Australian Government
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Renewable Energy Target

Administrative Report

C E R Renewable Energy Target

2023

CLEAN ENERGY REGULATOR

The Hon Chris Bowen MP
Minister for Climate Change and Energy
Parliament House
CANBERRA ACT 2600

Dear Minister

I am pleased to submit the 2023 Renewable Energy Target (RET) Administrative Report. This report covers the full 2023 calendar year and is submitted for presentation to Parliament under section 105 of the *Renewable Energy (Electricity) Act 2000* (the Act). The report incorporates key information and data relating to the RET from the December Quarter 2023 Quarterly Carbon Market Report (QCMR). The QCMR includes key information and metrics covering the operation of the Act.

I am also pleased to report that the objects of the Act continue to be met. That is, to encourage additional generation of electricity from renewable sources and to reduce emissions of greenhouse gases in the electricity sector. In 2023, generation from all renewable energy incentivised by the RET reduced greenhouse gas emissions by 48.3 million tonnes of carbon dioxide equivalent (CO_2-e). This uses a conservative approach of multiplying the total megawatt hours (MWh) of zero emissions generation by the average emissions intensity of all generation in Australian electricity grids. However, if a displacement approach is used where every additional MWh of renewable energy displaces a MWh of fossil fuel generation. The estimated greenhouse gas emissions reduction is about 78.7 million tonnes CO_2-e.

The RET supports renewable investment through incentives via large-scale generation certificates (LGCs) and small-scale technology certificates (STCs). In 2023, 49.6 million LGCs were validated, a 7.5 million increase compared to 2022. Additionally, 37.3 million STCs were validated in 2023, similar to the 38 million created in 2022.

Corporate ambition to demonstrate renewable energy use continued to drive LGC demand in addition to the 33 million LGCs required for the statutory Large-scale Renewable Energy Target (LRET). In 2023, 8.7 million LGCs were cancelled for voluntary ambition, a 1.3 million increase compared to 2022.

In 2019, when sufficient capacity was installed to meet the 33,000 gigawatt hour LRET, the renewable generation share in the National Energy Market was 23%. This has increased each year to 39% in 2023, and we expect a further increase to around 40% in 2024.

In 2023, Australia continued to deploy renewables at pace. It was the 6th year in a row that more than 5 gigawatts (GW) of total capacity was added. In total, 5.3 GW of capacity was installed in 2023 across the large and small-scale schemes.

Australian households and businesses continued to take control of their energy bills. In 2023, 3.1 GW of rooftop solar capacity and 135,000 air source heat pumps were installed in the Small-scale Renewable Energy Scheme (SRES). This is the second highest annual rooftop solar capacity installed, just short of the 3.2 GW record set in 2021. It was also the highest number of air source heat pump installations, 48,000 more than the 87,000 installed in 2022.

For large-scale wind and solar projects, 2.2 GW of large-scale capacity was approved to generate LGCs in 2023, slightly less than the 2.5 GW in 2022. Final investment decisions for large-scale renewable energy power stations were lower in 2023 with 1.6 GW of capacity announced, compared to 4.5 GW in 2022. Noting, Q2 2022 was a very large quarter for final investment decisions.

Looking forward, additional renewable energy capacity reaching first generation is trending up. We expect total added renewable energy capacity to exceed 7 GW in 2024 with 3.1 GW of rooftop solar and around 4 GW of large-scale renewables. In 2024, there has also been a return to higher levels of investment in large-

scale wind and solar. In the first half of 2024, 1.8 GW of new projects reached a final investment decision, already exceeding the 2023 total.

The RET augmented by the Capacity Investment Scheme and the enduring Renewable Energy Guarantee of Origin (REGO) certificate will support achievement of your goal of 82% renewable energy by 2030 and play an important part in Australia meeting its legislated greenhouse gas emissions reduction target.

Yours sincerely

Carl Binning
Acting Chair and CEO
Clean Energy Regulator

5 November 2024

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Report objective

In accordance with section 105 of the *Renewable Energy (Electricity) Act 2000* (the Act), the Clean Energy Regulator must give the Minister a report on the working of the Act during the year for presentation to Parliament.

To meet this legislative requirement, the 2023 Renewable Energy Target Administrative Report covers the operations of the Renewable Energy Target and the performance of the large-scale and small-scale renewable energy schemes for the 2023 calendar.

Report disclaimer

All figures are sourced from the Clean Energy Regulator (CER) unless otherwise referenced. All statements in this report reflect current policy settings, other than in specific instances where the Australian Government has announced or is consulting on proposed policy changes.

This Renewable Energy Target (RET) Administrative Report represents the views of the CER at the date of publication. The CER is providing this information to the market to increase market transparency, help identify genuine low-cost carbon abatement opportunities, and assist entities that produce or need to source units and certificates under the schemes the CER administers. The CER has used its best endeavours to ensure the quality of the information in this document but cannot guarantee its accuracy or completeness. The RET Administrative Report is not legal, business or financial advice. You should obtain independent professional advice on your circumstances before making any investment decisions. The information is provided as general information only. Neither the CER, nor the Commonwealth of Australia will accept liability for any direct, incidental or consequential loss or damage resulting from the RET Administrative Report, or the information provided through the RET Administrative Report, or the availability or non-availability of the RET Administrative Report.

Version history

Version	Date	Changes
1.0	24 January 2025	Initial publication

Glossary

The CER glossary includes definitions/explanations of many terms and acronyms used throughout this report.

Executive summary

Accelerating carbon abatement for Australia

The schemes we administer continue to accelerate carbon abatement. In 2023, 65.5 million tonnes of carbon dioxide equivalent (CO_2-e) were abated. This is 5.5% more than 2022. This calculation is based on an Australian carbon credit unit (ACCU) being equivalent to 1 tonne of CO_2-e. The calculation also conservatively estimates abatement of renewable energy that is incentivised by the Renewable Energy Target (RET). This is calculated by multiplying megawatt hours (MWh) by the rapidly declining emissions intensity of the grid (0.58 tonnes per MWh in 2023).

Alternatively, a thermal displacement method could be used to estimate renewable energy abatement. This alternative calculation multiplies the MWh of renewable energy by the weighted average emissions intensity of the thermal generation it displaced (0.94 tonnes per MWh in 2023). In 2023, using this method the schemes we administer contributed 95.9 million tonnes of CO_2-e emissions reduction.

Explore further detail in the emissions reduction chapter.

Renewable energy generation records in the National Energy Market (NEM)

In Q4 2023, there was an average of 43% renewable energy generation in the NEM. This contributes significantly to the Australian Government's 82% renewable electricity by 2030 target. Noting, the 82% target is an annual target and applies to the 5 grids across Australia. For the whole of 2023, renewable energy generation averaged 39%. In 2024, we expect an average of 42% renewable electricity.

Australia continued to deploy renewables at a rapid pace in 2023. It was the 6th year in a row of more than 5 gigawatts (GW) of total capacity being added, with 2023 totalling 5.3 GW. Over 90% of this capacity was added in the NEM.

Small-scale rooftop solar continues to grow with 3.1 GW of capacity installed in 2023. This is an increase from the 2.8 GW installed in 2022. We expect about 3.1 GW to be installed again in 2024. An annual record would be set in 2024 if the upward trend from 2022 to 2023 continues.

Final investment decisions (FID) are an indication of large-scale wind and solar investment. In 2023, 1.5 GW was announced, of which 0.8 GW was announced in Q4 2023. This was well down on the 4.5 GW announced in 2022. However, Q1 2024 started positively with 0.56 GW announced in January 2024. FID capacity is expected to be higher in 2024 driven by the expanded Capacity Investment Scheme (CIS).

At the end of 2023, 6.5 GW of large-scale capacity was under construction. This capacity is expected to reach first generation in 2024 to 2026.

Read more in the large-scale generation certificate (LGC) and state of total renewables chapters.

Record LGC supply and demand

In 2023, total LGC supply was a record 49.6 million, with 13.1 million LGCs supplied in Q4 2023. The key sources of LGC demand are the renewable power percentage (RPP), cancellations for shortfall charge refunds and voluntary demand. Total LGC demand in 2023 was about 43.9 million.

In 2023, liable entities surrendered 29.9 million LGCs towards their 2023 RPP compliance obligations. Some liable entities opted to take shortfall equal to 4.1 million LGCs, where a shortfall charge must be paid. Other liable entities carried forward 0.5 million LGCs, where the shortfall was less than 10% of their obligation.

Liable entities that pay the shortfall charge are eligible for a refund if they surrender the equivalent number of LGCs within 3 years. In 2023, 5.3 million LGCs were surrendered for refund.

In Q4 2023, 0.75 million LGCs were cancelled for non-Renewable Energy Target (non-RET) demand to prove the use of renewable energy. This brought the 2023 total to 8.7 million, an annual record. We expect about 10 million LGCs to be cancelled for non-RET demand in 2024.

In 2023, the LGC spot price dropped to a low of $39.75 in February 2023. This drop is typical in February following the annual RPP surrender on February 14. The spot price then recovered to a peak of $58.75 in June 2023. In Q4 2023, the price fluctuated between $45.50 and $52.00, with 2023 ending at $49.50.

Read more in the LGC chapter.

Australians continue to invest in rooftop solar and air source heat pumps

In 2023, households and small businesses installed 331,000 rooftop solar systems and 135,000 air source heat pumps. The average rooftop solar system size in Q4 2023 was 9.8 kilowatt (kW), a quarterly record. The average rooftop solar system size with a battery was even bigger at 10.2 kW. Installing bigger systems with a battery can support home electrification. For example, charging electric vehicles and switching to electric appliances.

In 2023, 37.3 million small-scale technology certificates (STCs) were created. For the 2023 compliance year, liable entities surrendered 29.2 million STCs towards the 2023 small-scale technology percentage (STP). For the Q4 2023 compliance period, liable entities surrendered 5.0 million STCs.

The STC clearing house acts as a liquidity mechanism for the STC market. While the STC clearing house spent much of 2023 in deficit, it's been in a modest surplus since September 2023. The growing surplus in the clearing house and in accounts likely influenced the STC spot price dropping slightly to $39.30 at the end of Q4 2023. Conversely from April 2022 to August 2023, the STC spot price fluctuated between $39.90 and $39.95. This is just below the STC clearing house price of $40. During this time, the STC clearing house was in deficit.

Read more in the STC chapter, including state and territory installation trends.

Table ES.1: Renewable energy certificate prices

Unit or certificate	Spot price (31 December 2023)	Change over the quarter
LGC	$49.50	-$2.25
STC	$39.30	-$0.50

Data is sourced from Jarden and CORE markets.

1. State of total renewables

Investment in renewables is supported by the Renewable Energy Target (RET) through large-scale generation certificates (LGCs) and small-scale technology certificates (STCs). LGCs and STCs provide incentives to bring forward investment in additional renewable energy and support the economic case for new projects and installations.

