Australian Government
Clean Energy Regulator

CLEAN ENERGY REGULATOR

Quarterly Carbon Market Report

June Quarter 2020

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Report objective

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

This report consolidates information across the three national carbon markets that the Clean Energy Regulator administers for the June Quarter 2020 (1 April 2020 to 30 June 2020) and provides information on supply and demand trends and opportunities to inform market decisions.

Report disclaimer

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

This Quarterly Carbon Market report represents the views of the Clean Energy Regulator at the date of publication. The Clean Energy Regulator 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 Clean Energy Regulator administers. The Clean Energy Regulator has used its best endeavours to ensure the quality of the information in this document but cannot guarantee its accuracy or completeness. The Quarterly Carbon Market report is not legal, business or financial advice. You should obtain your own independent professional advice in light of your particular circumstances on the state of these markets before making any investment decisions. The information is provided as general information only. Neither the Clean Energy Regulator nor the Commonwealth of Australia will accept liability for any direct, incidental or consequential loss or damage resulting from the Quarterly Carbon Market report, or the information provided through Quarterly Carbon Market report, or the availability or non-availability of Quarterly Carbon Market report.

Version history

Version	Date	Changes
1.00	3 September 2020	

Executive summary

Carbon markets have remained resilient in the face of the economic downturn brought on by COVID-19 and have been a source of growth for the Australian economy.

Total delivered additional renewables capacity for 2020 now looks likely to match the record of 6.3 gigawatts (GW) set in 2019. While the large-scale renewables estimate remains the same (3.4 GW), the Small-scale Renewable Energy Scheme (SRES) small-scale solar PV estimate has been revised up to 2.9 GW (from 2.7 GW). To put this number in perspective, the total across both schemes was 1.2 GW in 2016.

Strong rooftop solar grows jobs

Small-scale rooftop solar PV installation and capacity accelerated further in Quarter 2 2020. The number of small-scale installations grew to 82,400 in Quarter 2 up from 81,000 in Quarter 1 2020. These installations added an estimated 677 megawatts (MW) of capacity, a 41 per cent increase in installed capacity since Quarter 2 2019.

The Clean Energy Regulator's previous estimate of 2.7 GW of rooftop solar PV in the SRES for 2020 will be exceeded if this momentum is maintained. It is now likely that 2.9 GW will be installed[1].

Total rooftop solar PV is likely to exceed 3 GW if mid-scale rooftop solar PV in the Large-scale Renewable Energy Target (LRET) (100 kilowatts to 5 MW) is included.

Key drivers of this growth include large numbers of people working from home, increased spending on home improvement and low interest rates. The strong growth in rooftop solar PV over the first six months of the year is estimated to have added 2800 jobs[2] at a time when employment in other sectors has contracted.

Increased installations and capacity throughout Quarter 2 2020 have resulted in high levels of small-scale technology certificate (STC) creations. A surplus of 4.8 million STCs remained after Quarter 2 surrender on 28 July 2020, and an estimated surplus of 6 million STCs is expected following Quarter 3 surrender on 28 October 2020. Given the size of the surplus and expected creation rates, the STC clearing house will stay in surplus for the remainder of the 2020 assessment year.

An analysis of the potential impacts of the Victorian Stage 4 restrictions on rooftop solar PV in the SRES can be found in Chapter 3 Small-scale technology certificates.

Can the system evolve to accommodate accelerating rooftop solar PV capacity?

Approximately 29 per cent of suitable dwellings across Australia have solar PV installed on their roofs. Penetration rates of rooftop solar PV at a state-based level are as high as 42 per cent in Queensland and 40 per cent in South Australia.

Total installed rooftop solar PV is now 12 GW, growing by 3 GW per annum. As the penetration of solar PV increases, operation of Australia's electricity grids (both distribution and transmission) become significantly more complex.

The Australian Energy Market Operator (AEMO) released Stage 1 of its Renewable Integration Study (RIS) in April. It provides recommendations to help Australia's electricity network continue its transition to support more renewable energy.

For distributed energy resources (DER), the RIS suggests updating inverter standards and streamlining standard setting processes to strengthen system security as key recommendations that will enable higher levels of rooftop PV to be successfully integrated into Australia's energy networks.

[1] The original estimate of 2.7 GW was made in the March 2020 Quarterly Carbon Market Report. The estimate of 2.9 GW takes the current Victorian COVID-19 restrictions into account.

[2] This is based on Australian Bureau of Statistics (ABS) 2018-19 reported levels of employment in the rooftop solar PV sector and recent installation growth. The installation of rooftop solar is labour intensive. It is assumed additional employment is roughly proportional to increased installations.

With rooftop solar PV capacity up 41 per cent year on year, the key question is whether changes to distribution networks, DER technical standards and other rule changes can occur quickly enough to accommodate ongoing record increases in rooftop solar PV. This is explored further in the Chapter 4 spotlight on PV penetration and localised grid stability.

The 2020 Large-scale Renewable Energy Target

Large-scale renewable energy generation for the first half of 2020 is estimated to be 13,500 gigawatt hours (GWh)[3] compared to 12,300 GWh at the same point in 2019. Total large-scale renewable energy generation in 2019 finished at 28,300 GWh.

Generation for the first half of 2020 was lower than the Clean Energy Regulator had expected. This is due to delays in connecting new renewable energy power stations as well as delays in ramping up to full generation capacity. Lower than usual wind resource has been another contributing factor.

Australia remains on track to meet the 33,000 GWh target in 2020 if there is a strong seasonal electricity generation for wind, solar and hydroelectric power in the second half of the year.

The current fleet of accredited power stations is expected to generate in excess of 40,000 GWh once generating at full capacity in 2021. This means that even if the Clean Energy Regulator did not accredit any further capacity, expected generation would be significantly higher than the 33,000 GWh of legislated demand for large-scale generation certificates (LGCs) from 2021 onwards.

Over 2 GW of large-scale renewable capacity was accredited in the first half of 2020 with a further 283 MW under application. 3.4 GW of accredited capacity is still expected for the full year, provided there are no major delays in construction.

The next wave of large-scale renewable investment is emerging

The total capacity of new projects reaching financial close for the first half of 2020 remains at 837 MW. As expected, issues around COVID-19 impacted financial close processes and decisions. However, 2 to 3 GW is still expected to reach financial close in 2020.

After Quarter 2, on 4 August 2020, Murra Warra Wind Farm Stage 2 reached financial close for a total of 209 MW, taking the total committed capacity to over 1 GW for the year.

Probable projects[4] have reached their highest level recorded by the Clean Energy Regulator at 2.8 GW. These projects, including nearly 1.5 GW of recently announced power purchase agreements (PPAs) for the Western Downs solar farm and MacIntyre and Clarke Creek wind farms, signal a new wave of investment.

Proposed renewable energy zones (REZs) and transmission grid upgrades are also driving substantial interest from renewables developers. During Quarter 2 2020, registrations of interest for New South Wales' first REZ in the state's central west totalled 27 GW, well beyond the planned 3 GW zone.

Acquisition activity, and international developers with a proven track record, are also areas to watch for the next wave of investment.

Steady ACCU supply and big step up in new projects

Australian carbon credit unit (ACCU) supply was 4.8 million in Quarter 2 2020, a similar volume as Quarter 2 2019.

For the first half of 2020, supply has increased by 8.4 per cent to 8.4 million when compared to the first half of 2019. Supply of ACCUs in 2020 is still estimated to reach 16 million up from the 14.8 million in 2019.

At the end of Quarter 2 2020, there was a balance of 7.5 million ACCUs in the Australian National Registry of Emission Units (ANREU).

[3] This figure covers all generation from power stations accredited under the LRET but does not include any above baseline hydro power that will also contribute to the target as the volume will only be known at the end of the year.
[4] Probable projects have a high degree of confidence that they will proceed following a public announcement of a power purchase agreement with a strong counter party or other evidence of funding.

For the first time, a breakdown of these holdings by category has been published[5] (see Chapter 1 Australian carbon credit units).

The increase in ACCU balances overtime is likely to reflect an increase in uncommitted supply.

A new wave of project registrations has taken off, likely driven by the higher average price of $16.14 at Auction 10 and the availability of the new optional delivery contract. There have been 43 new projects registered in the first half of 2020, more than the total number of projects registered in 2019. These projects are estimated to generate 12 million ACCUs out to 2045.

The lead up to the September auction has seen a very large number of additional project registration applications received, with over 90 on hand at the end of July. The Clean Energy Regulator will update on this in the auction results in the September Quarterly Carbon Market Report (QCMR).

Voluntary emissions reduction activity is gaining momentum

Over the last 12 months, voluntary private, state and territory demand for units and certificates has doubled compared to the previous financial year.

Quarter 2 2020 reflected this trend with substantial surrenders of 206,000 ACCUs and 177,000 LGCs, collectively 3.3 times the total 114,000 units and certificates surrendered in Quarter 2 2019.

International units still make up most of the voluntary offset market to date.[6] In Quarter 2, 2.7 million Certified Emissions Reductions (CERs) were surrendered in ANREU, bringing the total to 3.4 million in the first half of 2020, more than double the surrenders in the first half of 2019.

Quarter 2 2020 also saw the Australian Energy Council, representing major electricity and gas companies, join business groups including the Business Council of Australia and the Australian Industry Group, in support of a transition to net zero emissions by 2050. This increasing support for net zero targets will drive growth in private sector demand for LGCs and ACCUs.

Greater detail can be found in Chapter 5 Voluntary markets.

Surrendering LGCs proves renewable claims

At the end of Quarter 2 2020, the Australian Capital Territory government, surrendered 2.2 million LGCs to show they had achieved their 100 per cent renewable energy target. These LGCs can be traced to renewable projects supported by the Australian Capital Territory government's reverse auction process. Voluntarily surrendered LGCs are taken out of circulation and cannot be used for compliance against the legislated national LRET.

Surrendering one LGC for each megawatt hour (MWh) of electricity consumed is recognised by Climate Active[7] and GreenPower[8] as proving the use of renewable electricity and offsetting scope 2 electricity emissions. A simple agreement to buy LGCs does not establish the use of renewable electricity, they must be surrendered to the Clean Energy Regulator to prove renewable claims.

Projected emissions reduction in 2020

Total emissions reduction from the Renewable Energy Target (RET) and Emissions Reduction Fund (ERF) is expected to be approximately 54.5 million tonnes CO_2-e in 2020, compared to 47.7 million tonnes delivered in 2019. This estimate is down slightly from the 56.6 million tonnes previously estimated in Quarter 1 2020.

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[5] Under the current *Clean Energy Regulator Act 2011*, the individual holdings are not public information as they are for international carbon units and renewable energy certificates. The Climate Change Authority recommended in December 2017 an amendment to make ACCU holdings transparent.

[6] Clean Energy Regulator, Quarterly Carbon Market Report - September Quarter 2019, 2019. ACCUs and LGCs each make up 10 per cent of the voluntary market and eligible international units make up 80 per cent based on 2018 Climate Active data. An updated market share will be reported in future Quarterly Carbon Market Reports when 2019 Climate Active data is available.

[7] Climate Active is an ongoing partnership between the Australian Government and Australian businesses, which provides a certification to businesses that have satisfied the Climate Active Carbon Neutral Standard.

[8] GreenPower is a voluntary government accreditation program that enables electricity providers to buy renewable energy on behalf of electricity consumers.

The downward revision is mainly due to a reduction in estimated large-scale renewable energy generation for 2020 and a downward revision in the average grid emissions intensity factor that the Clean Energy Regulator uses to estimate emissions reduction from renewable energy.

Abatement from ERF should be broadly in line with the Clean Energy Regulator's earlier estimates.

Refer to Chapter 6 Carbon abatement for more information.

Unit and certificate prices

The ACCU spot price declined from $16.50 at the end of Quarter 1 2020 to $15.85 at the close of Quarter 2 2020 (see Table 1). Since then, the spot price rebounded in July reaching $16.05, before falling again to $15.90 at the end of August.

STC spot prices were $39.45 at the close of Quarter 2 2020. STC prices declined further to $38.40 at the end of July, likely due to the growing surplus following Quarter 2 surrender on 28 July 2020.

The LGC spot price experienced a 44 per cent increase from end of Quarter 1 2020 to end of Quarter 2 2020. Lower LGC supply and increased voluntary surrender of LGCs may be supporting LGC price increases. LGCs prices settled around $40.00 at the close of Quarter 2 2020.

Table 1: Price trend, Q2 2020

Certificate type	Spot price AUD (30 June 2020)[9]	Quarterly trend
ACCU	$15.85	-$0.55
LGC	$40.00	+$11.75
STC	$39.45	-$0.25

[9] Data sourced from Jarden and TFS Green.

1. Australian carbon credit units

- Supply of Australian Carbon Credit Units (ACCUs) was 4.8 million in Quarter 2 2020 and on track for 16 million ACCUs in 2020.
- ACCU holdings grew to 7.5 million.
- Voluntary demand surged with 206,000 ACCUs surrendered in Quarter 2 2020, up 85 per cent compared to Quarter 2 2019.
- Project registrations surpassed 2019 with 43 projects registered in the first half of 2020, compared to 39 projects in all of 2019.
    - 23 new projects were registered in Quarter 2 2020, representing an estimated 3.5 million tonnes of potential abatement out to 2045.
    - At 31 July 2020, 91 project registration applications were on-hand, under assessment.
- Auction 11 has been scheduled for 9 to 10 September, where the Optional Delivery contract will be available following a successful pilot at Auction 10.
- Advance payments of up to $5,000 to assist with upfront costs of soil sampling will be offered to eligible proponents.
- Spot prices declined from $16.40 at the end of Quarter 1 2020, to $15.85 at the end of Quarter 2 2020. It has since rebounded reaching $16.05 in July, before falling again to $15.90 at the end of August.

1.1. Supply and demand balance

Supply of ACCUs increased by 4.8 million, a similar volume to that issued in Quarter 2 2019. Demand for ACCUs was 17 per cent higher than Quarter 2 2019, with 3.3 million contract deliveries.

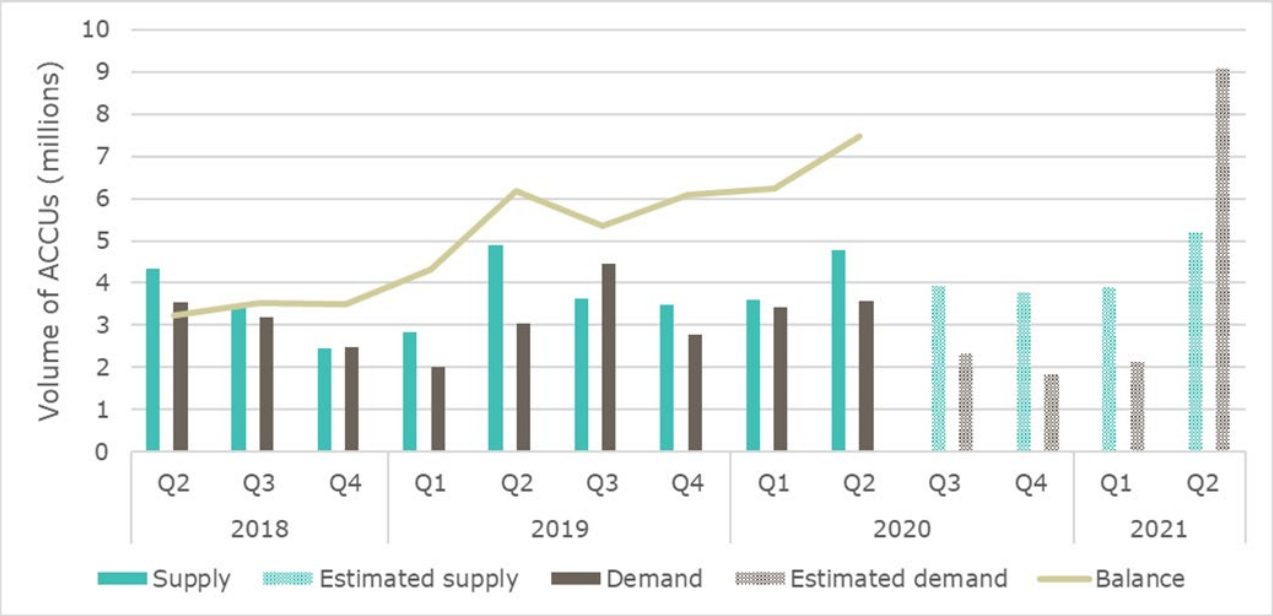
The balance of ACCUs held in ANREU increased by 1.2 million from Quarter 1 2020 to 7.5 million at the end of Quarter 2 2020 (Table 2).[10]

Table 2: Balance of supply and demand at Quarter 2 2020 close[11]

Balance/supply of ACCUs from Quarter 1 2020	6,251,570
ACCUs issued Quarter 2 2020	4,786,232
Emissions Reduction Fund contract deliveries	-3,352,122
Safeguard surrender[12]	0
Voluntary surrender[13]	-206,019
ACCU relinquishment[14]	0
Net balance at the end of Quarter 2 2020	7,479,661

[10] While the balance in accounts is rising, these may not be available for sale as a proportion of these ACCUs may be held or banked for future needs (e.g. delivery under contract, future safeguard mechanism liability or voluntary cancellation).
[11] Within a specified period, supply of ACCUs refers to ACCUs issued, and demand of ACCUs incorporates three sources including Commonwealth ERF contract deliveries, Safeguard mechanism surrender and state and private sector voluntary cancellation.
[12] Safeguard mechanism surrender does not include deemed surrender. A 'deemed surrender' occurs when ACCUs issued under an ERF project at a Safeguard facility, in a particular year, are delivered to the Commonwealth under an ERF contract.
[13] Voluntary surrender refers to voluntary cancellation of units in the ANREU by states and territories and the private sector.
[14] For more information see ACCU relinquishments.

