Australian Government
Clean Energy Regulator

CLEAN ENERGY REGULATOR

Quarterly Carbon Market Report

March 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 March Quarter 2020 (January 2020 to March 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.

Executive summary

The current global COVID-19 pandemic began in Quarter 1 of 2020 with all countries across the world significantly impacted. World-wide efforts to minimise the human impact are resulting in significant demand and supply side impacts on economies and markets.

The Clean Energy Regulator acknowledges the impact COVID-19 is having on its scheme participants and more broadly the community. This is a difficult time for all industries during this period of unprecedented uncertainty.

Predicting the future in markets is always difficult, but current conditions mean that there is more than the usual degree of uncertainty. This report includes a range of information about developments in carbon markets and expectations of market participants.

Overall, the Clean Energy Regulator expects that industries supported by carbon markets in Australia can perform relatively well during this very difficult period. The total value of scheme entitlements (units and certificates) to be issued in the 2020 calendar year is estimated to be circa $3 billion.

In the context of the Australian Government's significant economic stimulus, the Clean Energy Regulator is focused on maintaining service standards for entry to its schemes, and timeliness in issuing entitlements and payments for purchasing of Australian Carbon Credit Units (ACCUs). Flexibility in assessing scheme compliance obligations is also being actively considered, where it is necessary and the law allows.

Strong supply side performance in Quarter 1 across all schemes has provided some buffer to any supply contraction that may emerge throughout the year.

Following the severe bushfires, drought and other severe weather events, there was a broad expectation of voluntary demand for carbon offsets to grow rapidly in 2020. However, this demand may now be muted for some businesses as they work through significant challenges, and in some cases opportunities, during the current economic conditions.

Despite this, total demand for units and certificates will remain very strong in 2020. Statutory demand in the Renewable Energy Target (both small and large) is at record levels this year. Government ACCU contract deliveries will underpin the market and the Clean Energy Regulator will continue with regular purchasing processes.

The Clean Energy Regulator will monitor the impact of COVID-19 on carbon markets as it continues to unfold. Updates between Quarterly Carbon Markets Reports (QCMRs) will be provided if significant issues arise that affect any of the schemes.

The impact of COVID-19 on carbon markets

While it is too early to accurately predict the extent of change to carbon markets due to social distancing measures and the economic slowdown, early trends have emerged.

Small-scale Technology Certificates coming to market faster

Small-scale solar photovoltaic (PV) capacity installed in Quarter 1 2020 was up 33 per cent on Quarter 1 2019 and current supply of Small-scale Technology Certificates (STCs) is tracking ahead of the surrenders required to meet the 2020 Small Technology Percentage (STP).

After the Quarter 1 surrender for STCs (35 per cent) on 28 April 2020, there were still 3.8 million STCs in the market.

If not for the potential impacts of COVID-19, total added capacity for 2020 appeared on a trajectory for 2.7 gigawatts (GW) against the record 2.2 GW in 2019. However, with current uncertainties it is too early to say whether the 42.6 million STC creations anticipated in the STP will be achieved over the whole year.

System orders have remained strong through to May. Many in the industry expected a reduction in demand for new systems owing to increasing unemployment and other factors. Some businesses do appear to have been affected but overall the size of any downturn has been

muted. Towards the end of May there was still no sign of any reduction in STC creations.

There has been a significant reduction in the time taken to claim and process STCs, meaning STCs are coming to market faster. This should support the upcoming 2020 quarterly surrender requirements. Clean Energy Regulator average processing times decreased from 10 days in Quarter 4 2019 to 8 days in Quarter 1 2020. There has been an observable shift in behaviour of installers and registered agents, where average time between install and claim fell from 32 days in February to 26 days in March.

The uptake of the Solar Panel Validation (SPV) initiative is a strong driver of this trend. SPV uptake has increased, with 25 per cent of all claims in Quarter 1 now using SPV up from 10 per cent in Quarter 4 2019. A total of 36 per cent of STC claims in Quarter 1 were validated within 24 hours, providing a swifter cash flow to business. There are four free SPV apps available representing 18 manufacturers. The Clean Energy Regulator expects more solar retailers and installers will consider the value of getting on board.

Supply chain and international economic conditions affect renewables markets

New supply of components was also expected to face constraints owing to increased importation costs, timing for shipping slots, changing exchange rates and supply chain disruptions for PV panels, wind turbines, inverters and transformers.[1]

The extent to which these factors results in a material increase in the cost of components delivered to Australia, or issues in obtaining sufficient supply, depends on many factors including what happens world-wide with demand for such components and the details of any long-term supply contracts.

Initial industry analysis suggests that Australian solar businesses have been relatively insulated from the shock to date as a result of long order books and solid inventory in Australia, and production of key components from China is rapidly returning to 100 per cent.

Economic conditions will have broad effects on markets but the duration and scale are uncertain

Reduction in aviation travel, postponement of major events and financial pressures on business may soften voluntary demand for ACCUs in the short to mid-term. However, this demand still represents a small component of the market. Demand from the Australian Government, the primary purchaser of ACCUs, is unaffected.

Market analysts are projecting a reduction in overall electricity demand for Australia for 2020. Depending on the extent of this decline, Large-Scale Generation Certificate (LGC) and STC demand will be proportionately reduced. This is because liable entities (typically electricity retailers) must surrender certificates based on the percentages set in Regulations and their actual electricity acquisitions.[2]

Retailers are able to propose new estimates to adjust their quarterly surrender liability for STCs in the case of a material fall in their electricity sales. Adjustments are made via application on a case by case basis.