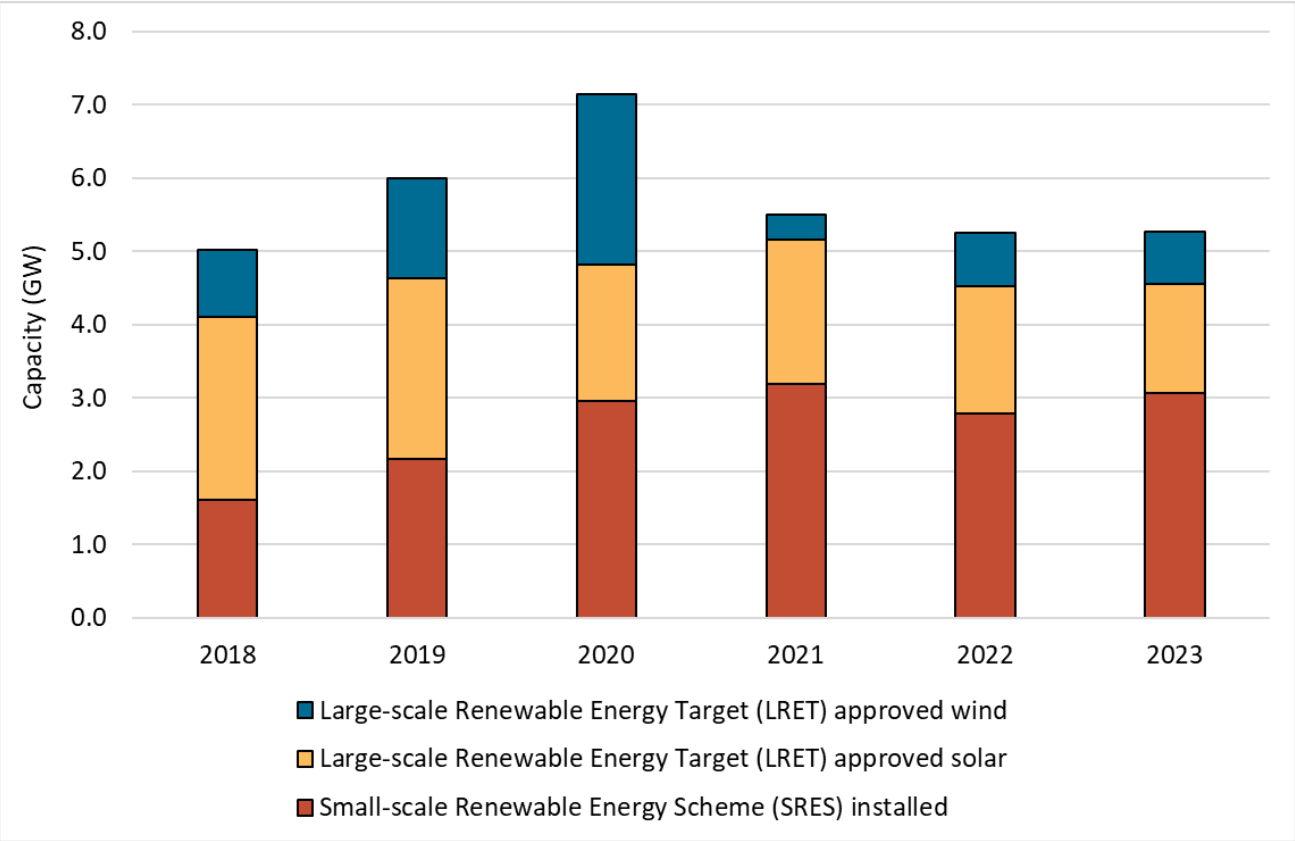
In 2023, Australia continued to deploy renewables at a rapid pace. It was the 6th year in a row of more than 5 gigawatts (GW) of total capacity being added. The total renewable capacity added in 2023 was 5.3 GW.

Rooftop solar rebounded to the second highest annual capacity with 3.1 GW installed in 2023. Households and businesses also installed a record 135,000 air source heat pumps, which are energy efficient hot water systems. This is up 55% compared to the 87,000 installed in 2022. Additionally, 2.2 GW of newly completed large-scale renewable capacity was approved by the Clean Energy Regulator (CER) to create LGCs.

In 2023, the total estimated generation incentivised by the Small-scale Renewable Energy Scheme (SRES) and Large-scale Renewable Energy Target (LRET) was 27,900 gigawatt hours (GWh) and 48,800 GWh respectively. This represented around 28% of all electricity generation in Australia, 12% higher than 2022.

In 2024, we expect at least 3.1 GW of rooftop solar and 2.5 to 3.0 GW of large-scale renewables to be added. If the large-scale power stations under construction progress on schedule, the total renewable capacity added in 2024 could exceed 6 GW.

Figure 1.1: Installed and approved renewable capacity by technology type, 2018 to 2023



About Figure 1.1

This figure shows installed capacity under the SRES and approved capacity for wind and solar power stations under the LRET in gigawatts (GW) over time.

The small print

A 12 month creation period for registered persons to create small-scale technology certificates (STCs) applies under the Renewable Energy (Electricity) Regulations (2001). SRES installed capacity in 2023 has been lag-adjusted to account for the 12 month creation rule and is an estimate only. The 2023 installed capacity figure may change.
Capacity figures relating to the LRET are based on the approval date. This is the date a renewable energy power station was approved by the Clean Energy Regulator (CER) to be accredited to create large-scale generation certificates (LGCs).

Households continue to make a large contribution to the renewables transition

The acceleration of households preparing for electrification and taking control of their energy costs continued. In 2023, 331,000 rooftop solar systems were installed with an average system capacity of 9.3 kilowatts (kW), an annual record. This is up 0.5 kW compared to 2022 and the highest growth in 3 years.

In 2023, 27,000 batteries were reported to be installed with rooftop solar systems. This is about 8% of rooftop solar systems installed in 2023. Battery data is voluntarily reported to the CER and is incomplete. Other market sources suggest the rate is higher at around 14%.

Since 1 January 2020, 12 GW of rooftop solar capacity has been installed. This is over half the total capacity installed since the SRES commenced. Payback periods for rooftop solar remain relatively stable at an average of about 4 years despite the reducing incentive under the SRES. In the second half of 2023 prices for systems began falling again after two years of modest increases.

Large-scale deployment stable despite the complexity of connecting to the grid

In 2023, 2.2 GW of large-scale renewable power station capacity was approved by the CER to create LGCs. This was slightly down compared to the 2.5 GW approved in 2022, but similar to the 2.3 GW approved in 2021. Challenges in connecting and integrating new renewable projects remain. However, announcements of new grid scale batteries and further investment in grid infrastructure should enable additional deployment of large-scale renewable projects.

Typically, wind and solar power stations take a minimum of 12 months from commencing construction to reach first generation of electricity, with many taking much longer. It then takes additional time to complete the build for these power stations to generate at full capacity. These timeframes are getting longer in part due to the projects getting bigger as well as construction delays due to the weather and workforce constraints.

About 1.5 GW of large-scale renewable power stations tracked by the CER reached a final investment decision (FID) in 2023. This was down from the 4.5 GW that reached FID in 2022. The lower FID in 2023 may have been partly due to some 2023 announcements being pulled forward to 2022. At the end of 2023, 6.5 GW of large-scale renewable power stations remain under construction. These power stations will likely be approved by the CER to create LGCs in 2024-26. In January 2024, an additional 0.56 GW reached FID.

Solar power stations accounted for around 67%, or 1.5 GW, of the 2.2 GW approved in 2023. This is up from 57% in 2022. 96% of power stations approved in 2023 had a capacity of less than 30 megawatts (MW). These smaller power stations include rooftop solar installed by businesses as well as smaller solar farms near mines and industrial sites. In 2023, 12 utility scale solar power stations with a capacity greater than 30 MW were approved. The average size of these power stations was 130 MW. Solar power stations greater than 30 MW are typically classified as scheduled or semi-scheduled generation and may follow the Australian Energy Market Operator's (AEMO) central dispatch process.

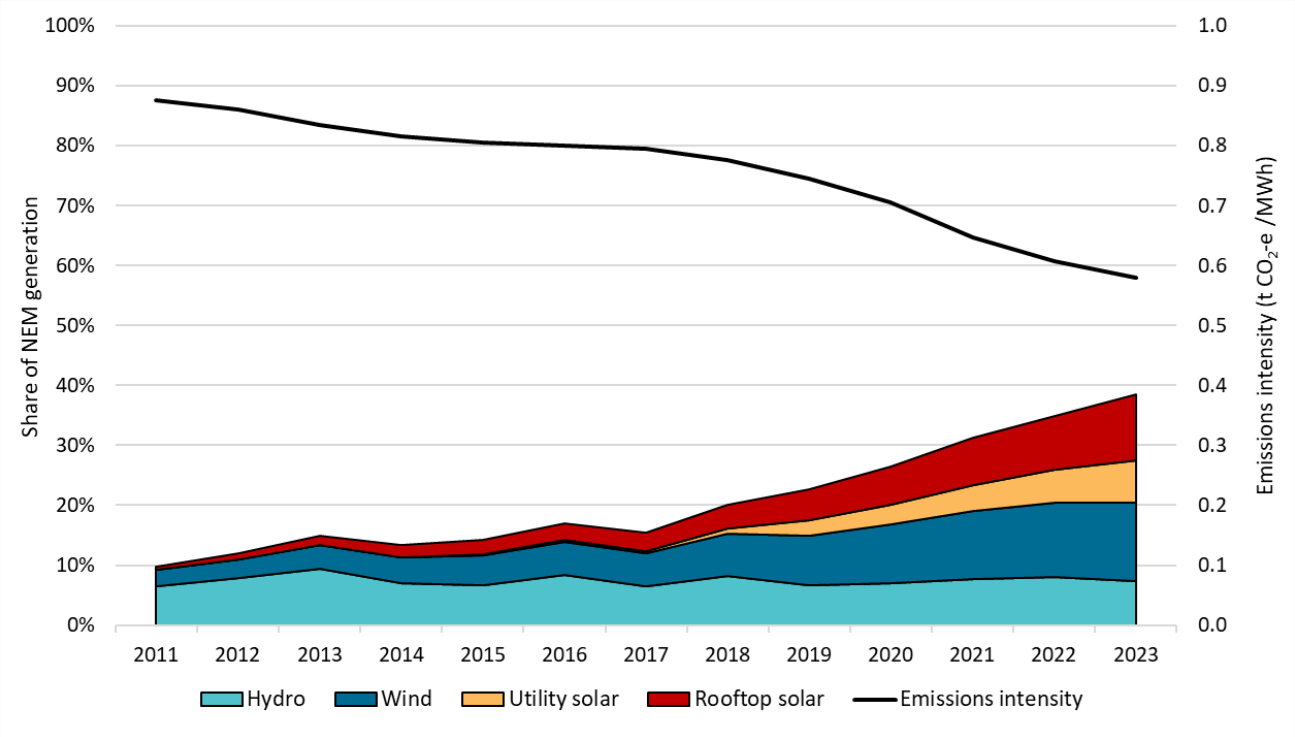
NSW accounted for nearly half of approved capacity in 2023, up from 33% in 2022. This is followed by Queensland with over 30% of approved capacity.

Solar is driving renewable generation growth

The Australian Government has a target of 82% renewable electricity nationally by 2030. We expect an average of 42% generation from renewable electricity in the National Energy Market (NEM) in 2024. Overall, the average was 39% for 2023, falling just short of our estimate of 40%. However, the year ended well with Q4 2023 averaging 43%, which is typically a seasonally high quarter for renewable electricity generation.

In 2023, renewable generation growth in the NEM was driven by rooftop and large-scale solar, which grew by 25% and 28%, respectively. Impressively, at times in Q4 2023, rooftop solar met more than 100% of demand in South Australia. In December 2023, South Australia achieved an average of 82% renewables.

Figure 1.2: Renewables generation share and emissions intensity of the National Electricity Market (NEM), 2011 to 2023



About Figure 1.2

This figure shows the share of generation contributed by renewables in the NEM over time. It also shows the emissions intensity of the NEM as tonnes of carbon dioxide equivalent (t CO_2-e) per megawatt hour (MWh) over time. The NEM operates in ACT, NSW, Queensland, SA, Victoria and Tasmania. It does not include WA or NT.

The small print

Generation and emissions intensity data sourced from OpenNEM on 17 January 2024. A small portion of renewable generation, including biomass, is not shown.

In January 2024, the AEMO released the Quarterly Energy Dynamics (QED) report for Q4 2023. The report highlighted many records related to renewables in the NEM were broken in Q4 2023. On 24 October 2023, the maximum instantaneous share of renewable energy generation in the NEM reached a record 72%.

Storage is key to maximising Australia's renewable output

A balanced generation mix in the grid is important to ensure it is secure and stable. Wind has the potential to balance solar generation, as it can generate energy at different times. More wind is being built with 3.5 of the 6.5 GW under construction at the end of 2023 being wind and hybrid power stations.