Figure 1: ACCU supply and demand balance, Q2 2018 to Q2 2021[15]



Supply is on track to reach over 16 million ACCUs in 2020. With this estimated supply and a healthy balance in accounts of 7.5 million ACCUs, the balance of units in the ANREU is expected to grow over the short term (see Figure 1).

However, early contract deliveries and additional abatement contracted through Auction 11 could moderate this growth.

Growth in ACCU holdings

The volume of ACCUs held in ANREU accounts has steadily increased from 2.5 million at the start of 2018 to nearly 7.5 million at end of Quarter 2 2020. Although a large proportion of these ACCUs are held or banked for identified future uses, there is also likely to be an increase in uncommitted supply.

Following requests from some market participants, the Clean Energy Regulator is providing some analysis on the types of entities holding ACCUs. In December 2017, the Climate Change Authority recommended increased transparency of ACCU holdings by regularly publishing ownership and volume data. For the secondary market to operate efficiently, market participants need to have some visibility of ACCU holdings.

As the current legislation does not provide for disclosure of individual account level data, ACCU holdings have been aggregated in Table 3 into three categories: ERF project proponent, business and government enterprise, and intermediary.

The change in holdings from January 2018 to June 2020 for each of the above categories is illustrated in Figure 2 below. Project proponents comprise the biggest portion of holdings with 73 per cent of current volume. Many of these ACCUs are likely being held in preparation for scheduled delivery against Commonwealth contracts, with holdings typically falling following peak delivery in June and July each year.

[15] Estimated supply is calculated using both extrapolations from supply this year to date and Clean Energy Regulator estimates. Supply estimates from existing ERF projects are calculated by modelling project start dates, relevant land areas and abatement profiles for each registered project. As this is a projection, there are inherent uncertainties and assumptions that will change over time. Demand estimates consist of estimated ERF contract scheduled deliveries and voluntary demand estimates. ERF scheduled deliveries will change over time due to early deliveries, rescheduled deliveries, contract lapses and terminations, and new contracts.

More recently, feedback from market participants to the Clean Energy Regulator suggests some proponents are also holding ACCUs to supply to increasing voluntary demand.

Business and government enterprises are holding 14 per cent of the current ACCU balance. These participants are accumulating ACCUs for a range of reasons including as a hedge against possible future liability, contributing to long term voluntary emissions targets and for upcoming safeguard mechanism surrenders.

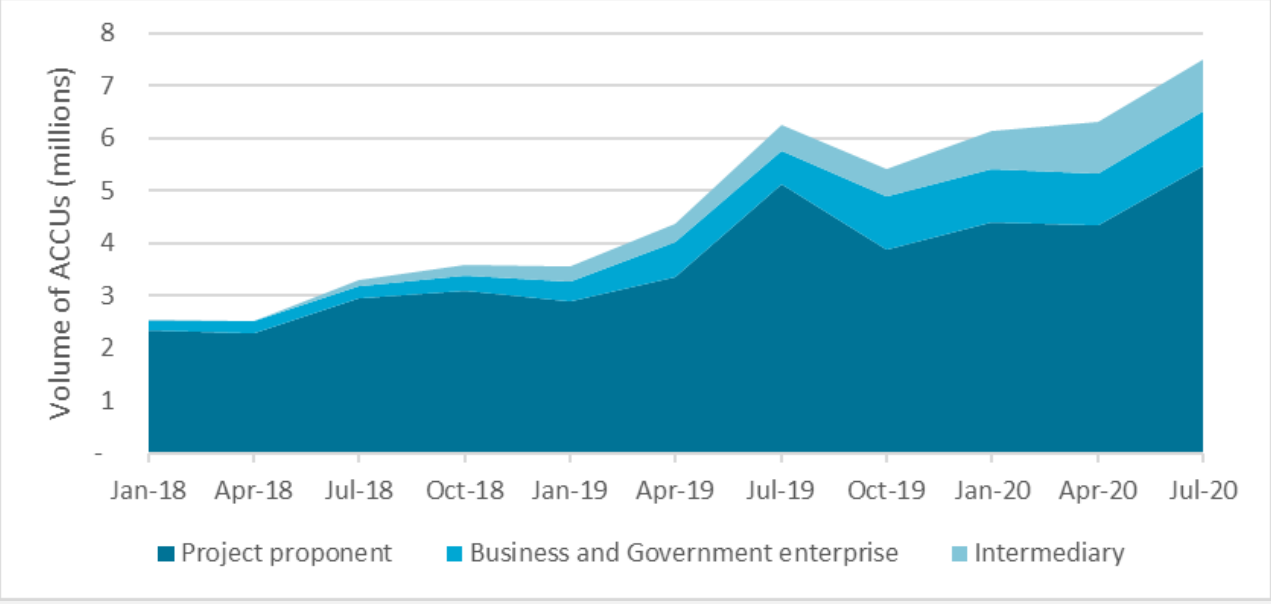
Table 3: Breakdown of the current account holdings as at end of Q2 2020, by category

Holder category	Definition	Volume of ACCUs held at end of Q2 2020 (millions)	Number of accounts*
ERF project proponent	Account holder is connected to one or multiple ERF projects.	5.5	169
Business and Government enterprise	Account holders that do not have direct link to ERF projects^. These include safeguard entities, voluntary participants, local government entities that are accumulating for voluntary or compliance purposes.	1.0	21
Intermediary	Account holder's primary operation is to facilitate trading of units between the supply and demand sides of the market.	1.0	12

*Does not include accounts with nil volume at 30 June 2020.
^Connection to projects has been determined based on project information available as at 30 June 2020. Entities may have linkages to projects that have not been disclosed to the Clean Energy Regulator.

Intermediaries, including traders and brokers, hold 13 per cent of the current balance. These participants are involved in spot and forward trading and hold ACCUs for other market participants. Accumulation by intermediaries has grown from 0.3 per cent of the balance at the start of 2018 to 13 per cent at the end of Quarter 2 2020, providing additional liquidity in the market.

Figure 2: Breakdown of ACCU holding by market participation



1.2. Factors impacting supply

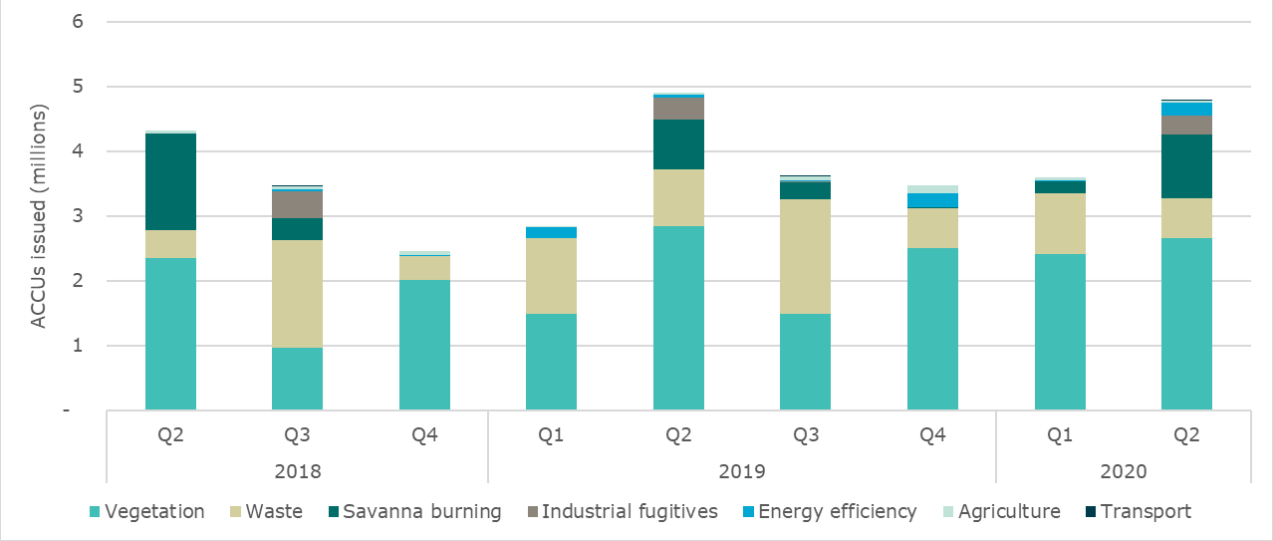
Crediting

There were 4.8 million ACCUs issued in the quarter. Quarter 2 is typically the largest quarter for issuance, in particular, for projects under savanna burning and vegetation methods, as shown in Figure 3. Reporting cycles (savanna burning) and contract cycles (vegetation) are key drivers of this trend.

During Quarter 2 2020, total ACCU issuances exceeded 80 million since ACCUs were first issued in 2012.

Seven projects were credited for the first time in Quarter 2 2020, contributing more than 200,000 ACCUs for the quarter. There are now 485 projects generating ACCUs and 328 projects yet to be credited from 813 registered projects.[16] Of the 328 projects yet to receive ACCUs, 106 are unconditionally registered and 222 are registered with conditions that must be removed before ACCUs can be issued.[17]

Figure 3: ACCUs issued per method type, Q2 2018 to Q2 2020



Projects

A new wave of project registrations has taken off, likely driven in part by the increase in the average price paid at Auction 10 of $16.14, along with the new optional delivery contract. A total of 23 new projects were registered in Quarter 2 taking total registrations in 2020 to 43. These projects are expected to generate 12 million ACCUs over their crediting life if they proceed. By comparison, the 39 projects registered in 2019 were estimated to generate 9 million ACCUs over their lifecycle.

The project portfolio has continued to diversify in Quarter 2 2020 with 60 per cent of projects registered under methods other than vegetation, compared to 33 per cent in 2019 (see Figure 4).

Further growth in project registration under the 'Soil Carbon Sequestration in Agricultural System' method is expected following the announcement that the Clean Energy Regulator is now offering an advance payment of up to $5000 to eligible proponents to assist with the upfront costs of soil sampling, to be paid back with ACCUs to the Clean Energy Regulator within five years.

As well as helping to support proponents with upfront project participation costs, the pilot advance payment contract will require that data

[16] For many projects to be issued credits they are first required to meet certain project conditions (e.g. eligible interest holder consents). Projects are also required to submit a report to receive credits within certain time periods depending on the method. If projects do not meet their conditions or report within their allotted time periods, then these projects may not proceed and may be revoked.

[17] Projects generally take one to two years from when they are registered before they are issued their first ACCUs. Once projects are registered, they have a crediting period between 7 to 25 years depending on the method.

collected through soil sampling be made available to help improve the science underpinning soil carbon projects in the ERF.

There was a material increase in project applications in the lead up to the project registration deadline for Auction 11 on 28 July. A total of 62 applications were received in July prior to this deadline, taking the number of applications under assessment to 91 at the end of July.

The growth in the project portfolio in Quarter 2 2020 was moderated by 13 project revocations, the majority of which were registered in 2016 or earlier.

Allowing for projects to be revoked is a deliberate design feature of the ERF. This is because a project must be registered before it can proceed, or it will not meet the newness test.

However, some projects may not proceed beyond registration for a range of reasons including difficulty in obtaining finance or consents from third parties, restructuring of project portfolios and other commercial decisions. Hence, it is always expected that some projects will not proceed and be voluntarily revoked before reporting for the first time.

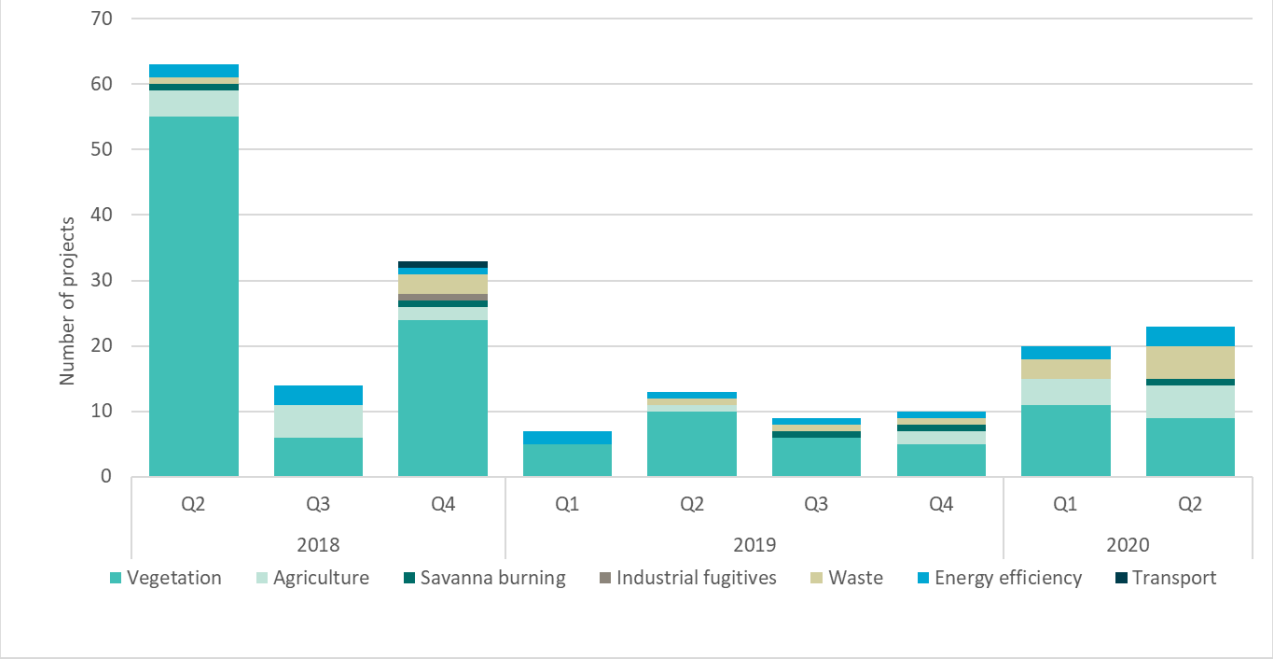
Investment builds

Investment in carbon initiatives gains momentum. Shell has announced it will purchase Western Australia based Select Carbon to generate credits and offset the emissions of its customers.

The global investment firm KKR has invested in project developer GreenCollar as part of their global impact strategy.

BNP Paribas has made $140 million available through a green bond issuance. Investment is linked to a newly developed Australian Climate Transition Index which aims to support ASX 300 companies with explicit strategies to reduce emissions. Initiatives may include energy efficiency and process improvements, use of electric vehicles, fuel switching to renewable energy and carbon forestry.

Figure 4: New registered projects per method type, Q2 2018 to Q2 2020

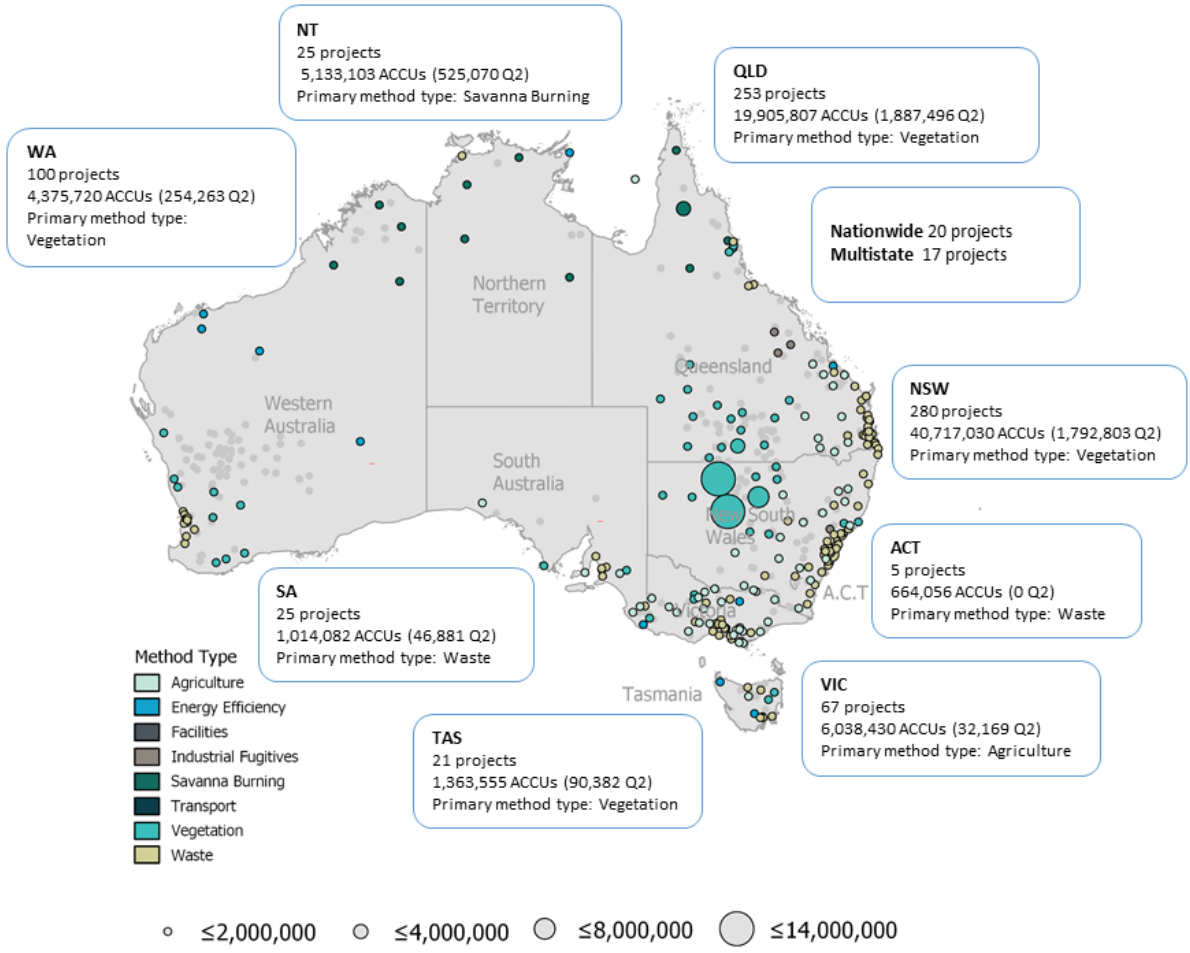


Queensland dominated Quarter 2 2020 with over a third of the new projects registered, potentially incentivised by the Land Restoration Fund.

