore, there are businesses claiming as recyclers though they are not properly recycling these PV systems, although respondents will still perceive them as specialist recyclers. The recovery of scrap metal (frames) and selling panels on informal second hand markets in Australia (10%) or overseas (10%) are also an important EOL destinations.

PV panel disposal pathway



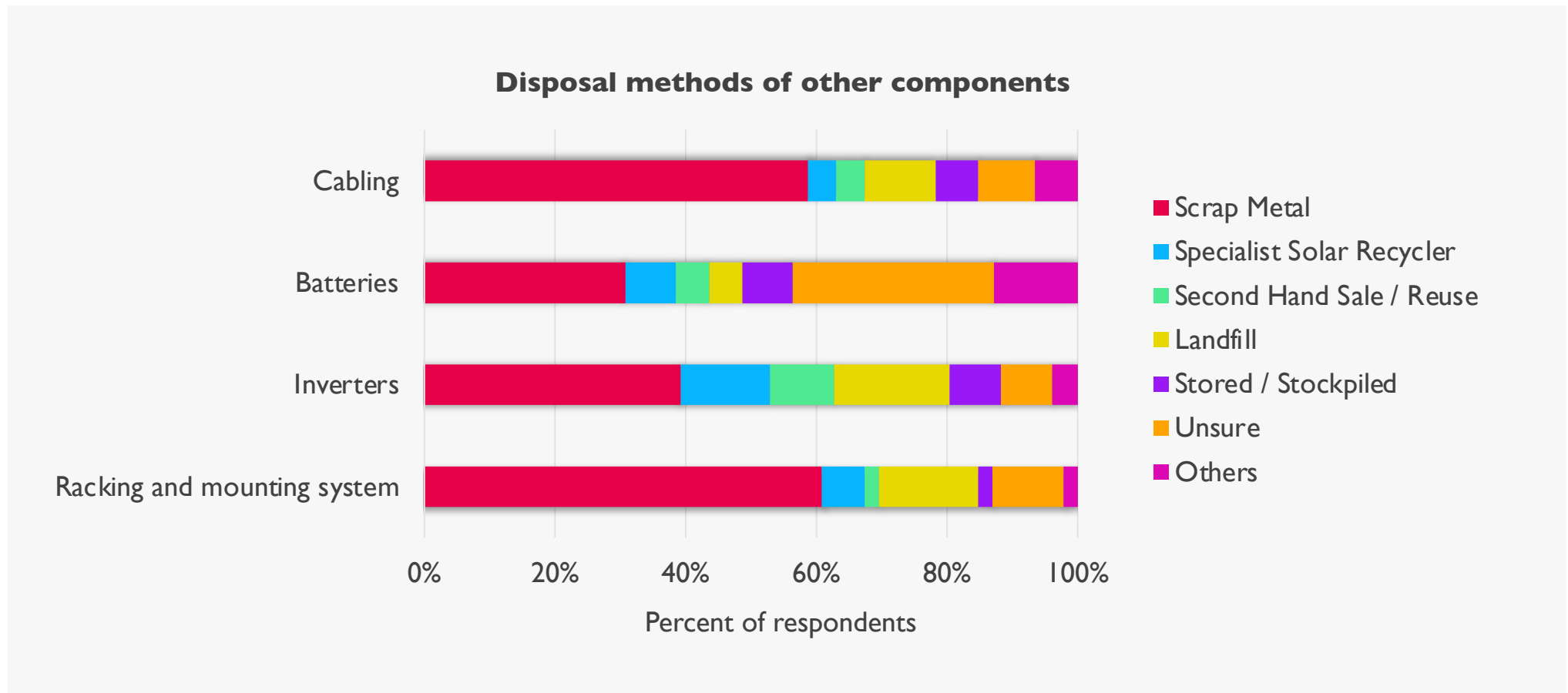
- Landfill
- Specialist Solar Recycler
- Scrap Metal
- Stored / Stockpiled
- Others
- Sold in Australia as Second Hand
- Given to someone claiming reuse overseas
- Taken back by Manufacturer (OEM)

Question(s): How do you dispose of solar panels?