Renewable energy generation is variable and dependent on the energy source, such as sunlight or wind, being available. At times, peak solar generation can be higher than the required demand. This results in some large-scale renewable power stations, particularly solar, being curtailed. The Q4 2023 QED stated the average quarterly curtailment was 215 MW in Q4 2023. This means renewable capacity is not being used to its full potential.

Storage is becoming central to maximising renewable output. Batteries can store excess generation and discharge the energy when needed. In 2023, many large and longer-term storage batteries were announced. Projects reaching FID in December 2023 and January 2024 included:

- AGL Energy Limited with a 500 MW/1,000 megawatt hours (MWh) battery to be located at AGL's Hunter Energy Hub in NSW
- Synergy with a 200 MW/800 MWh battery. The Kwinana battery storage system 2 will support the South West Interconnected System (SWIS) in WA
- Origin Energy with a 300 MW/650 MWh battery to be located at the Mortlake Power Station in Victoria.

Rapidly shifting policy landscape in 2023

In 2023, there was a substantial change in the policy landscape for renewables, including:

- Australia joined the global renewables and energy pledge on 3 December 2023. The pledge is to triple the world's installed renewable energy capacity by 2030 and to double the global average annual rate of energy efficiency improvements. Australia joined at the 28th meeting of the Conference of the Parties (COP28) to the United Nations Framework Convention on Climate Change (UNFCCC).
- In November 2023, the Australian Government expanded the Capacity Investment Scheme (CIS) to 32 GW nationally. The CIS covers new renewable energy, storage and other capacity for the grid. The first auction will be held in April to May 2024. Additional projects may reach FID driven by the CIS in 2024.
- In December 2023, the Department of Climate Change, Energy, the Environment and Water (DCCEEW) published the annual climate change statement 2023.
    - » The statement outlined increasing renewables is a priority. The statement called out a range of new policies that will drive renewables including the National Electric Vehicle Strategy, Hydrogen Headstart program, Community Energy Upgrades Fund, establishment of the Net Zero Economy Agency, Powering Australia plan and Rewiring the Nation.

2. Large-scale generation certificates (LGCs)

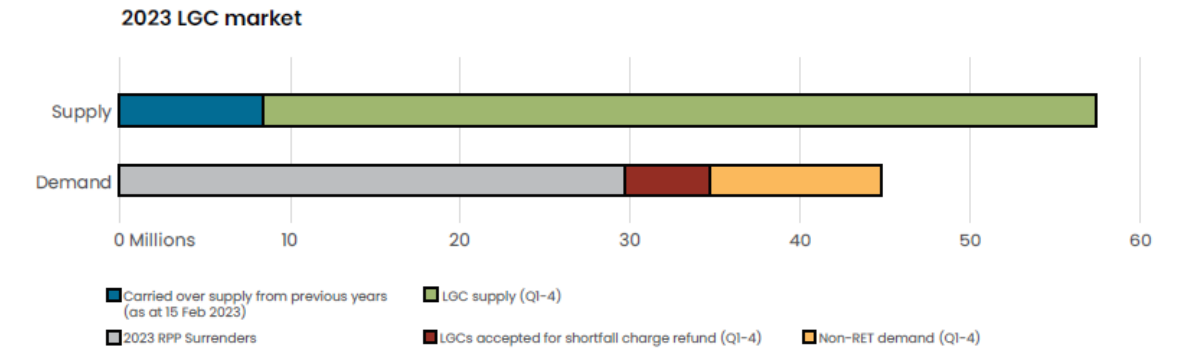
Key messages

- In 2023, 49.6 million LGCs were validated. Of which, 15.5 million LGCs were for solar, 30 million LGCs were for wind and the remaining was from hydroelectricity, biomass and other sources.
- In 2023, the Clean Energy Regulator (CER) approved 2.2 gigawatts (GW) of newly completed capacity to create LGCs.
- Liable entities surrendered 29.9 million LGCs towards their 2023 renewable power percentage (RPP) compliance obligations. Some liable entities opted to take shortfall equal to around 4.5 million LGCs, where a shortfall charge was paid.
- Following RPP surrender on 14 February 2024 there were 16.5 million LGC holdings. This is an increase of 7.7 million LGCs compared to the same time in 2022.
- In Q4 2023, 0.75 million LGCs were cancelled for non-Renewable Energy Target (non-RET) demand. An annual record of 8.7 million LGCs were cancelled for non-RET demand in 2023.
  - » In 2024, 10 million LGCs are expected to be cancelled for non-RET demand.

Q4 2023 LGC market dynamics

	Q4 2023	Change from Q4 2022	2023	Change from 2022	2023 estimate	2023 estimate outcome
LGC supply	13.1 mill	▲17%	49.6 mill	▲18%	48-50 mill	✓
Non-RET demand	0.8 mill	▼30%*	8.7 mill	▲19%	8 mill	▲
Approved capacity	0.6 GW	▼49%	2.2 GW	▼11%	2.5 GW	▼

*Our data shows entities do not always surrender LGCs for non-RET demand within the same quarter each year. Quarterly comparison should be interpreted with caution.



LIST OF ACRONYMS				
	GW	GIGAWATTS	RET	RENEWABLE ENERGY TARGET
	LGC	LARGE-SCALE GENERATION CERTIFICATE	RPP	RENEWABLE POWER PERCENTAGE
	mill	MILLION		

Insights

- Market dynamics

- Solar LGC validations grow, but wind still makes up the majority
- FID subdued in 2023
- Non-RET demand set a record in 2023 which will likely be broken again in 2024
- LGC forward prices strengthen

Market dynamics

In 2023, 49.6 million LGCs were validated on the supply side. While total LGC demand was 43.9 million, where:

- 29.9 million LGCs were surrendered for 2023 RPP compliance on 14 February 2024.
  - » Some liable entities opted to take shortfall equal to 4.1 million LGCs, where a shortfall charge must be paid. In total, there is $841 million consolidated revenue in shortfall charges equivalent to around 13 million LGCs. These LGCs are eligible for refund over the next 3 years. This acts as an effective liquidity mechanism for liable entities. Additionally, around 0.5 million in LGC liability was carried forward for the 2023 RPP, as the shortfall was less than 10% of the entity's obligation.
- 5.3 million LGCs were surrendered for shortfall refund. As this is more than the new shortfall taken, there was a net withdrawal from the market.
- 8.7 million LGCs were cancelled for non-RET demand purposes.

Table 2.1: Estimated LGC balance at the end of the 2023 assessment year

	Supply	Demand
LGCs available from previous assessment years	+7.8 million	
2023 LGC supply (available for 2023 surrender)	+49.6 million	
LGCs surrendered for the 2023 assessment year		-29.9 million
Shortfall charge refunds		-5.3 million
Non-RET cancellations		-8.7 million
Estimated balance for the 2023 assessment year	+13.5 million	

Following the 2023 RPP surrender on 14 February 2024 there were 16.5 million LGCs in holdings. This is 3 million more than the 13.5 million LGCs that are eligible for shortfall refund and carried forward liability. The LGC market is technically in a net surplus for the first time since 2018. This is due to more LGCs being in accounts than owed as shortfall. However, many LGCs in accounts seem to be being held for future voluntary use. These LGCs may be unavailable to meet other demands, such as shortfall.

The 2024 RPP has been set at 18.48%. Liable entities (generally electricity retailers) are required to surrender 33 million LGCs in 2024. Around 8.5 million LGCs are eligible for shortfall refund in 2024. We also expect 10 million LGCs for non-RET demand in 2024.

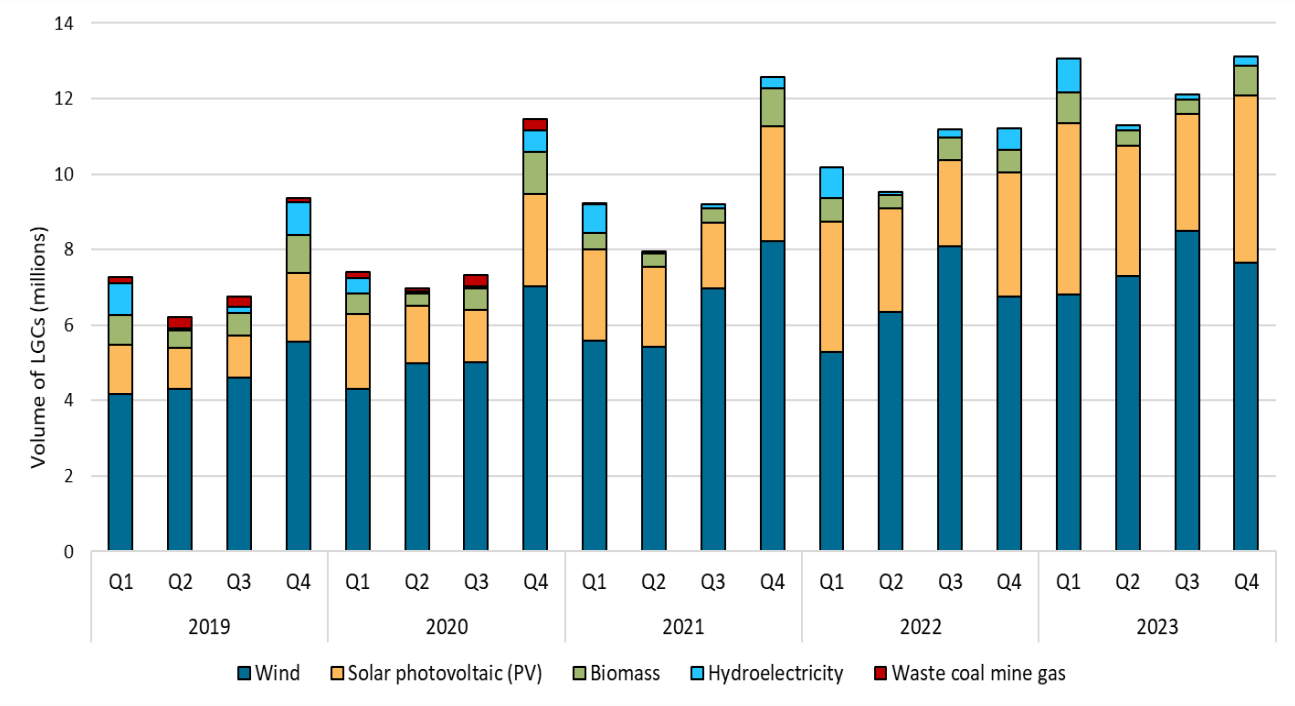
The LGC market will likely remain tight in 2024. For 2024 supply, we expect to validate 52 to 54 million LGCs. While demand could be up to 52 million LGCs, if the 2024 RPP is fully acquitted and all eligible shortfall is redeemed.

Solar LGC validations grow, but wind still makes up the majority

In Q4 2023, a record 13.1 million LGCs were validated, a strong end to 2023. Compared to 2022, 18% more LGCs were validated in 2023. In 2023, 49.6 million LGCs were validated, aligning with our estimate of 48 to 50 million LGCs. This included 30 million LGCs from wind and 15.5 million from solar compared to 26.5 million LGCs from wind and 11.8 million from solar in 2022.

Renewable generation and subsequent LGC supply can fluctuate. Many factors influence generation including weather conditions and natural disaster impacts. The Australian Energy Market Operator's (AEMO) Quarterly Energy Dynamics (QED) report for Q4 2023 highlighted that higher solar irradiance increased grid-scale solar availability in all regions, while lower wind conditions reduced wind generation.

Figure 2.1: Large-scale generation certificates (LGCs) validated by technology type, Q1 2019 to Q4 2023



About Figure 2.1

This figure shows the number of LGCs validated by technology type over time.