Two new projects were registered in the Australian Capital Territory in this quarter, the first registrations in the territory since 2018.

Both projects aim to upgrade existing landfill gas collection systems. A snapshot of the ERF project portfolio across Australia for Quarter 2 2020 is shown in Figure 5.

Figure 5: Total number of ACCUs issued per method type by location, Q2 2020 and scheme to date[18]



1.3. Factors impacting demand

Total demand of 3.5 million ACCUs in Quarter 2 2020 was 17 per cent higher than the same quarter in 2019 (see Figure 6). Commonwealth contracts remained the largest source of demand at 94 per cent. The share of voluntary and state and territory demand increased from four per cent in Quarter 2 2019 to six per cent in Quarter 2 2020.

In Quarter 2 2020, 3.3 million ACCUs were delivered under contract to the Commonwealth, up 15 per cent from the Quarter 2 2019 volume of 2.9 million ACCUs. Notably, 1.4 million of the 3.3 million delivered in Quarter 2 2020 were delivered earlier than the scheduled milestone.[19]

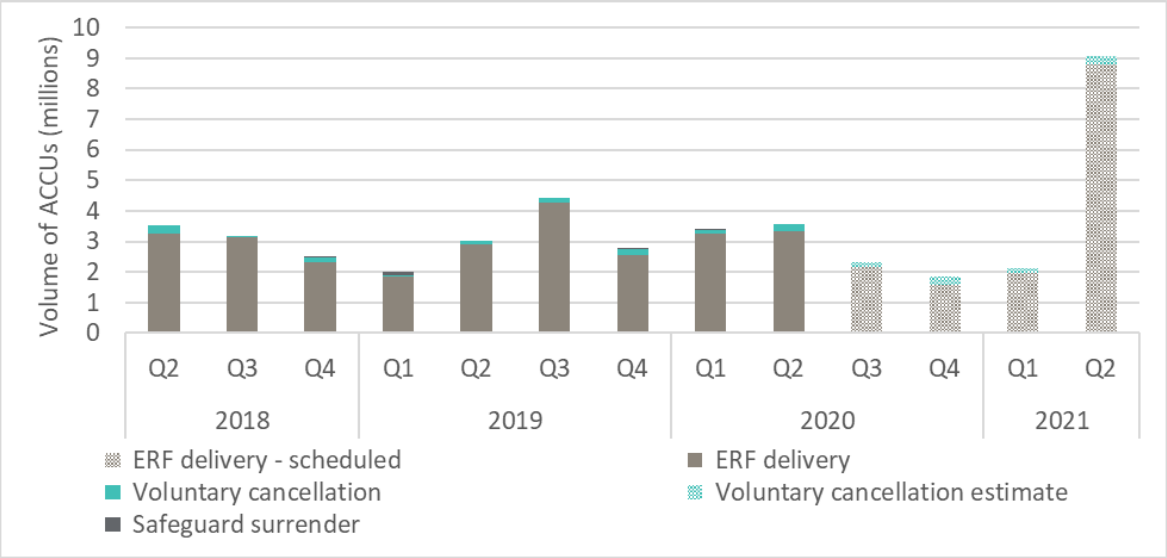
ERF contract holders are encouraged to contact the Clean Energy Regulator if they would like to deliver early. Early deliveries provide cashflow to contract holders. Where contracts are completed early, projects may be able to secure additional Commonwealth contracts, seek to supply the voluntary market or both.

[18] Primary method type refers to the method type under which most projects have been registered.

[19] Of the 3.3 million delivered in Quarter 2 2020, 1.4 million were delivered against a milestone that was set beyond this quarter. The commonwealth contract allows a degree of flexibility enabling delivery of ACCUs early from scheduled delivery milestones. While contract delivery schedules are determined at auction registration stage, variations to the delivery schedule can be negotiated with the Clean Energy Regulator in accordance with the Contract Code of Common Terms.

Demand from Commonwealth contracts is estimated to be 3.7 million ACCUs for the last half of 2020. However, early deliveries and additional abatement contracted through Auction 11 could increase this demand.

Figure 6: Actual and estimated demand for ACCUs, Q2 2018 to Q2 2021

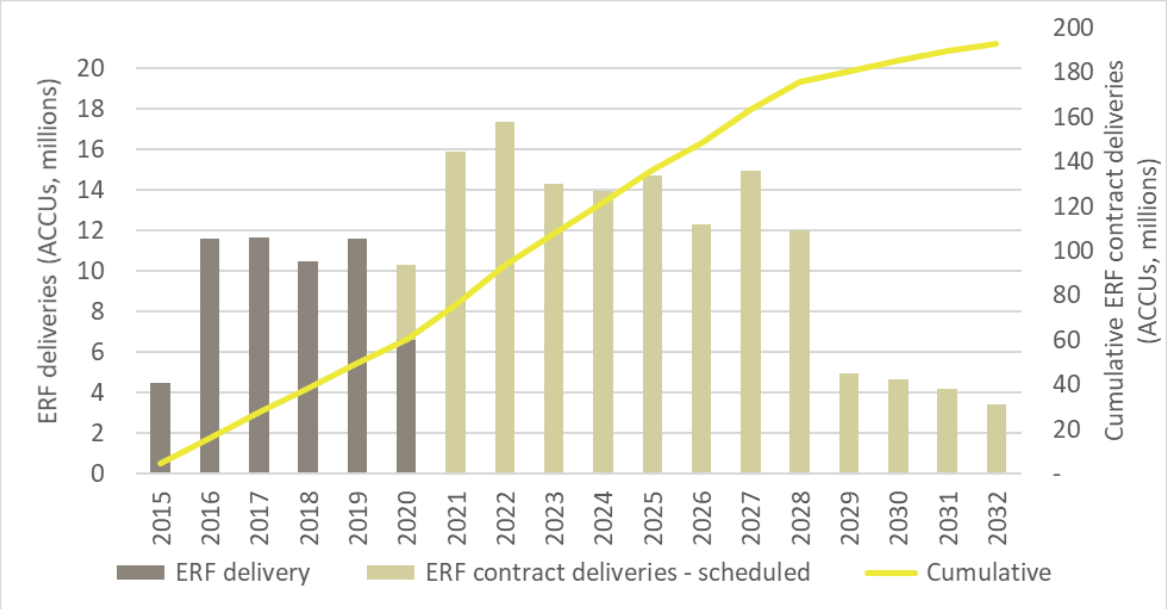


Commonwealth demand

The guidelines on stratification evidence and records for the Human Induced Regeneration (HIR) and Native Forest from Managed Regrowth (NFMR) methods were released by the Clean Energy Regulator on 8 May 2019. In some cases, changes to the expected timing of supply will occur as participants apply these guidelines to their projects.

Hence, during Quarter 2 2020 the Clean Energy Regulator agreed to changes in the timing of delivery milestones for a small number of (seven) contracts. This has reduced aggregated demand from contracted deliveries up to 2026 and increased demand between 2026 and 2032 relative to Quarter 1 2020 estimates. There is no change to the total volume to be delivered or price. Current Commonwealth delivery schedules are reflected in Figure 7.

Figure 7: Commonwealth delivery for current portfolio of projects, 2015 to 2032



Emissions Reduction Fund auctions

ERF Auction 11 will be held on 9 to 10 September 2020.

In addition to the fixed delivery contract, which requires sellers to deliver an agreed volume of ACCUs at a set price for the duration of the contract, the optional delivery contract[20] will be available at Auction 11, following a successful pilot at Auction 10.

This auction will also offer greater flexibility for contracts including the option of immediate delivery for volumes of 2000 ACCUs or more. Sellers with excess units can take advantage of this offer for immediate cash flow.

Safeguard mechanism surrender

The Clean Energy Regulator has published an estimate of the total number of ACCUs likely to be surrendered by facilities with multi-year monitoring periods during the next three years. This estimate is indicative only as it relies on projections of emissions and baselines for the facilities over a three-year period.

The Clean Energy Regulator estimates between 250,000 and 350,000 ACCUs will be surrendered by facilities with multi-year monitoring periods over the next three years. This estimate may not translate to additional demand, however, as units may already be held by entities, discussed in the Growth in ACCU balance section above.

In response to the widespread COVID-19 disruption caused to business operations, amendments have been made to the Safeguard Mechanism Rule to allow businesses to delay the transition to new emissions baselines by one year. This includes the option to extend a multi-year monitoring period that ceased on 1 July 2020. This change is likely to impact the volume of ACCUs required to be surrendered by safeguard entities with multi-year monitoring periods.

Voluntary and state and territory

Voluntary private and state and territory surrenders totaled 206,000 ACCUs in Quarter 2 2020, an 85 per cent increase on the volume cancelled in Quarter 2 2019. Growth in voluntary demand for ACCUs in 2020 is expected to continue with more companies pledging emissions reduction targets. The Clean Energy Regulator estimates that more than 750,000 ACCUs will be cancelled in 2020.

Policy Developments

The Expert Panel was appointed to investigate potential ways low cost abatement could be unlocked across the economy. The panel made 26 recommendations that aim to increase supply of carbon units in the market, encourage participation and reduce barriers to entry. The Government has agreed to 21 of these recommendations, which are now in various stages of planning, design and implementation, including:

- Regulatory amendments and streamlining for plantation forestry and farm forestry projects in areas where they are unlikely to have a material impact on the availability of water have been made to facilitate increased participation in the ERF.
- Optional delivery ERF contracts have been updated and will be offered from Auction 11 following stakeholder consultation.
- An advanced payment to eligible ERF proponents to assist with the upfront costs of soil sampling will soon be available.
- The development of a carbon capture and storage method.

In addition to these initiatives, crediting safeguard entities that achieve below-baseline emissions under the Safeguard Mechanism is also being examined. The Expert Panel envisages a new crediting unit, distinct from ACCUs, that would incentivise the deployment of low-emission technologies. This initiative has

[20] The optional delivery contract provides sellers with the right, but not the obligation, to sell ACCUs to the Commonwealth at a set price within a set timeframe. Project proponents can make use of this contract option to secure financing for projects that are in early stages of commercialisation.

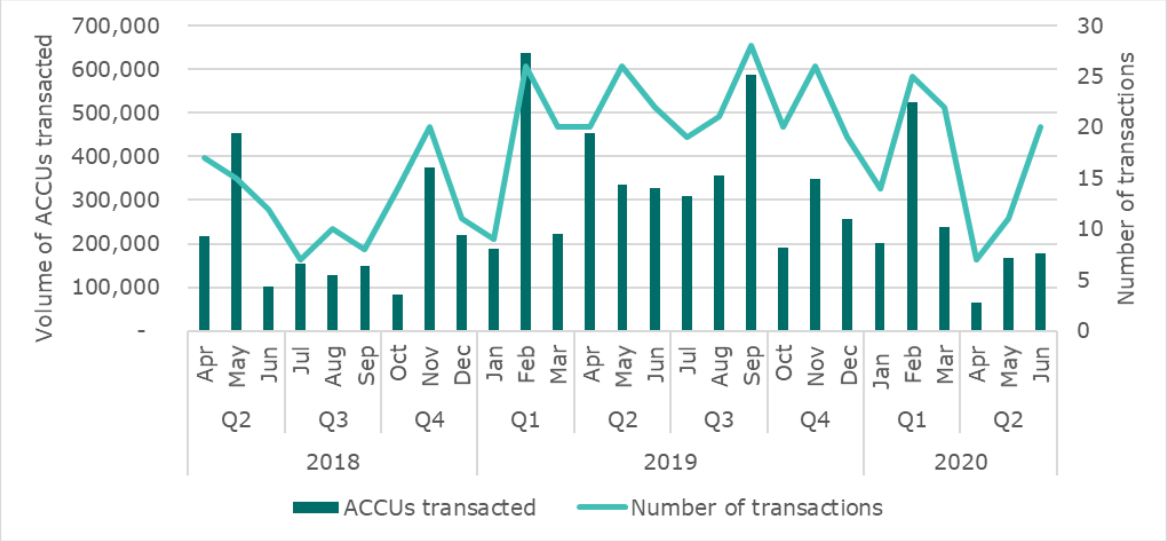
the potential to unlock significant abatement in large industrial facilities.

Market trading

During Quarter 2 2020 over 413,000 ACCUs were traded through 38 transactions with an average parcel size of 10,800 ACCUs (Figure 8).

Transaction numbers and ACCU volumes fell in April before rebounding in June to similar levels seen in Quarter 1 2020.

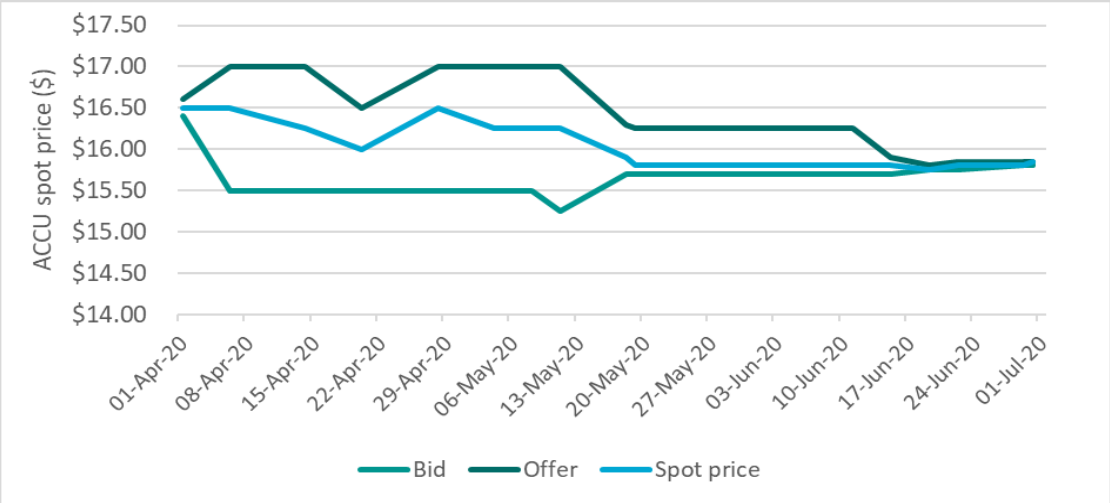
Figure 8: ACCU market transactions (excluding ERF transactions)[21], Q2 2018 to Q2 2020



Spot price

The ACCU spot price dropped from $16.40 at the end of Quarter 1 2020 to $15.85 at the end of Quarter 2 2020, shown in Figure 9. While voluntary surrender in the quarter was high, the majority of purchases to source these units had likely occurred ahead of this quarter. This has resulted in an increased balance, which in turn may have put downward pressure on the spot price. Since the last auction, the spot price has, on average, stayed marginally below (less than one per cent) the Auction 10 average price of $16.14.

Figure 9: ACCU spot prices, Q2 2020



[21] ACCU market transactions refer to the transfer of ACCUs between separate entities or groups and does not include issuances and surrenders of ACCUs. Transactions involving the transfer of ACCUs between project proponents, between project proponents and project developers, and between accounts belonging to the same company and/or subsidiaries are excluded.

1.4. Key dates

Date	Event	Significance
26 June to 28 August 2020	**Participating in Australia's carbon market to meet corporate climate goals: virtual-seminar series**	The virtual seminar series are led by the Carbon Market Institute and Clean Energy Regulator. The seminars provide foundational information about Australia's carbon markets and opportunities for voluntary participation.
9 to 10 September 2020	ERF Auction 11	The auction guidelines and details about the auction process is available on the Clean Energy Regulator's Participating in an auction webpage.
31 October 2020	NGER and Safeguard application deadline	Deadline for NGER reporters and Safeguard entities to submit: • 2019-20 NGER data, and • Calculated and production adjusted baseline applications (for baselines commencing 1 July 2019).
2 to 3 December 2020	**Carbon Market Institute's Australasian Emissions Reductions Summit**	The 2020 Emissions Reduction Summit, Accelerating to Zero, has been re-scheduled to December 2020. The program and registration details can be found on the Carbon Market Institute's event page.

2. Large-scale generation certificates

- No new utility scale projects reached financial close in Quarter 2 2020. However, Murra Warra Wind Farm Stage 2, representing 209 MW has since reached financial close taking total committed projects for the year to over 1 GW.
- 2 to 3 GW of committed projects is still expected for 2020, primarily owing to the largest ever pipeline of projects, 2.8 GW, with PPAs.
- Large-scale renewable energy project activity at concept and development approval stages continued at record pace in Quarter 2 2020, likely due to proposed investment in transmission infrastructure.
- LGC supply for Quarter 2 2020 was lower than expected due to a combination of curtailment, lower wind and solar resource and delays in project connection and ramping to full generation. The Clean Energy Regulator expects a lower LGC supply of 32 million in 2020, down from 34 million.
- Large-scale renewable energy generation for the first half of 2020 is estimated to be 13,500 GWh[22] compared to 12,300 GWh at the same point in 2019.
- LGC spot and forward prices increased across Quarter 2 2020 ending at $40.00. This may be due to significant volumes of LGCs offered for voluntary surrender and lower than expected LGC supply.

2.1. Supply and demand balance

An estimated 39.4 million LGCs are expected to be available for the 2020 assessment year. This includes 7.4 million LGCs[23] carried over from previous years.

Approximately 32 million LGCs are expected to be validated in 2020, down from the 34 million LGC estimate in the March 2020 QCMR (see LGC supply section below).