The Clean Energy Regulator had estimated that at least 2 GW of large-scale renewables would reach financial close in 2020. Quarter 1 started with 864 megawatts (MW). There are currently 1.9 GW of projects with a Power Purchase Agreement (PPA) between strong counterparties. Current circumstances may cause delays and renegotiations to get some of these projects to financial close.

Quarter 1 also saw the announcement of the McIntyre wind farm, a 1 GW project backed by a power purchase agreement with Clean Co.[3] This project is nearly double the size of the largest wind farm power station in Australia, Stockyard Hill at 531 MW, and was announced in late March after the emergence of COVID-19.

[1] While the Australian dollar initially fell materially against the United States dollar in mid-March, it has recovered quickly.
[2] Further information on the STP and Renewable Power Percentage (RPP) can be found here. Any reduction in demand for STCs and LGCs this year is added back into the calculations for the following year.
[3] Please note, only 540 MW of this project have been included in the Clean Energy Regulator's project pipeline, as there is not development approval for the remaining capacity yet.

In addition, the Clean Energy Regulator is tracking probable projects from large international companies whose circumstances and plans may not be impacted as significantly as other project developers.

The Clean Energy Regulator believes there are still prospects for two to three GW of capacity to reach financial close in 2020.

Social distancing changes business practices

Social distancing requirements are impacting on-site client interaction and installations, which could affect new supply in some schemes.

Emission Reductions Fund (ERF) project aggregators and rooftop PV installers are actively adapting their client engagement models. Time will tell whether new projects and installations slow during this adaptation stage.

Most large-scale renewables developers are reporting they have quickly implemented new safety regimes for COVID-19 and are not expecting material delays for projects under construction.

Progress in unlocking the next wave of renewables

The Renewable Energy Target for 2020 of 33,000 gigawatt hours (GWh) is still expected to be exceeded despite grid constraints limiting the amount of generation getting to market in some areas.

Resource sector renewables have emerged as a new driver of large-scale renewables investment. The Chapter 6 spotlight on off-grid and resource based renewable generation outlines the new trend and the potential growth in this sector.

Progress was made on resolving some grid constraints with the announcement of a renewable energy zone in New South Wales and the Australian Energy Regulator (AER) approved new and upgraded interconnector investments between New South Wales and South Australia, and Queensland and New South Wales.

The Clean Energy Regulator made a submission to the Australian Energy Market Operator (AEMO) on the 2020 Integrated System Plan (ISP). In its submission, the Clean Energy Regulator highlighted the need to move quickly and the risk of underestimating the pace of renewables.

The Clean Energy Regulator submitted that on balance the tendency for modelling to underestimate renewable investment could continue. This raises concerns, as reliance on conservative forecasts for the purpose of network planning represents a substantial risk that could become a self-fulfilling prophecy. This is discussed in more detail in this report in Chapter 4 on the risks of underestimating renewable investment.

Tenth auction shows new pathways for carbon projects

At the tenth auction in March, the Clean Energy Regulator committed to purchase 1.7 million tonnes of abatement across 11 projects. Purchasing resulted in an average price of $16.14 per tonne of abatement.

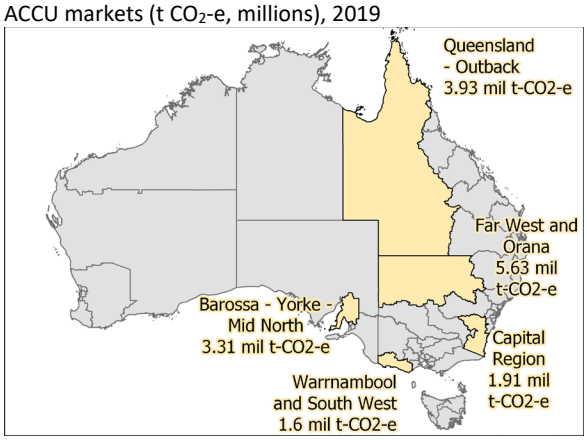
Project participants saw merit in the trial of optional delivery contracts with two thirds of those successful choosing this type of contract. This included one project proponent who chose to manage project risk by securing both a fixed and optional delivery for different portions of their expected ACCU supply from the project.

Optional delivery contracts have the potential to drive new participation across different methods, enabling projects to better match risk and return. Early signs suggest growing project diversity with 45 per cent of project registrations in Quarter 1 from projects other than vegetation compared to 33 per cent of all registrations in 2019.

The regions driving carbon abatement

Regional Australia is playing a key role in reducing or offsetting carbon emissions in all carbon markets. Over one third of all carbon abatement last year came from five regions, as seen in Figure 1.

Figure 1: Top 5 abatement regions across STC, LGC and ACCU markets (t CO_2-e, millions), 2019



All five regions are located around regional centres, with ERF and large-scale renewable projects being the predominant form of abatement. Urban centres only accounted for 18 per cent of abatement, with rooftop solar PV making up the bulk.

Unit and certificate prices

The LGC price has experienced a 29 per cent decline over Quarter 1. There is a large balance of LGCs in the registry as many businesses took advantage of shortfall provisions in the 2019 assessment year. Whilst a lower price trend post-surrender is observable in most years, the extent of this decline is more pronounced than usual. The average fall in LGC price over the past 4 years from the end of Quarter 4 to the end of Quarter 1 was six per cent.