The small print

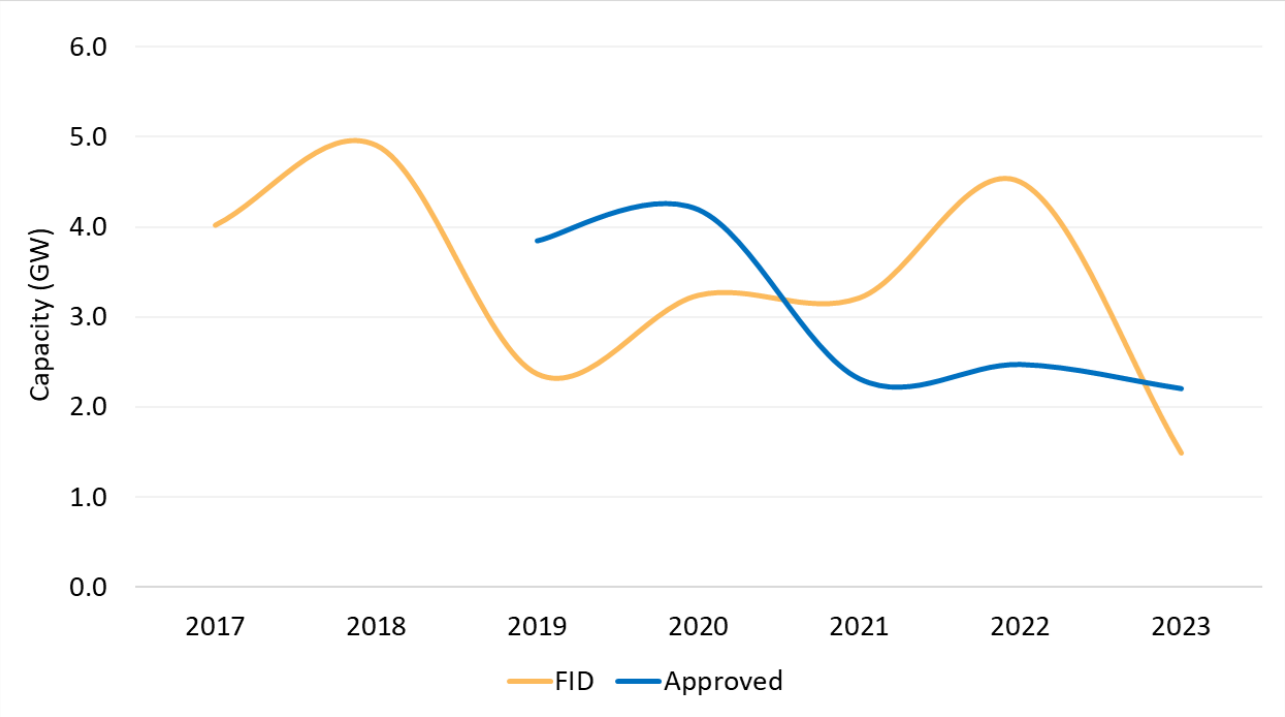
Waste coal mine gas is no longer eligible to create LGCs as of 2021. Any 2021 validations reflect LGCs that were created prior to 2021.

In Q4 2023, 0.65 GW of newly completed capacity was approved by the CER to create LGCs. This included large solar power stations in NSW, Victoria and SA. In 2023, 2.2 GW of newly completed capacity was approved, of which 0.7 GW was wind. This fell short of our 2023 estimate of 2.5 GW. However, in early January 2024, 1 GW of wind and solar power station applications were under assessment by the CER.

In 2024, we expect to approve 2.5 to 3.0 GW of newly completed renewable power stations. We expect this to be from about 60% solar and 40% wind.

Around 8 GW of the 14.5 GW that reached a final investment decision (FID) in the past 5 years has been approved. This means at the end of 2023 about 6.5 GW is under construction. This capacity will likely be approved by the CER to create LGCs in 2024 to 2026 and could add around 17 million LGCs to total supply. Meanwhile new projects will continue to be added to this pipeline. The lag between FID and approval of power stations is discussed in the state of total renewables chapter.

Figure 2.2: Final investment decision (FID) and approved capacity in gigawatts (GW), 2017 to 2023



About Figure 2.2

This figure shows FID and approved capacity in gigawatts (GW) over time. Large-scale renewable power stations are approved by the Clean Energy Regulator (CER) to create large-scale generation certificates (LGCs). Typically, power stations take a minimum of 12 months to be built and reach first generation of electricity, with many taking much longer.

The small print

The Clean Energy Regulator (CER) tracks public FID announcements, this information may not be complete and may change retrospectively.
Data as at 31 December 2023 for approved capacity.
Data as at 1 March 2024 for FID.

FID subdued in 2023

In Q4 2023, 3 new power stations totalling 0.8 GW reached FID. A total of 1.5 GW reached FID in 2023, with around 1 GW from solar and around 0.5 GW from wind and hybrid power stations. In January 2024, 0.56 GW reached FID, a positive start to 2024.

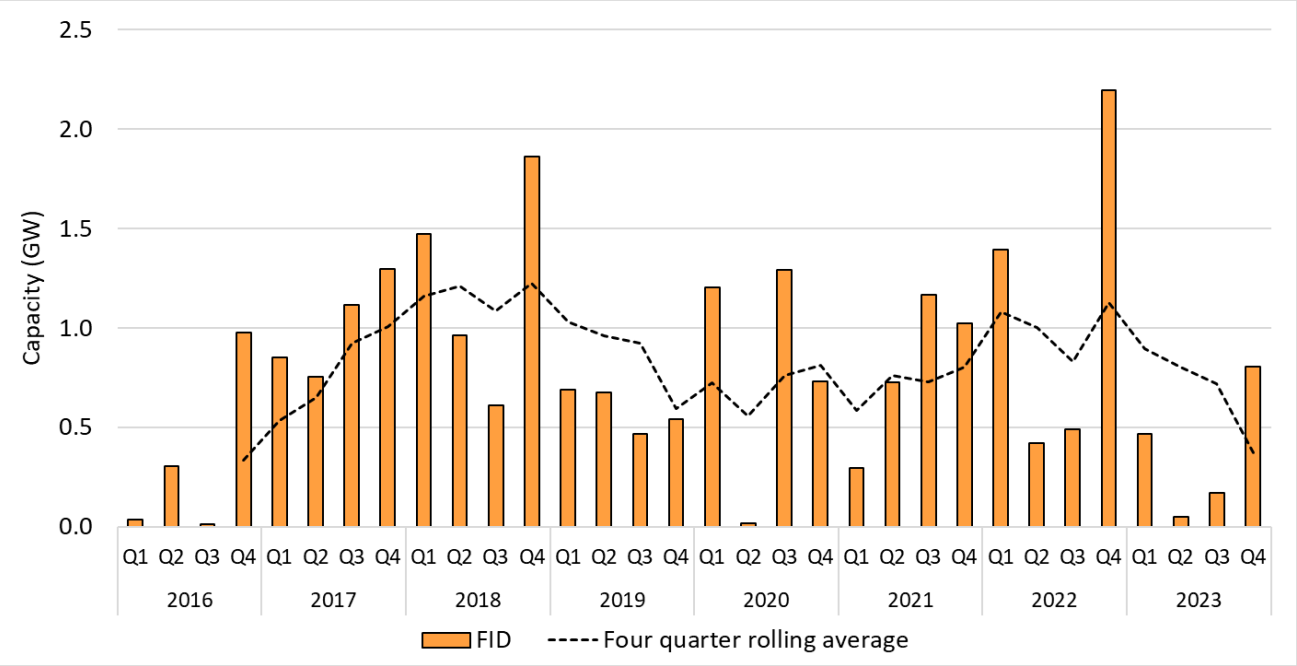
It is difficult to estimate how much capacity will reach FID in 2024. Developers continue to face several challenges including securing power purchase agreements (PPAs), connection approvals and sourcing components and labour. Our engagement with project developers suggests policy outcomes, such as the expanded Capacity Investment Scheme (CIS), are also playing a role. Some developers indicated the outcome of the CIS auctions will play a crucial role in the timing of announcements. We will continue to engage with project developers and the market to inform and report on outcomes throughout the year.

The Renewable Energy Target (RET) also supports renewable power stations and investment. The proposed Renewable Guarantee of Origin (REGO) certificate mechanism would continue certification beyond 2030 and build on the LGC framework. Once legislated, the REGO will support investment, especially when the REGO certificates can be appropriately valued in PPAs.

In November 2023, Infrastructure Partnership Australia released the Australian Infrastructure Investment Monitor 2023 report. The report includes survey results of international and Australian investor's views. The

report found renewables are an attractive investment. In particular batteries and other short duration storage assets as well as energy transmission and distribution. The report also found there are barriers to investment. This includes ensuring an adequate transmission network, ongoing supply chain constraints and skilled labour shortages.

Figure 2.3: Final investment decision (FID) capacity in gigawatts (GW) for large-scale renewable generation, Q1 2016 to Q4 2023



About Figure 2.3

This figure shows the capacity and four quarter rolling average of large-scale renewable power stations to reach FID over time.

The small print

The Clean Energy Regulator (CER) tracks public FID announcements, this information may not be complete and may change retrospectively.
Data as at 1 March 2024.

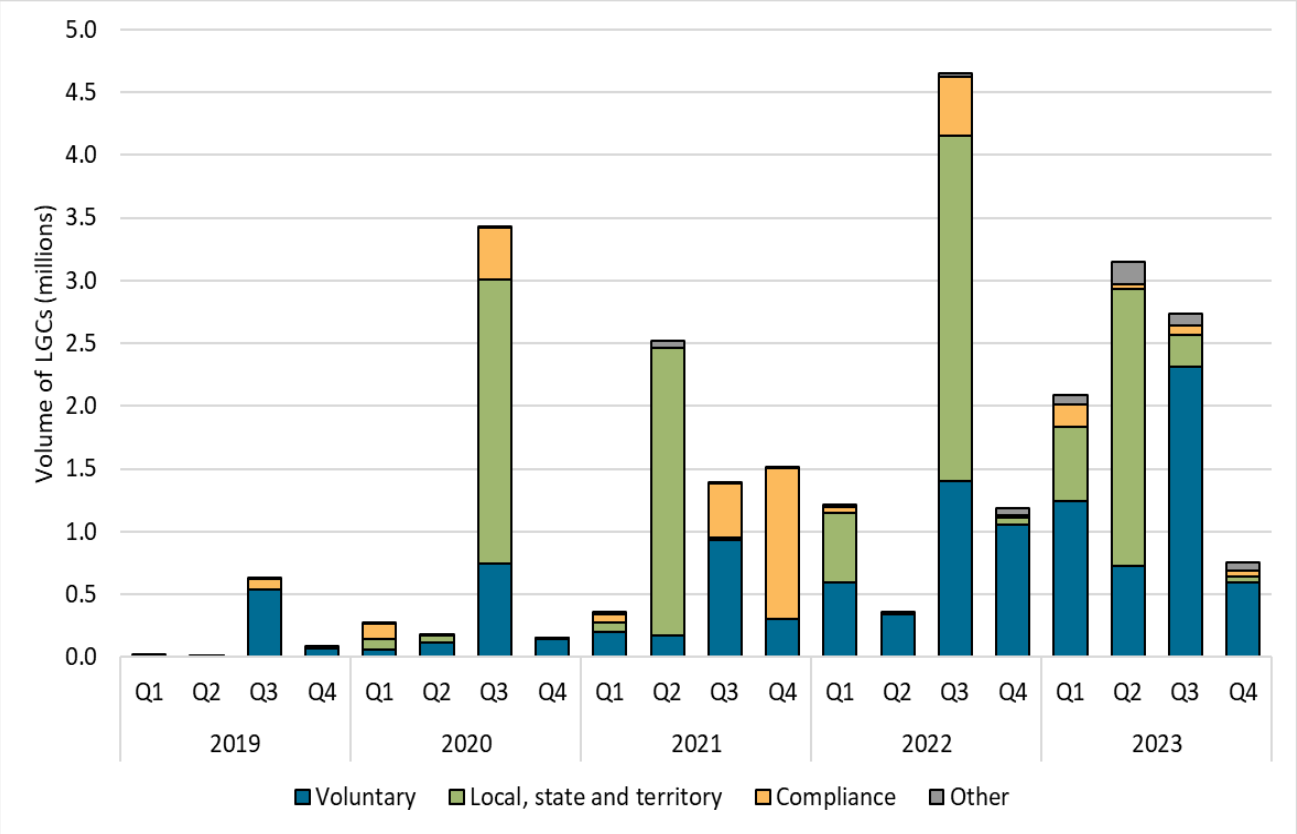
PPAs can be a lead indicator of potential FID announcements. A range of industries are entering into PPAs for new and existing renewable power stations, including the:

- mining industry - Rio Tinto signed a PPA with European Energy Australia to buy all energy generated from the 1.1 GW Upper Calliope solar farm for 25 years.
- IT industry - Equinix, Inc signed a PPA with TagEnergy for 151 megawatts (MW) of the Golden Plains Wind Farms.

