Australian Government
Clean Energy Regulator

Quarterly Carbon Market Report






CLEAN ENERGY REGULATOR

December Quarter 2024

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Report objective

Carbon markets play a key role in Australia's efforts to reduce emissions. The Clean Energy Regulator (CER) has prepared this report to support the effective operation of Australia's carbon markets.

This report consolidates information across the national carbon markets that the CER administers for the December Quarter 2024 (October to December 2024). It provides information on supply and demand trends and opportunities that may inform market decisions. As usual, the December Quarter report includes 2 chapters looking back at the calendar year as a whole for renewable electricity (chapter 2) and emissions reductions from CER schemes (chapter 5).

Report disclaimer

All figures are sourced from the 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 Quarterly Carbon Market Report (QCMR) 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 QCMR 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 QCMR, or the information provided through the QCMR, or the availability or non-availability of the QCMR.

Version history

Version	Date	Changes
1.0	28/02/2025	Initial publication

Glossary

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

Highlights

- In 2024, schemes administered by the Clean Energy Regulator (CER) are estimated to have reduced emissions by at least 69.2 million tonnes of carbon dioxide equivalent (CO_2-e), up 8% from 2023.
  - This is a conservative estimate as it uses the average emissions intensity of the electricity grid rather than assuming renewables are solely displacing coal and gas generation.
- Overall Australian carbon credit unit (ACCU) market liquidity looks strong in the year ahead, with new ACCU supply for 2024 reaching 18.8 million and the 2025 new supply outlook expected to be between 19 and 24 million ACCUs depending on the timing of ACCU claims and issuances.
- We estimate about 60% of total ACCUs are held by safeguard or safeguard related entities. We saw increased trading activity in the fourth quarter as safeguard facilities worked to ensure they have adequate supply to meet their compliance obligations.
- Implementation of the reformed Safeguard Mechanism continues to progress well in the lead up to the first compliance deadline under the reforms on 31 March 2025. Following the CER's quality assurance processes and the assessment of applications under flexibility and excess management options, the CER:
  - expects 144 facilities to have a total excess of approximately 9.2 $MtCO_2$-e
  - has issued over 8.0 million Safeguard Mechanism credit units (SMCs) to facilities.
- These figures update the Climate Change Authority's early analysis of the outcomes of the first compliance period under the reformed Safeguard Mechanism on 15 November 2024. Updates to the preliminary data include adjustments for the CER's assessment of applications under flexibility and excess emissions management options. The CER will publish full details on the operation of the Safeguard Mechanism by 15 April 2025.
- In 2024, we saw a record year of total added renewable energy generation capacity of 7.5 gigawatts (GW), up from 5.3 GW in 2023.
  - Large-scale generation also reached a record and was largely made up of new wind generation capacity.
- Rooftop solar capacity added in 2024 is likely to have been about 3.2 GW and we expect it will match or exceed the previous record.
  - This is still an estimate because rooftop PV certificates can be created up to 12 months after installation. A clearer picture of 2024 will be available by April.
- In 2024, 10.4 million large-scale generation certificates (LGCs) were cancelled for non Renewable Energy Target (non-RET) purposes. We expect this to be higher in 2025, with drivers including commitments made by many large Australian businesses to be powered by 100% renewables. We anticipate voluntary cancellations of around 12.5 to 15 million LGCs this year.
- Renewable contributions to the National Electricity Market (NEM) reached an all-time high of 75.6% on 6 November 2024 and small-scale solar output reached an all-time quarterly high in all regions, driving a record share of 46% of supply in the NEM from renewable sources.
- Looking ahead, the CER anticipates that renewable penetration in the NEM could reach 44% to 46% in 2025. This range assumes a return to average generation conditions, particularly for wind and hydro. It also assumes no material increases in curtailment or electricity demand growth.

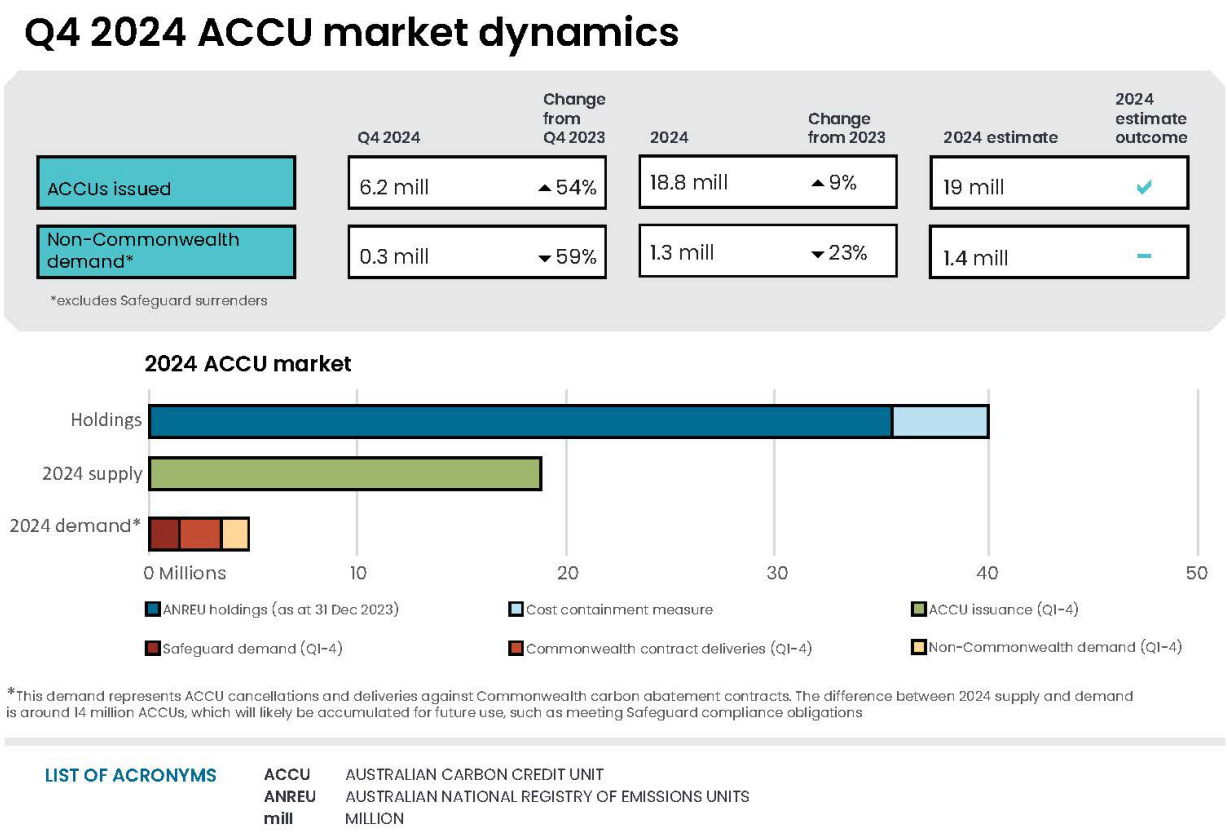
1. Safeguard and Australian carbon credit unit (ACCU) schemes

Insights

- Implementation of the reformed Safeguard Mechanism continues to progress well in the lead up to the first compliance deadline under the reforms on 31 March 2025.
  - In 2023-24, aggregate covered emissions from safeguard facilities were approximately 136 million tonnes of carbon dioxide equivalent ($MtCO_2$-e), down from 138.7 $MtCO_2$-e in 2022-23.
- This decrease in emissions indicates a positive start to the first full year of the Safeguard Mechanism's operation and its role in regulating and creating incentives for industrial decarbonisation.
- Following the publication of the Climate Change Authority's 2024 Annual Progress Report, we have undertaken additional quality assurance over the data and finalised facility emission positions as a result of safeguard entities using some of the flexibility mechanisms available to them. As of 18 February 2025:
  - Over 8 million Safeguard Mechanism credit units (SMCs) have been issued to 57 facilities.
- Following application of flexibility measures we estimate total excess emissions requiring the surrender of Australian carbon credit units (ACCUs) or SMCs to be approximately 9.2 $MtCO_2$-e from 144 facilities.
- Full details on the operation of the Safeguard Mechanism will be published by 15 April 2025 after the 31 March 2025 surrender deadline.
- The ACCU market has been highly active in 2024, with safeguard demand being the main driver of trading in the latter part of the year.
  - Market traders have reported 2024 as the biggest trading year (in volume) for ACCUs to date.
  - Safeguard holdings of ACCUs have been building up over the last few years in anticipation of the upcoming surrender deadline as well as compliance obligations in future years.
  - We estimate around 60% of ACCU holdings were held by safeguard and safeguard related entities as of 31 December 2024.
  - Figure 1.2 shows ACCU spot prices traded during the year in a range between $30and a peak of $42 in Q4. They then trended slightly lower to around $35 by 14 February. Overall, the spot price averaged about $35 during the year. The run up to $42 was off large volumes being bought by safeguard entities to meet compliance obligations before the price settled back to about $35.
- The intent of the reformed Safeguard Mechanism is to progressively reduce industrial emissions at source. Industry intelligence over the course of 2024 has revealed that many owner corporations have advanced plans in place for decarbonisation. Others are earlier in the journey or face significant technological challenges.

- Decarbonisation projects will typically have long lead times to replace capital stock including electrification and new renewable energy projects. Hence, the use of ACCUs to manage excess emissions is an important design feature to offset emissions on the journey to reduce them at source.
- Facilities surrendering ACCUs equal to 30% or more of their baseline are required to provide a statement to the CER on why more onsite abatement has not been undertaken, which we will publish.
- Overall ACCU market liquidity looks strong in the short term, with new ACCU supply for 2024 reaching 18.8 million and the 2025 new supply outlook expected to be in between 19 and 24 million ACCUs depending on the timing of ACCU claims and issuances.
  - The fourth exit window for Commonwealth carbon abatement contract milestones struck a balance between delivery under contracts to support the Cost Containment Measure (CCM) under the Safeguard Mechanism and supporting market liquidity.
  - 4.5 million ACCUs were released and 2.4 million delivered into the CCM.
- On 31 December 2024, the total ACCU stock in Australian National Registry of Emissions Units (ANREU) was 50 million with an additional 3.9 million in the Cost Containment Measure (CCM).

Image 1: Q4 2024 ACCU market dynamics



Safeguard Mechanism

The Safeguard Mechanism is designed so that facilities can generate SMCs by reducing onsite emissions and getting below their baseline. Default emissions intensity values under the policy have generally been calculated based on industry average emissions intensity values. These industry average baselines provide an incentive for production to occur where it is least emissions-intensive, while facility-specific baselines recognise individual facility circumstances and keep initial costs low. By starting the weighting closer to facility-specific values, costs are introduced in manageable increments, giving business sufficient time to plan and implement emissions reduction projects.

Facilities that are more emissions intensive may be above their baselines and incur a liability. Facilities with a liability can either surrender ACCUs or SMCs, or use flexibility measures under the Safeguard Mechanism such as multi-year monitoring periods (MYMPs).

The Climate Change Authority (the authority) published early analysis of the outcomes of the first compliance period under the reformed Safeguard Mechanism on 15 November 2024. Based on as-reported National Greenhouse and Energy Reporting (NGER) data as of 31 October, and before use of any of the excess emissions options available under the Safeguard Mechanism, the authority's report indicated that:

- 153 of the 215 covered facilities had emissions higher than their baselines, by an estimated aggregate amount of 10.7 Mt CO2 -e.
- 60 facilities reported emissions below their baseline and could be eligible to apply for a total estimated 9.2 million SMCs in 2023–24.

Following the CER's quality assurance processes and the assessment of applications under flexibility and excess management options, the CER:

- Expects 144 facilities to have a total excess of approximately 9.2 $MtCO_2$-e.
- Has issued over 8 million SMCs to facilities.

The total excess may still change, as 'borrowing adjustment' applications, which allow a facility in excess to borrow up to 10% of its baseline from the following year, are yet to be included in these figures.

We will continue to report progress with complete data from the first compliance period to be published by 15 April 2025.

The CER is not anticipating substantial volumes of SMC trade prior to 31 March 2025. Market intelligence suggests safeguard entities are more likely to bank SMCs to meet their future liabilities rather than trade on the open market.

