



Australian Government
Clean Energy Regulator



IS23-000001

27 September 2023

Mr Tas Larnach
Committee Secretary
Senate Standing Committees on Economics
PO Box 6100
Parliament House
Canberra ACT 2600

Dear Mr Larnach

I refer to your letter of 5 July 2023 informing the Clean Energy Regulator of the inquiry into residential electrification and inviting us to make a submission.

The Clean Energy Regulator (CER) is a Commonwealth economic regulator. Our purpose is accelerating carbon abatement for Australia. We achieve this through the administration of schemes that measure, manage, reduce and offset Australia's carbon emissions, including the [Renewable Energy Target \(RET\)](#).¹

This submission focuses on data and insights from our administration of the RET, specifically the Small-scale Renewable Energy Scheme (SRES). It responds to terms of reference (i) and (j), limited to the coverage of the SRES. The SRES incentivises the uptake of small-scale solar photovoltaics (PV) and efficient water heaters.

Australia is recognised as having the highest penetration of residential rooftop solar in the world.² 1 in 3 suitable³ dwellings have a rooftop solar PV system in Australia. This compares to about 1 in 4 in the [Netherlands](#), 1 in 25 in the [United States](#) and 1 in 50 in [New Zealand](#).

Supportive Federal and State/Territory policy and programs, as well as electricity feed in tariffs, have contributed to strong uptake of residential solar PV in Australia. Until 2021 system costs had steadily declined. This is in part owing to the scale of the competitive industry that had been built in Australia off the back of these incentives and declining technology costs. While installation costs have since increased, in part owing to pandemic related supply chain issues, energy costs have increased so payback periods for households have remained low.

¹ The Renewable Energy Target (RET) was established under the *Renewable Energy (Electricity) Act 2001*.

² According to the [International Energy Agency](#).

³ This excludes high density apartments.





The SRES and household rooftop solar

The SRES is a certificate⁴ based incentive available for all rooftop solar PV systems as long as the system capacity is no more than 100 kilowatts (kW). Key eligibility criteria for the incentive are that a specially trained and accredited installer (who must also be a licenced electrician) has supervised the installation and that the panels and inverters used have been proven to meet Australian Standards. The quarterly obligation to acquire and surrender certificates rests primarily with electricity retailers. Hence, costs would be passed through to electricity users.

In recent years the SRES incentive has represented about one third of the total cost of a rooftop solar PV system and has likely been the primary driver of the high uptake of rooftop solar in Australia. This incentive is typically provided as a material upfront discount to consumers. The average payback period for residential small-scale solar PV in 2023 is about 4-5 years.

The RET has been in operation since 2001. In 2011 it was split into two parts, the Large-scale Renewable Energy Target (LRET) and Small-scale Renewable Energy Scheme (SRES).

Since 2001, 3.6 million small-scale solar PV systems have been installed contributing more than 21 gigawatts (GW) of generating capacity. Of these, 3.3 million systems with an installed capacity of 20.5 GW have been installed under the SRES since the RET was split in 2011. Combined, these small-scale solar PV systems contribute an estimated 27,000 gigawatt hours (GWh) to annual electricity generation.

Both residential and commercial/industrial systems (up to 100 kW) are eligible to participate in the SRES, however the majority of installs historically are for households. Overall, households represent more than 90% of installs and 80% of installed capacity.

Attachment 1 is a graph showing an overall upward trend in rooftop solar installations and capacity since the SRES commenced in 2011. The graph also shows the trend for each State and Territory. Where States and Territories have offered incentives additional to the SRES, these have change over time and it is not possible for us to comment specifically on what their impact may have been on installation rates.

Australia is tracking to install close to the record level of new small-scale solar PV capacity of 3.2 GW in 2023. Rooftop solar PV is expected to contribute about 10% to total electricity generation in the National Electricity Market in 2023.⁵ In the [Q2 2023 Quarterly Carbon Market Report](#), we said that average system sizes has increased (from 8.7 to 9.3 kW year on year) suggesting households are increasingly preparing for electrification.

The SRES and efficient hot water

1 million efficient hot water units have been incentivised under the SRES through the same certificate mechanism as rooftop solar. Recently, there has been significant growth in the installation of air source heat pump (ASHP) water heaters. In the first half of 2023, an estimated 60,000 ASHPs were installed, up 70% from the same time in 2022. Efficient hot water systems incentivised under the SRES are replacing existing old electric and gas systems as well as being installed on new dwellings. Of all water heaters installed under the SRES in 2022, 46% were replacing existing electric systems while 7% replaced existing gas.

There are typically more complexities and costs involved when it comes to converting from an existing gas hot water system to a solar hot water system or ASHP compared to converting from an existing electric

⁴ Small-scale technology certificates (STCs) are issued upfront based on expected system generation (or reduction in electricity consumption in the case of efficient hot water systems) until when the scheme ends at the end of the 2030 calendar year.