Non-RET demand set a record in 2023 which will likely be broken again in 2024

In Q4 2023, 0.75 million LGCs were cancelled for non-RET demand. In 2023, an annual record of 8.7 million LGCs were cancelled for non-RET demand. This was lower than our revised estimate of 9.5 million LGCs largely due to cancellations occurring earlier than anticipated. For 2024, we expect a record 10 million LGCs to be cancelled for non-RET demand.

Figure 2.4: Non-Renewable Energy Target (non-RET) large-scale generation certificate (LGC) cancellations by demand source, Q1 2019 to Q4 2023



About Figure 2.4

This figure shows LGC cancellations by demand source over time.

The small print

Classification	Covered activities
Voluntary demand	Cancellations made against voluntary certification programs such as Climate Active, and any sort of organisational emissions or energy targets.
Local, state and territory government demand	Cancellations on behalf of local, state and territory governments, for example, to offset emissions from state fleets or meet emissions reduction targets.
Compliance demand	Cancellations by private organisations and corporations for compliance or obligations against municipal, local, state and territory government laws, approvals, or contracts. For example, to meet Environmental Protection Authority requirements.
Other demand	All activity not covered in the previous categories, primarily due to a lack of available information.

This classification system is uniform across Australian carbon credit unit (ACCU) and LGC cancellations.

A wide range of entities cancel LGCs to prove their use of renewable energy. Growth in non-RET demand was driven by the voluntary component of the market. In 2023, 4.9 million LGCs were cancelled for voluntary purposes. This was up 48% compared to the 3.3 million LGCs voluntarily cancelled in 2022.

Cancellations for Climate Active and GreenPower purposes grew. Compared to 2022 LGC cancellations increased by:

- 58% for Climate Active to 0.3 million
- 40% for GreenPower to 1.5 million.

Growth occurred across a broad range of industries, including the retail, real estate and transport sectors. These industries are cancelling both directly and through intermediaries. As discussed in the Q3 2023 Quarterly Carbon Market Report (QCMR), we expect changing policy and voluntary program participation to continue to drive this growth.

Our data shows companies with 100% renewable commitments are accumulating LGCs. For the financial year (FY)23 National Greenhouse and Energy Reporting (NGER) reporting year, the total reported scope 2 emissions were 75 million tonnes carbon dioxide equivalent (CO_2-e). Scope 2 emissions are generally from the use of electricity. In FY23, NGER reporters consumed around 115,700 gigawatt hours (GWh) of electricity that was imported into facilities. This is equivalent to around 115.7 million LGCs. Substantial voluntary demand could be added if all NGER reporters progressively made and implemented commitments to use market-based accounting to report net zero for scope 2 emissions.

Available LGC supply and the spot price could impact voluntary demand growth. There will likely be a ceiling price where LGCs are perceived to be too expensive for voluntary demand. Alternatively, if the LGC spot price drops with sufficient supply, voluntary demand may increase.

On 12 December 2023, the Australian Competition and Consumer Commission (ACCC) released making environmental claims: a guide for business. The guide includes 8 principles. Principle 5 is to avoid broad and unqualified claims. The guidance recommends the use of tradeable certificates associated with electricity generation. The guidance also states when making renewable energy claims with LGCs, they must be cancelled to avoid double counting.

LGC forward prices strengthen

LGC prices are determined by the market. Numerous factors influence LGC prices, including supply, demand and policy.

Figure 2.5: Large-scale generation certificate (LGC) spot price, January 2015 to December 2023

About Figure 2.5

This figure shows the LGC spot price from January 2015 to December 2023.

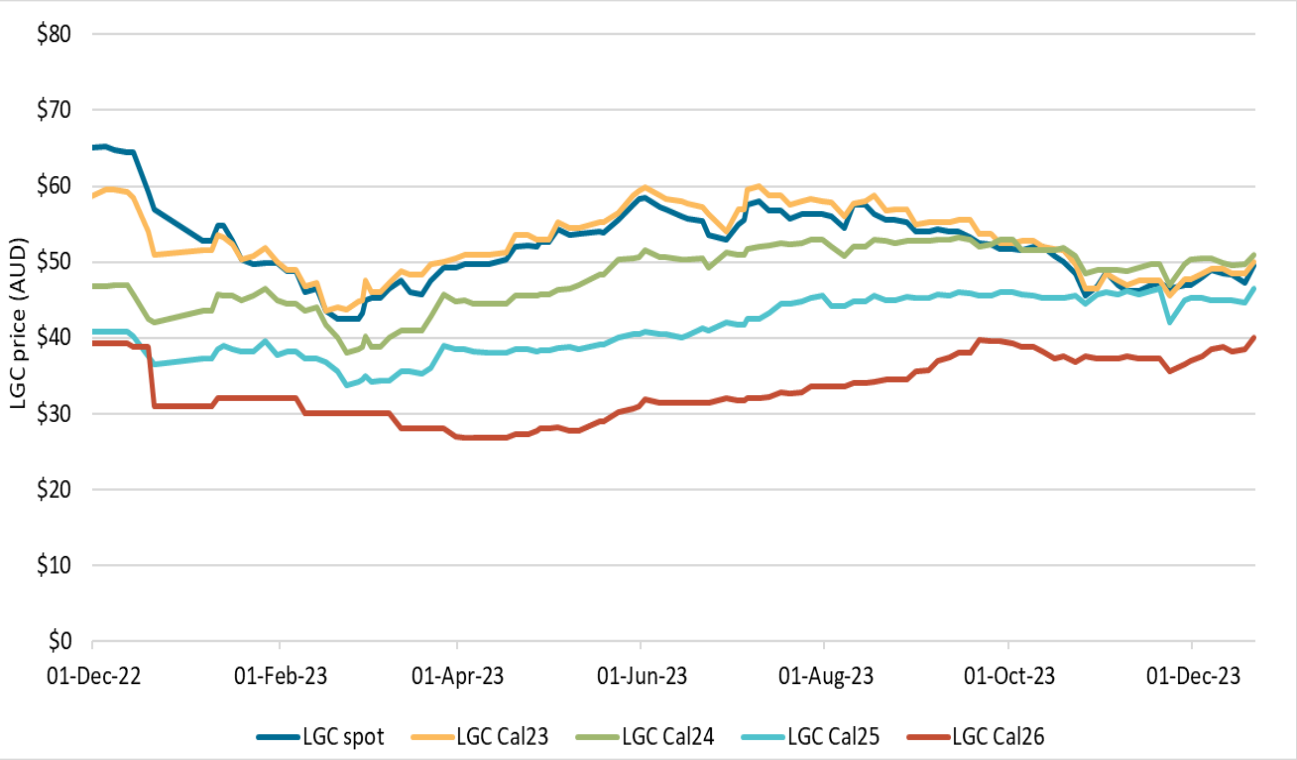
The small print

Pricing data is compiled from trades reported by CORE markets and may not be comprehensive.

In February 2023, the LGC spot price dropped to a low of $39.75. This February drop is typical following the annual RPP surrender. The LGC spot price recovered to a peak of $58.75 in June 2023 and then fell steadily in Q3 2023. In Q4 2023, the LGC spot price fluctuated between $45.50 and $52.00. The increasing LGC spot price following the annual RPP surrender is typical. This occurs as liable entities secure supply to meet their next RPP compliance obligations. In Q3 and Q4 each year, the LGC spot price typically drops and stabilises. This occurs as companies realise sufficient LGCs are available, or they have secured sufficient LGCs to meet their compliance obligations.

Following the expanded CIS announcement on 23 November 2023, the LGC spot price dropped to $45.50 before recovering quickly to above the preannouncement price. The LGC spot price was $49.50 at the end of 2023. It then settled back to about $44 after the 2023 RPP surrender on 14 February 2024.

Figure 2.6: Large-scale generation certificate (LGC) reported spot and forward prices, December 2022 to December 2023



About Figure 2.6

This figure shows the LGC spot price and calendar year forward prices over the last 12 months. For example, Cal24 is the 2024 calendar year.

The small print

Pricing data is compiled from trades reported by CORE markets and may not be comprehensive.

Forward contracts are an agreement to buy LGCs at a specified price at a specified time. Over 2023, forward prices for future vintages strengthened. Much of this growth was seen in near term vintages. Prices for calendar year (CY)24 and CY25 LGCs increased by $4.12 and $8.39 respectively in 2023. Market intelligence suggests there are several reasons entities may enter into forward contracts. This includes ensuring supply to meet:

- future RPP obligations
- current or anticipated future shortfall

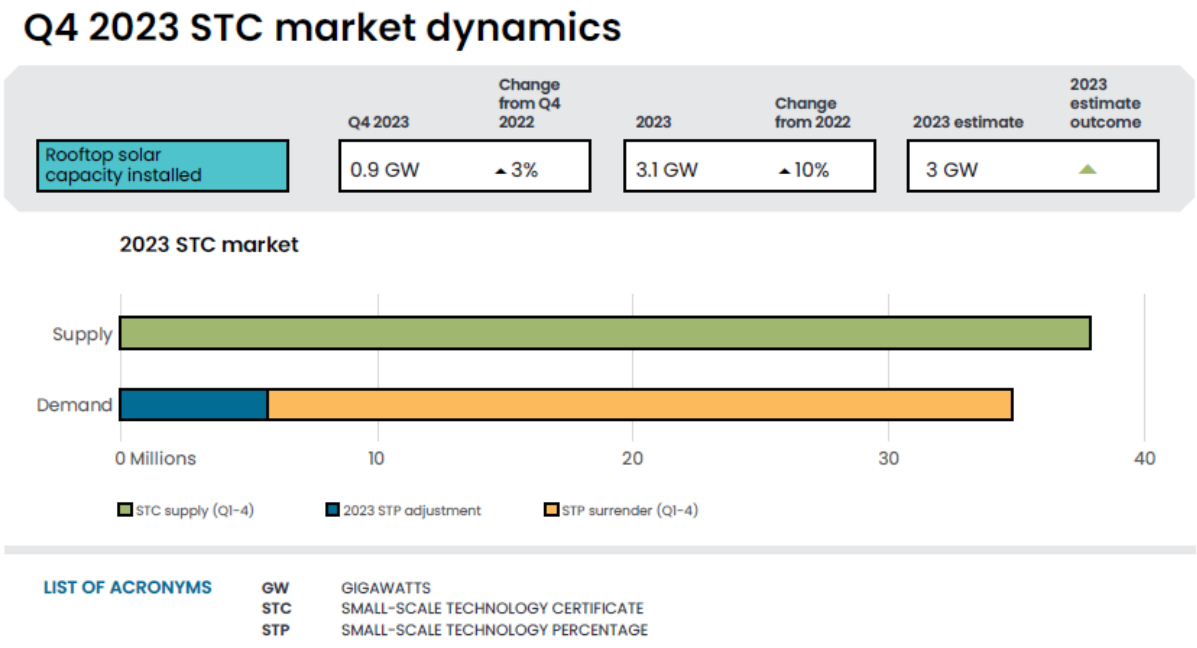
- renewable energy commitments, such as 100% renewable energy by a specified year.