Scrap metal is the most common EOL option for all other system components

Scrap metal recycling provides an established pathway for system components including frames, racking and mounting systems and cables.

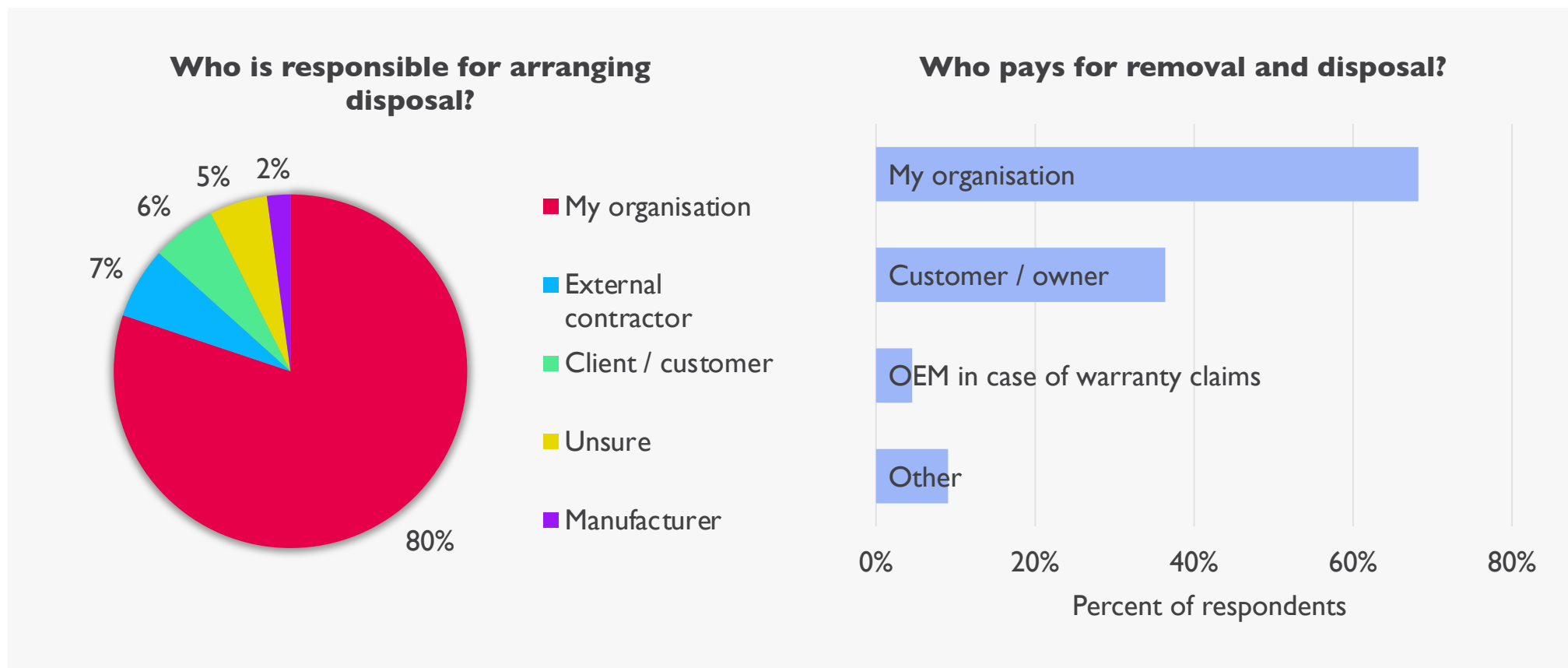
Many respondents (27%) were unsure where to dispose of batteries.



Question(s): How do you dispose of the various components?

PV system installers are generally responsible for removing and disposing decommissioned PV systems

Survey respondents reported that they are responsible for arranging disposal of decommissioned PV systems most (80%) of the time. This also includes paying associated disposal costs. This is not surprising given the important role of installers in the value chain and the primary point of contact with customers for installation, deinstallation, replacement, and warranty claims are taking place. The average cost of removal and disposal of PV panels was reported to be ~ \$20 per panel.