⁵ The National Electricity Market operates in New South Wales, the Australian Capital Territory, Queensland, South Australia, Victoria and Tasmania. It does not include Western Australia or the Northern Territory.



system. This means that households considering solar water heaters or ASHPs may need to do so in advance of their existing system failing.

From our data it appears State/Territory jurisdictions with additional incentives to the SRES are experiencing the strongest growth in uptake of efficient water heaters. In our [Q2 2023 Quarterly Carbon Market Report](#) we note a significant step up in New South Wales and Victoria in recent years following the introduction of state-based incentives.

CER Submission

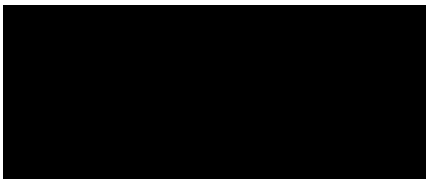
In addition to this letter, Attachment 2 provides greater detail on how the SRES operates and how it has contributed to world leading uptake of residential rooftop solar as well as a material increase in efficient hot water systems.

The strength of the SRES design is that it is available to all, eligibility criteria are clear, no pre-approval is required and it provides an upfront discount to the consumer. Hence, it operates efficiently and effectively.

However, those strengths don't make it suitable for delivering differentiated levels of support based on income (terms of reference (h)) or tenancy type.

We would be pleased to assist the Committee with any further information that may be required.

Yours sincerely



David Parker
Chair and CEO
Clean Energy Regulator

Phone: [Redacted]

Email: enquiries@cleanenergyregulator.gov.au

Website: cleanenergyregulator.gov.au

Postal address: GPO Box 621 Canberra ACT 2601



Attachment 1: Graphs showing uptake of solar PV under the Small-scale Renewable Energy Scheme

Figure A1.1 Small-scale solar PV installed capacity in Australia, 2011 to 2022

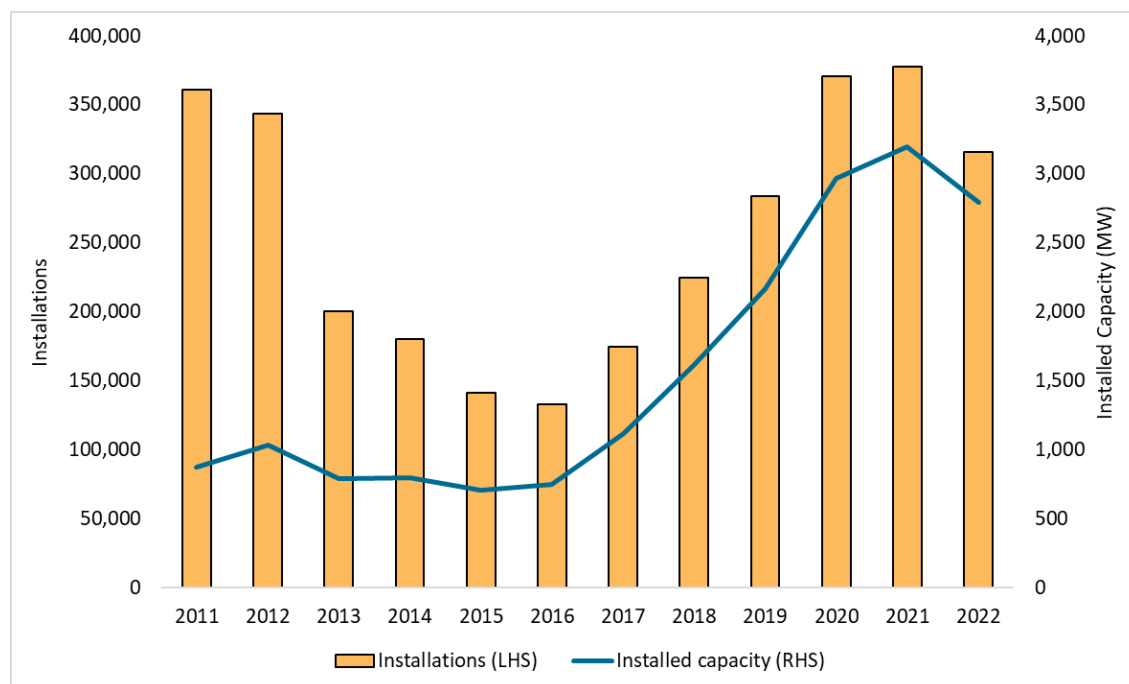


Figure A1.2 Small-scale solar PV installed capacity by State and Territory, 2011 to 2022