The compression between forward and spot prices in 2023 continues a pattern observed in previous years.

3. Small-scale technology certificates (STCs)

Key messages

- In 2023, 3.1 gigawatts (GW) of rooftop solar capacity was installed, just short of the record 3.2 GW installed in 2021.
  - » In 2023, the average system capacity installed was 9.3 kilowatts (kW), an annual record.
  - » NSW installed the greatest capacity in 2023 at 1.0 GW. While the ACT installed the highest capacity per population at 174 kW per 1,000 people.
- In 2023, 135,000 air source heat pumps were installed compared to 87,000 in 2022.
  - » NSW accounts for over half of all air source heat pumps installations.
- For the Q4 2023 compliance period, 5.0 million STCs were surrendered, a surrender rate of 102.79%.
  - » For the 2023 small-scale technology percentage (STP), 29.2 million STCs were surrendered, a surrender rate of 103.23%
- The STC clearing house has remained in surplus since September 2023.



Insights

- Market dynamics
- Second highest rooftop solar capacity installed in 2023 and 2024 may break the record
- Larger rooftop solar systems installed in 2023, especially those with a battery
- NSW accounts for over half of all air source heat pump installations

Market dynamics

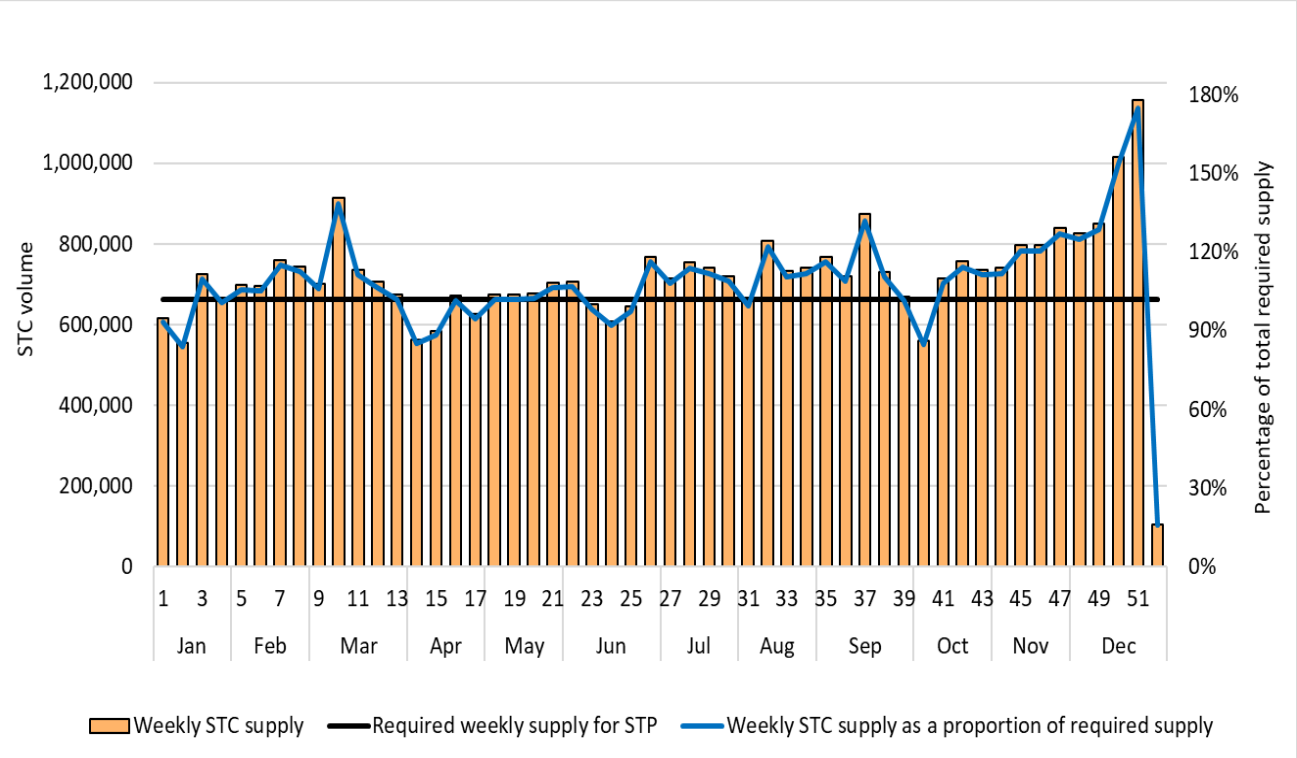
In 2023, 37.3 million STCs were created, similar to the 38 million created in 2022.

The 2023 STP was set at 16.29%. To meet the 2023 STP obligations, liable entities (generally electricity retailers) were required to surrender approximately 28.5 million STCs. The 2023 STP was set lower as the STC clearing house had been in a deficit since April 2022. The *Renewable Energy (Electricity) Act 2000* requires an STP adjustment to ensure supply and demand remain balanced.

Across the 2023 assessment year, a total of 29.2 million STCs were surrendered to meet the 2023 STP. This is a surrender rate of 103.23%. For the Q4 2023 compliance period, 5.0 million STCs were surrendered, a surrender rate of 102.79%. Entities can surrender more than 100% of their obligation to avoid shortfall. This also reduces the number of STCs that entities will need to surrender in future quarters.

The 2024 STP is set at 21.26%. Liable entities will be required to surrender approximately 37.9 million STCs to meet the 2024 STP. To calculate the STP, we engage consultants to model and estimate the number of STC creations for the following year. STCs in the clearing house and in accounts are also incorporated into the calculation of the STP. The modelling of STC creations includes a forecast of total rooftop solar installations. Total installations include new, additional and replacement rooftop solar systems.

Figure 3.1: Weekly small-scale technology certificate (STC) supply and the required supply to meet the small-scale technology percentage (STP), January to December 2023



About Figure 3.1

This figure shows the weekly supply of STCs. It also shows the required weekly supply of STCs to meet the STP and the weekly supply of STCs as a proportion of this required weekly supply.

The small print

Required STC supply refers to the estimated number of STCs to be created (34,400,000) to meet the annual STP liability and under/over supply from previous years. Some weeks are spread across multiple months, the month label refers to the month as at the end of the week.

In Q4 2023, 9.9 million STCs were created, of which:

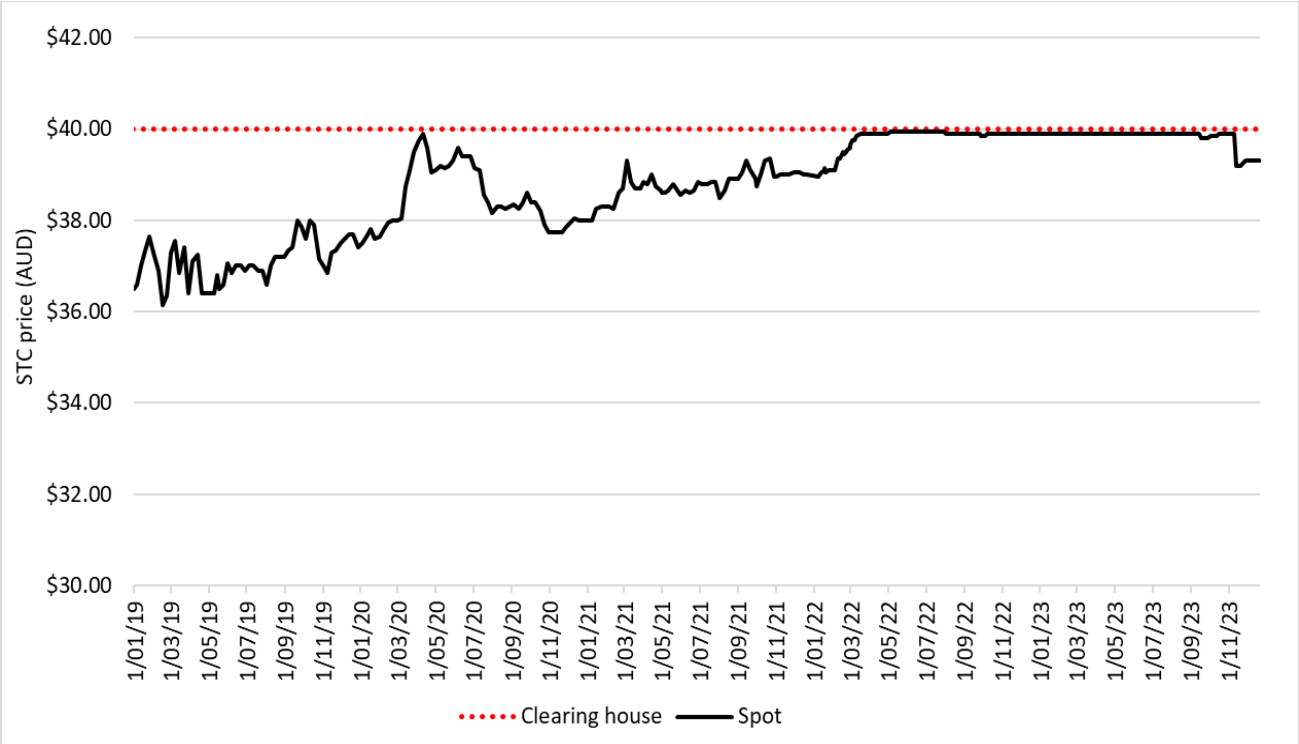
- 8.9 million were from rooftop solar installations
- 0.8 million were from air source heat pump installations
- 0.2 million were from solar water heater installations.

Following the Q4 2023 compliance surrender on 14 February 2024, the STC clearing house was in an effective surplus of over 0.45 million. The STC clearing house has been in an effective surplus since the end of September 2023. As at 15 February 2024, 5.5 million STCs were held in accounts.

The STC clearing house was in deficit from April 2022 to August 2023. During this time, the STC spot price fluctuated between $39.90 and $39.95, just below the STC clearing house price of $40 as the market remained tight.

During Q4 2023, STC supply and accumulation in accounts grew. This signalled to the market sufficient supply was available for the Q4 2023 STP surrender. The growing surplus in the STC clearing house and in accounts likely flowed through to small changes in the STC spot price. In Q4 2023, the STC spot price fell from $39.85 to $39.20 in mid-November. It then recovered slightly to $39.30 at the end of 2023.

Figure 3.2: Small-scale technology certificate (STC) reported spot and STC clearing house prices, January 2019 to December 2023



About Figure 3.2
This figure shows the STC spot price and STC clearing house price over time.

The small print
STC spot price sourced from CORE markets. Renewable Energy Target (RET) liable entities and other buyers who have a valid REC Registry account may buy STCs from the STC clearing house. If there are no STCs available for sale in the STC clearing house the Clean Energy Regulator (CER) will create 'CER created STCs' for buyers to purchase. CER created STCs can be traded and surrendered exactly like ordinary STCs. Small-scale renewable energy system owners and registered agents have the option to sell STCs through the open market for an uncapped price, or through the STC clearing house at a fixed price of $40 (excluding GST). Before STCs can be sold through the STC clearing house they must be validated and registered.