Legislated demand remains at approximately 33.7 million LGCs. Liable entities eligible for shortfall refunds may increase demand by 1.1 million LGCs.

The final balance of LGCs after surrender is expected to be 1.45 million LGCs. This balance assumes no shortfall is taken for the 2020 assessment year (see Table 4). Material shortfall is, however, expected given the arbitrage opportunity due to lower forward LGC prices and the clarification regarding the tax treatment of LGCs.

[22] This figure covers all generation from power stations accredited under the LRET but does not include any above baseline hydro power that will also contribute to the target as the volume will only be known at the end of the year.
[23] This was reported as 6.8 million LGCs in the March 2020 QCMR. This has been adjusted to 7.4 million LGCs to better reflect the balance of LGCs after surrender that were of a 2019 or earlier vintage.

Table 4: Supply and demand balance, 2020

	Supply	Demand
LGC balance 14 February 2020	+7.4 million	
Expected LGC supply (available for 2020 surrender)	+32.0 million	
Legislated demand		-33.7 million
ACT Government scheme[24]		-2.2 million
GreenPower		-0.5 million
Other surrenders		-0.45 million
Shortfall charge refunds[25]		-1.1 million
Total balance		**+1.45 million**

2.2. Factors impacting supply

LGC supply

There were 16.9 million registered LGCs in the REC Registry at the end of Quarter 2 2020.

In Quarter 2 2020, 7 million LGCs were validated (see Figure 10) a 12 per cent increase on Quarter 2 2019. This increase is significantly lower than expected considering the 4.7 GW accredited over the past 12 months.

Challenges facing renewable power stations in the National Electricity Market (NEM) have negatively impacted LGC supply in 2020.

Low wind and solar resources led to decreased capacity factors for NEM registered renewable energy power stations (particularly in New South Wales and Queensland) in the first half of the year. This reduced LGC supply compared to expected levels.

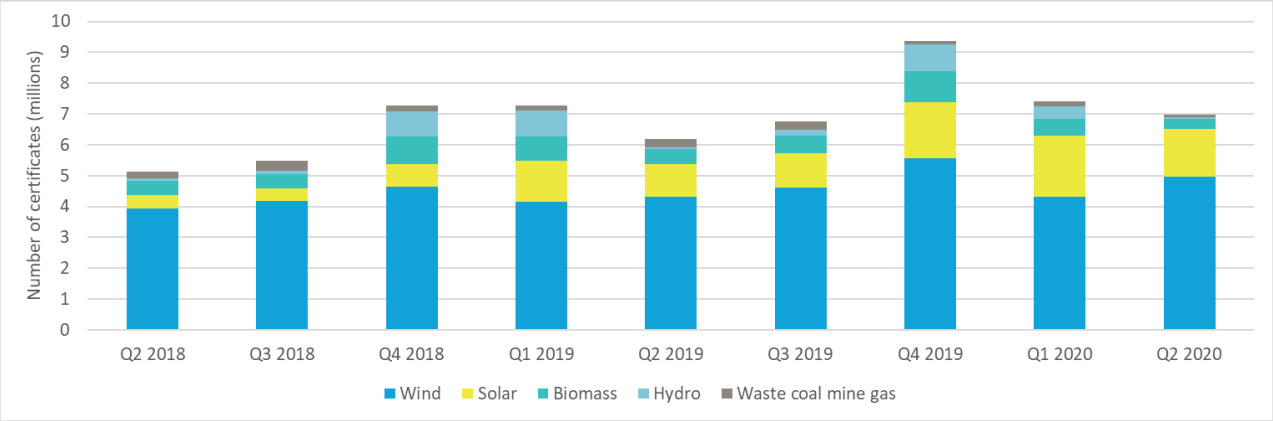
Curtailment of power stations in congested areas of the transmission network further reduced operational capacity by 300 MW and decreased expected supply by approximately 375,000 LGCs in the first half of the year. Curtailment of renewable power stations dropped substantially in Quarter 2 2020 to three per cent.[26]

The delay in ramping of large wind farms from partial to full generation and continued connection delays has also lowered expected LGC supply. Approximately 2.2 GW of wind farms, expected to be at full generation by Quarter 2 2020, have faced issues in generating at full capacity, lowering supply by an estimated 1.5 – 2 million LGCs.

Owing to these factors, the Clean Energy Regulator, has revised expected LGC supply for 2020 to circa 32 million LGCs, down from 34 million LGCs. However, uncertainty remains on the final figure due to wind resource and that hydro power stations typically only create LGCs for their above baseline generation at the end of the year.

[24] This is the expected annual accumulation of LGCs held by the Australian Capital Territory government that is not expected to be available for surrender.
[25] This is the amount of paid shortfall from previous assessment years that entities may surrender to receive a refund. Forward prices are lower than current prices, so an incentive remains to take paid shortfall for the 2020 assessment year.
[26] AEMO, Quarterly Energy Dynamics Q2 2020, July 2020.

Figure 10: LGCs by technology type, Q2 2018 to Q2 2020

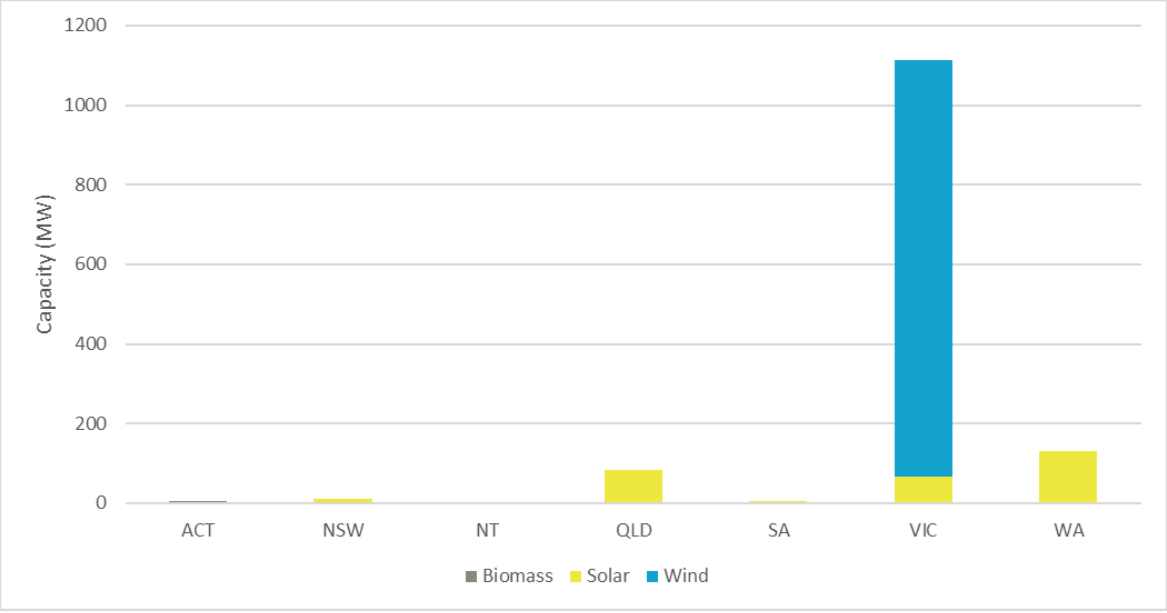


Accreditation

Over 60 power stations were accredited in Quarter 2 2020 with a cumulative capacity of 1.35 GW (see Figure 11). Accredited capacity increased 16 per cent in Quarter 2 2020 compared to Quarter 2 2019.

As with previous quarters, solar power stations accounted for most number of accreditations while wind power stations accounted for most capacity. Over 2 GW was accredited in the first half of 2020 with a further 283 MW of capacity under application. More than half of the expected 3.4 GW to be accredited in 2020 has now been delivered.

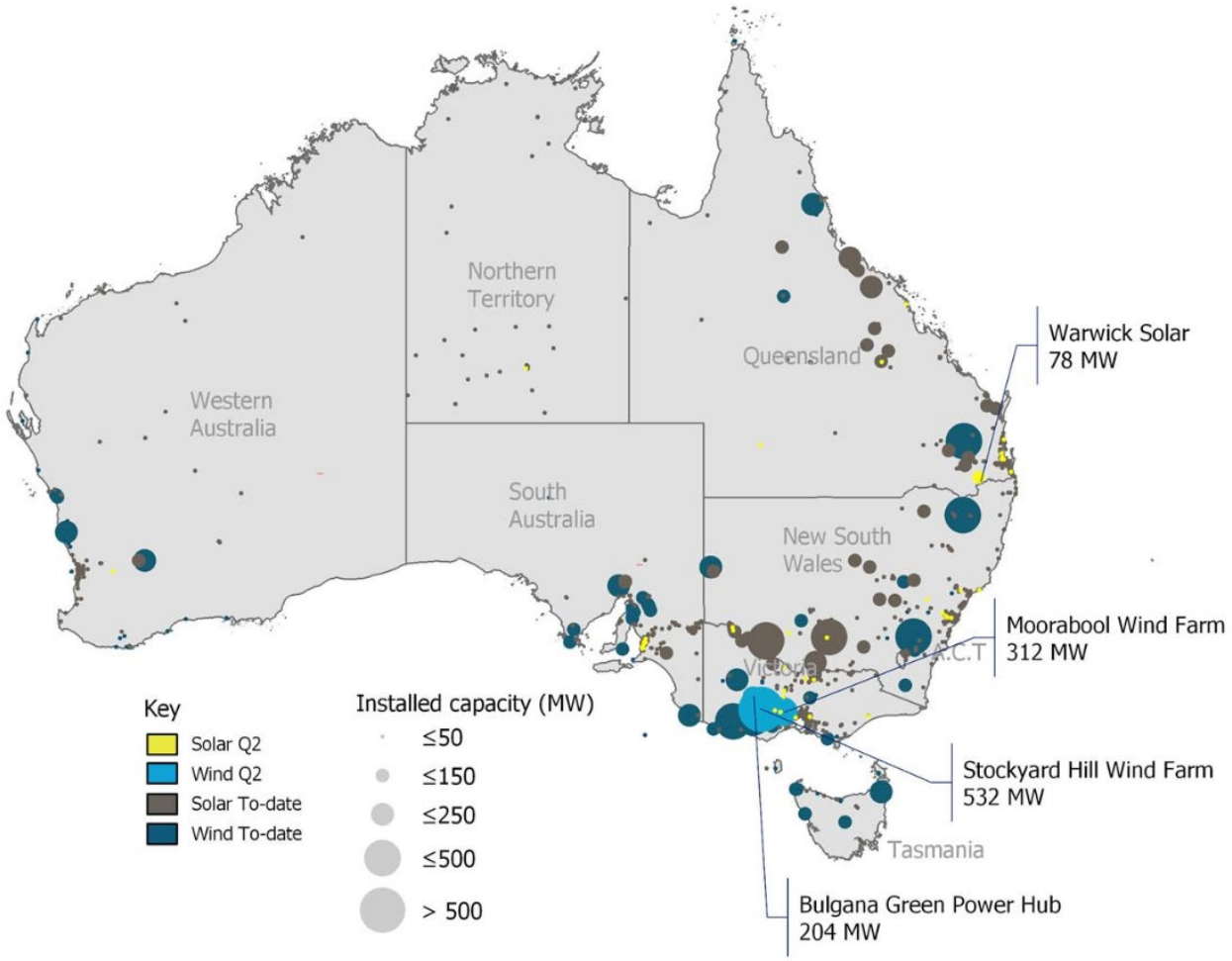
Figure 11: Power station accreditation across the states in Q2 2020



1.05 GW of the capacity accredited in Quarter 2 2020 came from three large wind farms in Victoria (see Figure 12). Stockyard Hill Wind Farm, the largest wind farm in the Southern Hemisphere at 532 MW is included in this capacity.

Merredin Solar Farm was also accredited this quarter. At 132 MW it is the largest solar farm in Western Australia. At full generation it is expected to generate 281 GWh annually.

Figure 12: Wind and solar power stations accredited capacity by location, Q2 2020 and scheme to date



Committed and probable projects

Total capacity committed for 2020 remains the same as Quarter 1 2020 at 837 MW (see Figure 13). Announcements can be uneven from quarter to quarter, financing was expected to be challenging in Quarter 2 2020 due to significant fluctuations in foreign exchange and other financing issues associated with COVID-19.

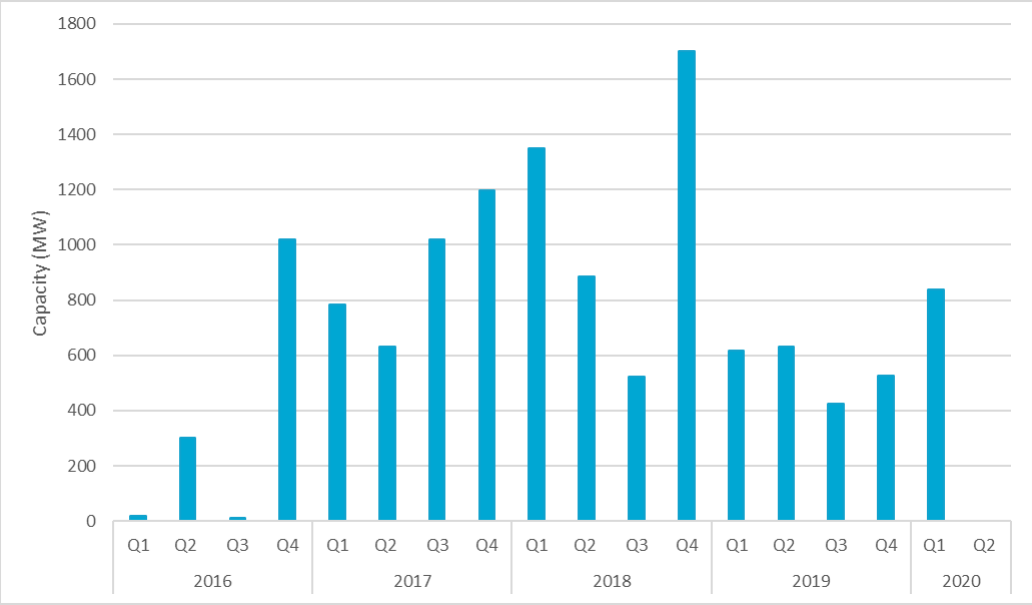
After Quarter 2, on 4 August 2020, Murra Warra Wind Farm Stage 2 reached financial close for a total of 209 MW, taking the total to 1 GW for the year.

Probable projects have reached their highest ever level recorded by the Clean Energy Regulator at 2.8 GW. These projects, including nearly 1.5 GW of recently announced power purchase agreements for the Western Downs solar farm and MacIntyre and Clarke Creek wind farms, signal a new wave of investment.

Over 65 per cent of projects tracked through the pipeline that have proceeded to financial close were underpinned by a PPA. A PPA is a solid indicator that a project will reach financial close. State and territory governments, electricity retailers and large corporates continue to be the main entities entering PPAs.

Several utility-scale projects received development approval or made interim status announcements in Quarter 2 2020; this suggests some of these projects may secure financial close this year. Current activity suggests 2 to 3 GW of committed capacity in 2020 remains likely. However, given the commercial nature of these transactions it is not possible to estimate this with accuracy.

Figure 13: Capacity committed per quarter, Q1 2016 to Q2 2020



Meeting the 2020 target

The LRET will be met when 33,000 GWh of renewable electricity is generated in the calendar year.

Renewable energy generation and LGC supply are closely linked. The factors that have negatively impacted LGC supply in the first half of 2020 have similarly reduced the amount of renewable electricity generation.

Large-scale renewable energy generation for the first half of 2020 is estimated to be 13,500 GWh compared to 12,300 GWh at the same point in 2019.

Historical trends indicate that Quarter 3 typically has the best wind resources for electricity generation and long days with ample sunlight sees Quarter 4 as the best quarter for solar generation. Australia remains on track to meet the 33,000 GWh LRET in 2020 if the seasonal trend of high electricity generation for wind, solar and hydroelectric power occurs in the second half of the year and recently connected projects ramp quickly to full production.

The current fleet of accredited power stations will generate in excess of 40,000 GWh in a year once generating at full capacity.

The next wave of investment

The investment climate for new renewables has changed since the Clean Energy Regulator first began tracking projects to meet the 2020 target in 2015. Low wholesale electricity and LGC prices have weakened the investment signal for utility-scale projects. This is compounded by the current financial risk of extended grid connection delays and unexpected curtailment.

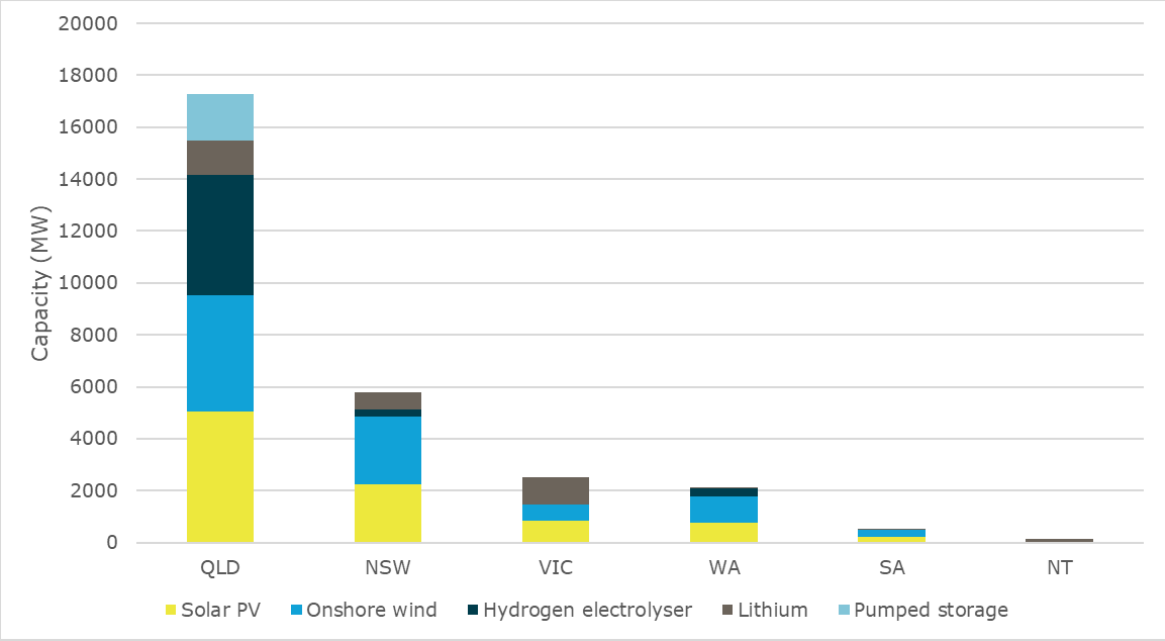
There is no shortage of projects at the concept or development stage (see Figure 14).