Question(s): On average, who is responsible for arranging the disposal of the solar panels and equipment? Generally, who pays the costs of removal and disposal?

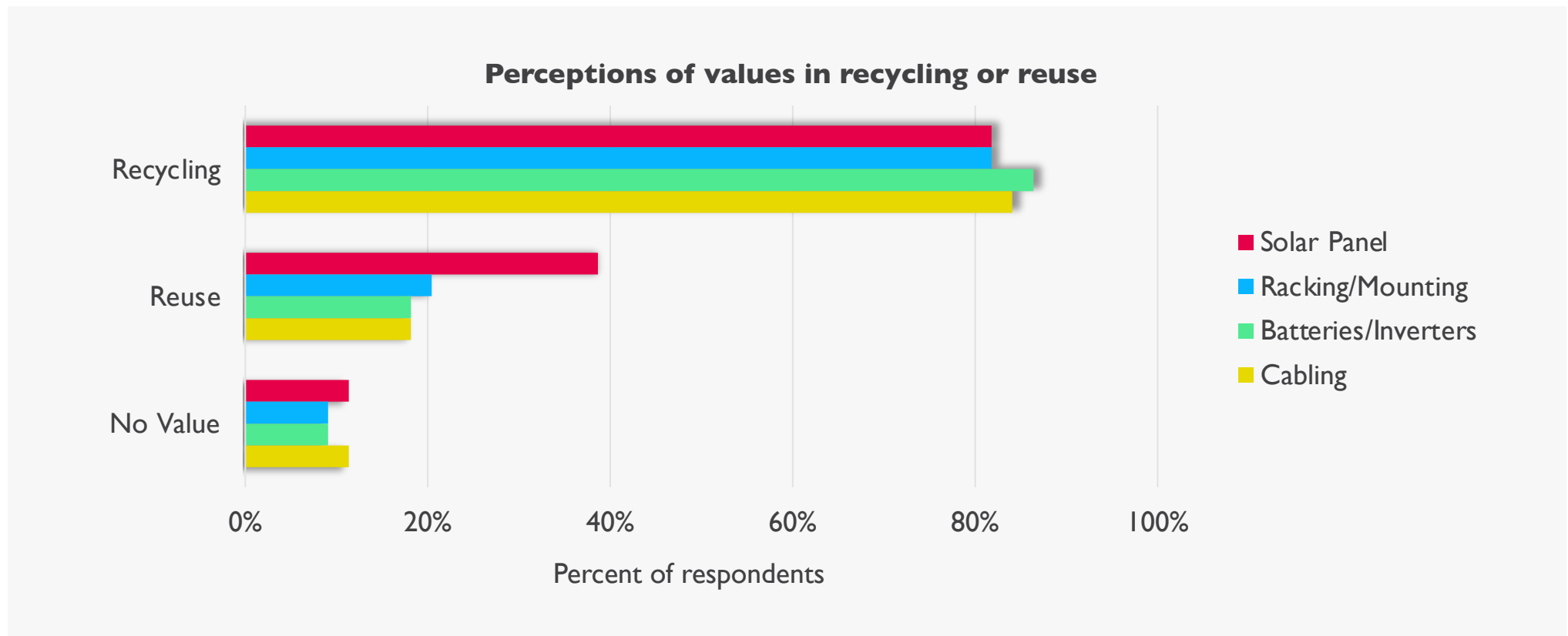
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Attitudes and drivers

Attitudes and drivers for increasing participation in reuse and recycling

More than 80% of respondents see value in recycling PV systems. By contrast, only ~40% see value in reusing solar panels and < 20% for other components