In contrast, STC prices experienced a small jump in price, coinciding with the announcement of the 2020 STP of 24.4 per cent and anticipation of a potential decline in supply as a result of COVID-19. At the end of Quarter 1, the STC price was just below the STC clearing house price of $40, which forms an effective ceiling on prices. Since that time STC prices have moderated to $39.20 in early May.

The ACCU price[4] was stable early in the quarter on low volume safeguard buying for the 28 February surrender deadline, before losing $0.85 off lower demand from voluntary buyers to finish at $16.40 (see Table 1). Since then the price has continued to decline with trades in early May at $15.90, reflecting a possible drop in voluntary spot demand related to COVID-19. The Clean Energy Regulator will continue to monitor developments in the market and stands ready to hold an additional purchasing event based on the average price paid at the last auction if the need arises. Any further decline in price is limited, as the ACCU price is underpinned by the Commonwealth as the largest buyer with 95 per cent of market demand.[5]

Table 1: Price trend, Quarter 1 2020

Certificate type	Spot price AUD (31 March 2020)[6]	Quarterly trend
ACCU	$16.40	-$0.85
LGC	$27.75	-$11.25
STC	$39.65	+$2.25

On 19 May 2020, The Government announced its response to the Expert Panel[7] report (King Review) examining additional sources of low cost abatement. This will have significant implications for carbon markets over time. The next QCMR will examine some of these likely effects.

[4] Please note the ACCU price represents secondary market trades for immediate delivery of ACCUs and only includes trades reported through Jarden and TFS Green.
[5] Sellers under fixed Commonwealth contracts may buy ACCUs from the secondary market at prices below their contracts and then deliver those ACCUs to the Commonwealth for a profit. This essentially anchors the ACCU spot price at below fixed Commonwealth contract prices. The average volume weighted price for fixed contracts at auction 10 was $16.32, with the spot price currently trading $0.42 below this price.
[6] Data sourced from Jarden and TFS Green.
[7] The Expert Panel consisted of Grant King, Susie Smith, Andrew Macintosh and David Parker

1. Australian carbon credit units

- The tenth Emissions Reduction Fund (ERF) auction secured 1.7 million tonnes of forward carbon abatement from 12 contracts and 11 projects at an average price of $16.14 per tonne, for a total commitment of $27.6 million.
  - The new optional delivery contract offering saw strong interest, drawing in 1.4 million tonnes of abatement from eight contracts and eight projects.
- COVID-19 is not expected to have a material impact on ACCU supply with 2020 still expected to be a record year with over 16 million ACCUs issued. However, travel constraints may limit the opportunity to recruit new projects.
- 20 new projects were registered in the quarter, including two projects under the Industrial Electricity and Fuel Efficiency (IEFE) method which aim to achieve abatement by replacing grid electricity with on-site renewable energy.
- Safeguard demand for the 2018–19 compliance year (58,731 ACCUs) was lower than previous years, in part due to an additional 14 safeguard entities using multi-year monitoring periods.
- Spot prices trended down from $17.25 at the end of Quarter 4 2019 to $16.40 at the end of quarter 1 2020.

1.1. Supply and demand balance

The balance of ACCUs held in the Australian National Registry of Emissions Units (ANREU) increased by 0.17 million from Quarter 4 2019 reaching over 6.2 million at the end of Quarter 1 2020 (see Table 2).[8]

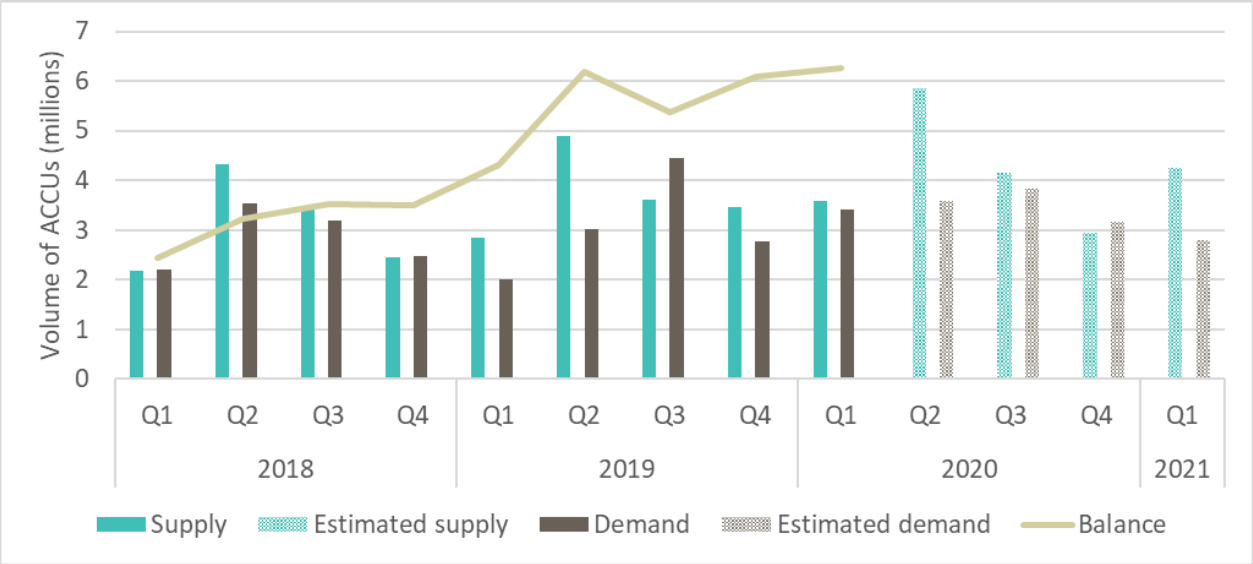
This balance slightly surpassed the balance of 6,187,793 at the end of Quarter 2 2019, making it the largest quarterly balance on record.