The CCM is a source of ACCUs for safeguard entities in an excess position. Safeguard facilities that have exceeded their baseline can apply to purchase ACCUs from the CCM at a fixed and known price during the current 17 February to 5 March 2025 window. The 2024-25 price is $79.20 per ACCU. The price is indexed in future financial years by the Consumer Price Index (CPI) plus 2% each year. We do not expect responsible emitters to use the measure in 2024–25 as ACCUs are readily available in the market for around $35.

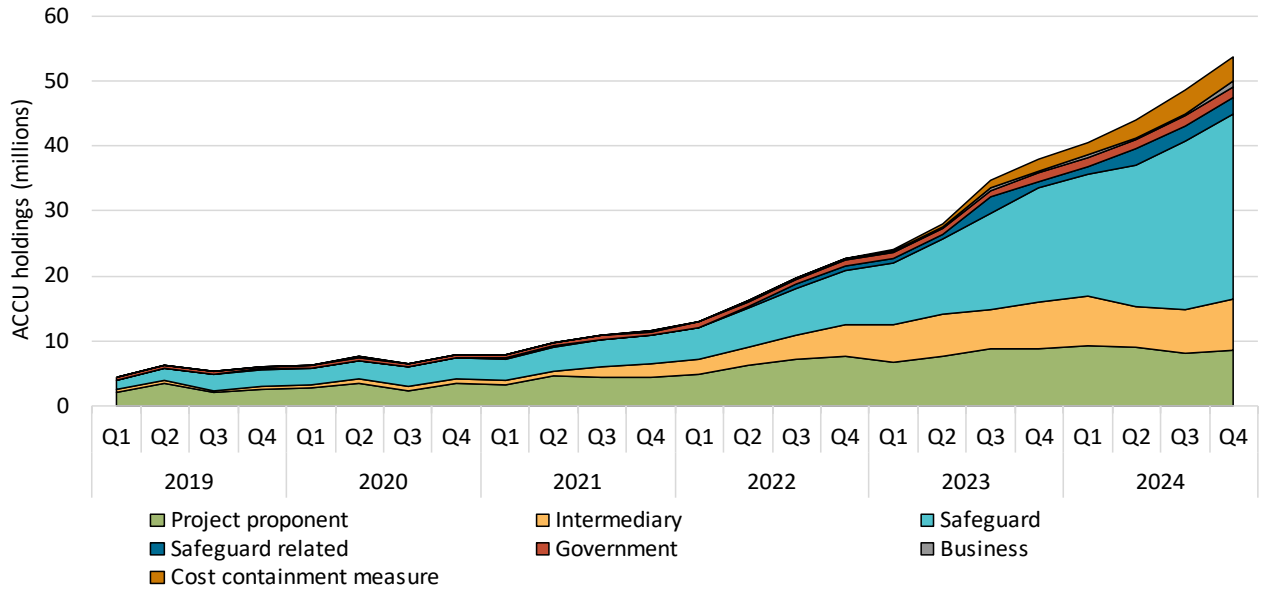
Looking beyond this compliance year, baselines will continue to decline at 4.9% per year and generally transition from facility-specific to industry average emission intensity values over the period to 2030. Overall, covered facilities will reduce net emissions cumulatively by approximately 200 $MtCO_2$-e by the end of the decade as part of meeting Australia's legislated emission reduction target of 43% below 2005 levels by 2030.

Holdings by safeguard entities rise ahead of surrender

Holdings in the ANREU totalled just under 50 million ACCUs at the end of 2024, with safeguard or safeguard-related entities holding around 60% of these units. Some accounts previously categorised as safeguard related have been reclassified to safeguard. This is because they can now be linked to a responsible emitter that has operational control of a safeguard facility. The classification of ANREU accounts is indicative only because entities may participate in the market for multiple reasons. For example, a safeguard entity may also act as an intermediary and trade ACCUs with other entities. Safeguard entities can also arrange to have ACCUs surrendered on their behalf and do not need to maintain holdings directly.

The Commonwealth received 2.4 million ACCUs in the fourth pilot exit window for ACCU fixed delivery exit arrangements, which covers delivery milestones between 1 July 2023 and 31 December 2024. These arrangements provide eligible participants with an option to exit their carbon abatement contracts, subject to conditions such as a minimum partial delivery requirement of 20%. ACCUs delivered under the exit window are added to the CCM, which can be accessed by safeguard participants. The fourth pilot exit window has increased the CCM to 3.9 million by the end of 2024.

Figure 1.1: Australian carbon credit unit (ACCU) holdings (in millions) by market participation



Market dynamics

Table 1.1: ACCU supply and demand summary for Q4 2024

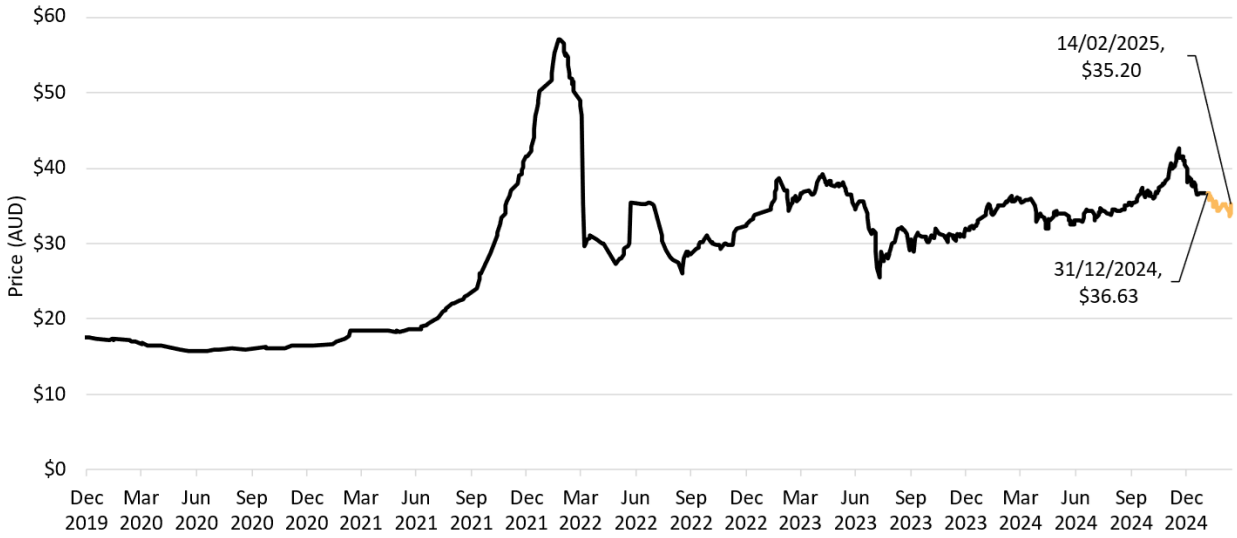
	Q4 2024	2024 annual change
Balance carried forward from respective period	45.0m	36.2m
ACCU supply	6.2m	18.8m
ACCU Scheme contract deliveries*	0.31m	2.2m
Non-Commonwealth cancellations	0.33m	1.3m
Safeguard surrenders	0.62m	1.5m
Net balance at the end of Q4 2024	49.9m	
Cost containment measure	3.9m	

**This refers to ACCUs delivered under Commonwealth carbon abatement contracts in 2024. These ACCUs are held in the cost containment measure. These ACCUs are available to eligible safeguard entities for purchase at a fixed price of $79.20 for 2024-25.*

The generic ACCU weighted-average spot price reached a peak of around $42 in mid-November. The price then retreated to close out the year at around $36. This drop in price started to occur when most safeguard entities had calculated their emissions positions and secured their ACCUs in the lead up to November.

Prices have since fallen slightly to around $35 by mid-February.

Figure 1.2: Generic Australian carbon credit unit (ACCU) volume weighted average spot price

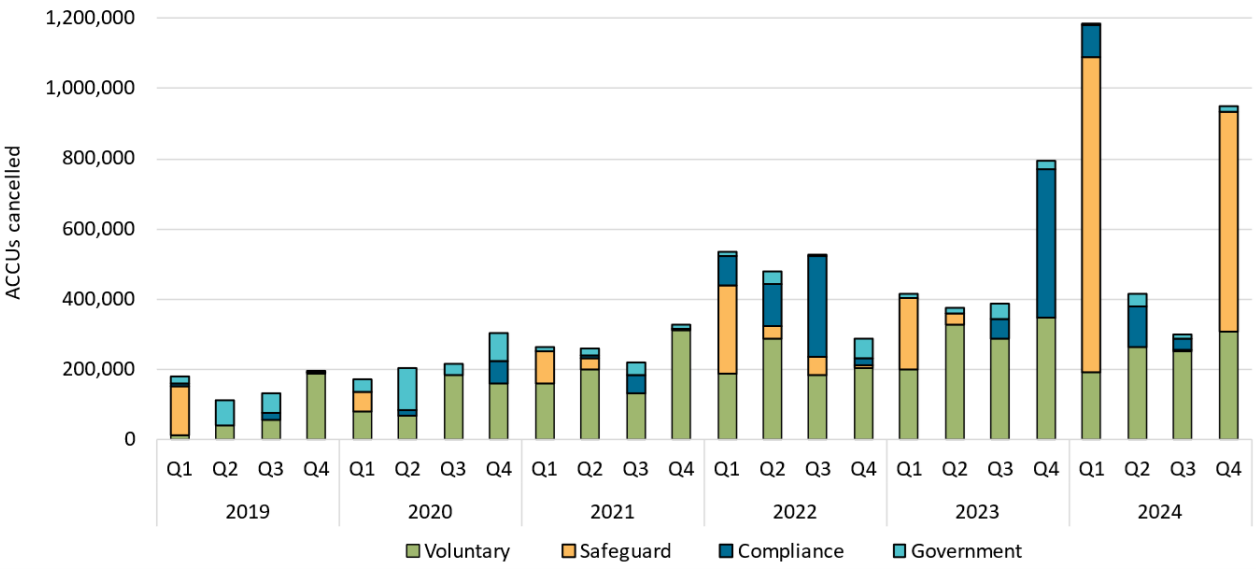


ACCU cancellations by demand source

1.3 million ACCUs were cancelled for non-safeguard purposes in 2024. Of this total, 0.2 million were cancelled by entities for non-safeguard compliance purposes such as Environmental Protection Authority requirements. The remaining 1.1 million were cancelled voluntarily. This is slightly lower than our estimate of 1.4 million and is lower than the 1.7 million surrendered in 2023. We expect non-safeguard ACCU cancellations to remain relatively stable in 2025 at between 1.3 to 1.5 million.

1.5 million ACCUs were cancelled for safeguard purposes in the 2024 calendar year. Of this total, 0.6 million were cancelled in late 2024 for the 2023-24 reporting year, ahead of the 31 March 2025 surrender deadline. The remaining 0.9 million were cancelled in the first few months of 2024. The majority of these cancellations were to meet obligations for monitoring periods ending 30 June 2023.

Figure 1.3: Australian carbon credit unit (ACCU) cancellations by demand source



2024 ACCU issuances and project registrations

ACCU issuances in 2024 reached 18.8 million ACCUs, driven by issuances of 6.2 million ACCUs in the final quarter of the year. This is in line with our revised estimate and is 1.6 million more than 2023 issuances. Higher issuances were driven by Waste method projects which were 1.3 million higher than in 2023. This was because a larger proportion of Waste method ACCU submissions were made in December 2023. Most of these submissions were issued in 2024.