Investment in new and upgraded transmission infrastructure in key areas of the NEM and funding towards new REZs provides a firm signal for the potential future build of renewables. Registrations of interest for the New South Wales Central-West REZ, during Quarter 2 2020, totalled 27 GW of projects, nine times more

than the planned 3 GW REZ. A second REZ in the New England region was announced in early July. This REZ aims to support a further 8 GW of capacity.[27]

Queensland had the most proposed renewable capacity at concept and development approval stage in the first half of 2020. Most of this capacity is focused in Central Queensland, around Gladstone, the state's main industrial hub and home to multiple coal, aluminium and gas export facilities. Several hydrogen projects are proposed for this region that will utilise renewable electricity to produce low carbon hydrogen for export.

Figure 14: Proposed capacity for Australia, Quarters 1 and 2 2020[28]



Economies of scale have also emerged as a driver for progress in gigawatt-scale projects such as the Asian Renewable Hub (15 GW) and the Tennant Creek solar farm (10 GW)[29]. These projects are not bound by the same constraints that face traditional grid-connected renewable projects, due in part to their ability to finance and build their own transmission infrastructure. While still emerging, these types of projects will be a watch point and have the potential to substantially eclipse all installed renewable power stations.

[27] New South Wales Government, New England to light up second NSW renewable energy zone media release, July 2020.
[28] Data sourced from Rystad Energy Analytics.
[29] The Asian Renewable Hub, Tennant Creek solar farm and Star of the South windfarm are not included in Figure 14.

Tracking large-scale renewable investment trends

There is general agreement that 2017 and 2018 were absolute boom years for financial close decisions in large-scale renewables. There are different views on the scale of the investment decisions in those years.

However, some commentators have publicly described what has happened since the boom as a "collapse" or a "stall" in investment.

The Clean Energy Regulator does not agree with such descriptions; this section analyses the data and causes to explain why such commentary is misleading.

The Clean Energy Regulator's view is that the large-scale renewables market is in a new post-boom where substantial real investment is occurring, with around 2 to 3 gigawatts of capacity reaching a definite investment decision point each year – six times the average capacity in the years prior to 2017.

Financial close decisions involve complex commercial processes and negotiations; hence, they are 'lumpy' from quarter to quarter. New announcements were not expected in Quarter 2 2020 as foreign exchange moved quickly in a significant range as a result of COVID-19; this and other matters arising from the pandemic would have made financing decisions difficult in the quarter. As such, annual trends are more useful to understand what is happening.

Table 5 shows the annual capacity that has reached financial close as tracked by the Clean Energy Regulator, the Clean Energy Council (CEC) and Rystad Energy since 2016. While there is consensus that 2017 and 2018 were the biggest years by far, the CEC numbers are significantly higher than the Clean Energy Regulator's and Rystad for these years.

Table 5: Annual capacity tracked financial close by the Clean Energy Regulator, CEC and Rystad Energy, since 2016

	Clean Energy Regulator	CEC [30]	Rystad [31]
2016	1200	-	-
2017	3600	4700	3800
2018	4500	6200	4000
2019	2200	2400	2800
2020 [a]	835[b]	1200	505

[a] Data in this table is at 30 June 2020.

[b] With the announcement of Murra Warra (209 MW) and a number of other projects likely to reach financial close in 2020, 2 to 3 GW is still expected to reach financial close in 2020.

Rystad's data shows the average for 2017 and 2018 at 3.9 GW, the Clean Energy Regulator at 4 GW and the CEC at 5.5 GW. Large-scale renewable energy power stations accreditation lags financial close decisions by an average of 12 months. The Clean Energy Regulator accredited 4.1 GW in 2019 and 3.4 GW is expected in 2020, this is consistent with both Rystad's and the Clean Energy Regulator's financial close numbers for 2017 and 2018.

The sudden exit of Hazelwood power station in early 2017 led to a significant increase in wholesale electricity prices. The market then saw the revised LRET (legislated in mid-2015) as a firm signal, which led to LGC prices quickly reaching over $80 in early 2016. This was because the market saw scarcity for certificates as a result of the large amount of capacity that had to get to financial close and be built to meet the 2020 target of 33,000 GWh.[32] Hence, the high combined total price signal led to the boom in investment in 2017 and 2018.

Approximately 2 GW of large-scale renewable energy capacity was accredited in the first half of 2020 with a further 10.4 GW already built or under construction – far more than what is needed to meet the target. Wholesale electricity prices have fallen for a range of reasons. Recently they have fallen further as a result of falling gas prices, including due to COVID-19.

The extra supply of large-scale renewable energy has put downward pressure on LGC prices (see Figure 15). The combined build signal (total spot prices of electricity and LGCs per megawatt hour) in 2019 and 2020 fell to approximately half of what it was in 2017 and 2018. Hence, the new level of investment (circa 2 to 3 gigawatts per annum) is a typical post-boom 'pullback' in investment due to the significantly reduced build signal.

This is typical of all markets when a large increase in supply from the boom (which resulted from high prices) reduces prices and hence the incentive to invest.

The Clean Energy Regulator views this 'pullback' of 2 to 3 GW per annum as an impressive result from the industry given the significantly lower build signal and increased connection risk and cost. Also, many commentators argued back in 2018 that investment would come to a halt once sufficient capacity had been built to meet the 2020 target – and that has not actually happened. Whether it be using capacity or dollars, recording all investment when the financial close decision is made is only a lead indicator of the actual investment which will be made over the following 1 to 3 years (depending on whether solar or wind and the size of the power station). What is important in terms of investment is when the dollars flow, and workers are employed.

Section 2.2 of this report (above), explains why 2 to 3 GW per annum can be maintained and the next wave of investment can be unlocked as transmission (including interconnection and REZs) is built and as further opportunities at resources sites and off-grid and industrial sites 'behind the meter' are leveraged.

[30] CEC, Renewable Projects Quarterly Report Q2 2020, August 2020.
[31] Data sourced from Rystad Energy.
[32] The Clean Energy Regulator stated in 2018 that at least 6,400 MW of capacity needed to be built by the end of 2019 to meet the target in 2020.

2.4. Voluntary demand

In Quarter 2 2020 a total of 177,517 LGCs were voluntarily surrendered, predominantly by corporates and state and territory governments to meet their own renewable energy commitments or carbon neutrality goals.

An additional 3.2 million LGCs were surrendered in July 2020 by the Australian Capital Territory government, GreenPower entities and desalination plants; bringing the total to 3.7 million LGCs in 2020 (see Chapter 5 Voluntary markets). LGC demand is expected to reach approximately 4 million LGCs in 2020.

2.5. Market trading

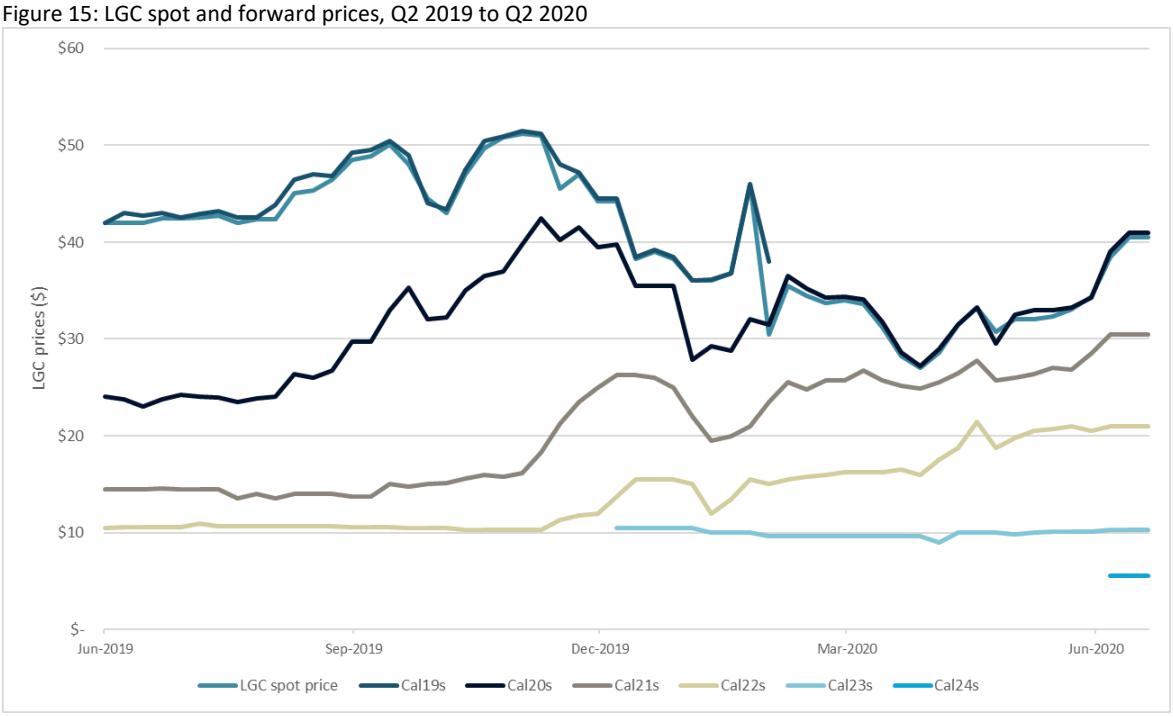
The LGC price experienced a 44 per cent increase in Quarter 2 2020 and closed at $40.00 (see Figure 15). Forward LGC prices to Calendar 22 also steadily increased during the quarter.

The price movement aligns with the substantially increased levels of voluntary private and state and territory surrenders in June and July, combined with lower than expected LGC supply in Quarter 2 2020. This reduced expected available LGCs for the 2020 assessment year.

During Quarter 2 2020, the first trades for LGCs to be delivered in calendar year 2024 took place at $5.50. This price point suggests that LGCs will retain value well after the 2020 target has been met and positions LGCs as a competitive emissions reduction unit for voluntary use.

The difference between the high spot price and lower forward prices suggests shortfall will remain an option for liable entities this year.

Figure 15: LGC spot and forward prices, Q2 2019 to Q2 2020



2.6. Key dates

Date	Event	Significance
26 June to 28 August 2020	**Participating in Australia's carbon market to meet corporate climate goals: virtual-seminar series**	The virtual seminar series, are led by the Carbon Market Institute and Clean Energy Regulator. The seminars provide foundational information about Australia's carbon markets and opportunities for voluntary participation.
14 February 2021	Lodgement of energy acquisition statement and surrender of LGCs Submit Electricity Generation Returns	This will be the final date for liable entities to: • lodge their energy acquisition statement(s) and surrender LGCs for the assessment year, and • pay any applicable shortfall charges for the assessment year.
30 March 2021	The RPP is published on or before this date	The RPP aims to meet the annual target for renewable electricity set out in the legislation each year.

3. Small-scale technology certificates

- Installations and capacity of small-scale rooftop solar PV accelerated in Quarter 2 2020 with an estimated 677 MW installed, 41 per cent higher than Quarter 2 2019.
- If current trends continue, capacity should reach 2.9 GW for 2020, exceeding the Clean Energy Regulator's estimate of 2.7 GW earlier this year, the actual added capacity in 2019 was 2.2 GW.
- Market balance grew to 4.8 million STCs post Quarter 2 surrender.
- The STC spot price ended Quarter 2 at $39.45.

3.1. Supply and demand balance

A balance of 4.8 million STCs remained in the market after the 28 July 2020 Quarter 2 surrender of approximately 10.7 million STCs. Less than 35,000 STCs were purchased via the clearing house and used for surrender for Quarter 2.

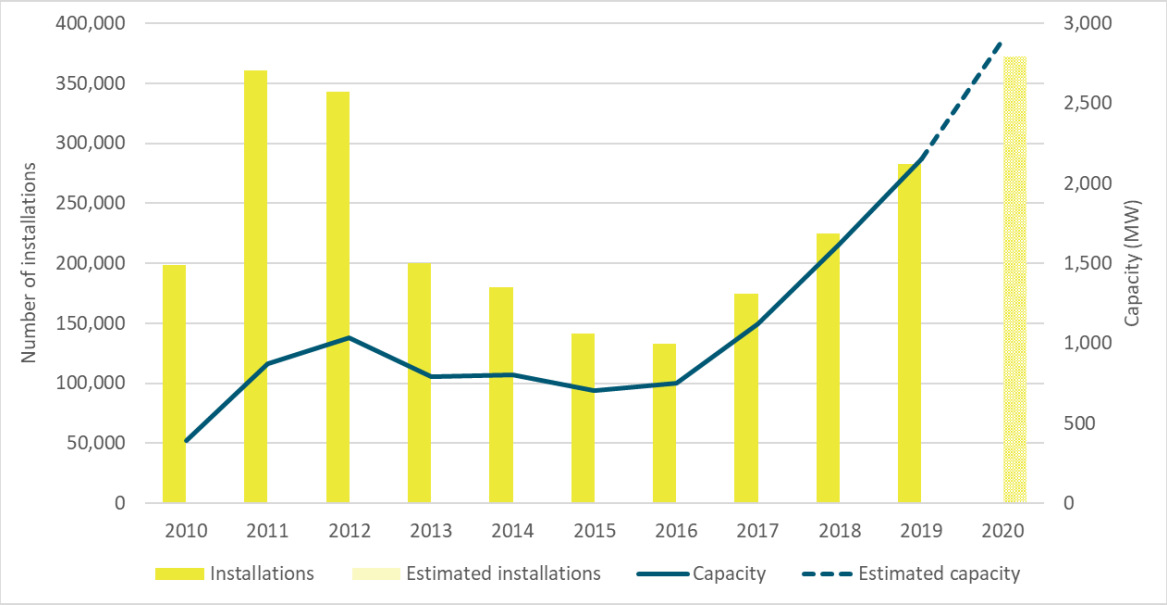
Rooftop solar PV capacity accelerated with an estimated 677 MW installed in Quarter 2 2020, an 11 per cent increase on Quarter 1 2020 and 41 per cent higher than Quarter 2 2019 (see Figure 16). The average kilowatt (kW) capacity installed rose to 8.2 kW in Quarter 2 2020 up from 7.6 kW in Quarter 1 2020. Strong growth in installations in the first half of 2020, coupled with a step change in system sizes and negligible COVID-19 impact means that the outlook for STC supply remains strong and the STC clearing house will stay in surplus for the remainder of 2020.

The difficulty in accurately predicting uptake of rooftop solar PV is borne out in the SRES market. The 2020 small-scale technology percentage (STP) was set on the expectation that 2.4 GW of small-scale solar PV would be installed based on forecasts from consultants. In March the Clean Energy Regulator revised the estimate for 2020 up to 2.7 GW. Based on Quarter 2 2020 trends it is now likely that 2.9 GW of small-scale rooftop solar PV will be installed in 2020[33]. The Clean Energy Regulator will closely monitor market trends throughout Quarter 3 and adjust the 2020 estimate accordingly.

If rooftop solar PV capacity under the LRET (100 kW – 5 MW) is accounted for, then a total of 3 GW of rooftop solar PV may be installed behind the meter in 2020.

[33] This estimate accounts for the current Stage 4 restrictions in metropolitan Melbourne.

Figure 16: Small-scale solar PV installations and capacity, 2010 to 2020



3.2. Factors impacting supply

Small-scale market dynamics

The March 2020 QCMR examined COVID-19's potential impact on the supply and demand of STCs. At that time, most market commentators expected installations and STC supply would reduce as consumers experienced reduced household income.

Quarter 2 2020 data and early indications for July show the reverse – installations of small-scale PV accelerated during COVID-19.

Market intelligence suggests COVID-19 may have improved the economic case to install residential rooftop solar PV. COVID-19 social distancing requirements have led to an increase in long term work from home arrangements across the country. In turn, daytime electricity consumption for households has increased. For Quarter 2 2020, AEMO indicated that residential consumption of electricity increased 18 per cent.

Research conducted by Energy Consumers Australia found consumer concerns over electricity bills have increased since the onset of the COVID-19 pandemic. Most consumers expect their electricity bills to increase this year.[34]

Low to middle income earners are typically more vulnerable to the risks of higher electricity bills. Reductions in solar PV costs and low interest rates have made the residential solar PV market more accessible for low- and medium-income households.

State governments are also increasingly opting to use solar PV to provide financial support to low income households. Both Western Australia and New South Wales have implemented specific programs to increase the accessibility of solar PV for low to medium income households. Solar PV is shifting from a luxury good to a utility good.

Solar PV will remain a way to manage electricity bills if work from home arrangements become part of the new status quo. Increased daytime electricity consumption when working from home also reduces the payback period of solar PV, making it more affordable for homeowners who work from home.

[34] Energy Consumers Australia, Shock to the System: Energy consumers' experience of the COVID-19 crisis, June 2020.