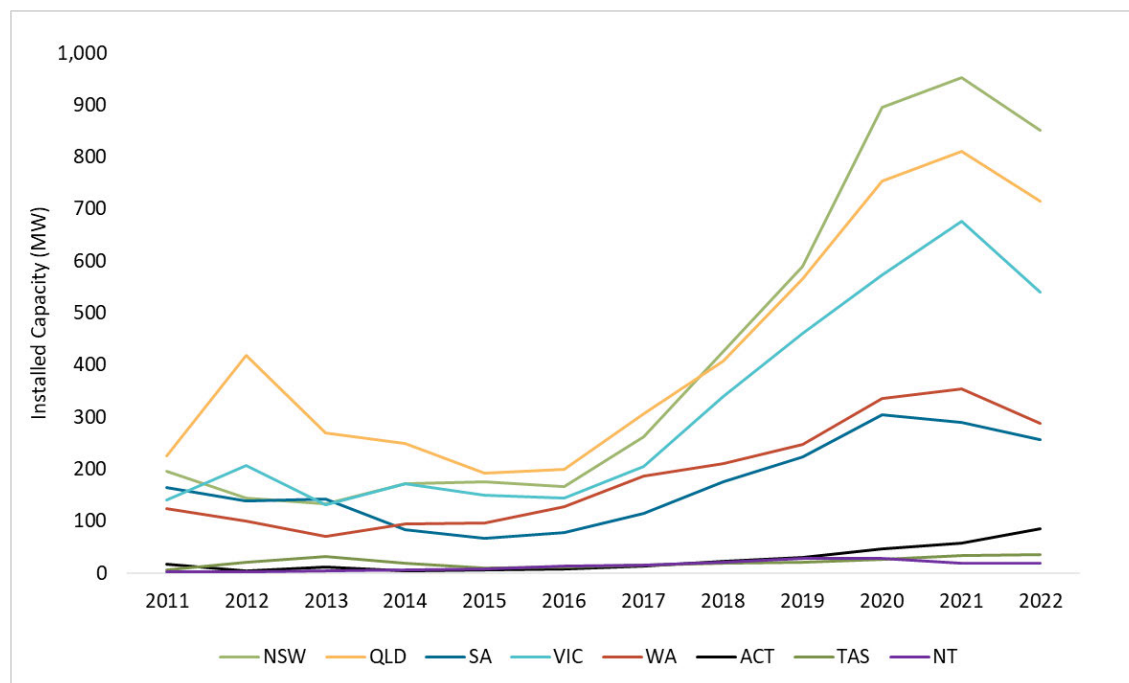
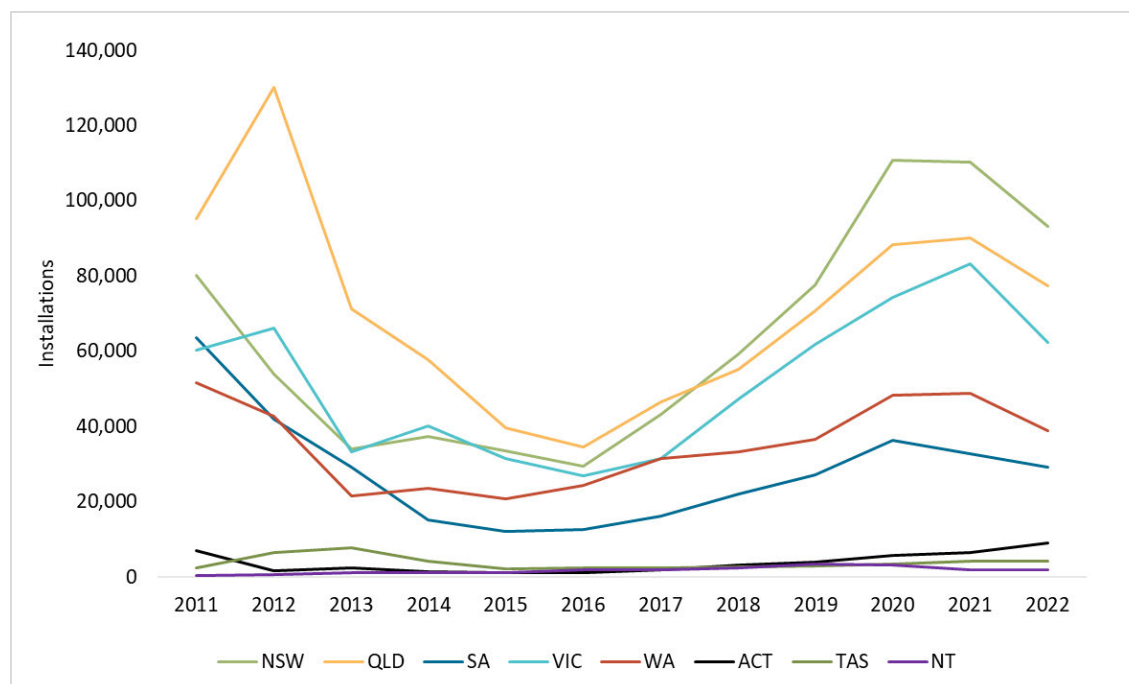