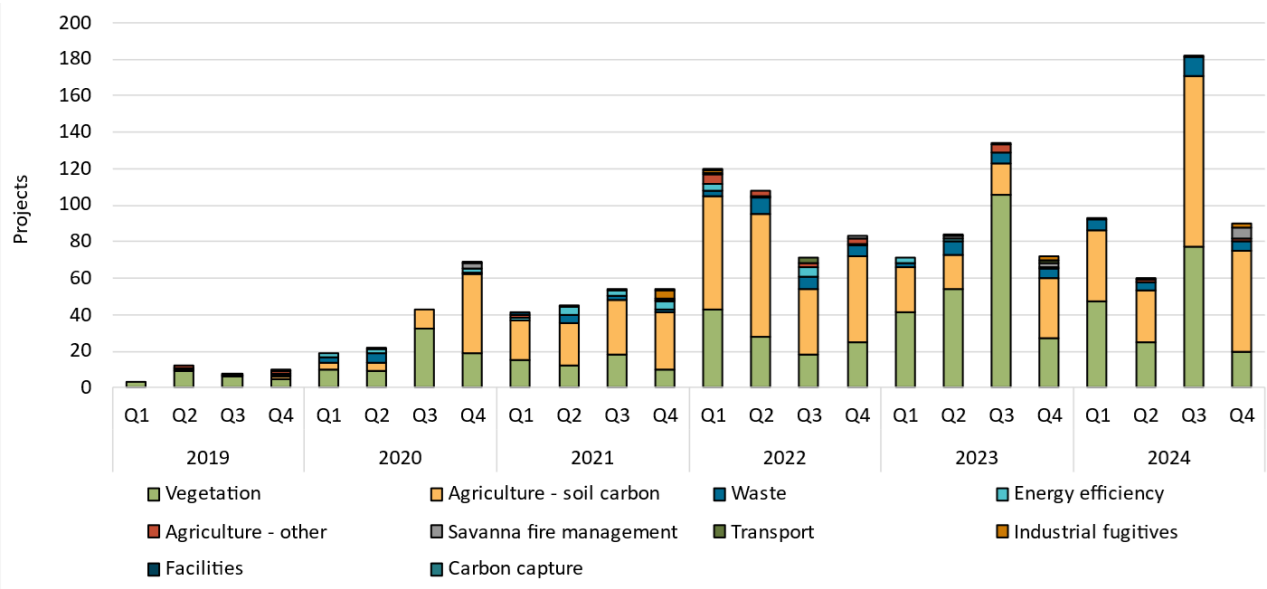
The Orica Kooragang Island Decarbonisation Project is the first Facilities method project to be issued ACCUs. This project which was first issued ACCUs in Q3 was issued a further 0.5 million ACCUs this quarter. This was the largest single issuance ever to an ACCU Scheme project. 0.6 million ACCUs have been issued to this project in its first year of claiming.

425 projects were registered under the ACCU scheme in 2024, an 18% increase from 2023. This increase was driven by soil carbon projects registered in the second half of 2024.

In October 2024, the Australian Government announced 4 new prioritised proponent-led methods for development. The interim proponent led process involves ACCU Scheme methods being developed outside of government by groups or organisations. This approach was a recommendation from the 2022 Independent Review of ACCUs. It augments the ongoing work by the Department of Climate Change, Energy, the Environment and Water in finalising priority methods to generate new ACCUs. The updated Environmental Plantings method was made in November 2024. Exposure drafts of the department led methods – the reformed landfill gas method, new integrated farm and land management method, and new savanna fire management method – are expected to be delivered in the first half of 2025.

Delivery of these new methods will provide further support to the ACCU supply pipeline later this decade.

Figure 1.4: Registered Australian Carbon Credit Unit (ACCU) Scheme projects by method type



2025 ACCU issuances expected at between 19 and 24 million

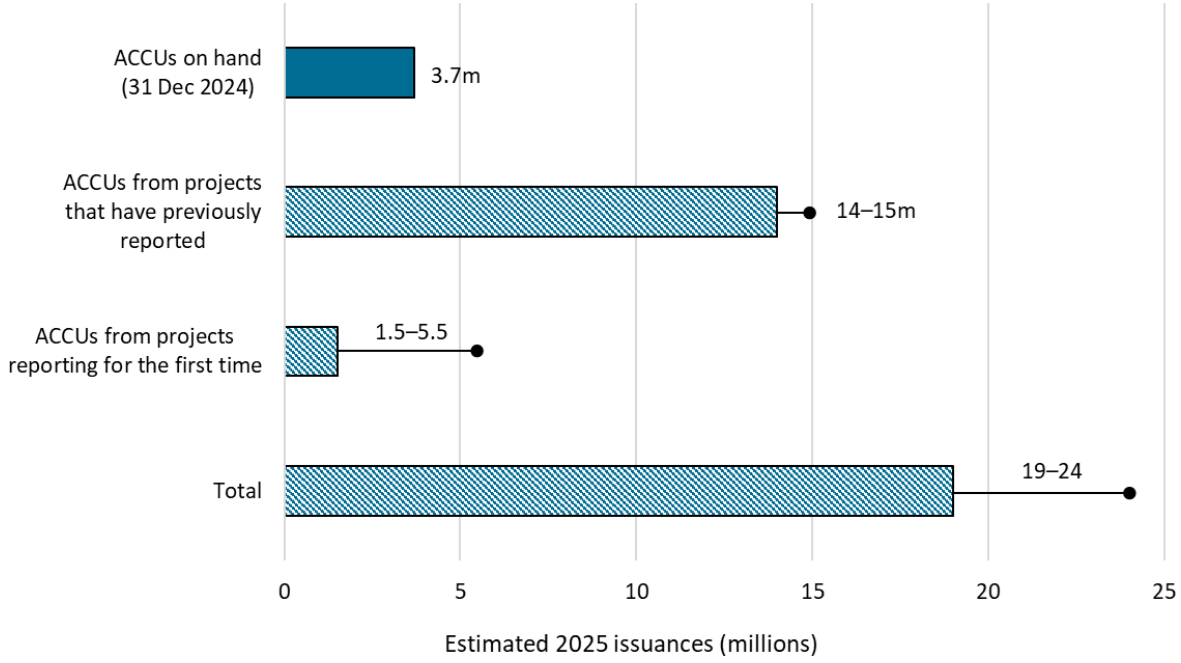
The CER expects ACCU issuances in 2025 to be between 19 and 24 million. The CER will refine this range across the year. As shown in Table 1.1, expected 2025 issuances comprises 3 key categories with the following factors likely to affect the final outcome:

- 3.7 million ACCUs where the CER already holds claims and could issue the ACCUs in 2025 ('ACCUs from claims on hand'), subject to assessment outcomes. This includes around 0.5 million ACCU claims submitted by 38 projects that have not previously been issued ACCUs.
- 14 to 15 million ACCUs from over 500 projects that have reported in the past. This figure refers to ACCUs that are expected to be claimed and issued in 2025, based on past claiming behaviour. The estimate incorporates that a proportion of ACCUs submitted in 2025 will be issued in 2026.
- Between 1.5 to 5.5 million ACCUs from projects that may report for the first time. This figure involves a high degree of uncertainty because there is less information available on the volume of abatement until projects begin reporting. This timing of first reporting is also uncertain because reporting periods can be up to a maximum of 2 years and 5 years for emissions avoidance and sequestration projects, respectively. Project start dates can also be varied, further adding to the uncertainty of when projects will first report. Total ACCU issuances in 2025 could vary significantly depending on the outcomes from just one or two projects. For example, the Moomba carbon capture storage (CCS) project commenced operations in October 2024 and is the first ACCU project of its kind. However, the size of their first claim will not be known until the application is submitted. This can have a material impact on supply for the year. As the Moomba CCS project reduces covered emissions at a safeguard facility, the number of ACCUs issued in relation to the project will be added to the net emissions number of the Moomba facility, to ensure that the carbon abatement is not counted twice.

Table 1.2: Estimated Australian carbon credit unit (ACCU) issuances by source

	Estimated 2025 issuances (millions)
ACCUs from claims on-hand from the end of 2024	3.7
Projects that have previously been issued ACCUs	3.2
Projects that have never been issued ACCUs	0.5
ACCUs from projects that have previously reported	14–15
ACCUs from projects that are reporting for the first time	1.5–5.5
Total ACCUs	19–24

Figure 1.5: Estimated Australian carbon credit unit (ACCU) issuances in 2025



2. State of total renewables

This chapter is included in each Q4 QCMR and functions as the basis for the annual Renewable Energy Target's administrative report. It consolidates material in the chapters on the Large-scale Renewable Energy Target (LRET) and Small-scale Renewable Energy Scheme (SRES) and places these in context of the Australian Government's wider suite of electricity sector policies.

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 the consequential reduction in greenhouse gas emissions.

2024 saw Australia's rollout of renewable energy generation capacity reach new heights, with a record 7.5 gigawatts (GW) of renewable energy capacity being added over the year. This consisted of 4.3 GW of approved large-scale power stations (also a record year) and around 3.2 GW of small-scale rooftop solar installations (the latter equals the pandemic induced record in 2021). For the second year in a row, households and businesses also installed more than 100,000 air source heat pumps (energy efficient hot water systems).

In 2024, the total estimated generation incentivised by the SRES and LRET was 32,400 gigawatt hours (GWh) and 50,100 GWh respectively, for a total 82,500 GWh. This represented around 32% of all electricity generation in Australia, nearly 4% higher than 2023. The total amount of renewable generation includes hydro and other baseline renewables not eligible for LGCs. Across both the National Electricity Market (NEM) and Western Australia's South West Interconnected System (SWIS) ((NEM+SWIS)), renewable generation was 92,700 GWh in 2024.

While total generation incentivised by the SRES and LRET increased from 2023 to 2024, the total renewables share in the NEM+SWIS remained unchanged at 39% because of a shortage of water for hydro generation and a wind drought experienced through late autumn to early winter. Renewable penetration in the NEM was particularly strong in Q4 2024 at 46% and continues to make a strong showing in early 2025.

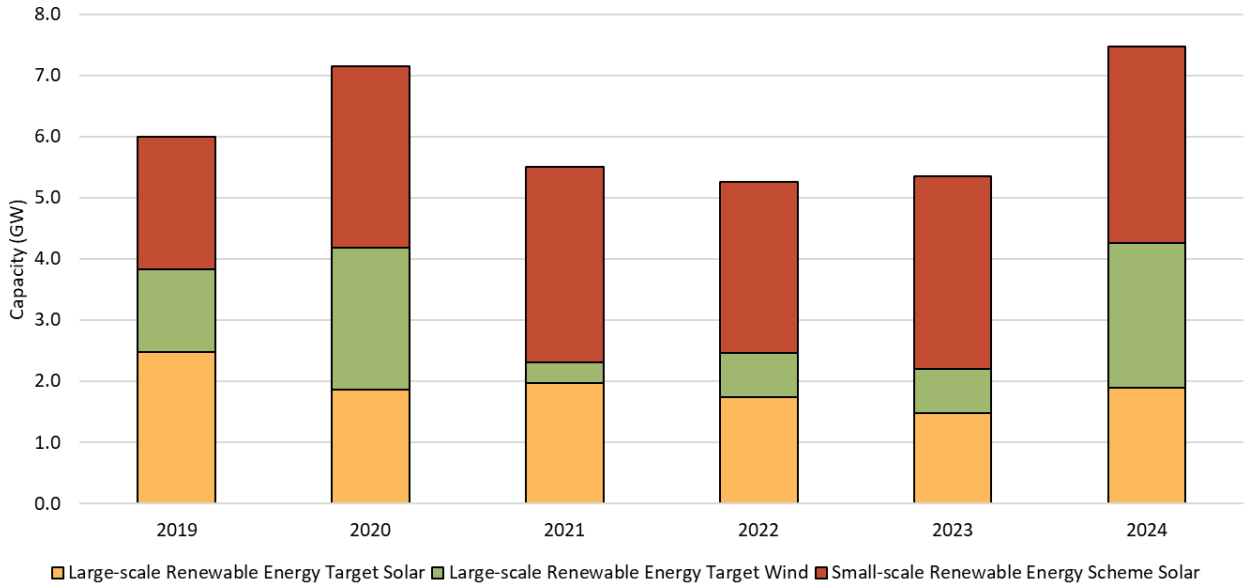
In 2025, an estimated 2.9 GW to 3.2 GW of rooftop solar is expected to be added to the grid.

- Trends from later in 2024 and January 2025 suggest that the actual capacity may currently be heading for the top end of this range. The lower bound on rooftop solar is based on modelling from consultants prepared in mid-2024 to inform the small-scale technology percentage (STP) for 2025. The drivers of rooftop capacity are discussed further in chapter 4.