Table 2: ACCU supply and demand balance at Quarter 1 2020 close[9]

Balance/supply of ACCUs from Quarter 4 2019	6,078,172
ACCUs issued Quarter 1 2020	3,594,465
Emissions Reduction Fund contract deliveries	-3,249,125
Safeguard surrender[10]	-56,994
Voluntary surrender	-114,843
ACCU relinquishment[11]	-105
Net balance at the end of Quarter 1 2020	6,251,570

[8] While the balance in accounts is rising, 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).
[9] Supply of ACCUs refers to ACCUs issued and any balance from previous periods. Demand of ACCUs incorporates three sources including Commonwealth ERF contract deliveries, Safeguard mechanism surrender and state and private sector voluntary surrender.
[10] 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.
[11] For more information see ACCU relinquishments.

Figure 2: ACCU supply and demand balance, Q1 2018 to Q1 2021



Supply of ACCUs increased by 3.6 million, up 27 per cent compared to Quarter 1 2019 (see Figure 2). Of the 3.2 million ACCUs delivered under contract during Quarter 1 2020, over 2.5 million ACCUs were delivered earlier than scheduled.[12]

With COVID-19 not expected to have a material impact on existing projects, supply remains on track for over 16 million ACCUs in 2020. Supply is expected to exceed current estimations of demand for 2020.

1.2. Factors impacting supply

Crediting

Quarter 1 saw 3.6 million ACCUs issued. Vegetation and waste projects continued to dominate ACCU supply with 67 per cent and 26 per cent of total ACCUs issued in the quarter respectively (see Figure 3).

Of the 803 registered projects, 478 are currently generating ACCUs, whilst 325 are yet to be credited.[13] Of the 325 projects yet to receive ACCUs, 105 are unconditionally registered and 220 are registered with conditions that are required to be removed prior to ACCUs being issued.

ERF 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.

Ten projects were credited for the first time in Quarter 1 2020, contributing over 0.17 million ACCUs to supply. This includes the first plantation forestry project, where over 19,000 ACCUs were issued to a project in Victoria.

Growth in plantation forestry ACCUs will continue with 21 projects now registered including four registered in Quarter 1.

Regulatory amendments have been introduced to reduce the regulatory burden for ERF plantation forestry and farm forestry projects in areas where they are unlikely to have a material impact on the availability of water. Once implemented, it is expected that this will remove some barriers to project development in these areas, likely driving additional project registrations.

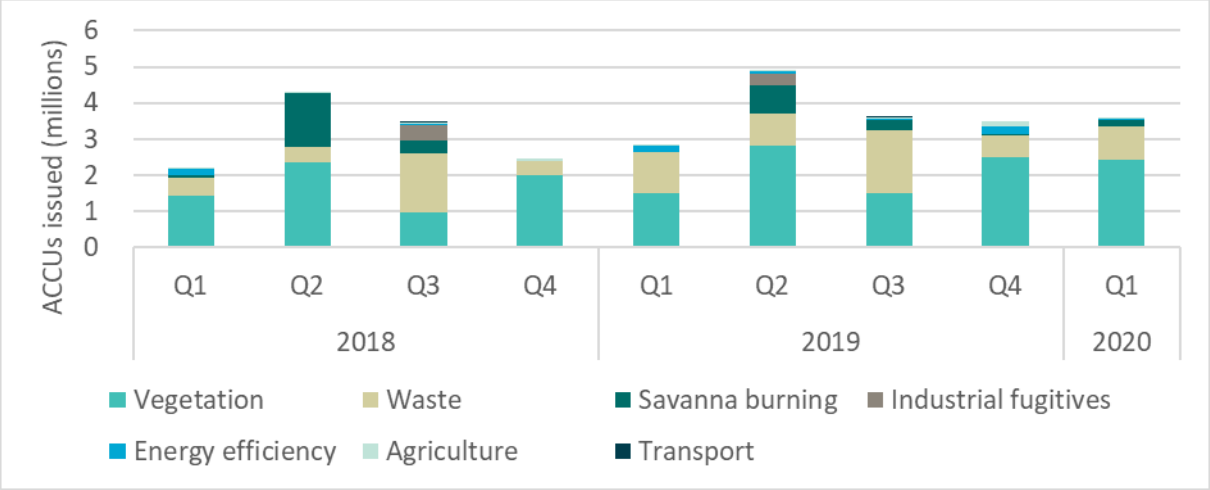
[12] Of the 3.2 million delivered in Quarter 1 2020, 2.5 million were delivered against a milestone that was set beyond this quarter. The commonwealth contract allows a degree of flexibility enabling delivery of ACCUs early from scheduled delivery milestones. While contract delivery schedules are determined 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.

[13] Before many projects can 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.

For some projects, COVID-19 travel restrictions and strict social distancing measures may affect project activities such as access to site for project developers and auditors. The Clean Energy Regulator has published guidance for project participants and auditors:

- Guidance for auditors, which encourages them to find innovative ways to provide assurance on projects where site and office visits cannot occur.
- Guidance for project participants on ground truthing for projects and obtaining eligible interest holder consents during this period.