Figure A1.3 Small-scale solar PV installation quantity by State and Territory, 2011 to 2022





Attachment 2: The Small-scale Renewable Energy Scheme (SRES)

Under the Small-scale Renewable Energy Scheme, eligible small-scale renewable energy systems are entitled to small-scale technology certificates (STCs). One STC is equal to one megawatt hour (1 MWh) of renewable electricity either generated (such as by a solar photovoltaic system) or displaced (such as by solar water heaters and air source heat pump water heaters). STCs create a financial incentive to install small-scale renewable energy systems by reducing upfront installation costs.

Two of the key eligibility requirements for the scheme are:

- The installation is required to be supervised by an electrician accredited by the Clean Energy Council (CEC) specifically trained in such installations; and
- In the case of solar PV the key components (i.e. panels and inverter) are listed by the CEC as meeting Australian Standards. In the case of efficient hot water, they are registered by us as approved units for STCs.

No pre-approval is required for the incentive. STCs can be claimed for up to 12 months after the installation date. Agents registered by us create the certificates on receipt of necessary documentation from installers and retailers selling systems.

The scheme design provides for very efficient administration of an incentive to everyone. However, as it has no pre-approval step, it isn't suitable for a tailored level of support based on income eligibility or type of tenancy (such as rented or owner occupied).

The number of certificates that can be created per system is based on several factors. These factors are described below.

1. Geographical location

Solar radiation varies across Australia. Solar PV systems installed in locations with more solar radiation are likely to produce more renewable electricity, all else equal. There are [4 postcode zones](#), based on solar radiation, used to calculate the quantity of renewable energy certificates a solar photovoltaic (PV) system or solar hot water system may be eligible for once it is installed. Solar PV systems installed in areas with higher solar radiation will receive more STCs than an equivalent system in a lower solar radiation region. Most Australian households are in the same zone (zone 3).

The CER has determined 5 postcode zones for air source heat pumps. These zones are based on regional climate.

2. Installation date

The RET is scheduled to end in 2030. The STC incentive is available to all eligible small-scale renewable energy systems installed prior to 31 December 2030. The number of STCs issued per system depends on the date of installation, with the incentive reducing from 1 January each year from 2016 to 2030.

STCs are created upfront. Prior to 2016, the maximum deemed life of a small-scale solar PV system was 15 years. This meant the maximum number of STCs a system could create was based on the expected generation over a 15 year period. In 2023, the maximum STCs an eligible small-scale solar PV system can claim is based on 8 years of generation, representing the period remaining before the RET ends in 2030.

For solar water heaters and air source heat pump water heaters, one STC represents 1 MWh of avoided energy consumption over the system's deemed life which is 8 years for systems installed in 2023.



3. The amount of electricity that is generated or displaced.

The amount of electricity generated or displaced depends on the size and type of the system installed. Generation, meaning how much electricity is produced, is relevant for solar PV systems. Larger solar PV systems, in terms of installed capacity, generate more electricity than smaller systems and therefore are eligible for more STCs.

Electricity displacement is relevant for solar water heaters including air source heat pumps. The amount of electricity displaced refers to the estimated reduced demand for electricity from the grid after solar water heaters are installed. For a solar water heater, the manufacture must provide this information to the CER which is then transferred to the Register of solar water heaters.

Table 1 below shows how the number of STCs created for a solar PV system depends on the installation year, system size and location. For small-scale solar PV, the number of STCs created is equal to the post code zone rating multiplied by the deeming period in years multiplied by the system size in kilowatts (kW).