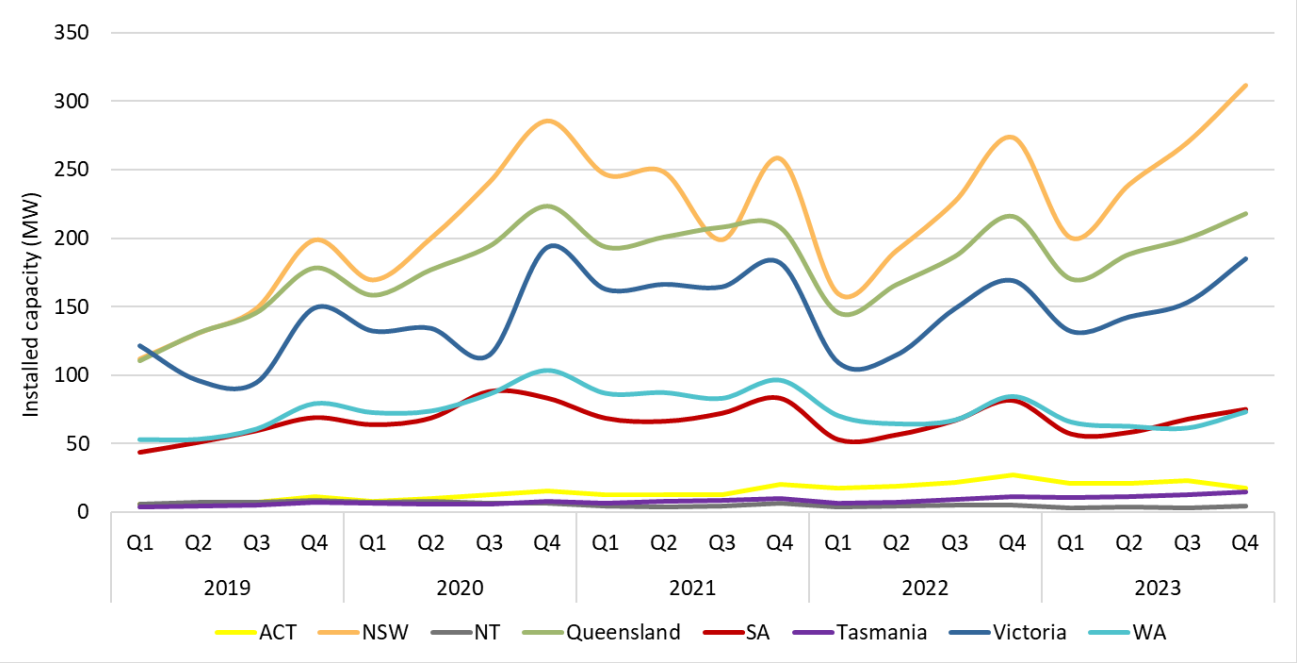
Second highest rooftop solar capacity installed in 2023 and 2024 may break the record

In Q4 2023, 91,000 rooftop solar systems were installed. This brought the 2023 total to 331,000 rooftop solar system installations, compared to 316,000 in 2022.

In 2023, 3.1 GW of rooftop solar capacity was installed compared to 2.8 GW in 2022. This is the second highest annual capacity installed, just short of the record 3.2 GW installed in 2021. This exceeded our expectation of 3 GW.

NSW accounted for a third of the rooftop solar capacity installed in 2023. Over 1 GW of capacity was installed in NSW alone. This is a state and territory record, breaking the previous record of 0.85 GW installed in NSW in 2022. However, the highest installed capacity by population in 2023 was the ACT with 178 kW per 1,000 people. This was followed by Queensland (142 kW per 1,000 people), SA (139 kW per 1,000 people) and NSW (122 kW per 1,000 people).

Figure 3.3: Small-scale rooftop solar installed capacity in megawatts (MW) by state and territory, Q1 2019 to Q4 2023



About Figure 3.3

This figure shows the small-scale rooftop solar installed capacity under the Small-scale Renewable Energy Scheme (SRES) by state and territory over time.

The small print

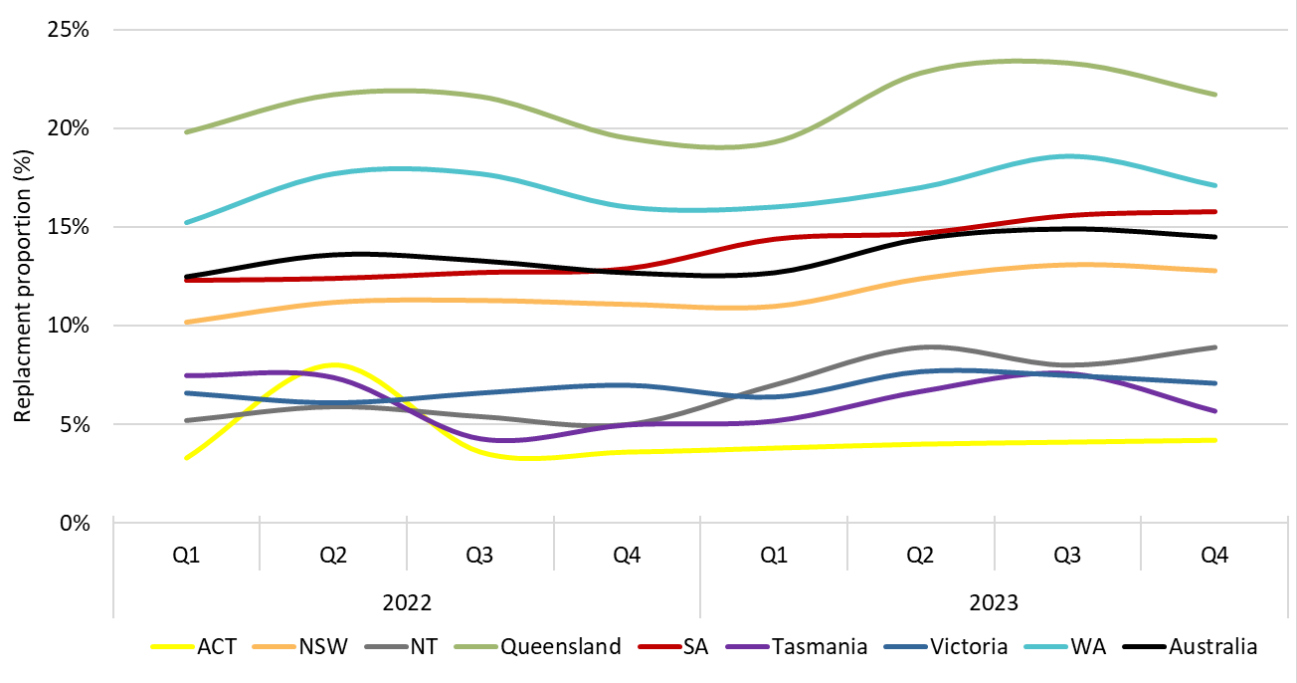
A 12 month creation period for registered persons to create small-scale technology certificates (STCs) applies under the Renewable Energy (Electricity) Regulations (2001). Data for installations in 2023 have been lag-adjusted to account for the 12 month creation rule and are estimates only. The 2023 installed capacity figures may change and totals may not sum.

For 2024, the STP was calculated with a forecast of 3.1 GW of rooftop solar to be installed. If the higher rates of installations at the end of 2023 continue, installed capacity will exceed 3.1 GW and reach a new record in 2024. Small-scale renewables are a consumer product. Installations are tied to the economic conditions faced by households and small businesses. The upward trend in 2023 occurred despite increasing cost of living pressures facing Australian households. Higher energy costs and interest rates may be offset by the reduction in energy bills solar offers. Additionally, interest free loans, decreasing system costs and the Small-

scale Renewable Energy Scheme (SRES) are keeping payback periods low at around 5 years. These factors are important considerations for consumers deciding whether to invest.

The SRES provides a financial incentive to install eligible small-scale renewable energy systems. An average sized rooftop solar system receives an effective rebate of around $4,200, equivalent to approximately one-third of the total system cost. Households and businesses replacing or adding capacity to existing rooftop solar systems may be eligible. The SRES is a high volume scheme available to all with an aim to incentivise additional renewable energy.

Figure 3.4: Proportion of replacement small-scale rooftop solar by state and territory, Q1 2022 to Q4 2023



About Figure 3.4
This figure shows small-scale rooftop solar replacements as a proportion of total installations by state and territory over time.

The small print
Replacement systems represent rooftop solar systems categorised in the Renewable Energy Certificate (REC) Registry as replacements.

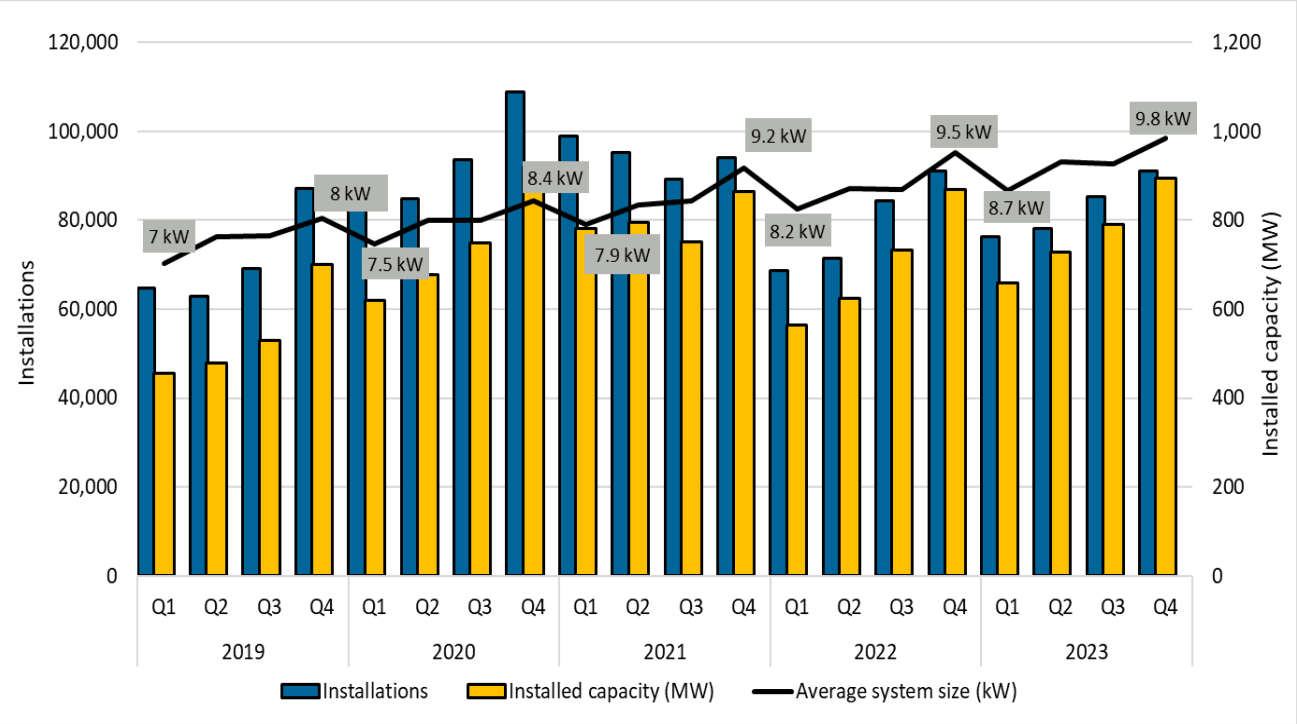
In 2023, 21% of rooftop solar system installations were reported as replacement or additional systems. Solar systems may be replaced or added to for various reasons, including:

- outdated technology
- damage, such as hail damage
- to increase the solar capacity for the household or small business, including for electrification.

Larger rooftop solar systems installed in 2023, especially those with a battery

Rooftop solar system sizes continue to increase. In Q4 2023, the average system size was 9.8 kW, a quarterly record. In 2023, the average system size exceeded 9 kW for the first time, with an average of 9.3 kW per system. This is compared to 8.8 kW in 2022.

Figure 3.5: Small-scale rooftop solar installations, installed capacity, and average system size, Q1 2019 to Q4 2023



About Figure 3.5

This figure shows the installed capacity in megawatts (MW), average system size in kilowatts (kW), and number of small-scale rooftop solar installations over time.