Figure 3: ACCUs issued per method type, Q1 2018 to Q1 2020



Projects

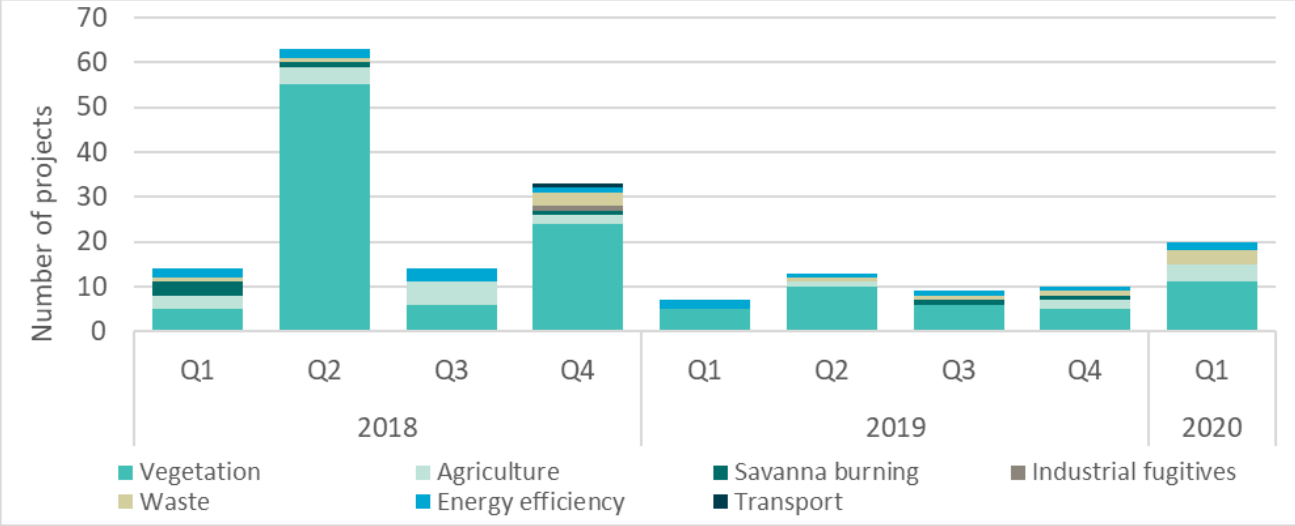
Twenty new projects were registered in Quarter 1 2020, double the average quarterly registrations in 2019. This was associated with the tenth auction, including the availability of the new optional delivery contract which lowers the risk of project development.[14]

There are early signs of increased project diversity. The share of registration for projects other than vegetation has grown steadily (see Figure 4) with 27 per cent in 2018 compared with 45 per cent in Quarter 1 2020.

Social distancing rules and travel restrictions may impede onsite access and face to face meetings between parties, possibly impacting the ability to obtain legal right and eligible interest holder consents, slowing new project registrations. Time will tell whether the number of new projects slow while ERF project developers actively adapt their client engagement models.

[14] The optional delivery contract provides a 'right', but not an 'obligation', to deliver ACCUs under an agreed contract with the Commonwealth. That is, sellers can choose whether to deliver abatement to the Commonwealth at a contracted price or sell some or all of their ACCUs elsewhere.

Figure 4: New registered projects per method type, Q1 2018 to Q1 2020



Renewables in the ERF

In Quarter 1, the Clean Energy Regulator registered two projects under the IEFE method, bringing the total number of projects to 35. These projects can receive credits for a broad range of activities that reduce emissions from energy consuming equipment at industrial or commercial sites. This includes switching a site's source of electricity to a less emissions intensive alternative, such as onsite solar PV.

The IEFE method is available to large electricity consuming sites such as shopping centres, manufacturing, industrial and off-grid facilities looking to switch to renewables using solar PV. Crediting under this method applies only for generation that is used on site and credit is not given for any electricity exported to the grid. Additionally, where a site can export electricity to the grid, this method is restricted to projects under 30 MW. A crediting period of seven years applies to this method.

Installation of medium scale solar PV has been incentivised under the Large-Scale Renewable Energy Target (LRET) where projects receive LGCs for all renewable generation. As LGC forward prices decline, the IEFE method may become a more attractive option for some participants.[15]