At this stage, a conservative view of additional large-scale renewable energy capacity in 2025 is around 2.7 to 3.1 GW. We will progressively update this estimate during the year as we track progress of construction and expected first generation dates.

- LRET applications totalling 1.7 GW of capacity are currently under assessment by the CER which forms a strong starting point for 2025.
- The timing of final investment decision (FID) and first generation for large renewables projects are inherently lumpy. Since 2019, between 3 and 3.5 GW of capacity has reached FID each year on average, while an average of less than 3 GW has been approved for LGC creation. This sustained gap was part of the reason for the record 4.3 GW approved in the 2024 year and could mean a higher capacity accredited this year or next. However, estimating the timing of large projects reaching first generation is subject to a range of uncertainties. For example, construction timelines can be affected by weather, workforce shortages and supply chain issues.

Figure 2.1: Installed and approved renewable capacity by fuel source, 2019 to 2024



SRES makes strong contribution to the renewable energy transition

Rooftop capacity installed in 2024 has exceeded 2023 capacity, despite a marginal drop of around 14,000 overall installations to 320,000. The rise in installed capacity is due to the increase in the average installed system size. The average capacity of solar PV systems installed in 2024 was 10.0 kW, an increase of 0.6 kW compared to 2023.

Batteries are also being installed with solar systems more frequently. Figures reported to the CER show that around 10% of rooftop solar systems installed in 2024 were connected to a battery. This is up from 8% in 2023. Battery installations are not covered under the SRES, so this data is reported on a voluntary basis. It is very likely that the proportion of systems being installed with a battery is higher. Increasing volumes of storage will be important to ensure more generation from rooftop solar can be used rather than being curtailed or leading to the curtailment of other renewables by network operators to maintain power system security.

Since 1 January 2020, 15.3 GW of rooftop solar capacity has been installed. This is nearly 60% of the total small-scale capacity installed since the SRES commenced in 2001. At the time of writing, 2024 was possibly a new annual record. However, due to the lag in certificate creation this will not be clear until around April when the bulk of December 2024 certificates are expected to have been created.

Industry analysts have reported a global oversupply of solar panels in 2024, attributing this to the introduction of new panel technology. This is a contributing factor to the fall in system prices over the course of 2024, from around $0.96 per watt in late 2023 to around $0.90 per watt in February 2025. The CER estimates that the average payback period for a new small-scale solar system has decreased from 4 years in late 2023 to approximately 3.5 years as of the end of 2024. This estimate uses the same method and assumptions as in the Q3 2023 QCMR with updated data.

Record year for large-scale renewables with strong future pipeline

In 2024, the CER approved 548 large-scale renewable power stations totalling 4.3 GW of capacity to create LGCs under the RET. This was a significant uplift from the 2.2 GW approved in 2023 and marks a new record for new capacity approved in a single calendar year. Headlining the new capacity added in 2024 were the

two largest large-scale renewable power stations in Australia – MacIntyre Wind Farm (923 megawatts ((MW)), and the Golden Plains Wind Farm East (756 MW). For the first time since 2020, Victoria led the nation in new large-scale capacity, with 32% of the capacity approved in 2024. Queensland and New South Wales contributed 24% and 23%, respectively.

In addition to the record-setting year for approved large-scale capacity, 2024 was a strong year for investment in renewables. Utility-scale wind and solar projects totalling 4.3 GW of capacity reached the FID phase of development within the year.

As discussed above, it is difficult to accurately predict exactly when capacity that has reached FID will be available to the grid given substantial uncertainties associated with construction and connection timelines. At this stage, a conservative view of additional large-scale renewable capacity in 2025 is around 2.7 to 3.1 GW. Utility scale renewables take a minimum of 12 months from commencing construction to reach first generation of electricity, with some projects taking considerably longer. These extended lead times understandably correlate with increasing project sizes. The CER will update this estimate throughout the year.

The recent announcement from the Capacity Investment Scheme (CIS) also support a strong outlook for renewables. This potential impact of the announcement is discussed later in the chapter.

Renewables penetration stable in 2024, but material lift expected in 2025

The Australian Government has a target of 82% renewable electricity nationally by 2030. We would generally expect a year-on-year increase of more than 3% as a reflection of annual capacity being added to the grid. However, renewables' share of generation in the NEM in 2024 remained at the 2023 level of 39%.

- This result is largely attributed to a wind drought experienced through late autumn to early winter and weaker-than-expected generation from hydroelectricity plants due to below-average rainfall in Tasmania.
- Australian Energy Market Operator (AEMO) data from the August 2024 Engineering Roadmap and more recently in the latest Quarterly Energy Dynamics (QED) report indicate that economic offloading and network curtailment of renewables is also likely to have made some contribution the result. Whether in response to low or negative wholesale prices (economic offloading) or to power system security requirements (network curtailment), material levels of curtailment mean existing renewable assets are not generating as much electricity for consumers as they could if more electricity could be stored or transmitted. The suite of Australian Government policies increasing both large-scale storage and transmission already in train, coupled with AMEO's work to reducing technical and engineering barriers to high renewables penetration, will facilitate greater use of existing assets.
- On the demand side, there was also material increase in the overall electricity demand in the NEM (3.0% compared to between 0.2% and 1.8% over the previous 3 years).

In combination, these factors resulted in the proportion of renewables generation in the NEM remaining stable. Only rooftop and large-scale solar saw growth in their generation contributions to the NEM in 2024 – by 9.5% and 5.5% respectively compared to 2023.

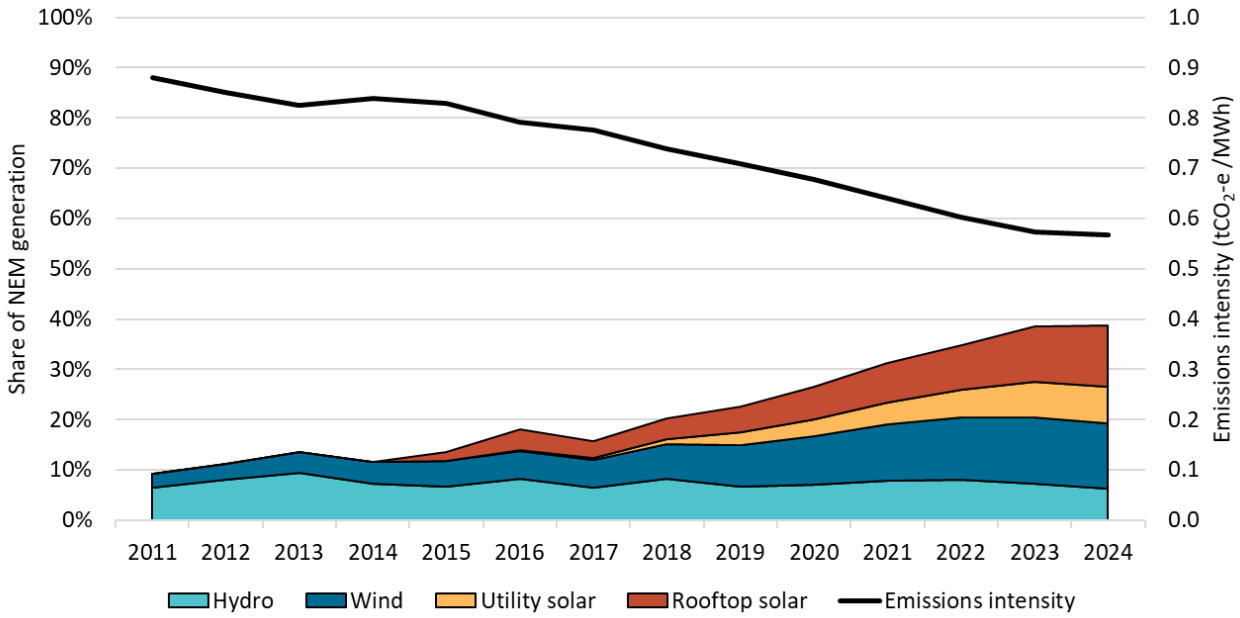
The emissions intensity of the NEM remained stable in 2024 compared to 2023, at 0.57 tonnes of carbon dioxide-equivalent per megawatt-hour (MWh) of generation. Further information on emissions from electricity is available in the 2023-24 NGER data release.

In January 2025, the AEMO released the Quarterly Energy Dynamics (QED) report for Q4 2024. The report highlighted that small-scale solar output reached an all-time quarterly high in all regions, driving a record

share of 46% of supply in the NEM from renewable sources. The QED report also detailed a half-hourly snapshot where renewable contributions to the NEM reached an all-time high of 75.6% on 6 November 2024.

The CER anticipates that renewable penetration in the NEM could reach 44% to 46% in 2025. This range assumes a return to average generation conditions, particularly for wind and hydro. It also assumes no material increases in curtailment or electricity demand growth.

Figure 2.2: Renewables generation share and emissions intensity of the National Electricity Market (NEM), 2011 to 2024



Capacity Investment Scheme poised to drive rise in large-scale generation and storage

On 11 December 2024, the successful projects under CIS Tender 1 of the CIS were announced. Successful projects are still subject to the signing of a Capacity Investment Scheme Agreement (CISA) with the Australian Government.

The successful projects consisted of a total 19 projects with a combined 6.4 GW of generation capacity and around 3.6 GWh of storage capacity. Solar projects made up 2.8 GW of the generating capacity, with wind projects making up the remaining 3.6 GW. The total 6.4 GW exceeded the indicative target generation capacity by 0.4 GW. Reflecting the increasing importance of dispatchable power to the renewable energy transition discussed above, 8 of the 19 successful CIS projects were hybrid generation and storage projects.

We would expect revenue underwriting agreements available to projects supported through finalised CIS contracts will increase the likelihood of reaching financial milestones such as FID in a reduced timeframe. Given the sizeable capacity of successful bids in Tender 1, total capacity reaching FID in 2025 could be around 6 GW or potentially more, noting announcements from further CIS rounds are scheduled from next month.

- Successful bids under Tender 2 – Wholesale Electricity Market (WEM) Dispatchable of the CIS are scheduled to be announced in March 2025. Tender 2 is seeking to deliver 2 GWh of storage capacity in the SWIS.

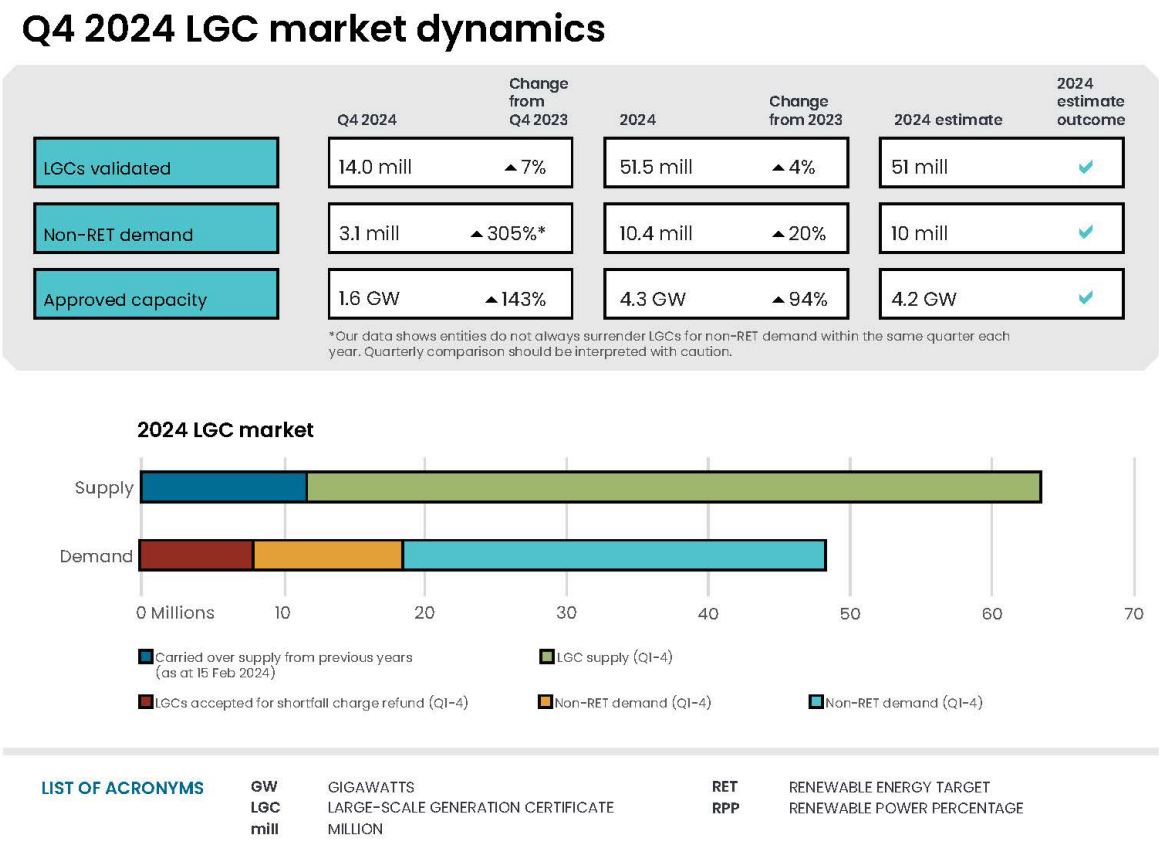
- There are also two further tenders underway – Tender 3 – NEM Dispatchable Capacity, aiming to deliver 4 GW of four-hour equivalent dispatchable capacity, or 16 GWh of dispatchable capacity in the NEM, and Tender 4 – NEM Generation, aiming to deliver a further 6 GW of renewable generation capacity in the NEM. Project bids for Tender 3 closed on 18 December 2024, and successful bids are expected to be announced in September 2025, while project bids for Tender 4 closed on 18 February 2025, and successful bids are indicatively scheduled to be announced in October 2025.