**Table 1 Examples of deeming period and STC incentive for a SRES solar PV system**

| Postcode zone | Installation year | Deeming period | System size | STCs | STC incentive |
|------------------|-------------------|----------------|-------------|------|---------------|
| 1 (1.622) | 2016 | 15 years | 6.6 kW | 160 | \$6,400 |
| | 2023 | 8 years | 6.6 kW | 85 | \$3,400 |
| | 2030 | 1 year | 6.6 kW | 10 | \$400 |
| | 2016 | 15 years | 10 kW | 243 | \$9,720 |
| | 2023 | 8 years | 10 kW | 129 | \$5,160 |
| | 2030 | 1 year | 10 kW | 16 | \$640 |
| 2 (1.536) | 2016 | 15 years | 6.6 kW | 152 | \$6,080 |
| | 2023 | 8 years | 6.6 kW | 81 | \$3,240 |
| | 2030 | 1 year | 6.6 kW | 10 | \$400 |
| | 2016 | 15 years | 10 kW | 230 | \$9,200 |
| | 2023 | 8 years | 10 kW | 122 | \$4,880 |
| | 2030 | 1 year | 10 kW | 15 | \$600 |
| 3 (1.382) | 2016 | 15 years | 6.6 kW | 136 | \$5,440 |
| | 2023 | 8 years | 6.6 kW | 72 | \$2,880 |
| | 2030 | 1 year | 6.6 kW | 9 | \$360 |
| | 2016 | 15 years | 10 kW | 207 | \$8,280 |
| | 2023 | 8 years | 10 kW | 110 | \$4,400 |
| | 2030 | 1 year | 10 kW | 13 | \$520 |
| 4 (1.185) | 2016 | 15 years | 6.6 kW | 117 | \$4,680 |
| | 2023 | 8 years | 6.6 kW | 62 | \$2,480 |
| | 2030 | 1 year | 6.6 kW | 7 | \$280 |
| | 2016 | 15 years | 10 kW | 177 | \$7,080 |
| | 2023 | 8 years | 10 kW | 94 | \$3,760 |
| | 2030 | 1 year | 10 kW | 11 | \$440 |

Notes: STC incentive is based on the \$40 STC Clearing House price. The actual upfront discount may vary depending on factors including but not limited to STC market prices and installer's business model. Information provided in this table is for illustrative purposes only. The CER maintains a [small generation unit STC calculator](#) and [solar water heater STC calculator](#) which can be used to calculate the number of certificates a system may be eligible for.



The RET requires liable entities, usually electricity retailers, to purchase and surrender a certain number of STCs to the CER each year. The number of STCs they are required to surrender each year is set by the small-scale technology percentage, made in regulations and published on our website. This process sets demand for STCs and hence facilitates the creation of a market which aims to balance supply and demand for STCs over time.

The CER supports scheme transparency and integrity by making recommendations to the Minister on setting the small-scale technology percentage each year, ensuring STCs are correctly created and that liable entities surrender the correct number each year to meet their obligations. We also manage [shortfall charge](#) arrangements under the scheme. Shortfall charge is incurred when liable entities do not fully acquit their STC liability. In 2023, the small-scale technology percentage (STP) was set at 16.29%. This requires 28.5 million STCs to be surrendered to the CER for the 2023 compliance year. We also publish market data in [Quarterly Carbon Markets Reports](#).

The STC incentive is available to all who install an eligible system under the SRES.

Small-scale solar PV

The SRES has been very effective in supporting households invest in rooftop solar PV. More than 3.3 million small-scale solar PV systems have been incentivised under the SRES since 2011 with a combined installed capacity of 20.5 GW (see Table 2). It is estimated that 1 in 3 suitable⁶ dwellings have rooftop solar PV in Australia.

Table 2 Rooftop solar PV systems installed under the SRES, 2011 to 2023

| Year | Total rooftop solar PV installations | Total installed capacity (MW) | Estimated residential rooftop solar PV installations | Estimated residential installed capacity (MW) |
|---------------------|--------------------------------------|-------------------------------|--|---|
| 2011 | 360,745 | 872 | 360,049 | 853 |
| 2012 | 343,320 | 1,036 | 342,255 | 1,008 |
| 2013 | 200,407 | 792 | 198,084 | 724 |
| 2014 | 180,139 | 800 | 176,623 | 684 |
| 2015 | 141,500 | 706 | 137,641 | 576 |
| 2016 | 132,697 | 748 | 128,142 | 584 |
| 2017 | 174,942 | 1,119 | 167,947 | 860 |
| 2018 | 224,852 | 1,617 | 214,924 | 1,252 |
| 2019 | 284,031 | 2,165 | 272,076 | 1,727 |
| 2020 | 370,320 | 2,965 | 355,547 | 2,438 |
| 2021 | 377,447 | 3,192 | 360,751 | 2,631 |
| 2022 | 314,930 | 2,782 | 299,918 | 2,291 |
| 2023 (to 31 August) | 191,741 | 1,716 | 182,725 | 1,447 |
| Total | 3,297,071 | 20,510 | 3,196,682 | 17,075 |

Note: A 12 month creation period for registered persons to create small-scale technology certificates applies under the Renewable Energy (Electricity) Regulations (2001). Data for installations and installed capacity in 2022 and 2023 may change. Estimated household rooftop solar PV installations is based on systems with an installed capacity of up to 15 kW. It is likely there are some

⁶ This excludes high density apartments.



commercial and industrial systems captured in the sub-15 kW figures, particularly in earlier years. This is likely offset by a portion of residential systems greater than 15 kW installed more recently.