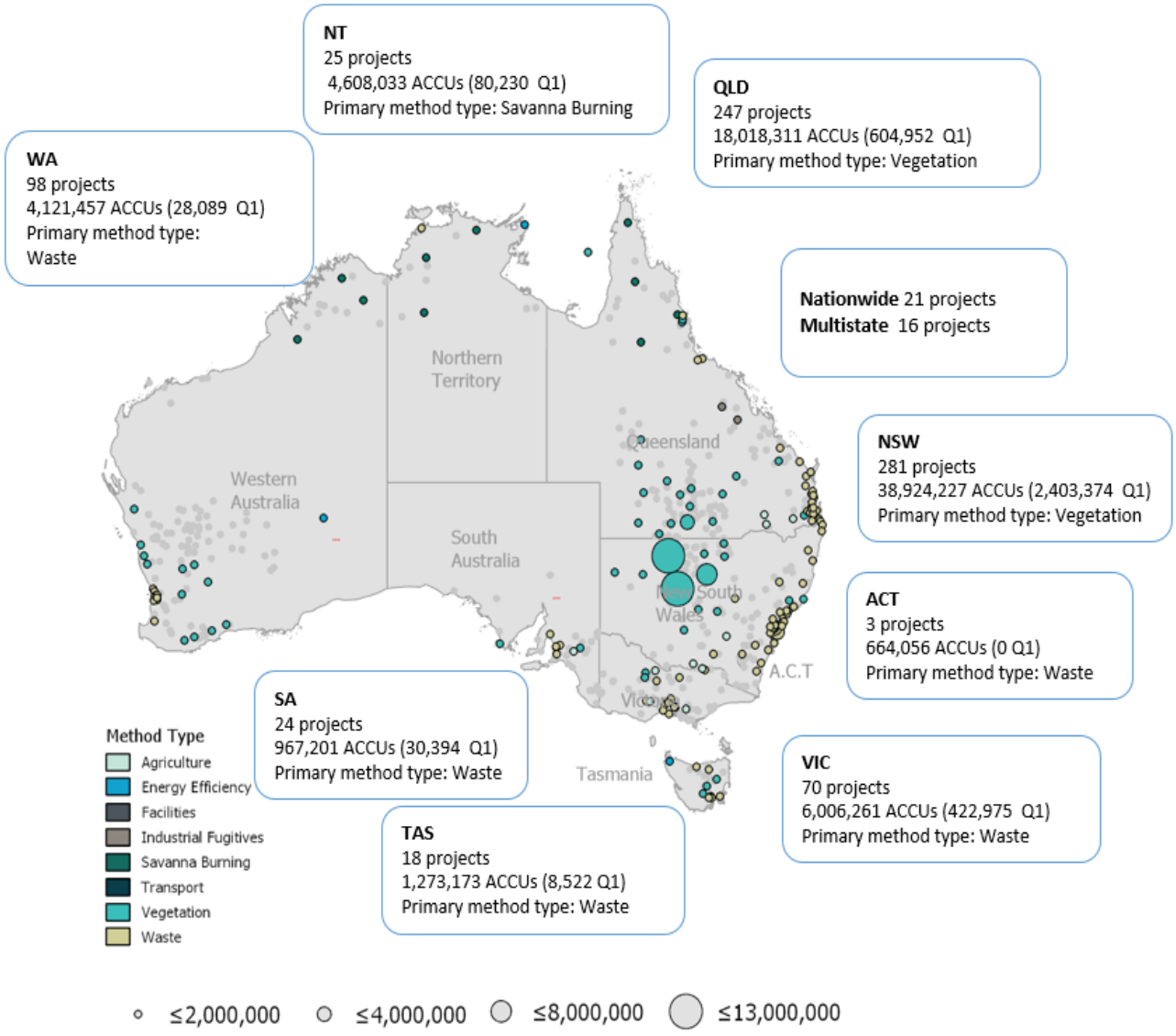
Further information on the IEFE method can be accessed from the Clean Energy Regulator's website.

[15] Project developers will need to do their own analysis on the advantages and disadvantages of registering a project/s through the ERF or the LRET, taking into account changing price dynamics (as shown in Figure 25: ACCU and LGC price convergence).

New South Wales has continued to dominate project registration and ACCU supply in 2020, with one third of the projects registered and 67 per cent of ACCUs issued in Quarter 1 attributed to this state.

A snapshot of the ERF project portfolio across Australia for Quarter 1 2020 is shown in Figure 5.

Figure 5: Total number of ACCUs issued per method type by location, Q1 2020 and scheme to-date



1.4. Factors impacting demand

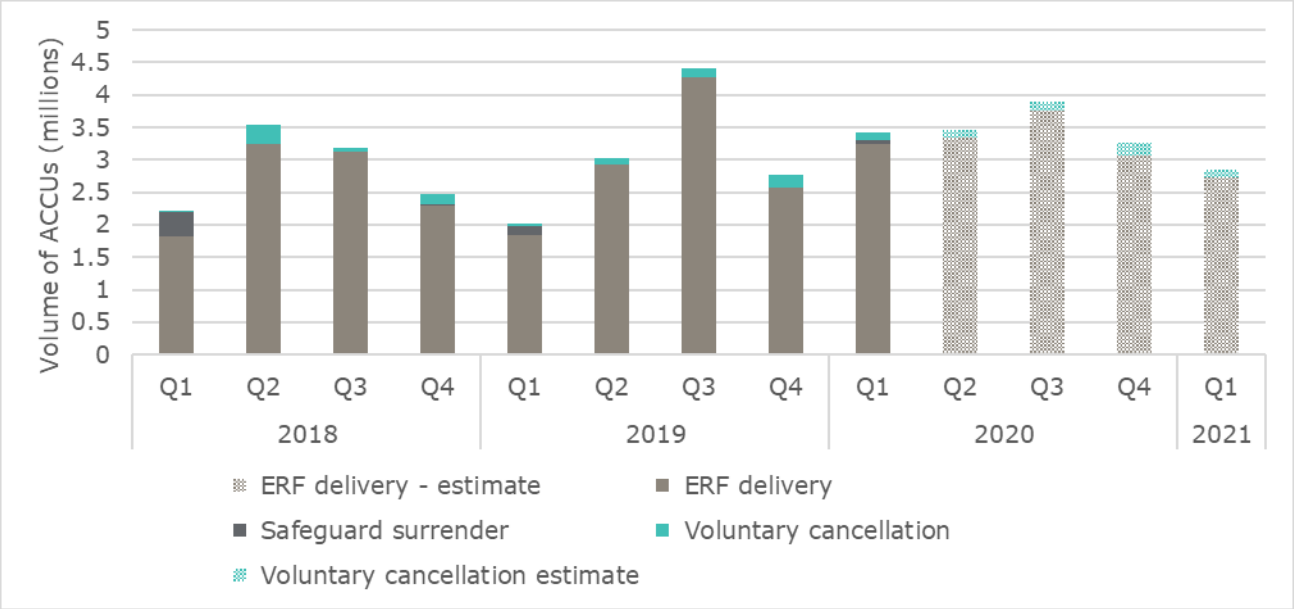
Total demand of 3.4 million ACCUs in Quarter 1 2020 was 1.4 million higher than the same quarter in 2019 (2.0 million ACCUs; see Figure 6). ERF delivery was the largest contributor with nearly 95 per cent of demand, with voluntary and safeguard demand making up three and two per cent of total demand respectively.