3. Large-scale generation certificates (LGCs)

Insights

- 2024 was a record year for large-scale renewables, with 4.3 GW of additional capacity approved for LGC creation.
  - » Wind projects were the largest contributors to new capacity in 2024, with a record 2.4 GW of all capacity approved coming from wind farms.
- Projects reaching final investment decisions in 2024 was 4.3 GW of capacity.
- LRET applications totalling 1.7 GW of capacity are currently under assessment by the CER. This is a strong starting position for approvals in 2025.
  - » At this stage, a conservative estimate is for between 2.7 and 3.1 GW would be approved by the end of the year.
- Voluntary demand for LGCs has continued to grow year-on-year, with non-RET surrenders of LGCs totalling 10.4 million in 2024.
  - » 2025 is expected to be even stronger than 2024 for voluntary demand, given commitments by many large Australian businesses to be powered by 100% renewables by 2025.
  - » Holdings by voluntary participants reached a record of 8.2 million in Q4 2024, suggesting a build-up of LGCs by entities intending to surrender to meet voluntary 2025 renewable energy targets.
- Following the 14 February 2025 surrender deadline LGCs for 2024 compliance, 6 liable entities went into shortfall with a combined 3.8 million LGCs totalling $248.6 million in shortfall charges.
  - » Total shortfall charges are around $800 million, covering 12.3 million LGCs.
- As expected, the LGC spot price has fallen from between $30 to $32 in the lead up to the 14 February surrender deadline to around $28 post-surrender.
  - » This follows the price correction from $45.50 that occurred in late 2024 that was discussed in the Q3 2024 QCMR.
- Cal25 futures contracts are trading about a dollar higher than the spot, which may be a reflection of market uncertainty around volume of 2025 voluntary LGC demand and the $800 million that can be redeemed by surrendering 12.3 million LGCs over the next 3 years.

Image 2: Q4 2024 LGC market dynamics



Market dynamics

Table 3.1: Large-scale generation certificate (LGC) supply and demand balance

	LGCs (millions)	
	Demand	**Supply**
Supply carried over from previous years (as of 15 Feb 2024)		11.9
LGC supply (Q1-4 2024)		+51.5
Non-RET demand (2024)	-10.4	
2024 RPP surrenders	-30.2	
LGCs accepted for shortfall charge refund (Q1-4 2024)	-7.5	
Estimated balance as of 15 Feb 2025		**21.1**

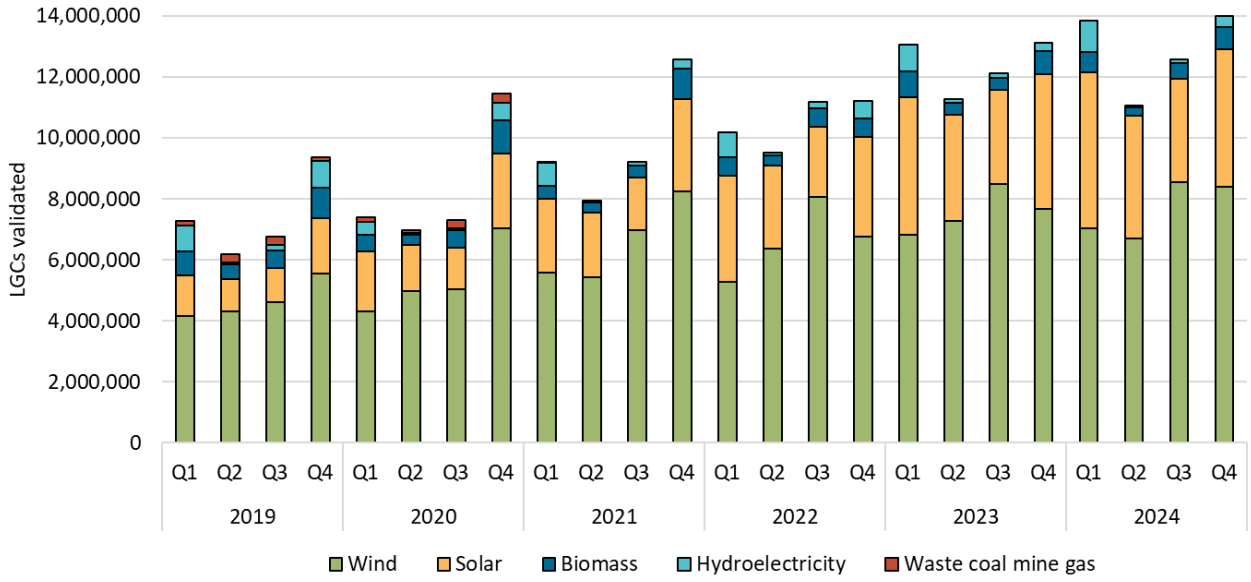
Note: There is a total of 4.3 million LGCs in shortfall that are eligible for shortfall refunds to be claimed from 2022. There is $800 million in consolidated revenue (representing 12.3 million LGCs) from shortall charges that are eligible for redemption as of 15 February 2025.

In Q4 2024, 14.0 million LGCs were created, bringing total LGC creations to 51.5 million for the year. This volume was in line with updated projections in the Q3 2024 QCMR. Assuming weather conditions are favourable throughout 2025, it is reasonable to expect 54 to 57 million LGCs to be created in the year.

The 14 February surrender deadline saw 30.2 million LGCs surrendered against a total liability of 34 million. Shortfall totalling 3.8 million LGCs was taken by 6 liable entities, with an additional 0.4 million in liability carried forward to next year's deadline by 17 liable entities.

Additional factors to consider in the LGC market throughout 2025 will be the impact of the introduction of mandatory climate disclosures and a material uplift in voluntary cancellations. These are discussed further below.

Figure 3.1: Large-scale generation certificates (LGCs) validated by technology type

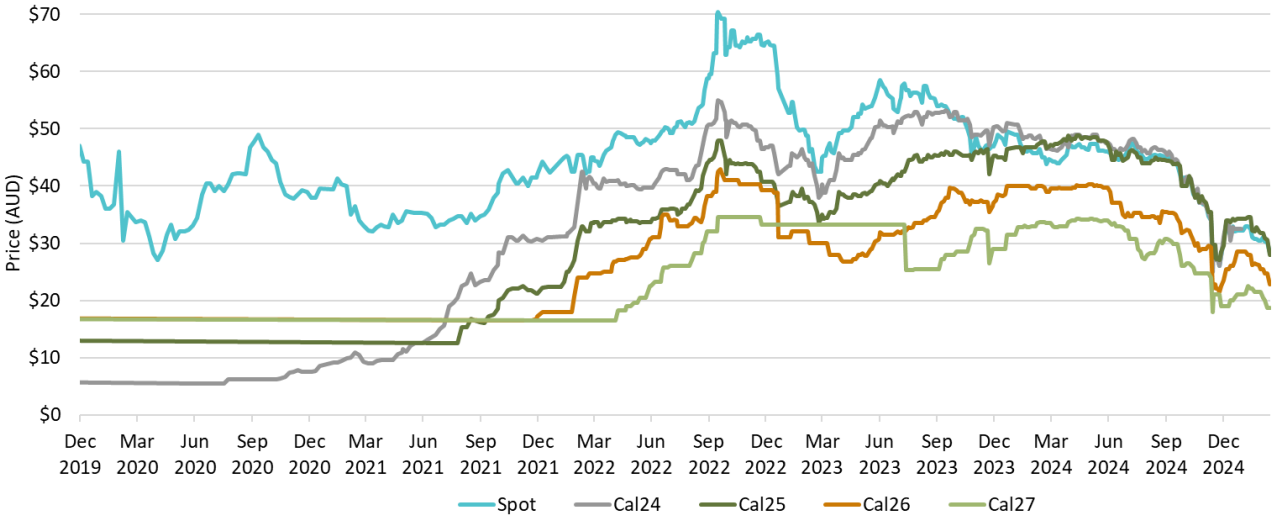


The LGC spot price experienced a sharp decline in mid-Q4 with a partial recovery later in the quarter. The spot price dropped from $41.50 at the start of Q4 to a low of $26.00 in late November, before rebounding to finish the year at $32.25. The LGC spot price has settled at around $28 since the 14 February surrender deadline.

It is difficult to quantify the absolute uplift in non-RET demand at this stage, but the CER expects a material uplift in surrenders. It would not be extreme to expect between 12.5 and 15 million LGCs could be surrendered for non-RET purposes in 2025. This is likely to be a factor influencing the Cal25 futures which were trading at $29.00 on 18 February. The CER has been informed that some entities with 100% renewable energy targets in FY2025 will be surrendering in Q3 2025. Early indications suggest that meeting these commitments could require an up to 4-fold increase in cancellations for some entities. The phased introduction of mandatory climate disclosures from 1 January will see the corporate disclosures in a new sustainability report. While disclosures do not create new emissions reduction requirements, the reporting requirements could increase interest in voluntary retirement of LGCs or other certificates. The CER will continue to consult with relevant entities throughout the year to refine this estimation.

Despite the uplift in voluntary demand, overall LGC supply (stock and expected creations) is still expected to readily account for demand coming from both RET and non-RET surrenders. This includes the 4.3 million currently eligible for shortfall refund.