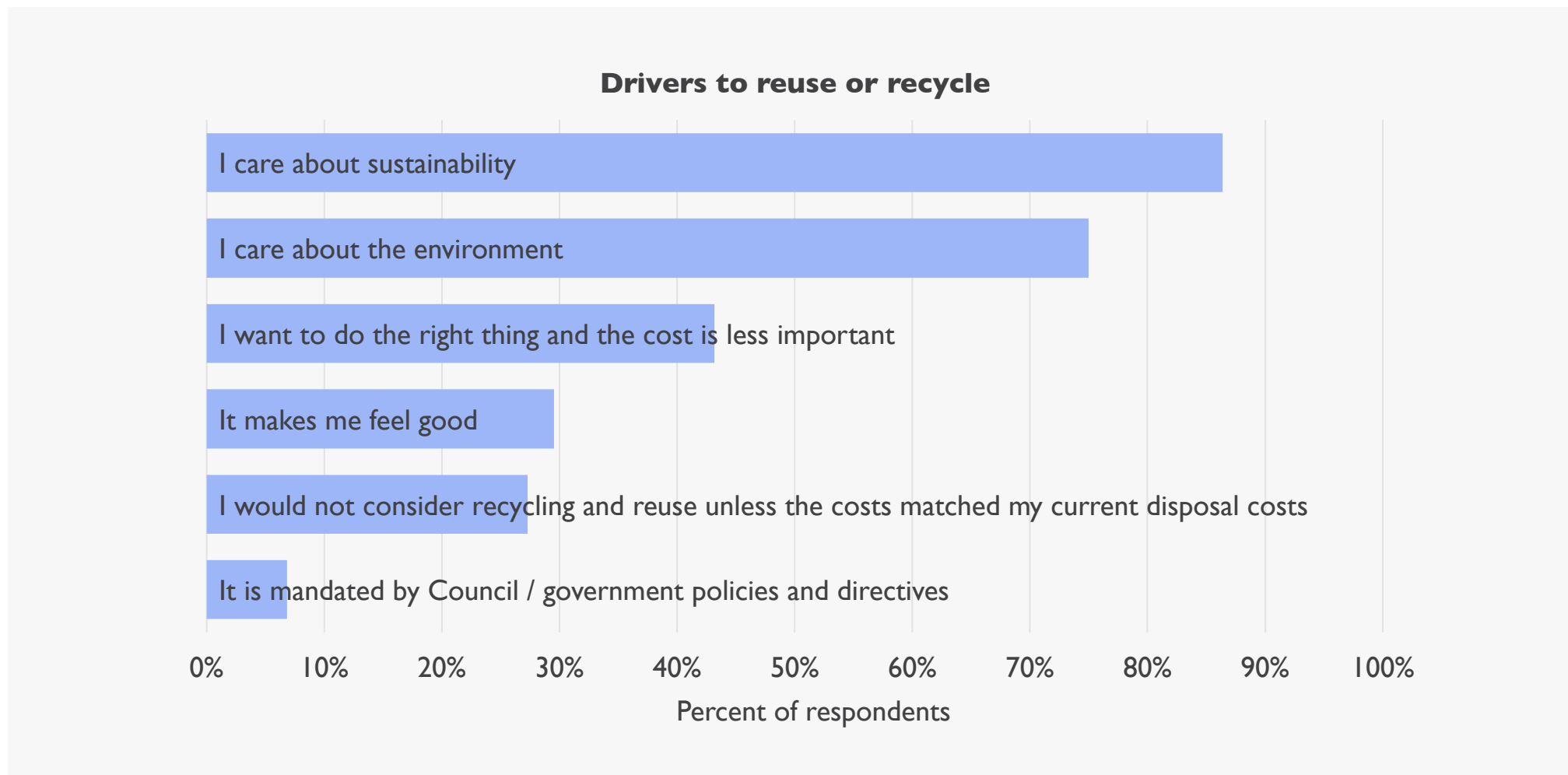
The relatively low perceived value in reuse is expected as there are a range of factors inhibiting reuse markets. This includes access to subsidies for new systems, the lack of established refurbishment and testing services that may be needed to provide quality assurances to customers of second-hand systems, the additional costs associated with necessary testing, recertification, handling, and transport processes as well as the low cost of new PV systems and technological advancements.



Question(s): Do you see value in recycling or reusing the material recovered from end of life solar panels and batteries?