The small print

Small-scale rooftop solar systems must have a capacity of less than 100 kW. A 12 month creation period for registered persons to create small-scale technology certificates (STCs) applies under the Renewable Energy (Electricity) Regulations (2001). Data for installations and installed capacity in 2023 have been lag-adjusted to account for the 12 month creation rule and are estimates only. The 2023 installation and installed capacity figures may change.

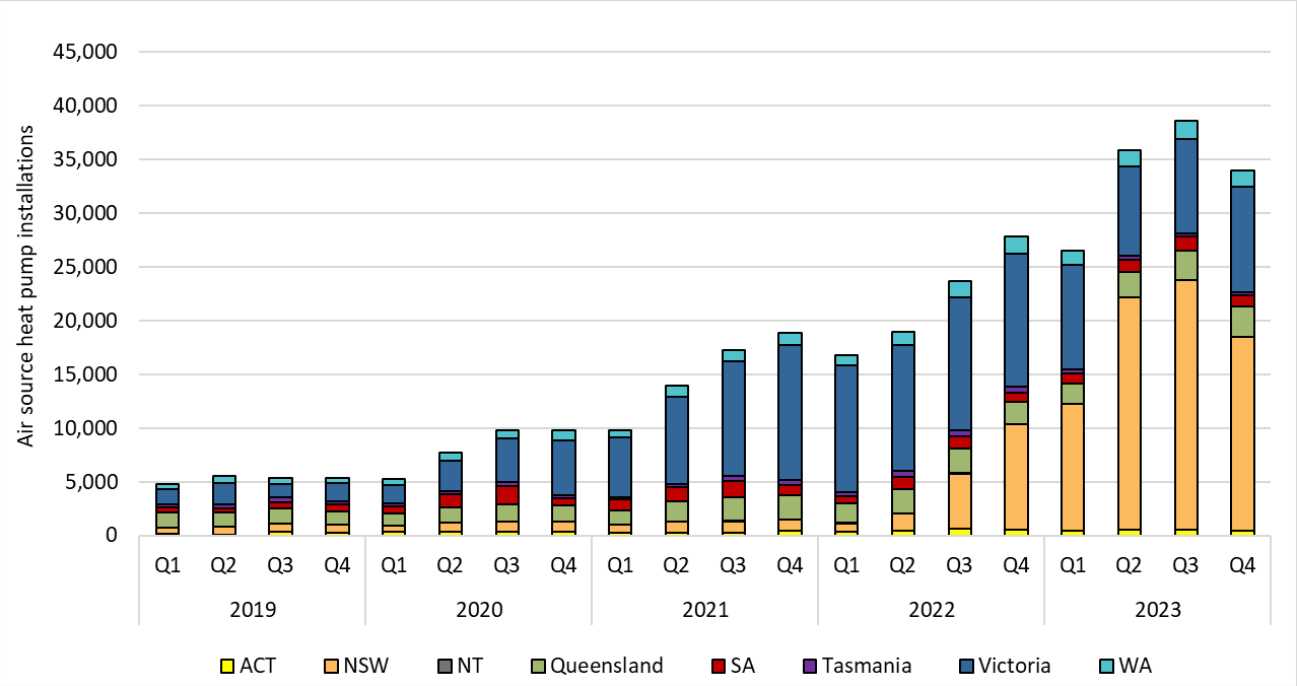
In Q4 2023, 8,000 rooftop solar systems were reported to be installed with a battery. The average rooftop solar system size connected to a battery in Q4 2023 was 10.2 kW.

The Community Batteries for Household Solar program will install 400 batteries across Australia. This will provide shared storage for up to 100,000 households. The program is run by the Department of Climate Change, Energy, the Environment and Water (DCCEEW). The second battery, a 412 kilowatt hour (kWh), was switched on in NSW Central Coast, as announced on 3 November 2023.

NSW accounts for over half of all air source heat pump installations

In Q4 2023, 34,000 air source heat pumps were installed. This brought the 2023 total to 135,000 installations, compared to 87,000 installations in 2022.

Figure 3.6: Air source heat pump installations by state and territory, Q1 2019 to Q4 2023



About Figure 3.6

This figure shows the number of air source heat pump installations under the Small-scale Renewable Energy Scheme (SRES) by state and territory each quarter over time.

The small print

Where values are less than 10 data have been modified due to privacy considerations. In the figure these values appear as 10.

A 12 month creation period for registered persons to create small-scale technology certificates (STCs) applies under the Renewable Energy (Electricity) Regulations (2001). Data for installations in 2023 have been lag-adjusted to account for the 12 month creation rule and are estimates only. The 2023 installation figures may change.

NSW accounts for over half of all air source heat pump installations. Both the Peak Demand Reduction Scheme and Energy Savings Scheme continue to drive strong uptake in NSW. As noted in the Q2 2023 Quarterly Carbon Market Report (QCMR), these schemes allow for certificates such as energy savings certificates and peak reduction certificates to be stacked increasing the incentive.

In Q4 2023, Queensland installed 3,000 air source heat pumps, a Queensland record. This was driven by the Queensland Climate Smart Energy Savers Program. The program offered a rebate of up to $1,000 to buy and install eligible energy-efficient appliances, including air source heat pumps.

4. Emissions reduction

In 2023, schemes we administer reduced emissions by 65.5 million tonnes of carbon dioxide equivalent (CO_2-e). This is 5.5% more than the 62.1 million tonnes of CO_2-e reduction in 2022. We estimate another 8.1% increase in emissions reduction in 2024, up to 70.8 million tonnes of CO_2-e across the CER schemes.

In 2023, the Australian Carbon Credit Unit (ACCU) Scheme (formerly known as the Emissions Reduction Fund) issued ACCUs equivalent to 17.2 million tonnes of CO_2-e emissions abatement. This is 3% less than 2022. This is based on one ACCU being equivalent to one tonne of CO_2-e. Noting, the carbon abatement for each ACCU may have occurred in prior years due to a lag from the crediting process.

In 2023, the Renewable Energy Target (RET) contributed 48.3 million tonnes of CO_2-e emissions reduction, a 9% increase from 2022. Of which:

- 29.3 million was from the Large-scale Renewable Energy Target (LRET)
- 19.0 million was from the Small-scale Renewable Energy Scheme (SRES).

This is based on multiplying megawatt hours (MWh) of renewable energy, that is incentivised by the RET, by the declining emissions intensity of the grid. The RET added an additional 7.9 million MWh of renewable energy to the grid in 2023 compared to 2022. Renewables produce zero emissions. This means as renewable energy is added to the grid, the emissions intensity of the grid declines. In 2023, the emissions intensity of the grid was 0.58 tonnes of CO_2-e per MWh. In comparison to 0.70 tonnes of CO_2-e per MWh in 2019, when we first produced this analysis.

If a 100% renewable grid is achieved, using the above method, renewable generation would contribute zero additional emissions reduction. This is because in a 100% renewable grid there would be an emissions intensity of zero. To assess the emissions reduction from renewable generation as it increases its share of generation, an alternative methodology would be to consider the generation that is being displaced by additional renewable energy.

We will continue to refine our approach to assessing the impact of the schemes we administer on emissions reduction. In particular as Safeguard baselines begin to decline in 2024.

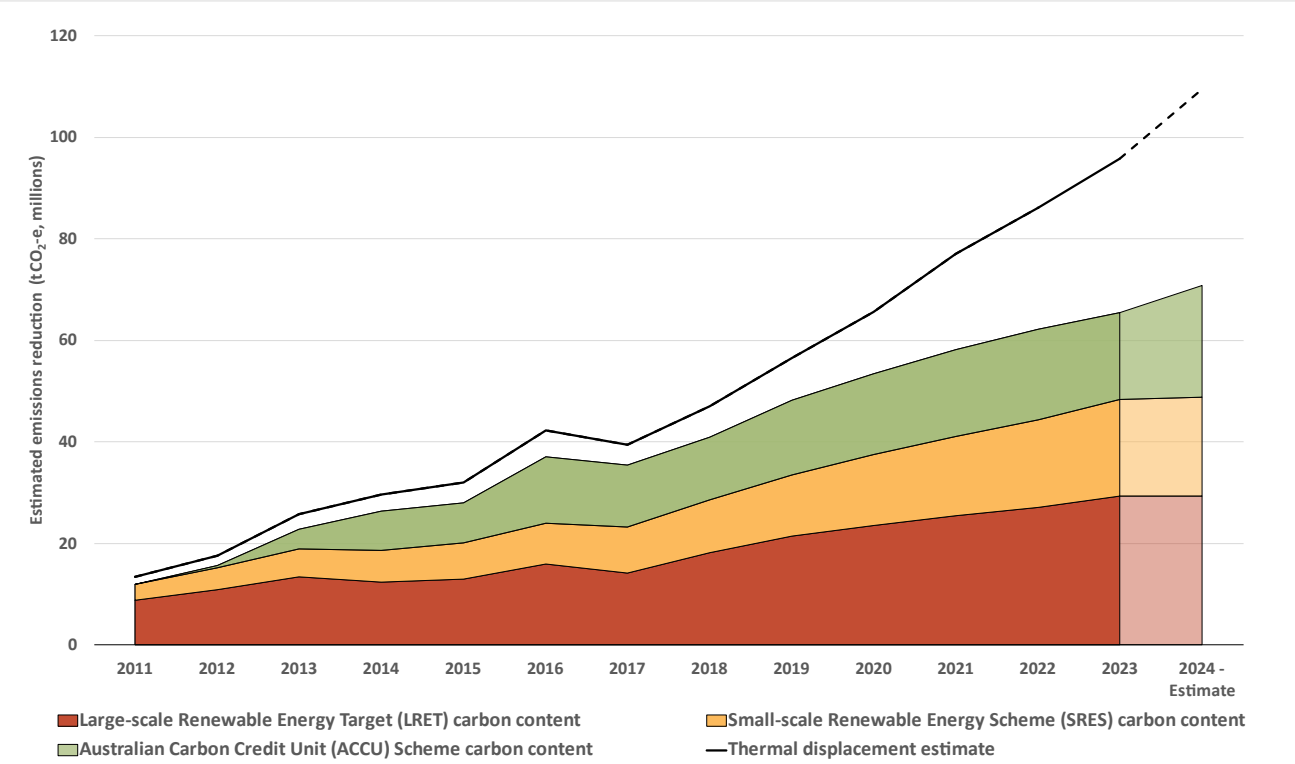
Emissions reductions using a displacement method

Using a displacement method, the schemes we administer contributed 95.9 million tonnes of CO_2-e emissions reduction in 2023. In 2024, we expect this to increase to 109.5 million tonnes of CO_2-e emissions reduction.

This is based on multiplying the MWh of renewable energy by the emissions intensity of thermal generation. This estimate assumes renewables are displacing thermal generation. Thermal generation uses fossil fuels, such as coal and gas, as a fuel source. In 2023, we estimated the weighted average emissions intensity factor for thermal generation to be 0.94 tonnes of CO_2-e per MWh. In comparison to 0.58 tonnes of CO_2-e per MWh for all types of generation in the grid.

A methodological overview of these estimates is available in the Q3 2021 Quarterly Carbon Market Report (QCMR). Noting, the thermal displacement method was previously referred to as the 'avoided emissions' method.

Figure 4.1: Estimated emission reduction from Clean Energy Regulator (CER) schemes, 2011 to 2024



About Figure 4.1

This figure shows the estimated emissions reduction from the 3 schemes administered by the CER in tonnes of carbon dioxide equivalent (t CO_2-e) over time.

Small print

A methodological overview of the emission reduction estimates is provided in the Q3 2021 QCMR.

The 2023 emission intensity of the National Energy Market (NEM) is sourced from OpenNEM. For the SRES carbon content, the estimated generation is based on the installation year only. The ACCU Scheme estimate is based on ACCUs issued in each calendar year, this may include abatement that has occurred in prior years due to the lagged nature of the claiming process.

Annual values may change over time due to updated generation, scheme information and minor revisions to the methodology.