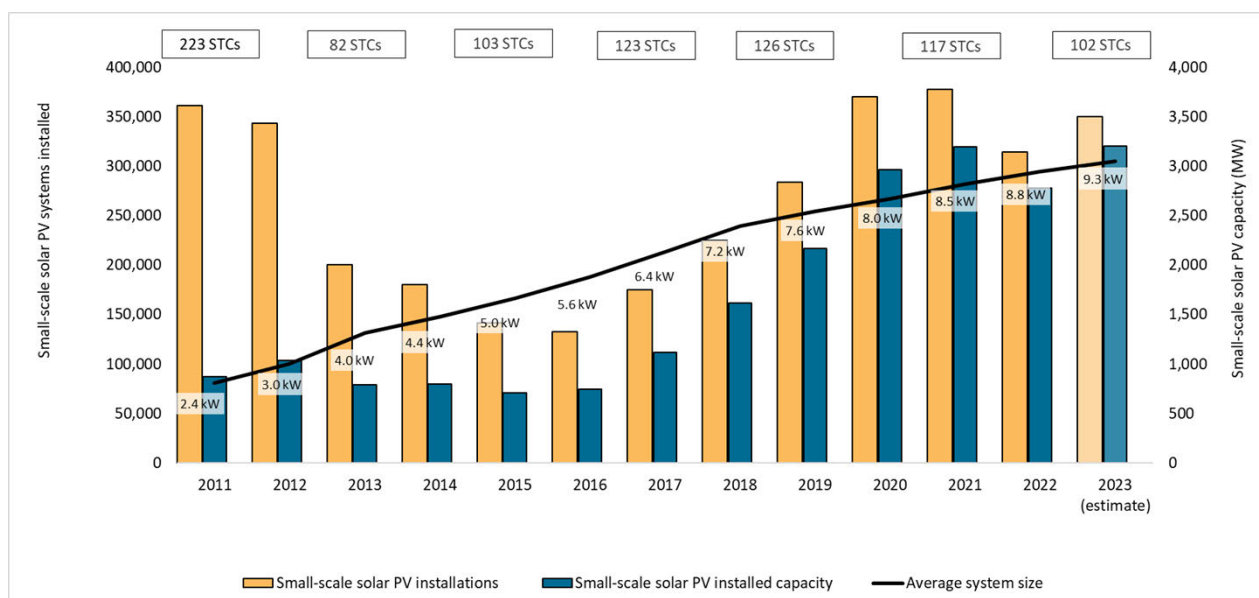
Data collected by the CER does not specifically identify where a solar PV system is installed on a residential or commercial building. The estimated number of residential systems are identified based on the system size. Based on an assumption that systems of less than 15 kilowatt (kW) in capacity are households, and systems above that size are commercial/industrial, 3.2 million systems for a total of 17.1 GW capacity are residential systems.

The STC incentive has in recent years represented about one third of the total cost of a solar PV system, typically provided as a material upfront discount to consumers with average payback periods of about 4 years. Since the COVID-19 pandemic, upfront system costs have increased. This reflects the gradual decline in deeming as less STCs are created per system, coupled with rising input costs. However, payback periods have remained similar as energy costs have also increased.

State/Territory incentives have also been periodically available for small-scale solar PV systems in some jurisdictions which are likely to have contributed to further uptake in these regions. Currently, ACT and Victoria have programs which further reduce the costs to consumers. See graphs showing installation trends over time in various jurisdictions (Attachment 1: Figure A1.2 and Figure A1.3).

Figure 1 below shows the number of small-scale solar PV systems and new installed capacity from 2011 to 2023 (estimated for the full year). It also shows the average system size over this period, represented by the mean. The number of STCs per system is calculated based on the average system size in that year. In 2011-2013 a multiplier was applied to the STC incentive, resulting in a greater number of STCs per system. This contributed to the high volumes of installs over this period. New installed solar PV capacity has grown over time as systems have increased in size.

Figure 1 Small-scale solar PV systems, new installed capacity, average system size and number of STCs per average system, 2011 to 2023



Note: postcode zone 3 (1.382) is used to calculate number of STCs.

The average system size has been increasing over time, as technology has improved and input costs have come down. This also corresponds to increasing demand for larger household systems as Australians prepare for electrification and look for ways to manage rising energy bills. The average system size for new



installations in 2023 is more than 9 kilowatts (kW), up from 2.4 kW in 2011. The most commonly installed household system size is 6.6 kW.