Concern for sustainable and positive environmental outcomes are the main drivers for installers participating in reuse or recycling activities

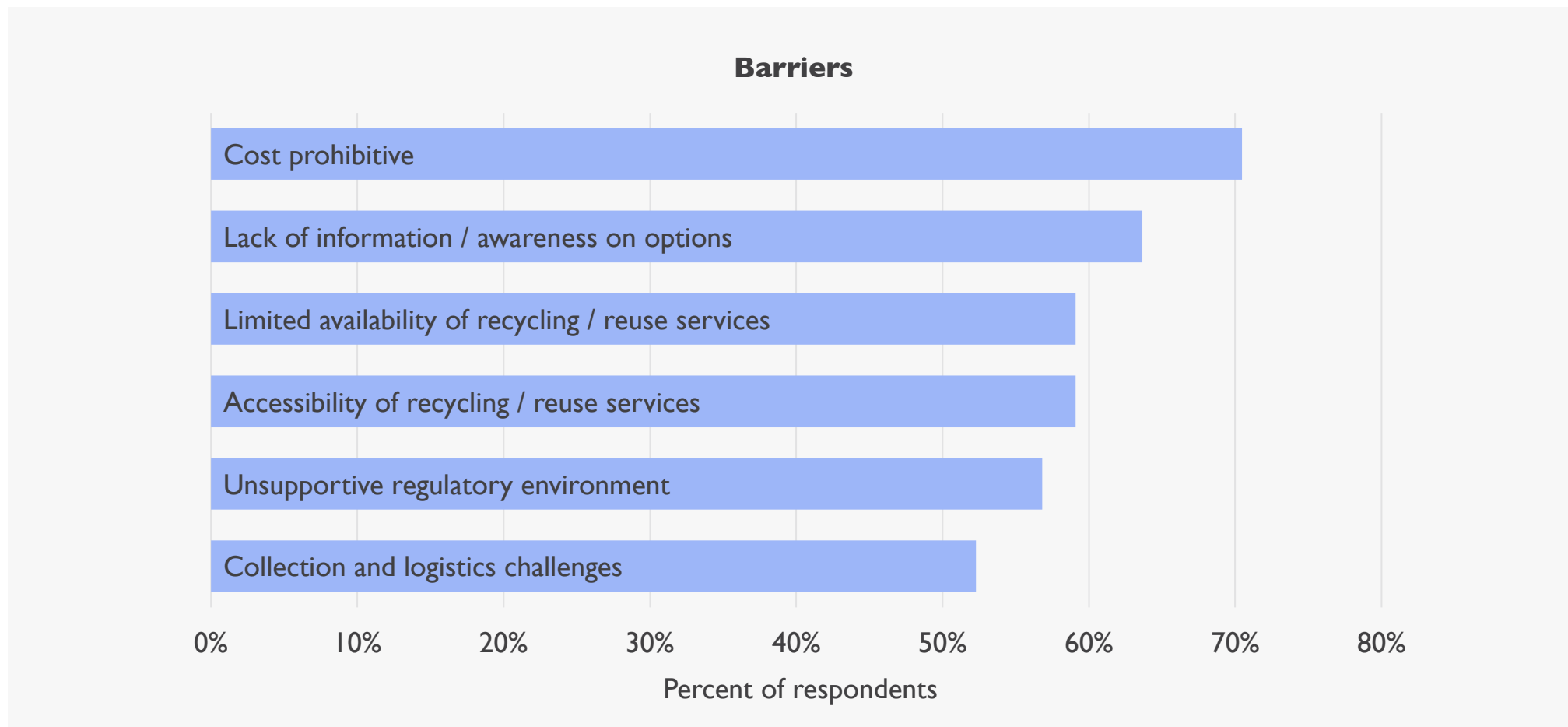
A lack economic drivers for installer businesses is a clear barrier to scaling up reuse and recycling activities.



Question(s): What is the main motivation for you to consider reuse and recycling options? Choose all that apply.