In Quarter 1 2020, 3.2 million ACCUs were delivered under contract to the Commonwealth, up 77 per cent from the Quarter 1 2019 volume of 1.8 million ACCUs. This was primarily driven by early deliveries against Commonwealth contracts.[16]

Commonwealth contract holders can make early deliveries against their contracts including, with the consent of the agency, against milestones due in future financial years. Making deliveries early facilitates additional near-term cash-flow.

Demand from the Australian Government, the primary purchaser of ACCUs, is estimated to be 3.5 million in Quarter 2 and 3.7 million in Quarter 3 2020 providing cash flow to businesses over this period.

Figure 6: Actual and estimated demand for ACCUs, Q1 2018 to Q1 2021



Demand from state and territory governments may continue to grow with the Queensland Government closing its second round of funding under the Land Restoration Fund on 29 April 2020.

Following a period of consultation, the Western Australia Environment Protection Authority (EPA) has published its final Environmental Factor Guideline. This guideline explains how Greenhouse Gas Emissions are considered in the environmental impact assessment process. Additionally, it provides a framework for managing emissions, including surrendering ACCUs, which the EPA recognises as a clear, enforceable and accountable method for managing excess emissions.

[16] Of the 3.2 million delivered in Quarter 1 2020, 2.5 million was delivered against a milestone that was set beyond this quarter. Variations to the delivery schedule can be negotiated with the Clean Energy Regulator in accordance with the Contract Code of Common Terms.

Updated posture on regulatory additionality

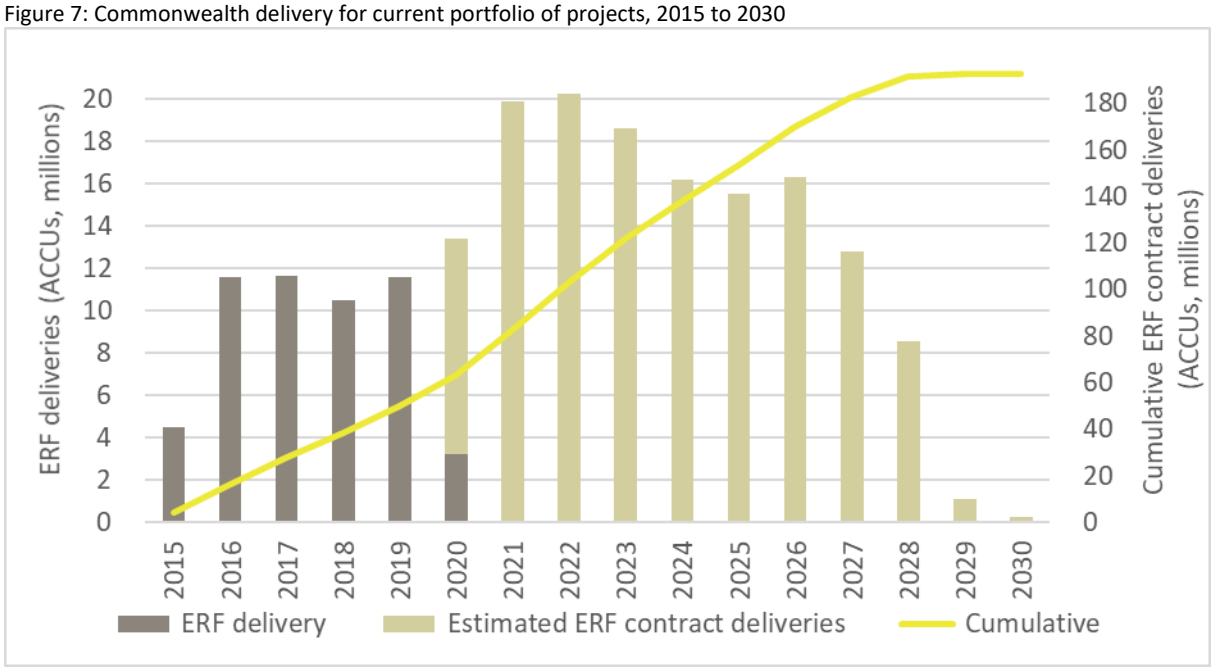
Some states and territories have expressed a desire for companies to meet their regulatory requirements to reduce emissions by undertaking ERF projects as the ERF provides a robust and established mechanism for carbon accounting and emissions reductions.