Rooftop solar PV installers and retailers have noted varied activity across mid-scale rooftop solar PV installations for small to medium enterprises. For some businesses, such as retail and hospitality, the COVID-19 restrictions have placed heavy downward pressure on revenue streams and made investments into solar PV difficult. Other business sectors that have retained revenue streams view solar PV as an opportunity to reduce their operating costs. Instant asset tax write-offs may also have assisted the growth in some sectors during COVID-19.

The strong growth in rooftop solar PV in the first half of the year added an estimated 2800 jobs in the small-scale solar industry. [35] The number of active accredited installers also increased by 14 per cent compared to the first half of 2019.

Solar PV and installations

Installations and capacity have increased by 31 per cent and 41 per cent, respectively compared to Quarter 2 2019 (see Figure 17).

Total installed capacity is still primarily driven by installations in New South Wales and Queensland, with Victoria the third largest (see Table 6).

The implementation of Victorian stage 4 COVID-19 restrictions on 2 August 2020 has largely halted metropolitan Melbourne rooftop solar PV installations. For the year to date, Victoria represents 20 per cent of national installations. If restrictions are prolonged, they may have a material impact on national installs and STCs. However, if the restrictions are in place for 6 weeks, around 58 MW of capacity would not be installed in that period. Pent up demand and a return to higher rates of installation following the shutdown may mitigate any reduction in annual installed capacity.

The Clean Energy Regulator will continue to monitor whether or not COVID-19 has any substantial impact on the small-scale industry.

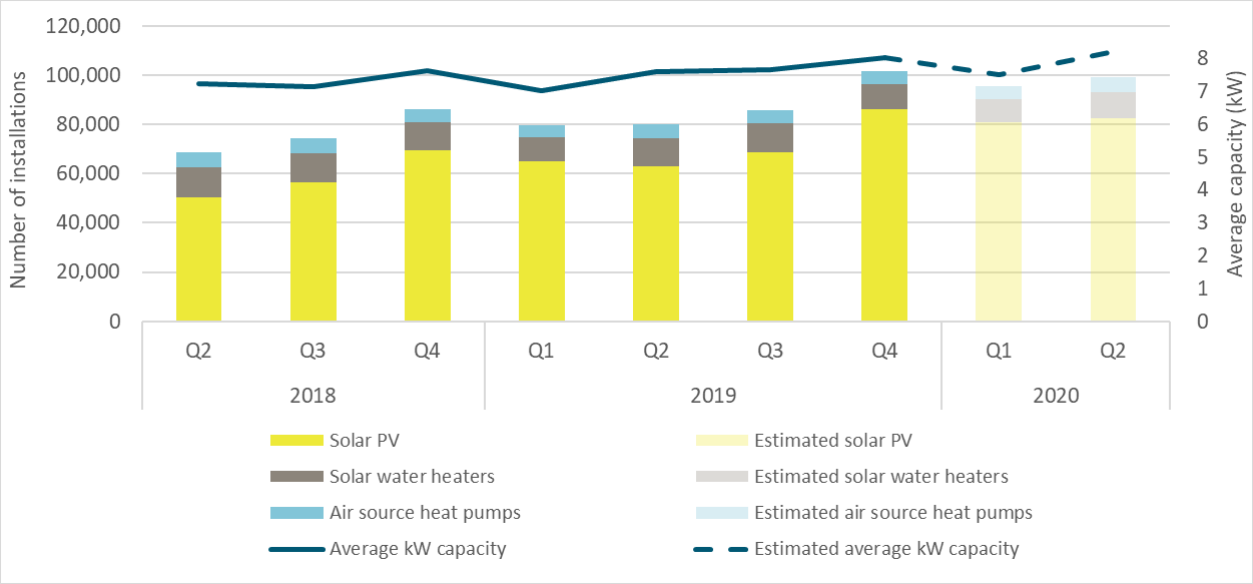
Table 6: Estimated rooftop solar PV (<100 kW) capacity by state, Quarter 2 2020

	Estimated capacity (MW)
ACT	10
NSW	205
NT	7
QLD	183
SA	69
TAS	6
VIC	118
WA	79
Total	**677**

There were 2250 concurrent battery storage systems installed in Quarter 2 2020, similar to the 2232 batteries installed in Quarter 2 2019. The increase in the quarter was modest, however, a threefold increase was observed in the 7.5-8 kW 10.5-11 kW and 13-13.5 kW system ranges compared to Quarter 2 2019, albeit off a low base.

[35] This is based on Australian Bureau of Statistics (ABS) 2018-19 reported levels of employment in the rooftop solar PV sector and recent installation growth. The installation of rooftop solar is labour intensive. It is assumed additional employment is roughly proportional to increased installations.

Figure 17: SRES installations and average kW capacity, Q2 2018 to Q2 2020



System size

The trend toward larger systems was confirmed in the first half of 2020 with noticeable shifts in installations between 7 and 15 kW (see Figure 18).

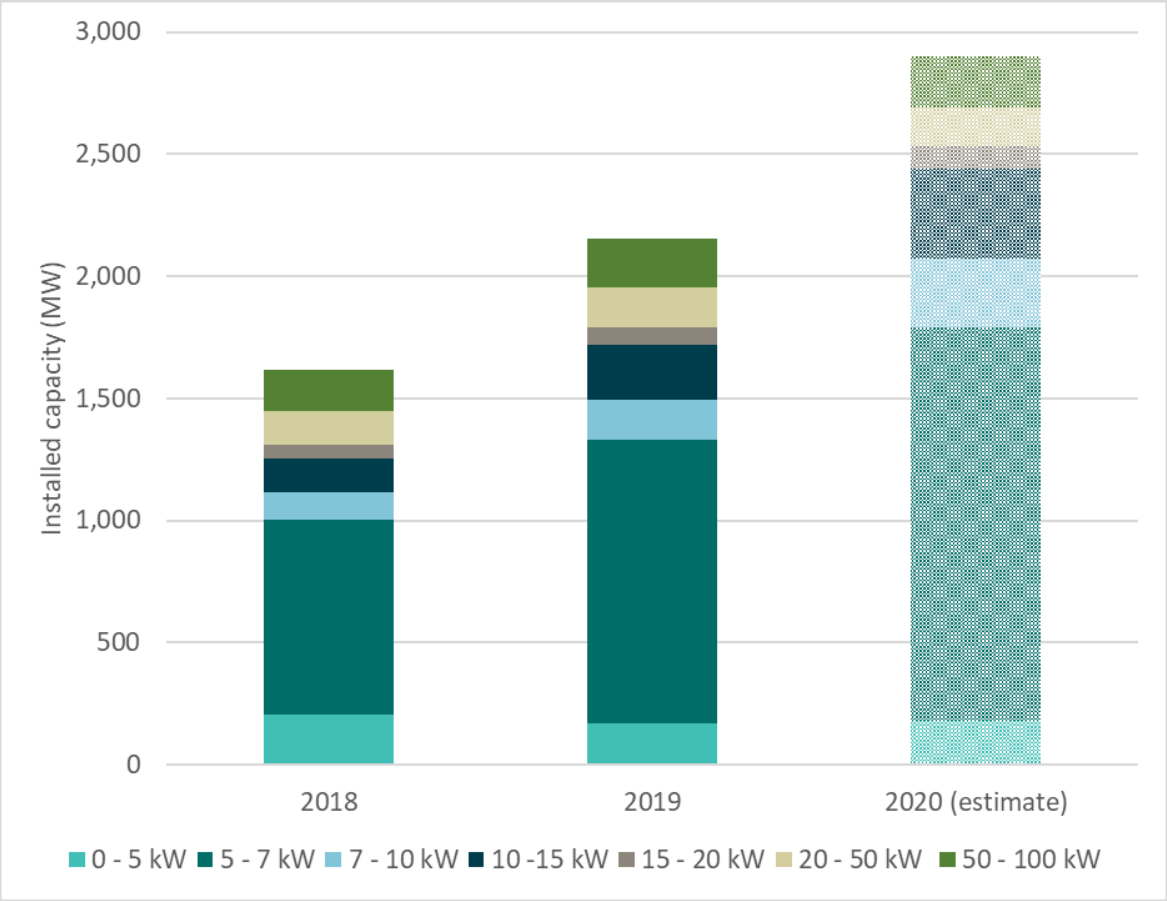
Residential consumers are demonstrating a clear preference towards larger sized systems with a 6.6 kW solar PV array and a 5 kW inverter, the current basic system of choice. The average kW capacity for residential rooftop solar PV installations[36] increased from 6.3 kW in Quarter 2 2019 to 6.8 kW in Quarter 2 2020. Over 50 per cent of residential rooftop solar PV installations in the first half of the year were between 6.5 – 7 kW, with a 55 per cent increase in installations and capacity compared to Quarter 2 2019.

Quarter 2 2020 data suggests that another step change in kW capacity is occurring. Systems sized between 7.5-8 kW increased by 85 per cent and systems between 9.5-10 kW, 10.5-11 kW and notably 13-13.5 kW more than doubled in Quarter 2 2020 compared to Quarter 2 2019. Low payback periods, state incentives and access to higher wattage panels may be contributing to this shift in system size.

Installation of mid-scale solar systems sized 15 kW to 100 kW continue to grow. Although the average system size has remained consistent in this band, there has been a 22 per cent increase in the number of mid-scale solar installations in Quarter 2 2020 compared to Quarter 2 2019. The instant asset tax write-off may have supported more businesses choosing to install solar in the first half of 2020.

[36] Small-scale solar PV systems between 0-15 kW are classified as residential, 15-100 kW are classified as mid-scale.

Figure 18: Small-scale solar PV capacity composition, 2018 to 2020



3.3. Factors impacting demand

Quarterly surrender

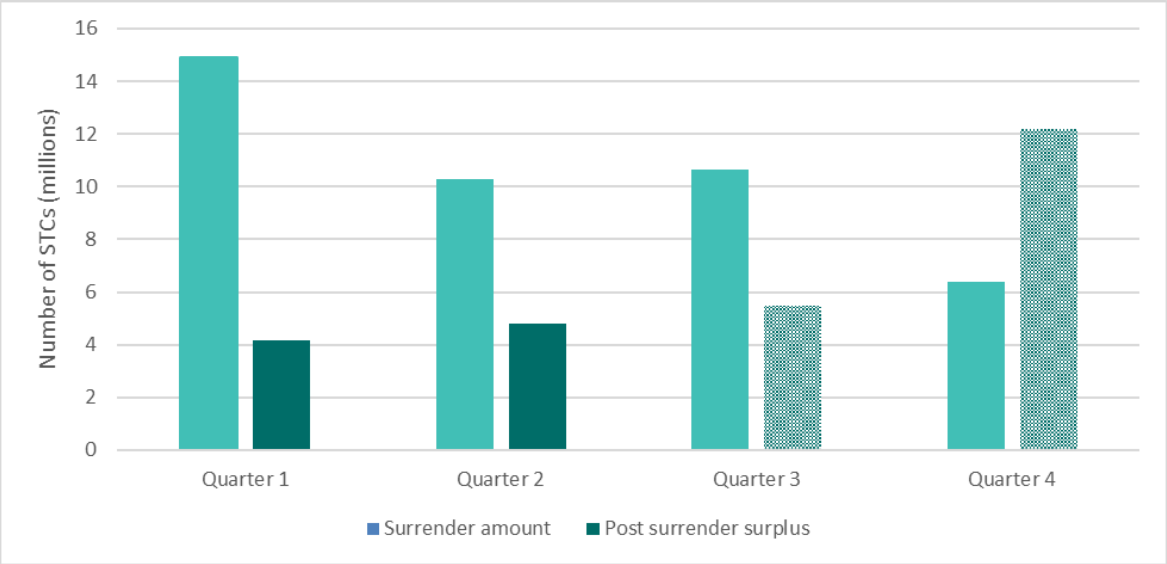
Approximately 10.7 million STCs were required to be surrendered by liable entities to meet their obligations on 28 July 2020 (see Figure 19). 10.3 million STCs were surrendered by 107 liable entities, a 97 per cent compliance rate. The post Quarter 2 2020 surrender balance was 4.8 million STCs.

The Clean Energy Regulator mentioned in the March 2020 QCMR, that owing to a potential decline in electricity consumption from COVID-19, that liable entities may apply to reduce their liable acquisitions for future surrender quarters under 38AF of the *Renewable Energy (Electricity) Act 2000*. Very few liable entities submitted applications under 38AF for Quarter 2 2020.

AEMO has indicated that during Quarter 2 2020 NEM operational demand reduced by 2 per cent. A large number of applications under 38AF for Quarter 3 surrender is not expected if operational demand reduction stays at this level.

Quarter 3 surrender will occur on 28 October 2020 with 10.7 million STCs required for surrender. If the current rate of STC creation continues throughout Quarter 3, the balance of STCs following surrender is estimated at 6 million STCs.

Figure 19: Estimated STC surplus after quarterly surrender, 2020



3.4. Spot price

STC spot prices were relatively stable during Quarter 2 2020 ranging between $39.00 to $39.90 and ending the quarter at $39.45 (see Figure 20). STC prices remain surprisingly high given the healthy STC balances expected in the market over 2020.

Market participants have indicated to the Clean Energy Regulator this may be due to uncertainty in STC supply due to COVID-19. This means sellers who would typically trade any excess STCs instead held on to them, driving a price increase. The STC spot price has since dropped to $38.20 as at 31 July.

Strong supply during Quarter 3 2020 could soften STC prices as the surplus increases and it becomes clear there will be more than sufficient certificates to meet the remaining surrender requirements for the 2020 assessment year.

Figure 20: STC spot and clearing house prices, Q2 2018 to Q2 2020

3.5. Key dates

Date	Event	Significance
30 March	Small-scale technology percentage (STP) announced on or before this date	The SRES aims to balance supply and demand by requiring all STCs that are created to be surrendered over time. To do this, the STP is set each year to require liable entities to surrender to the Clean Energy Regulator the same number of STCs as the number that are estimated to be created in that year, plus or minus an adjustment for previous under- or over-surrender.
29 April to 28 July	Quarter 2 surrender period	A liable entity must surrender 25 per cent of liability for the year in the REC Registry for this quarter.
29 July to 28 October	Quarter 3 surrender period	A liable entity must surrender 25 per cent of liability for the year in the REC Registry for this quarter.
29 October to 14 February	Quarter 4 surrender period	A liable entity must surrender 15 per cent of liability for the year in the REC Registry for this quarter. STC surrender liability for the fourth quarter of an assessment year must be made with the liable entity's energy acquisition statement for the year.
31 December	Application for liable entity required surrender amount due	The final date for liable entities to apply to set their required surrender amount for quarters one to three where no energy acquisition statement was lodged by 1 April of the assessment year.

4. Market spotlight: PV penetration and localised grid stability

An estimated 29 per cent of suitable dwellings[37] throughout Australia now have residential rooftop solar PV. Queensland, South Australia and Western Australia have the highest state-based rooftop solar PV penetration, with 42, 40 and 35 per cent respectively (see Table 7).

Table 7: Estimated residential solar PV (0 - 15 kW) penetration by state, to date[38]

	Capacity (MW)	Installations	PV penetration (%)
ACT	117	27,478	20%
NSW	2,307	568,928	24%
NT	87	16,024	25%
QLD	2,849	696,459	42%
SA	1,129	279,163	40%
TAS	144	37,518	17%
VIC	1,848	465,476	21%
WA	1,267	336,653	35%
Total	**9,748**	**2,427,699**	**29%**

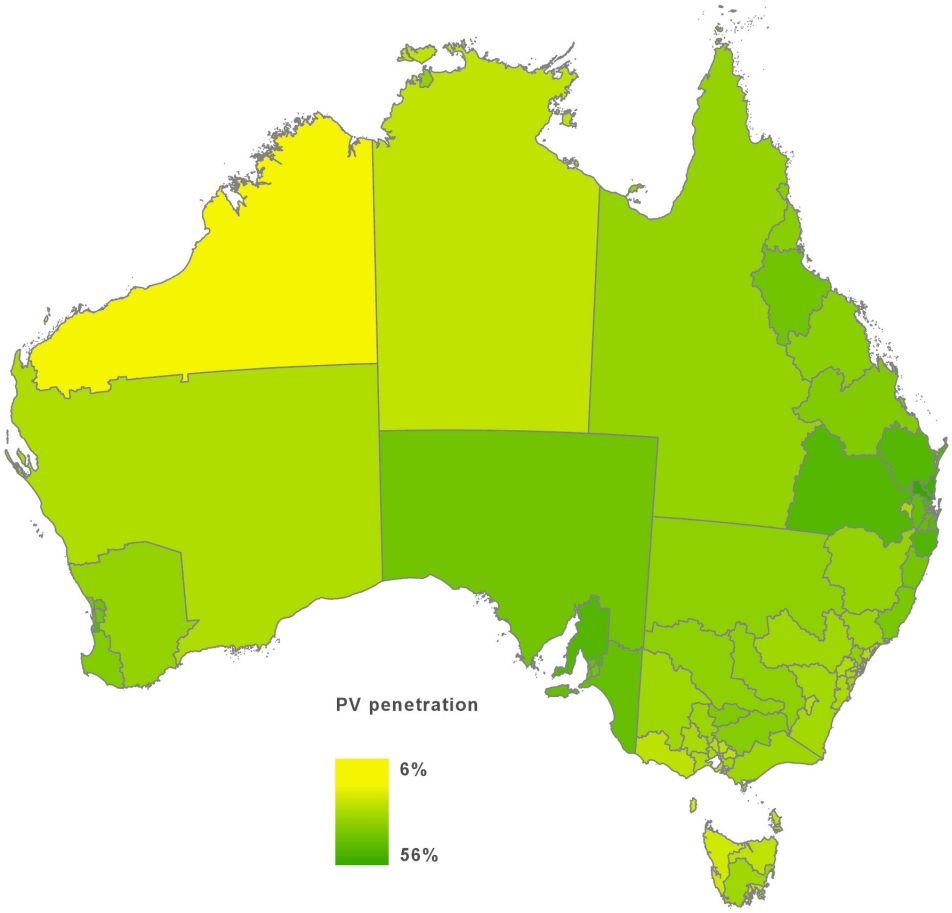
Australia now has over 2.4 million rooftop solar PV systems on residential dwellings with a combined capacity of 9.7 GW, these systems can generate an estimated 12,000 GWh annually. Total rooftop solar capacity, including rooftop systems in the LRET, is now at 12 GW. While each individual system is small, together they form one of the biggest generators in the electricity grid.