Solar installers report low awareness and access to recycling services as well as prohibitive costs as major barriers for participating in recycling

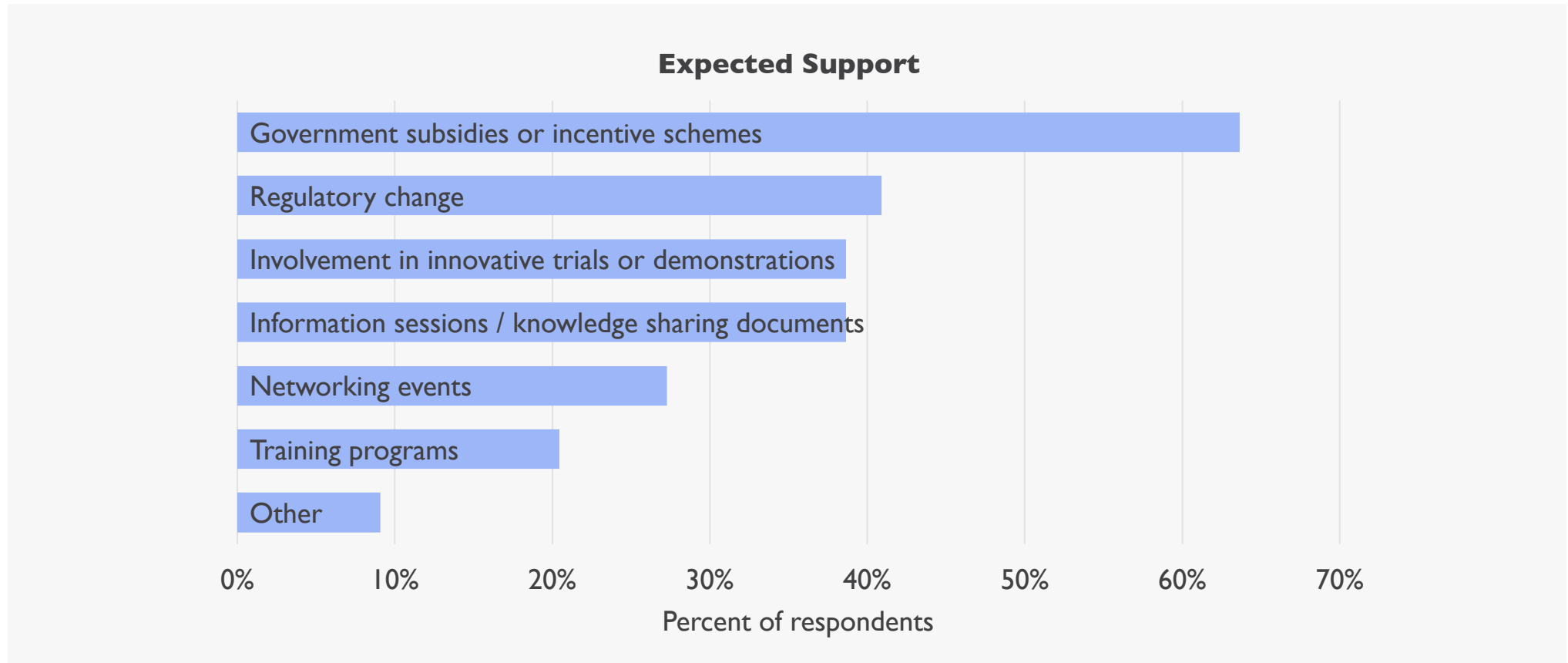
This finding is consistent with the current immaturity of specialist solar recycling services. There has been limited targeted promotion of recycling services and collection networks are not yet established.



Question(s): What challenges do you currently face or anticipate you might face for recycling and reuse recovery pathways?

Solar installers prefer financial support (64%) ahead of regulatory intervention (40%) to overcome challenges in participating in reuse and recycling activities

This finding is consistent with the finding that the cost burden for EOL management currently rests with installers. Given the price competitive environment that installers are operating in, an effective product stewardship solution will likely need to incentivise installer participation by offering financial and non-financial incentives to encourage their critical participation in reuse and recycling activities.



Question(s): What support would you like to help you overcome these challenges?