Figure 3.2: Large-scale generation certificate (LGC) reported spot and forward prices



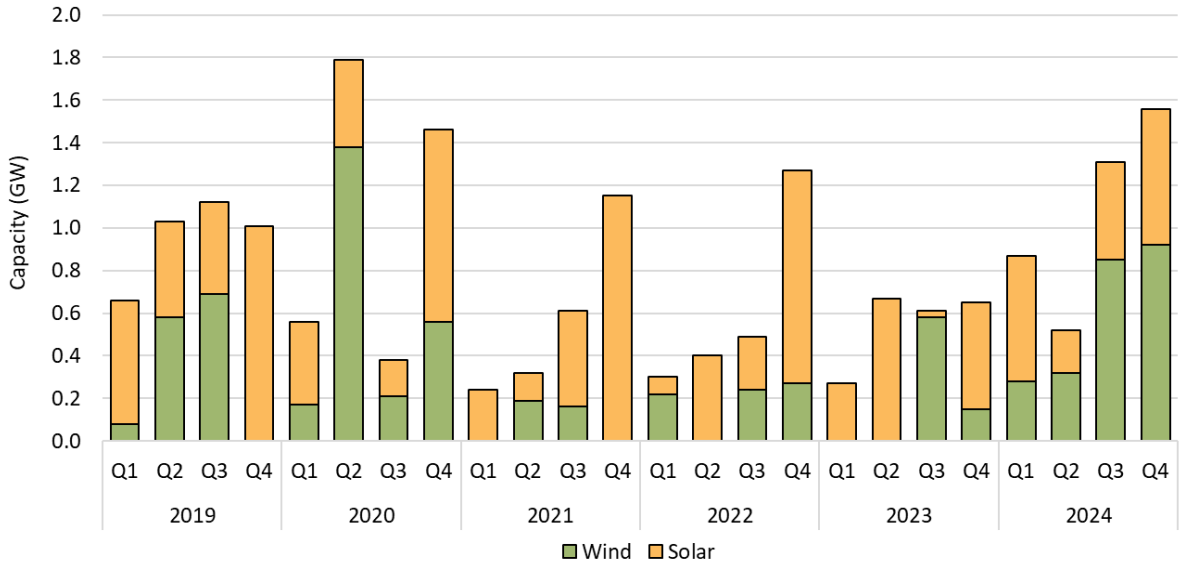
The 2025 renewable power percentage (RPP) has been set at 17.91%. The RPP is set by the Minister for Climate Change and Energy each year to meet the LRET's annual legislated target for renewable electricity which is 33,000 GWh each year from 2020 to 2030. Given the legislated target for renewable electricity is fixed, recommended RPP's tend not to vary much from year to year. The 2025 RPP is marginally lower than 2024 and will require liable entities – typically electricity retailers – to surrender approximately 32 million LGCs. The small decrease from the 33 million target in the 2025 RPP calculation reflects a rolling adjustment to account for over surrenders in previous years.

Record volume of approved large-scale capacity

Approved capacity in Q4 2024 under the LRET was very high with 1.6 GW of capacity approved during the period. This was driven by the approval of Australia's largest wind farm – MacIntyre Wind Farm (923 MW), as well as Walla Walla Solar Farm 1 and 2 (353 MW).

This outcome has resulted in a record 4.3 GW of renewable energy generation capacity being approved in 2024 – exceeding the previous record of 4.2 GW set in 2020, and nearly doubling the 2.2 GW of capacity approved in 2023.

Figure 3.3: Approved large-scale wind and solar capacity



2.4 GW of wind capacity was approved in 2024. For the first time since 2020, wind power made up the bulk of approved power stations in a calendar year. This is a significant metric as wind assets tend to have higher capacity factors and often generate significant energy at night. Solar assets also make a valuable contribution to the energy mix through reduced prices during daylight hours. The development of storage assets in the network will serve to reduce energy prices in high price periods as generation from wind and solar assets can be stored and shifted to meet demand as needed.

There is currently 1.7 GW of large-scale capacity under assessment by the CER. This suggests that the first half of 2025 could carry forward the strength in approvals seen in 2024.

Strong end to year for final investment decisions

2024 investment ended strongly, with 1.3 GW of capacity reaching Final Investment Decision (FID) in Q4. Total capacity to reach FID in 2024 was 4.3 GW.

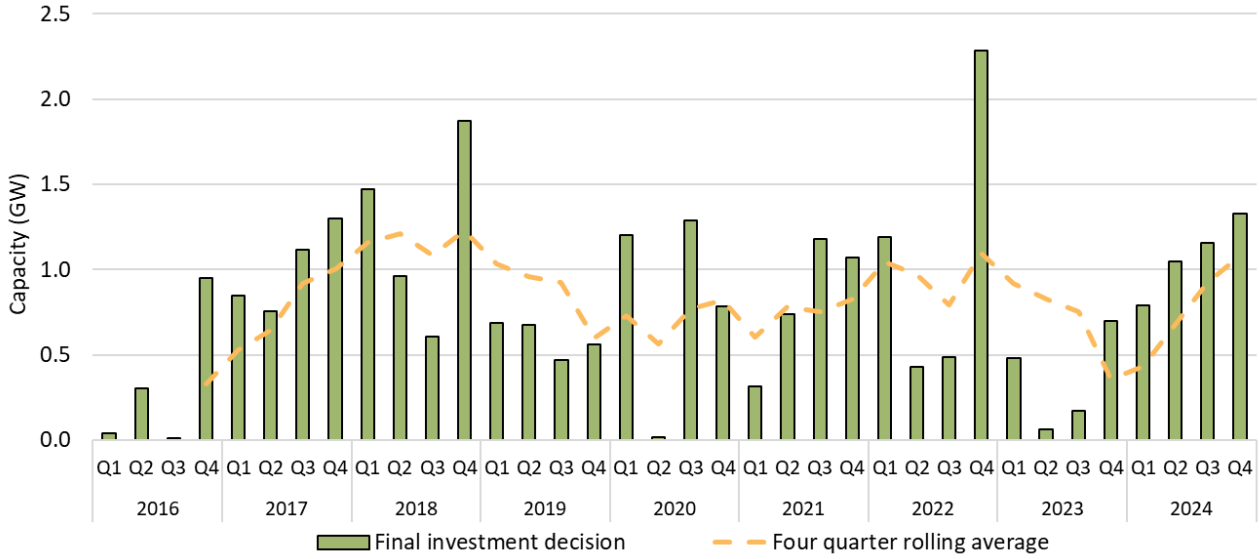
Significant projects reaching FID in Q4 2024 include:

- Goulburn River Solar Farm (450 MW)
- Wambo Wind Farm – Stage 2 (254 MW)
- Wambo Wind Farm – Stage 1 (250 MW)
- Carwarp Solar Farm (150 MW)
- Horsham Solar Farm (119 MW)
- Warradarge Wind Farm (108 MW).

Goulburn River Solar Farm reached FID following the announcement of its successful bid under Tender 1 of the Capacity Investment Scheme (CIS).

A total of 19 large-scale projects totalling 6.4 GW of generation and 3.6 GWh of storage capacity were successful in the first round of the CIS. The rate at which these project reach generation stage will vary. While a few are further advanced in the development cycle and could see accreditation under the LRET within 18 months, others will take more time.

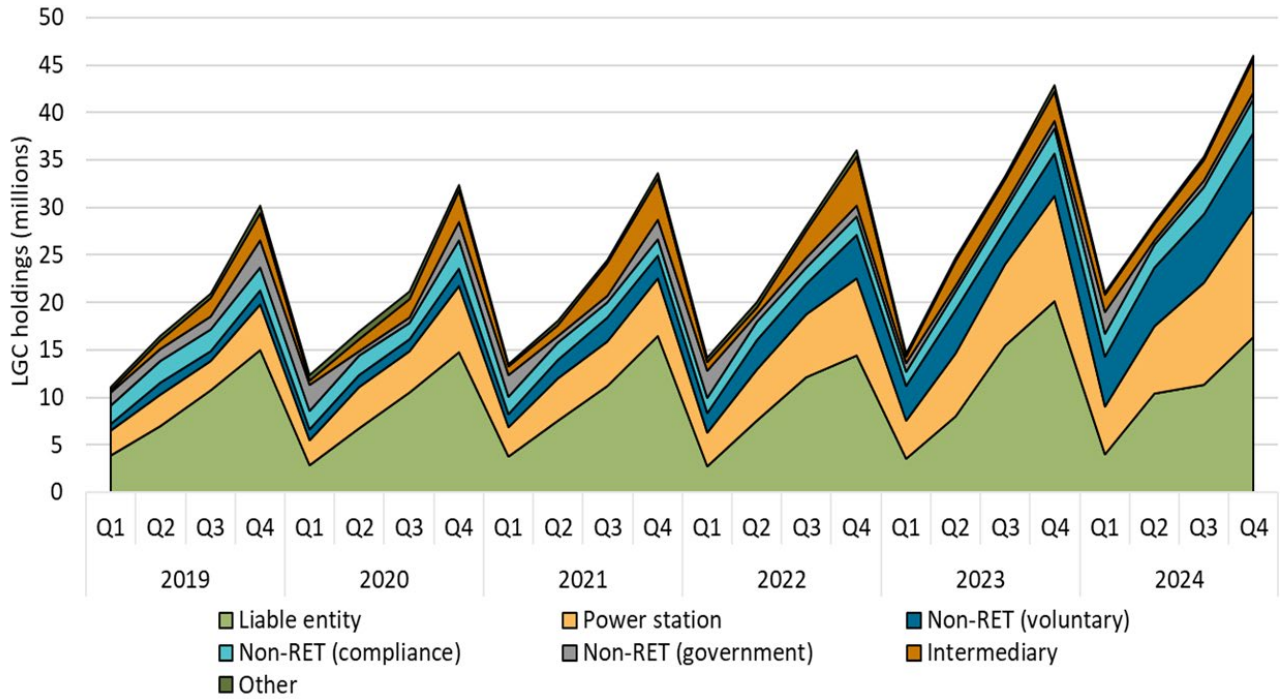
Figure 3.4: Final investment decision capacity (GW) for large-scale renewable generation



Voluntary (non-RET) LGC Holdings increase in Q4

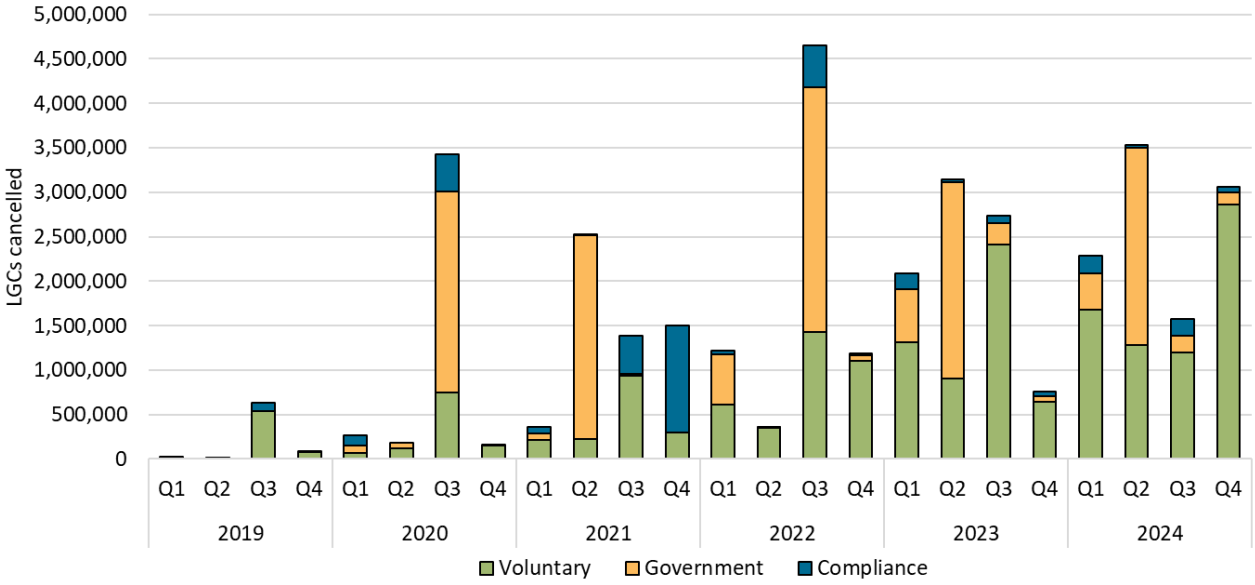
LGC holdings increased by 10.7 million to 46.0 million at the end of 2024, up from 42.9 million at the end of 2023. Holdings by voluntary participants at the end of 2024 were nearly double that at the end of 2023 (4.4 million in 2023 and 8.2 million last year).

Figure 3.5: Large-scale generation certificate (LGC) holdings (in millions) by market participation



Non-RET surrenders totalled 3.1 million LGCs in Q4 2024, bringing the annual total to a record 10.4 million. This was 20% higher than the 8.7 million surrenders in 2023. As discussed above, consistent with the substantial growth in non-RET holdings late last year, non-RET LGC surrenders in 2025 are expected to exceed those in 2024.