There are sizeable differences in penetration levels across regions (see Figure 21), which is notable in South East Queensland and the regions around Adelaide and Perth. This has been driven by several factors that make the returns from rooftop solar PV systems in these regions more attractive:

- Solar irradiance is higher in these areas than in South East New South Wales, Victoria and Tasmania[39] meaning more generation from the same sized system.
- Average household benchmark electricity consumption in these regions is higher than the levels for New South Wales and Victoria.[40]
- Installation costs are cheaper in these regions, and historically for Queensland and South Australia there were strong and prolonged government incentivised feed in tariff rates.[41]

[37] Suitable dwellings are defined by the ABS as a separate house, or a semi-detached, row or terrace house, townhouse.
[38] This data is derived by apportioning a rooftop solar PV's installation postcode to its Statistical Area Level 4 ABS region, as such these values may differ to other data publications by the Clean Energy Regulator.
[39] Department of Industry, Australian Energy Resource Assessment, 2014.
[40] AEMC, Residential Electricity Price Trends 2019, December 2019.
[41] Australian Energy Council, Solar Report, January 2020.

Figure 21: Residential rooftop solar PV (0 to 15 kW) penetration rates throughout Australia, to date



Managing increasing distributed energy generation

The Clean Energy Regulator's 2018 RET Administrative Report identified the development of renewable energy integration strategies as the next key phase in Australia's transition to a clean energy future. [42]

Action is underway by AEMO, industry bodies, governments and distribution network service providers (DNSPs) alike to manage increasing penetration of distributed and variable energy generation. Agencies such as the Australian Renewable Energy Agency (ARENA)[43] and the Clean Energy Finance Corporation (CEFC)[44] have also shifted their funding priorities in 2020 to focus on system strength and grid reliability.

AEMO's Renewable Integration Study

AEMO's RIS, released in Quarter 2 2020, indicates that Australia's rooftop solar PV has become a significant energy generation source throughout the NEM and Western Electricity Market (WEM). AEMO has forecast rooftop solar PV to grow to be 26 times larger than any single generator in the NEM or WEM by 2025.[45]

The study[46] indicates that substantial levels of solar PV in Australia pose unique operational challenges:

- Uncertain performance during power system disturbances.
- Low demand during the middle of the day can lead to challenges operating the power system securely.

[42] Clean Energy Regulator, 2018 RET Administrative Report – The acceleration in renewables investment in 2018, July 2019.
[43] ARENA, Major study to tackle weak, unstable energy grids, July 2020.
[44] CEFC, CEFC welcomes announcement of $1 billion Grid Reliability Fund, October 2019.
[45] AEMO, Renewable Integration Study 101 Webinar, April 2020.
[46] AEMO, Renewable Integration Study Stage 1 Appendix A: High Penetrations of Distributed Solar PV, April 2020.

- A large source of variable generation, that cannot be curtailed.

These challenges, if left unaddressed, could lead to system issues, voltage regulation issues, as well as cascading failures and potential blackouts.

Distribution network service provider response to these challenges

DNSPs that host significant rooftop solar PV penetration are now developing network and non-network strategies to mitigate potential risks from high solar PV penetration.[47] This includes upgrading transformers, installing community batteries and improving standards.

The Australian Energy Market Commission (AEMC) is currently considering a rule change to enable DNSPs to better support the two-way flow of energy between consumers and the grid. This includes charging consumers for the use of the network to export electricity to the grid, to invest in network upgrades and improving the allocation of costs and rewards for all customers.[48]

However, there has been limited work so far on changing tariffs to shift demand to match peak solar generation; for example, electric hot water typically heats at night.

Potential sources of grid stability

AEMO's RIS Stage 1 report provides recommendations to ensure Australia's electricity network can continue its transition towards higher penetration of instantaneous renewable energy generation. The study identified that improving technical standards and visibility of rooftop solar PV, as well as implementing remote curtailment capabilities were critical in maintaining system security. Achieving this will enable more systems to connect to the grid in the coming years and ensure the rooftop solar industry continues to thrive.

Proposed inverter standard and minimum technical standards changes, as well as residential and community batteries will provide additional stability to the grid if implemented.

New inverter standards

Proposed revisions to the AS/NZS 4777.2 inverter standard will allow AEMO to specify the conditions under which the inverter (and related PV system) should remain connected and generating power to the electricity grid or disconnect to help prevent major events.[49] Major electricity network events are an infrequent but high impact risk, and steps to mitigate this risk are vitally important.

An updated AS/NZS 4777.2 will allow the optimisation of inverter parameters and define the accuracy of measurement systems used in inverters. This will help to improve power quality, reliability of performance and allow for the provision of grid support functions for networks. The updated standard also improves testing procedures to ensure enhanced device compliance levels are met.

As rooftop solar PV continues to grow at a rapid rate, year on year, a fast-tracked revision to this inverter standard is important.

The AEMC is also currently considering a rule change to give effect to the new minimum technical standards currently being developed by AEMO.

Residential and community batteries

Residential and community batteries can store excess solar generation. This reduces high voltage issues and potentially enables small-scale solar to continue generating at high percentages without reducing AEMO's ability to maintain enough synchronous generation at times of high solar radiation.

[47] Energex, Distribution Annual Planning Report, December 2019, Western Power, Annual Report, 2019, and SAPN, Distribution Annual Planning Report, January 2020.
[48] AEMC, Access, pricing and incentive arrangements for distributed energy resources, July 2020.
[49] AEMO, AS/NZS 4777.2 Inverter Requirements standard, 2020.

Community and virtual power plant (VPP) [50] battery trials are occurring throughout Australia to explore their viability as a source of coordinated grid stability. There are several VPP trials in South Australia, most notably the AGL VPP trial[51] and the South Australian Government trial, which at full capacity is expected to provide 650 MWh of storage.[52] A report on the AGL VPP showed that the VPP was able to materially reduce solar exports throughout the day and reduce peak load during evening periods.[53]

In Western Australia, there are ongoing community battery trials which have led to the installation of 13 batteries throughout the state[54], ranging in size from 420 kWh[55] to 1.1 MWh.[56] Community batteries have the potential to play a central role in absorbing peak solar export levels at the distribution system level. A recent report from the Australian National University found that community batteries significantly reduce peak solar export levels.[57]

[50] Community batteries are moderately sized battery systems that can be used by nearby households with solar PV to store excess solar generation during the day for household usage in the evening. VPPs are a virtual network of private residential and commercial batteries, that can be dispatched in a coordinated manner to help stabilise the grid, while delivering extra value to customers.
[51] ARENA, Virtual Power Plant in South Australia, 2020.
[52] Government of South Australia, South Australia's Virtual Power Plant, 2020.
[53] AGL, Virtual Power Plant in South Australia Stage 2 Public Report, 2018.
[54] Western Power, Community batteries delivering community benefits, June 2020.
[55] Western Power, Our Community Battery Storage Trials, 2020.
[56] Synergy, Alkimos beach energy trial, 2020.
[57] Australian National University, Operating a community-scale battery: electricity tariffs to maximise customer and network benefits, 2019.

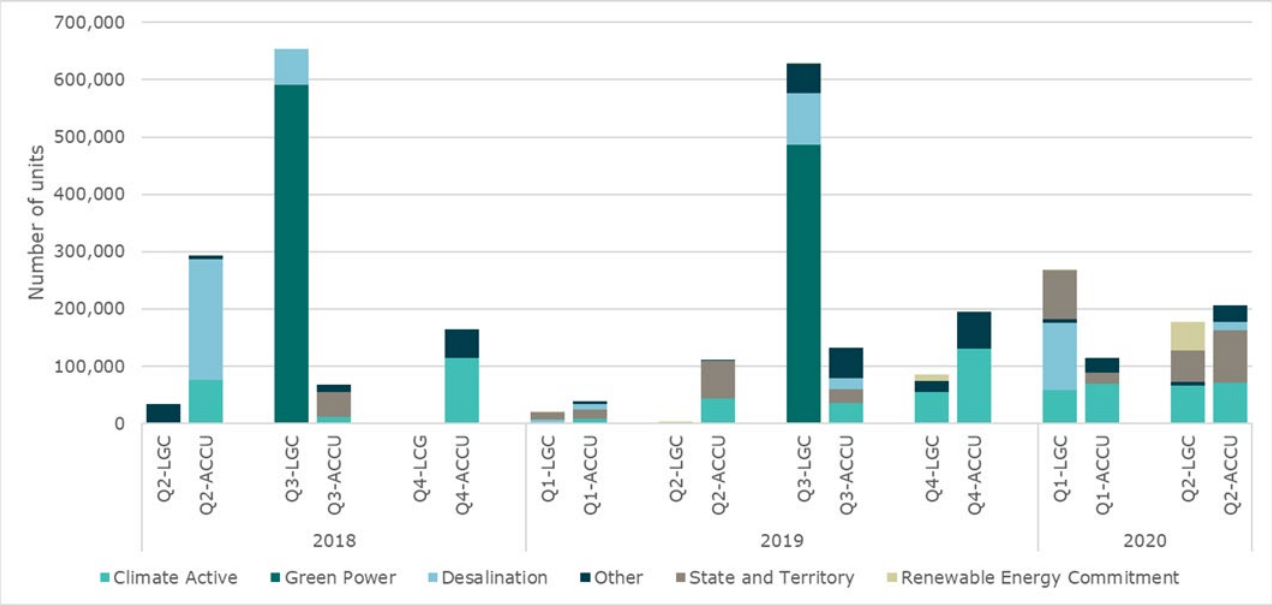
5. Voluntary, state and territory government markets

5.1. Domestic carbon market

The voluntary market has been resilient to the impacts of COVID-19 with the volume of units and certificates surrendered in the first half of 2020 exceeding 767,000 (see Figure 22).

This is a fourfold increase from the 173,000 surrendered during the first half of 2019.

Figure 22: Voluntary, state and territory government demand for ACCUs and LGCs, Q2 2018 to Q2 2020



LGC demand

177,000 LGCs were voluntarily surrendered in Quarter 2 2020, predominantly by corporations and state and territory governments to meet their own renewable energy commitments or carbon neutrality goals.

The surrender of LGCs is essential to legitimise claims of achievement against renewable energy commitments. The Clean Energy Regulator encourages companies that want to be able to demonstrate a renewable commitment to consider voluntary surrender of LGCs. The surrender of LGCs represents the end of the lifecycle for the certificates; once surrendered these LGCs cannot be used to meet legislated demand under the LRET.

In July, the Australian Capital Territory government surrendered 2.2 million LGCs for surrender to demonstrate the achievement of their 100 per cent renewable energy target. The LGCs surrendered can be traced to the renewable energy projects underpinned through PPAs as part of the Australian Capital Territory government's reverse auction process.

An additional 800,000 LGCs were offered for surrender in July 2020 for GreenPower and desalination plants, bringing the total to 3.7 million LGCs in 2020. Voluntary LGC demand is expected to reach 4 million LGCs in 2020.

ACCU demand

Voluntary surrender of ACCUs totalled 206,000 in Quarter 2 2020, an 85 per cent increase from the same quarter in 2019. The majority of these surrenders (44 per cent) are attributed to states and territory governments offsetting emissions from their fleet vehicles. ACCU surrenders from state government operated desalination plants contributed a further seven per cent of the surrendered volume.

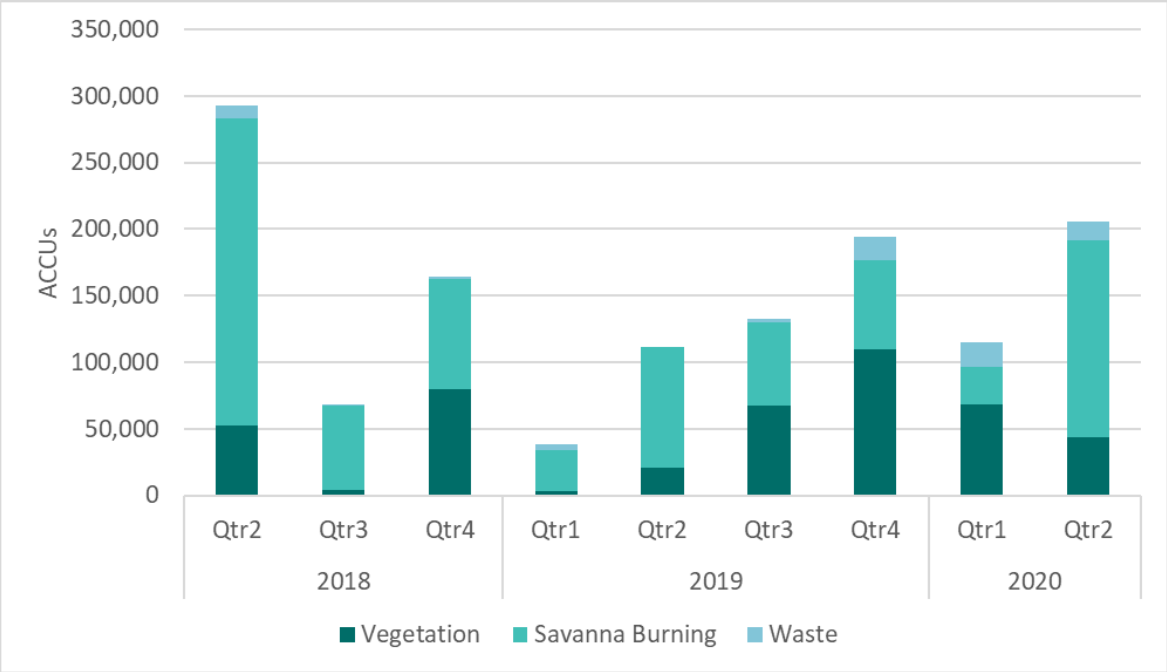
Surrenders from Climate Active participants increased by 64 per cent in this quarter compared to Quarter 2 2019, with 70,900 ACCUs surrendered. The Clean Energy Regulator estimates voluntary surrender of ACCUs to exceed 750,000 in 2020.

Voluntary market participants continue to show a preference for ACCUs that deliver co-benefits

in addition to carbon abatement, with ACCUs from savanna burning projects[58] accounting for 72 per cent of voluntary surrenders in Quarter 2 2020 (Figure 23).

Some project proponents appear to be accumulating ACCUs for future delivery, including to fulfil agreements with voluntary participants. Optional delivery contracts can provide security to ERF project proponents. Project proponents can choose to sell ACCUs to voluntary participants at market prices or to deliver against the yearly delivery option before it expires.

Figure 23: Voluntary, state and territory government ACCU demand by method type, Q2 2018 to Q2 2020



5.2. Growth in voluntary market

Key industry bodies have announced their support for net zero emissions this quarter, including the Australian Energy Council and Minerals Council of Australia, joining a growing number of business groups calling for increased emissions reduction targets. Additionally, superannuation funds HESTA and First State Super have both announced commitments to reduce emissions from their investment portfolios in order to manage climate risk and support the transition to a low-carbon economy.

Many Australian businesses now have ambitious voluntary emissions reduction targets. Detailed in ClimateWorks' Net Zero Momentum Tracker, this includes 44 businesses from diverse sectors of the economy with net zero emissions targets.

Individual businesses demonstrate different approaches to setting and achieving voluntary targets, including reducing emissions where possible and purchasing units to offset emissions from all or part of their business. For example, South Australia Water offsets emissions from their desalination operations with ACCUs and LGCs, and has announced new investments in solar PV and battery storage infrastructure to reduce scope 2 emissions. Telstra has achieved Climate Active carbon neutral certification for its operations, reducing electricity usage and surrendering a mix of international and domestic offsets.[59]

[58] Savanna burning projects often support employment in Indigenous and rural communities.
[59] Telstra, Climate Active Product Disclosure Statement, 2020. Telstra's carbon neutral certification covers operational emissions in Australia and internationally, excluding embodied emissions from manufacturing, transportation, and emissions from customer use and waste.

At present, there is little accountability or transparency of business' progress towards their claimed voluntary emissions reduction commitments. The Clean Energy Regulator is examining ways to build on the National Greenhouse and Energy Reporting architecture to allow businesses to report emissions and detail progress towards emissions reduction targets on an opt-in basis.