The number of SRES solar PV systems and capacity installed increased each year from 2016 to 2021. Between 2016 and 2021, installed capacity grew by an average 35% per year. Rooftop solar PV is a consumer product and as such is affected by a range of external factors. The COVID-19 pandemic resulted in a shift in discretionary spending away from leisure activities including travel towards home improvements. Many Australians were working from home and looked to solar PV as a way to manage rising energy costs. These factors contributed to the record 3.2 GW installed capacity in 2021. Following this increase in investment in 2021, there was a downturn in the first half of 2022. Adverse weather conditions and the return to recreational spending also contributed to fewer installations. In the first half of 2023, 1.4 GW of new small-scale solar PV capacity was installed, tracking to more than 3 GW in 2023, another strong year of uptake.

The STC incentive is available for the following eligible installation types:

- Original system installed. First system installed at address.
- Replacement systems. The panels and inverter are replaced.
- Additional separate systems. New panels and a new inverter are installed.
- Additional capacity/upgrade (extension). New panels are added using an existing inverter.

STCs are not available for replacement of panels only or second-hand panel purchases. This scenario is ineligible because at least one major component (i.e. panel or inverter) has been used to previously claim STC certificates in the entitlement period.

In 2022, over 80% of solar PV systems installed were new installations while 13% were replacements of existing systems including the inverter. Additional systems installed at the same address as an existing system made up 6% of all installations. Less than 1% of installations were extensions to an existing system. Given the commencement of SRES in 2011, older, smaller systems at end of life are now being replaced with larger systems. Extreme weather events have also contributed to a high proportion of replacement systems in certain regions.

Other small generating units

Small-scale hydro and wind systems are also eligible for STCs under the SRES. These systems are not common with less than 10 small hydro systems and 99 wind systems installed between 2011 and 2023.

Batteries

Batteries are not incentivised under the SRES. The CER collects voluntarily reported data on battery installations that accompany a small-scale solar PV system. This data suggests about 8% of all new systems are installed with concurrent battery storage. Market analysts suggest the true battery attachment rate could be closer to 15%.

There has been a trend in larger solar PV system sizes being installed with concurrent battery storage. The increase in the average solar PV system size and tendency for batteries to be paired with larger systems is an indication that households are preparing for electrification. Batteries are most often installed with extensions of existing solar PV systems where consumers are adding more panels to increase the generating capacity.

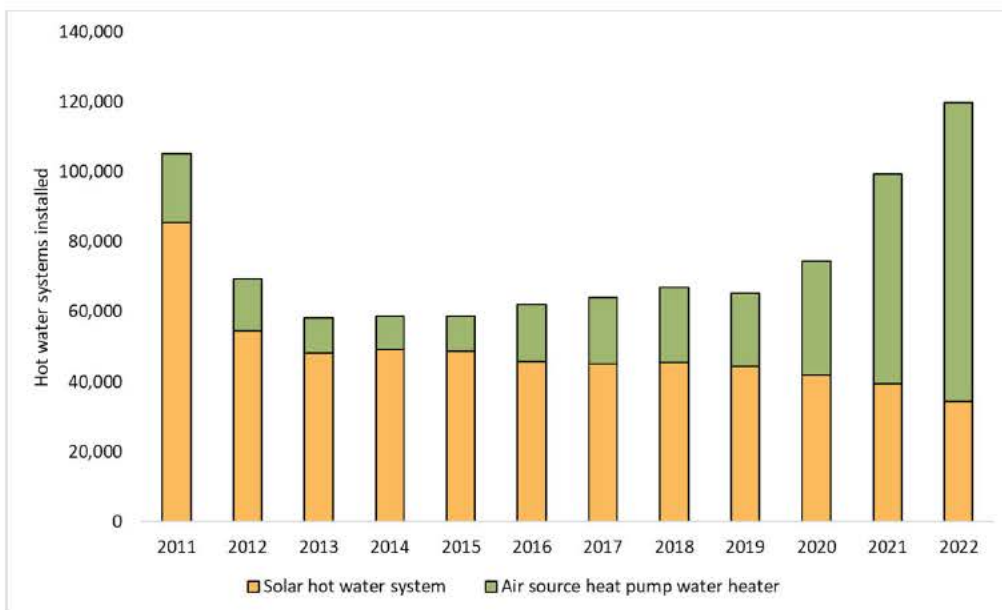
Water heaters

The STC incentive supports households to install efficient hot water systems. Solar hot water systems and air source heat pump water heaters (ASHPs) are eligible for STCs under the SRES. To be eligible the system must be on the [register of solar water heaters](#). From 2011 to 2023 almost 1 million of these systems were



installed. In 2011, 81% of hot water systems installed under the SRES were solar hot water and 19% were ASHPs. In 2021 ASHPs overtook solar hot water and in 2023 they represent 81% of water systems incentivised under the SRES (see Figure 2). The proportion of the total cost that the STC incentive covers varies between technology type and geographic region. The number of hot water systems installed under the SRES is an underestimate of total systems installed in Australia. The process for claiming the STC incentive for hot water system installations is not as well established as solar PV and there are some who may choose not to participate in the scheme.