Figure 3.6: Non-Renewable Energy Target (non-RET) large-scale generation certificate (LGC) cancellations by demand source

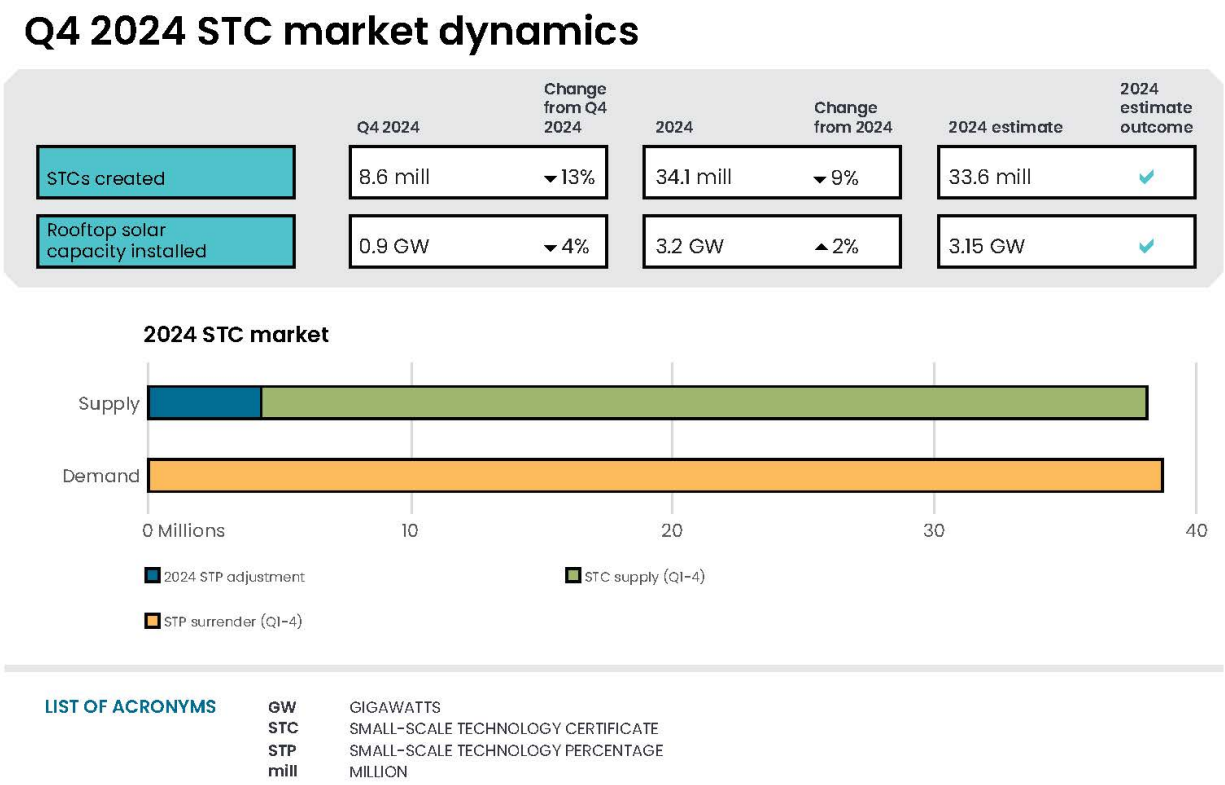


4. Small-scale technology certificates (STCs)

Insights

- Current data indicates a potential record of around 3.2 GW of small-scale renewable energy generation capacity was added in 2024.
  - » STCs can be created over a 12-month period with the bulk created after 3 months, so by around April there will be a clearer picture of 2024 capacity.
- In 2025, an estimated 2.9 GW to 3.2 GW of rooftop solar is expected to be added to the grid.
  - » Recent trends suggest that capacity may currently be heading for the top end of this range. The lower bound is based on modelling from consultants prepared in mid-2024 to inform the STP for 2025.
- Battery installations reached a record 10% in 2024 based on data voluntarily provided to the CER.
- The share new of installations with batteries is likely higher, with market analysts estimating a 2023 figure of around 17%.
- More than 100,000 air source heat pumps were installed under the SRES in 2024. This was nearly a quarter lower than 2023 installations. This is likely driven by changes in the NSW Hot Water System Rebate (NHWR) eligibility criteria to prevent 'double dipping' with the SRES.

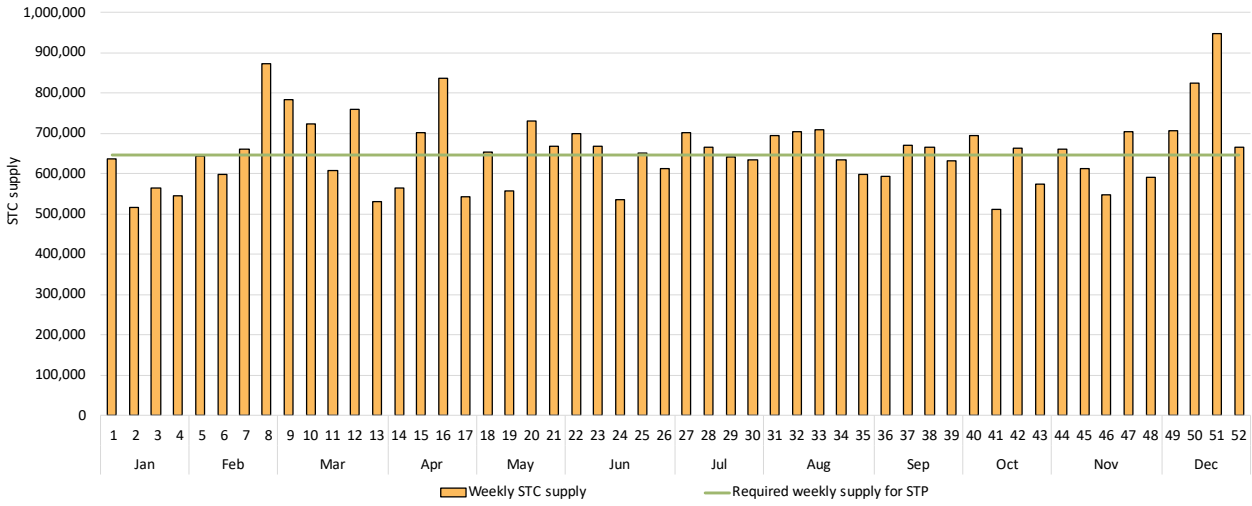
Image 3: Q4 2024 STC market dynamics



Market dynamics

In Q4 2024, 8.6 million STCs were created, bringing the 2024 total to 34.1 million. On average, around 656,000 STCs were created per week throughout 2024. This was above the average of around 646,000 required to meet the compliance demand set for the 2024 STP.

Figure 4.1: Weekly small-scale technology certificate (STC) supply and the required supply to meet the small-scale technology percentage (STP)



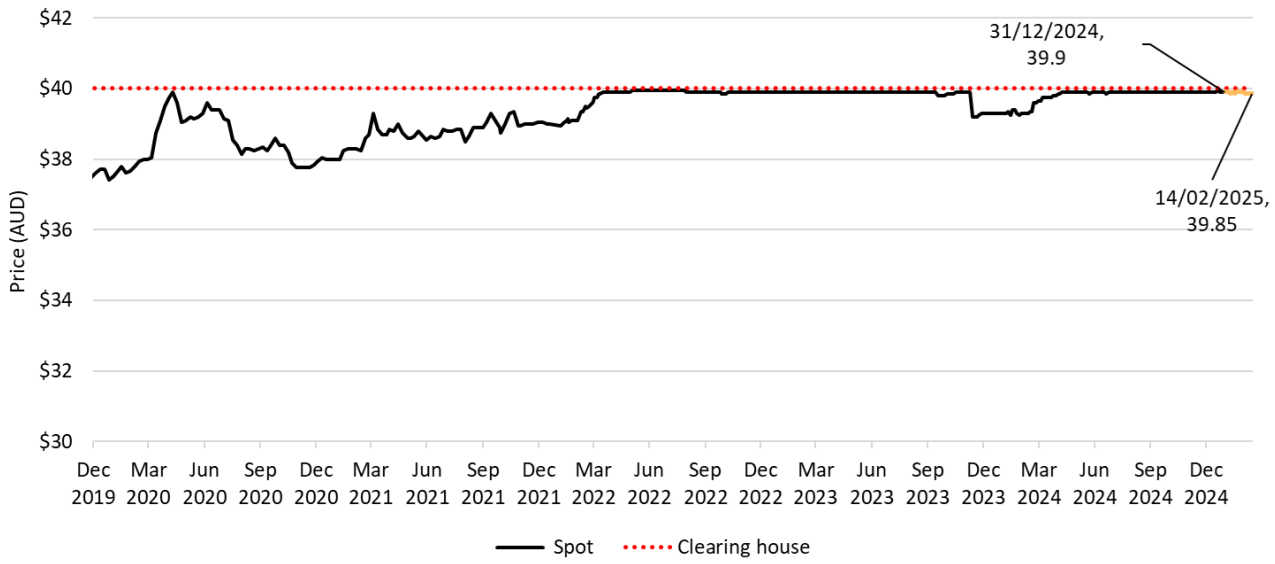
The surrender deadline for the Q4 2024 compliance period was 14 February 2025. A total of 7.0 million STCs were surrendered at a compliance rate of 102%. Over the course of 2024, 39.1 million STCs were

surrendered compared to the 37.9 million annual compliance requirements. Surrenders above the requirement can occur when there is a discrepancy between the relevant acquisitions or exemptions used to calculate the STP and the final figures from the year. In 2024, relevant acquisitions were 4.5 TWh higher and exemptions were 0.1 TWh lower than expected. This resulted in liable entities surrendering 1.2 million more STCs than the compliance requirement set out in the 2024 STP.

The 2025 STP has been set at 13.89%. The STP is set by the Minister for Climate Change and Energy each year and aims to set demand to match projected STC creation. That is, all certificates expected to be created in a year are required to be surrendered by liable entities, considering any over or underachievement from the previous year. The 2025 STP will require liable entities – typically electricity retailers – to surrender a cumulative total of 24.9 million STCs to meet the compliance requirements.

Estimated STC creation for 2025 is driven by the projected number of household solar PV systems and the STCs per system. By design, as the SRES phases down to its 2030 close, the annual percentage reduction in STCs per system increases by a sizeable and growing amount in percentage terms. For example, the decline from 7 years of upfront STCs in 2024 to 6 years in 2025 equates to a 14.3% reduction in rebate. On the other hand, system prices and payback periods have continued to fall as noted in chapter 2. While a lower rebate lowers demand for household PV other things equal, the CER expects that 2025 added solar capacity will be similar to 2024.

Figure 4.2: Small-scale technology certificate (STC) reported spot and clearing house prices



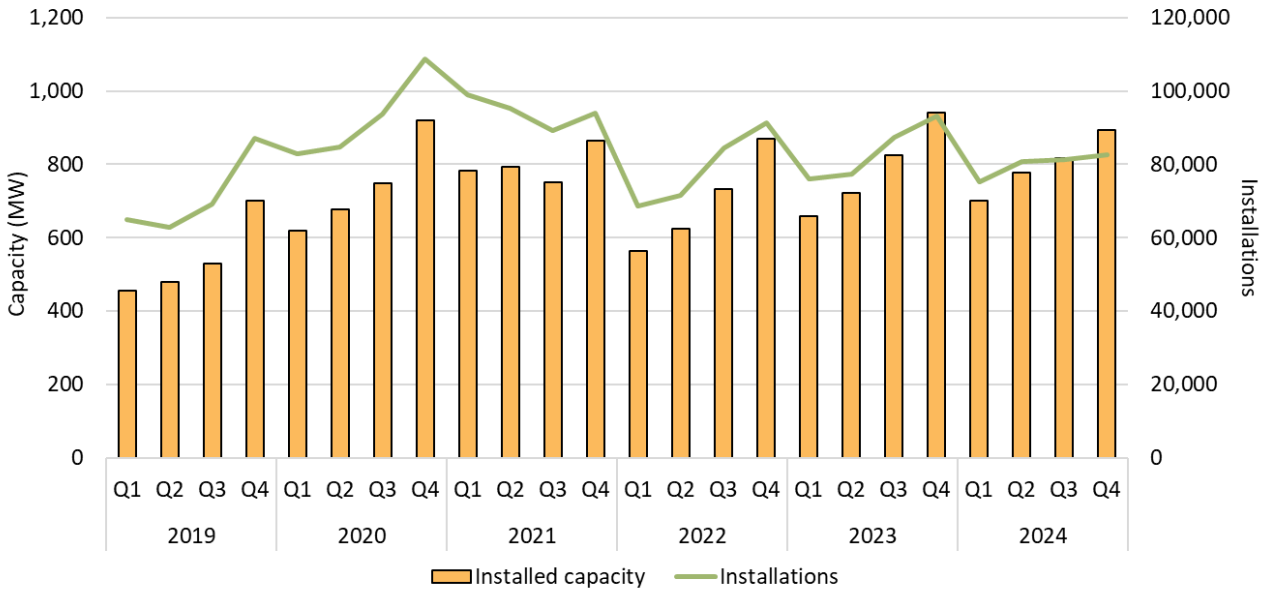
The STC spot price remained at $39.90 for the majority of Q4 2024. This was due to the STC clearing house remaining in deficit for most of the quarter. The STC clearing house entered surplus from 17 December 2024 but fell back into deficit in the lead up to the Q4 surrender deadline on 14 February 2025.