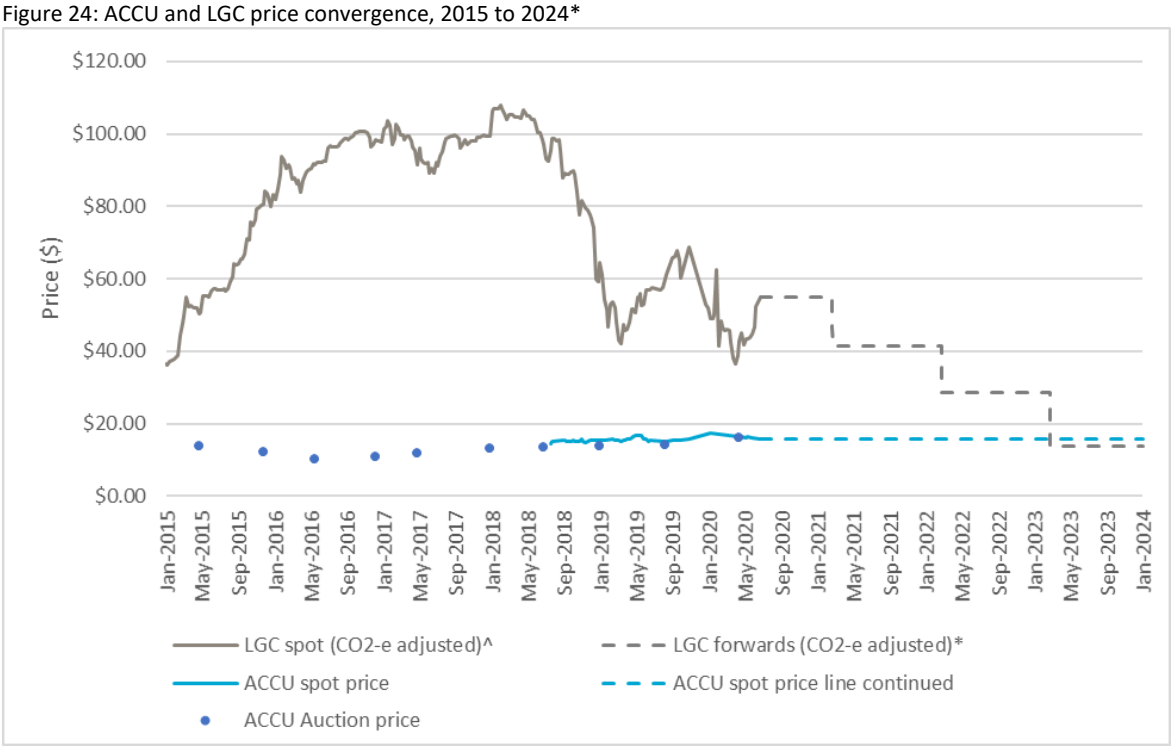
5.3. Prices

LGC spot and forward prices steadily increased across Quarter 2 2020.

These increases are not considered material enough to impact the estimated convergence of carbon adjusted LGC and ACCU prices in early 2023 (see Figure 24).

The supply of LGCs is still expected to significantly increase due to static statutory demand post-2020; this will in turn reduce spot and forward LGCs prices.

Figure 24: ACCU and LGC price convergence, 2015 to 2024*



*This convergence may occur earlier or later depending on the actual future LGC and ACCU prices. For example, if ACCU prices rise and LGC prices fall further over this time period, the convergence will occur earlier.

5.4. Other units

Prices have increased in both European Union and New Zealand emissions trading schemes in Quarter 2 2020 after decreasing last quarter due to COVID-19 impacts (see Table 8). New Zealand Carbon Units (NZUs) prices peaked late in the quarter following legislative reforms to strengthen the scheme, which will include an absolute emissions cap from next year.

The price of CERs moderated in Quarter 2, increasing marginally prior to the announcement by the International Civil Aviation Organisation that 2020 would be excluded from the Carbon Offsetting and Reduction Scheme for International Aviation (CORSIA) baseline determination, reducing the demand for offsets from airlines in the pilot period.

International units make up most of the voluntary offset market to date.[60] In Quarter 2, 2.7 million CERs were surrendered in ANREU, bringing the total to 3.4 million in the first half of 2020, more than double the surrenders in the first half of 2019.

However, there remains uncertainty as to the continued eligibility of CERs under the Paris Agreement, with further consideration required for all international units to avoid double-counting emissions reduction.

Gold Standard have announced plans to differentiate Verified Emissions Reductions (VERs) where corresponding adjustments have been made by host countries post-2020.[61] Demand for units that are not at risk of double counting will be high, as additionality is a requirement for offsets in CORSIA, and voluntary participants seek to continue carbon neutral claims.

Table 8: Domestic and international carbon market spot prices

Product	Spot price AUD (30 June 2020)[62]	Quarterly trend	Change in Price
ACCU	$15.85	Down	-$0.55
LGC (CO_2-e)	$55.00	Up	$17.75
ESC	$24.75	Down	-$3.65
VEEC	$30.20	Down	-$5.05
CER	$0.49	Down	-$0.07
EUA	$40.44	Up	$11.02
NZU	$29.89	Up	$6.61

CERs - Certified emissions reduction units (CERs) are issued through the Clean Development Mechanism.
EUA - European Union Allowances (EUAs)
NZU - New Zealand Carbon Units
ESC - Energy Saving Certificates (NSW)
VEEC - Victorian Energy Efficiency Certificates

The integrity of carbon units is increasingly becoming an important consideration for businesses and corporations purchasing these units to meet their corporate climate goals. ACCUs are considered high integrity units, generated through emissions reduction activities based in Australia and verified through an established mechanism under the ERF. ACCUs may also provide co-benefits that supports environmental, economic, social and cultural benefits for Australian communities.

Additionally, the price of ACCUs remains competitive with other high integrity international units, such as New Zealand Carbon Units and European Union Allowances as shown in Table 8.

[60] Clean Energy Regulator, Quarterly Carbon Market Report - September Quarter 2019, 2019. ACCUs and LGCs each make up 10 per cent of the voluntary market and eligible international units make up 80 per cent based on 2018 Climate Active data. An updated market share will be reported in future Quarterly Carbon Market Reports when 2019 Climate Active data is available.
[61] Gold Standard, Voluntary Carbon Market Policy Consultation, 2020.
[62] Data sourced from Jarden, TFS Green, ICE Futures.

6. Carbon abatement

6.1. National abatement

Expectations of abatement delivered in 2020 from schemes administered by the Clean Energy Regulator have moderated to 54.5 million tonnes of CO_2-e in Quarter 2 2020, down from 56.6 million tonnes CO_2-e estimated in Quarter 1 (see Figure 25).

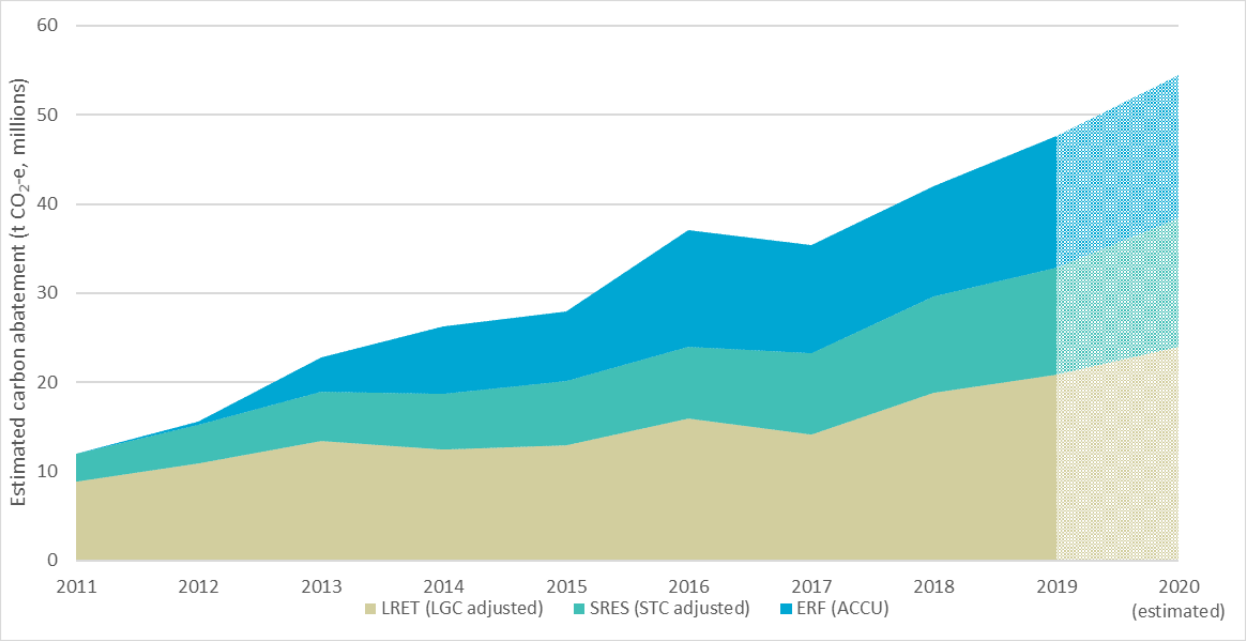
The average grid intensity factor has fallen by 1.4 per cent from the estimate used in Quarter 1.

Estimated abatement from large-scale renewables is now 1.8 million tonnes lower than previously estimated in Quarter 1, driven by lower than expected generation and the falling average emissions intensity factor.[63]

Estimated abatement from the SRES has slightly increased (0.1 million tonnes) due to higher than expected installed capacity, dominating the negative effect arising from the reduction in the emissions intensity factor.

The ERF is expected to generate ACCUs equivalent to 16.1 million tonnes of abatement in 2020.[64]

Figure 25: Estimated carbon abatement from ERF and RET, 2011 to 2020[65]



[63] LGC supply for Quarter 2 2020 was lower than expected due to a combination of factors including curtailment, lower wind and solar resource and delays in project connection and ramping to full generation. Expected eligible annual LRET generation in 2020 has been revised down to 33,000 GWh from 35,000 GWh to reflect these factors. The estimated generation in 2020 is higher than the estimated LGC supply for the 2020 assessment year due to the lag between generation and LGC creation.

[64] ACCU supply is 0.5 million tonnes lower than the previous estimate. The reduction in the ACCU supply is due to the revisions to the forecasts to account for Quarter 2 actuals.

[65] See Section 6.2 below for details on the QCMR methodology for estimating carbon abatement. Annual abatement values used in this graph are slightly different from those reported in previous QCMRs for some years due to updated generation, emissions intensity factor, scheme information and minor revisions to the methodology.

6.2. King Review, average carbon content

The expert panel of the King Review recommended estimating the implicit carbon content for an LGC based on either the average grid carbon intensity or the state-based grid emission factor.[66] The report states:

> 'Using a grid average or state average is in preference to an implicit carbon intensity based on the emissions intensity of thermal generation. While it is true renewable generation often displaces thermal generation, it need not in all circumstances—for example -where electricity demand was growing.'

The Clean Energy Regulator's current carbon abatement estimation methodology is considered conservative. The grid emissions intensity factor is falling due to flat demand and increasing penetration of renewables in the generation mix displacing non-renewable generation, which often has an emissions intensity factor of over 1 t-CO_2/MWh. The NEM emissions intensity factor in the first half of 2020 was 0.7264 tCO_2-e/MWh.

Australia's electricity sector emissions were 200 million tonnes of CO_2-e in 2011. Emissions fell by 20 million tonnes (9.8 per cent) to 181 million tonnes in 2018.[67] In comparison, carbon abatement from the RET increased over the same period by 17.6 million tonnes, lower than the reduction reported in electricity sector emissions, depicting the conservative nature of the Clean Energy Regulator's current carbon abatement estimate. An alternative approach that would use the weighted average emissions intensity of the coal and gas generation displaced by renewables would result in a higher carbon abatement estimate.

6.3. Economic benefits from carbon markets

Australia's carbon markets provide direct and indirect benefits to participants, with the most notable being the creation of jobs and generation of additional income sources.

The renewables energy sector has supported local economies by directly employing people in a variety of capacities including construction, design and approvals, installation, operations, maintenance and marketing.

From the Australian Bureau of Statistics' most recent update, annual direct full-time equivalent employment in the renewable energy industry reached 26,850 in 2018-19, reporting a 27 per cent increase from the previous reporting year. Rooftop solar PV accounted for 49 per cent of total employment. Large-scale solar, wind and hydro contributed to the total by 18, 12 and 11 per cent, respectively. As noted in Chapter 3, rooftop PV employment, in the first half of 2020, is estimated to have increased employment by 2800 jobs due to recent growth in installs.

A recently published report by the Clean Energy Council suggests that, under AEMO's step change scenario, small and large-scale renewables projects could generate 44,000 jobs by 2025.[68] The Clean Energy Regulator's view is that Australian renewable capacity is presently tracking on the step change scenario.

In addition to the employment opportunities directly created, renewables energy markets have indirectly supported local economies by improving participating households' and businesses' income via reduced electricity costs.[69]

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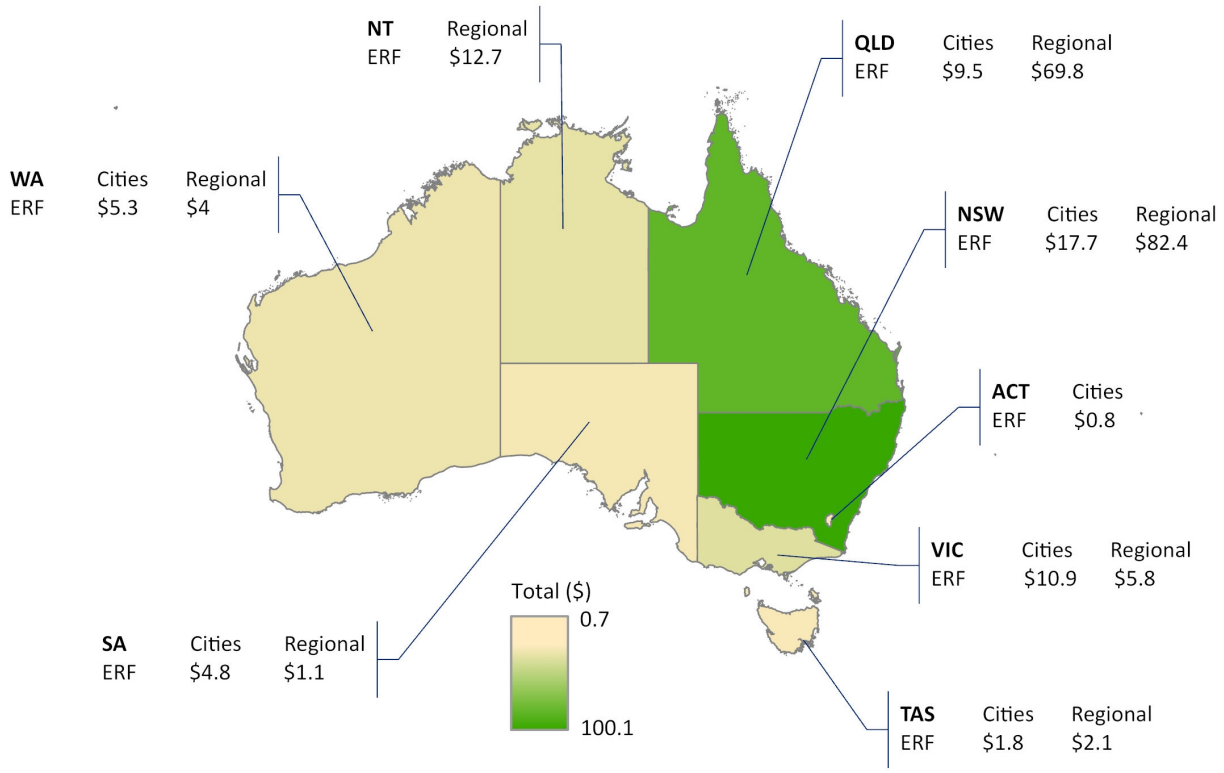
[66] Department of Industry, Report of the Expert Panel Examining Additional Sources of Low Cost Abatement (the King Review), May 2020.
[67] Department of Industry, National Greenhouse Gas Inventory, September 2019.
[68] Clean Energy Council, Clean Energy at Work, June 2020.
[69] Csereklyei, Qu and Ancev, The Effect of Wind and Solar Power Generation on Wholesale Electricity Prices in Australia, August 2019; Baldwin, Blakers and Stock, Australia's renewable energy industry is delivering rapid and deep emissions cuts; September 2018.

Further, the LRET and SRES let scheme participants to earn extra income for the electricity they generate through the creation of renewable energy certificates.

For the ACCU market, ERF projects have generated an additional revenue source for rural landholders and farmers.

Figure 26 provides an approximation of dollar value revenue from ERF projects based on their project locations. The total estimated revenue generated from ERF projects in 2019 was $234 million. The corresponding abatement was 14.8 million tonnes.

Figure 26: Estimated revenue from ERF projects ($, millions), 2019[70]



[70] The carbon abatement used in revenue calculation is estimated based on all ACCUs at the time they are issued under ERF projects. This estimate includes ACCUs that are not contracted to the Commonwealth. Abatement estimates disaggregated by cities and regional areas do not sum to the aggregated national total in Figure 25 due to the fact that some projects occur across multiple locations or locational data is not available for certain projects under commercial-in-confidence or legislated privacy provisions. This analysis is based on the Department of Home Affairs' definition of cities and regional areas in Australia that includes 3 categories. Category 1 represents major cities of Sydney, Melbourne and Brisbane; Category 2 covers cities and major regional centres' of Perth, Adelaide, the Gold Coast, the Sunshine Coast, Canberra, Newcastle/Lake Macquarie, Wollongong/Illawarra, Geelong and Hobart; and Category 3 includes regional centres and all other regional areas. The definition of 'cities' in Figure 26 covers category 1 and 2. The 'regional' definition is equivalent to category 3.

Glossary

Term	Acronym
Australian carbon credit unit	ACCU
Australian Energy Market Operator	AEMO
Australian Energy Regulator	AER
Australian National Registry of Emissions Units	ANREU
Australian Renewable Energy Agency	ARENA
Certified emission reduction unit	CER
Emissions Reduction Fund	ERF
Energy saving certificate	ESC
EU allowance unit	EUA
Integrated Systems Plan	ISP
Gigawatt	GW
Large-scale generation certificate	LGC
Large-scale Renewable Energy Target	LRET
Land Restoration Fund	LRF
Marginal loss factor	MLF
Megawatt	MW
National Electricity Market	NEM
National Greenhouse and Energy Reporting Act 2007	NGER
New Zealand carbon unit	NZU
Power purchase agreement	PPA
Renewable Energy Certificate Registry	REC Registry
Renewable Energy Target	RET
Renewable power percentage	RPP
Small-scale Renewable Energy Scheme	SRES
Small-scale technology certificate	STC
Small-scale technology percentage	STP
Verified carbon unit	VCU
Victorian energy efficiency certificate	VEEC
Verified emission reduction unit	VER

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