Figure 2 Solar hot water systems and air source heat pump water heater installations, 2011 to 2022

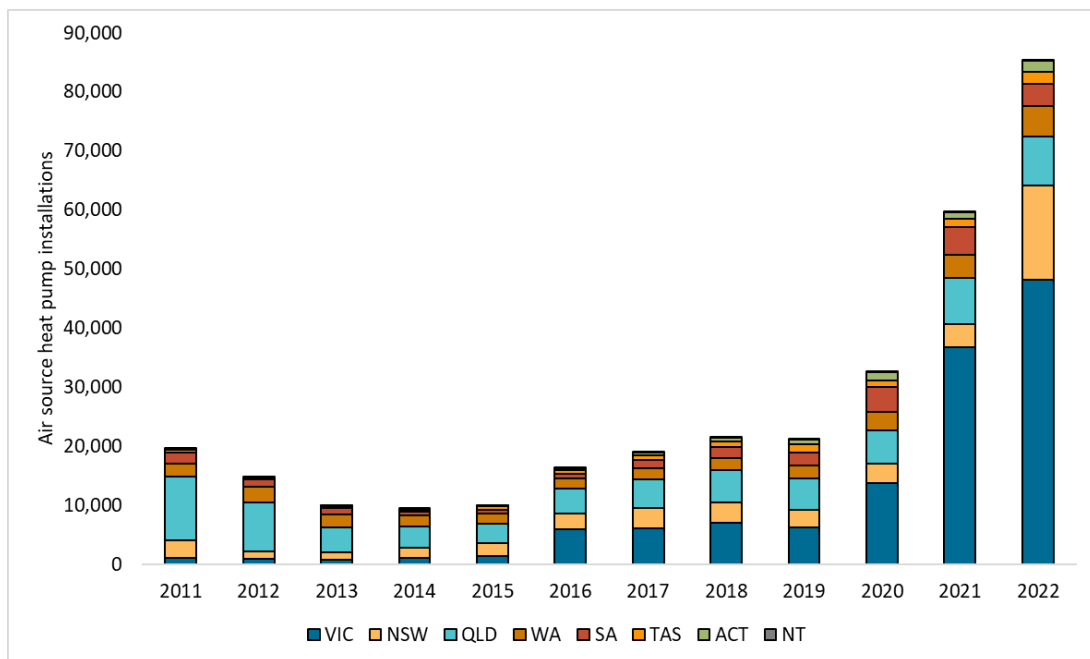


The SRES has supported households to replace their old electric or gas hot water systems with efficient air source heat pumps or solar water heaters. The CER collects data on the reason for installation for water heaters. Of the 123,000 water heaters installed under the SRES in 2022, almost half (46%) were replacing existing electric water heaters. There are typically more complexities involved when it comes to converting from an existing gas hot water system to a solar hot water system or air source heat pump. These types of installations represented 7% of water heaters installed under the SRES in 2022, expected to grow to nearly 10% in 2023. Hot water systems installed in new buildings made up 27% of all SRES water heaters in 2022. The reason for installation for the remaining water heaters installed under the SRES in 2022 was replacing existing solar water heaters (16%) or other (4%).

The most substantial growth in air source heat pump (ASHP) installations has been observed in states and territories with additional incentive programs. Figure 3 below highlights the recent growth in ASHP installations in Victoria and New South Wales. Both states offer additional incentive programs which may represent a significant upfront discount to the cost of the system.



Figure 3 Air source heat pump installations by state and territory, 2011 to 2022



In total, small-scale installations have the capacity to generate or displace approximately 32 million megawatt hours of electricity annually. Of this, approximately 27 million megawatt hours are from small generation units), with efficient water heaters displacing a further 5 million megawatt hours of otherwise-required generation.

Compliance and integrity

The CER undertakes activities to ensure compliance with the requirements of the *Renewable Energy (Electricity) Act 2000* and *Renewable Energy (Electricity) Regulations 2001*. In the SRES, these activities range from extensive automated checks and the validation of claims via supporting documentation through to investigations and enforcement action.

In 2018 the CER partnered with industry to implement the Solar Panel Validation (SPV) initiative. SPV aims to protect the integrity of the SRES. It gives industry and consumers an easy way to confirm that solar panels are backed by manufacturer warranties, meet Australian standards for quality and performance, and are eligible for STCs.

SPV has also improved the efficiency of the administrative process for creating STCs. Applications to create STCs submitted with verified solar panel information are likely to be processed more quickly, typically within 48 hours, subject to the application successfully meeting all eligibility requirements under the scheme.

Approximately 80% of STC applications are now completed using SPV.