Possibly a new record for rooftop solar installations

Strong Q4 2024 solar PV installation figures has kept the possibility of a record year of installed capacity alive. At the end of 2024, the validated annual capacity was marginally higher than the 2023 capacity at the same point in time. STCs can be created up to 12 months from installation, with the bulk created after 3 months, so a clearer picture of 2024 will be available by April 2025. At the time of publication, it is likely that 2024 capacity will be higher than the 3.14 GW installed in 2023. It could match or exceed the pandemic induced record of 3.2 GW in 2021.

The average system size installed in 2024 was 10.0 kW, 0.6 kW higher than 2023. This continues the trend of increasing average system sizes each calendar year, more than offsetting the annual decline in total installations.

Figure 4.3: Small-scale rooftop solar installations and installed capacity in megawatts (MW)



Continued growth in battery-connected systems

There was a significantly higher percentage of new small-scale systems being installed with batteries in 2024 relative to previous years. Data voluntarily reported to the CER shows that 10% of systems were battery-connected in 2024, up from 8% in 2023. The data also indicates a strong uptick of systems reported as having batteries in Q4, largely driven by the NSW battery incentive scheme. As discussed in previous reports, only systems installed from November 2024 onward are eligible for that scheme.

Increasing capacity of storage will be important to ensure the rapid increase in generation from rooftop solar does not result in increasing curtailment of large-scale wind and solar to maintain power system security. In addition, increases in storage help allow further large increases of rooftop solar capacity to be connected without creating security issues in both low and high voltage networks or the need to forcibly 'trip' or tun off rooftop solar.

Figure 4.4: Proportion of battery-connected small-scale installations in NSW and Australia

Strong year for air source heat pumps despite lower incentives

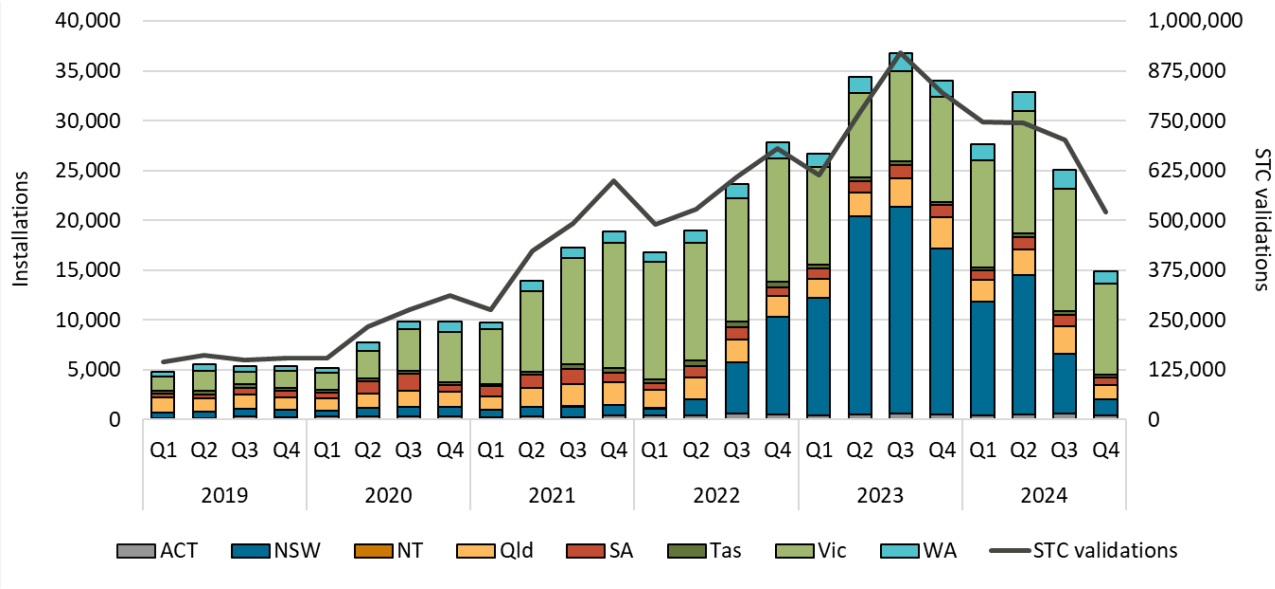
The CER has validated the installation of more than 100,000 air source heat pump (ASHP) systems, and 2.7 million associated STCs in 2024. This is the second consecutive year where ASHP installations under the SRES have surpassed 100,000. Air source heat pumps are estimated to have displaced approximately 1,580 GWh of grid sourced electricity in 2024.

NSW's quarterly air source heat pump installations continued to decline in Q4 2024, driven by reduced incentives offered under the NSW Government's NHWR under its Household Energy-savings Upgrades program. Prior to this change, the ability to access both schemes reduced the cost of an average ASHP installation in NSW by up to 33%. Consequently, NSW has observed a significant year-on-year decline in its total air source heat pump installations in 2024, which were 52% lower than in 2023. By comparison, the rest of Australia saw a year-on-year increase in air source heat pump installations of 7% over the same period.

Lower NSW installations in Q3 and Q4 2024 meant that Victoria led the nation in air source heat pump installations in 2024, with more than 44,000 validated installations. Market intelligence suggests that installers have been shifting their operations to Victoria following the changes to the NSW rebate scheme.

2024 installation numbers have not been lag adjusted for the 12-month creation period and will increase over the course of 2025 as the CER validates more systems.

Figure 4.5: Air source heat pump installations and STC validations by state



5. Emissions reduction

In 2024, schemes administered by the CER are estimated to have reduced emissions by between 69.2 and 100.6 million tonnes of carbon dioxide equivalent (CO_2-e). The estimates use different ways of calculating emission reductions from renewable energy.

Emissions reduction using grid average intensities

Using grid average emissions intensities, there were 69.2 CO_2-e of emissions reductions from CER schemes in 2024. This is 8% higher than the 64.2 million tonnes of CO_2-e reduction in 2023 and in line with our 2023 projection of 2024 emissions reductions. The 2024 is estimate based on:

- The ACCU Scheme issued ACCUs equivalent to 18.8 million tonnes of CO_2-e emissions abatement in 2024. This is 9% higher than in 2023. Each ACCU is equivalent to 1 tonne of CO_2-e emissions reduction.
- The RET is estimated to have contributed 50.4 million tonnes of CO_2-e emissions reduction in 2024. This is 7% higher than the previous year. It includes an estimated:
  - 29.0 million tonnes from the LRET.
  - 21.3 million tonnes from the SRES. This component considers the potential renewable electricity generated by rooftop solar as well as the reduction in electricity consumption from the use of more efficient hot water systems.

This is a conservative estimate as it uses the weighted average emissions intensity of the NEM and SWIS and multiples this by the MWh of renewable generation. The emissions intensity factor was 0.56 tonnes of CO_2-e per MWh in 2024, only marginally lower than the 0.57 tonnes of CO_2-e per MWh in 2023. This emissions intensity factor will fall as the share of renewables in the grid increases.

Emissions reduction using thermal displacement

Using the thermal displacement method, the emissions reduction associated with CER schemes could be as high as 100.6 million tonnes of CO_2-e in 2024.

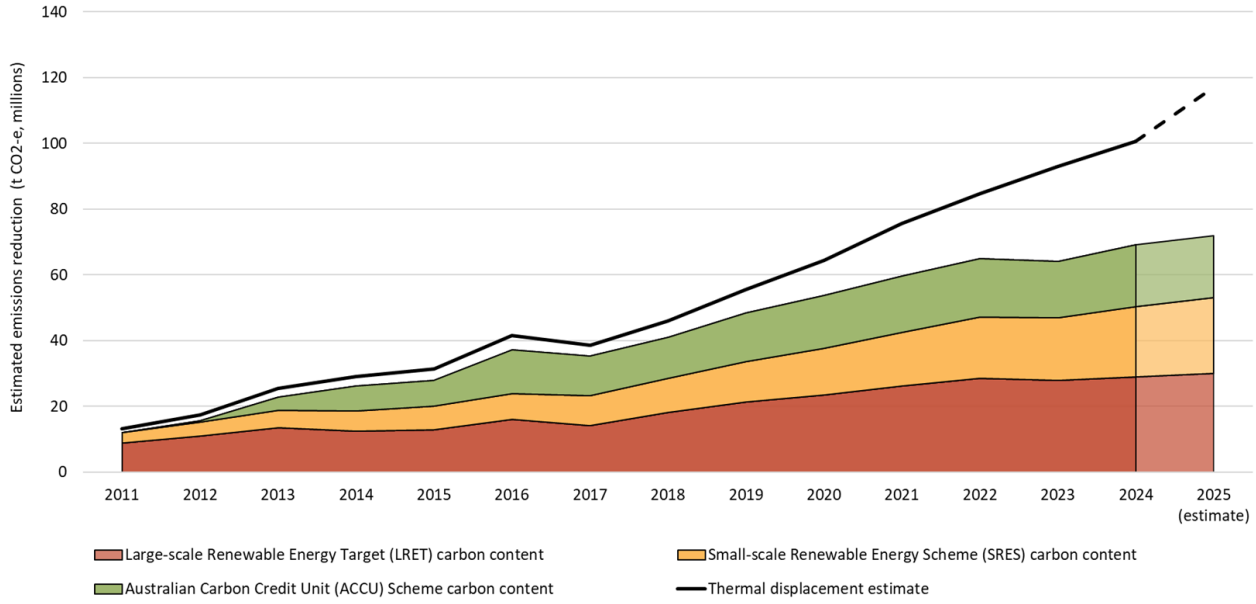
This estimate is higher than the estimate using grid average emissions intensity as it assumes renewables are fully displacing thermal generation. Thermal generation refers to electricity generated from fossil fuels, such as coal and gas. In 2024, the emissions intensity of thermal generation was estimated to be 0.91 tonnes of CO_2-e per MWh compared to 0.56 tonnes of CO_2-e per MWh for the entire grid. This difference will continue to widen as Australia's electricity grid decarbonises.

Projected 2025 emissions reduction

In In 2025, schemes administered by the CER are estimated to reduce emissions by between 72 and 117 million tonnes of CO_2-e.

- The 72 million tonnes of CO_2-e is based on using lower range estimates for the ACCU Scheme and the RET (of 19 million and 53 million tonnes of CO2-e respectively) and the average emissions intensity factor of the grid.
- The 117 million tonnes of CO_2-e is based on using higher range estimates for the ACCU Scheme and the RET (of 24 million and 93 million tonnes of CO2-e respectively) and the thermal displacement method.

Figure 5.1: Estimated emission reduction from Clean Energy Regulator (CER) schemes, 2011 to 2025



Feedback

To help us ensure that our QCMR are as helpful and informative as possible, we welcome your feedback on this report. Please provide feedback to Manager, Economic and Market Analysis via:

- Email: enquiries@cer.gov.au
- Post: Clean Energy Regulator, GPO Box 621 Canberra ACT