In keeping with developments in the carbon market and to facilitate the broader use of the ERF, the Clean Energy Regulator is proposing an updated approach to interpreting the regulatory additionality requirement under the Carbon Farming Initiative Act. The proposed approach offers an avenue through which ACCUs can effectively be taken out of circulation to allow project proponents to demonstrate their project is additional, including some particular circumstances where a legislative requirement exists to reduce or offset emissions. Consultation on this approach has commenced, with the submissions window closing on 5 June, further submissions received after this date may be considered at the Clean Energy Regulator's discretion.

Commonwealth demand

Contract delivery is estimated to be a record 13.4 million for 2020 before increasing by a further 49 per cent to reach 20 million in 2021 and 2022 (see Figure 7).

Figure 7: Commonwealth delivery for current portfolio of projects, 2015 to 2030



Emissions Reduction Fund auctions

The Clean Energy Regulator held the tenth ERF auction on 25–26 March 2020, contracting to purchase 1.7 million tonnes of carbon abatement. A total of 12 contracts were awarded for 11 projects at an average price of $16.14 per tonne, for a total commitment of $27.6 million.

Aside from 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 tenth ERF auction offered an 'optional delivery' contract on a pilot basis.

There was strong interest in the new optional delivery contract from the market, with 1.4 million ACCUs (83 per cent) optioned through 8 contracts.

By design, this new contract has the potential to incentivise projects that are in early stages of commercialisation. It does this by providing sellers the security of a Commonwealth contract price while also providing the flexibility to choose to deliver abatement to the Commonwealth at the contracted price, or to sell some or all ACCUs elsewhere if it is profitable to do so.

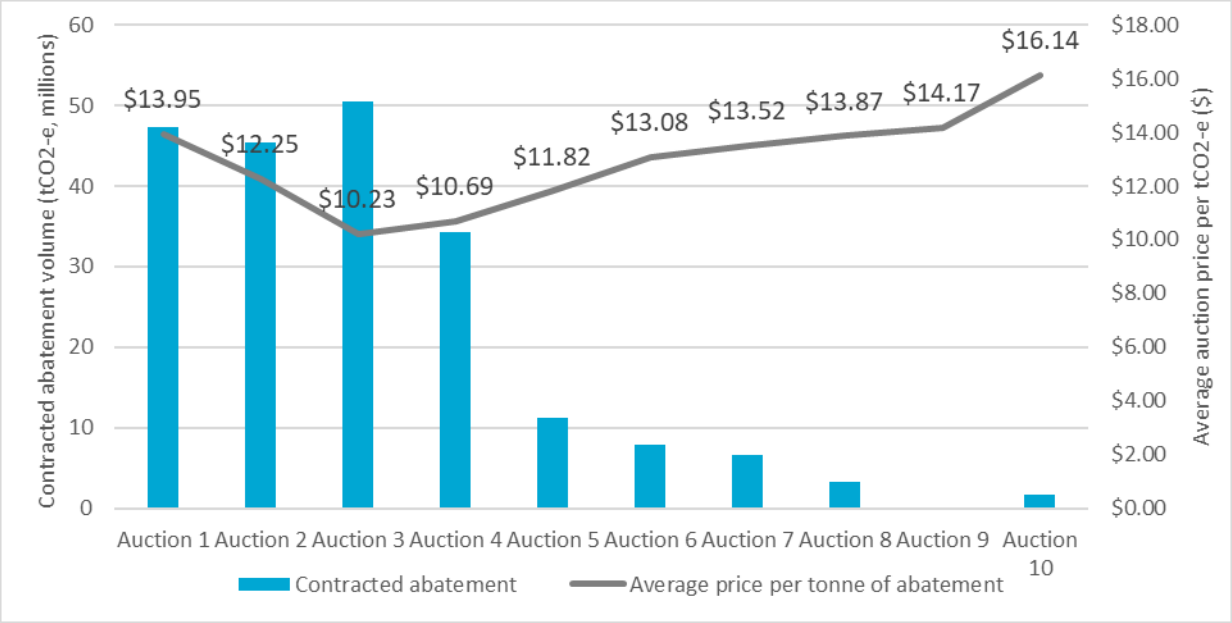
One example of how project developers are using the new optional delivery contract is a soil carbon project which secured both an optional and a fixed contract at the auction. This demonstrates a contracting model project developers may use to secure cash flow from their more certain forward supply through the fixed delivery contract, with the optional delivery contract used to sell abatement not contracted through the fixed contract to manage delivery risks or possibly sell to third parties at higher prices.

There are also signs of added diversity within the vegetation method type at the tenth auction with four projects under the plantation forestry method securing a contract. The remaining contracts were secured by three human induced regeneration projects, one landfill gas project, one avoided deforestation project, and one IEFE project.

The average price paid at the auction of $16.14 per tonne is an increase of $1.97 from the previous auction, as shown in Figure 8. The average price per tonne of abatement for the fixed delivery contract was $16.32 and that for optional delivery contract was $16.11.

Projects that were unsuccessful in obtaining a Government contract are still credited with ACCUs for the abatement they realise and can compete in a future auction.

Figure 8: ERF auction results



The tenth auction result means the ERF has committed to purchase 193 million tonnes of abatement through 463 contracts, with the total value of all contracts awarded reaching $2.3 billion.

The next auction will be held in September 2020. The Clean Energy Regulator will assess the results of the tenth ERF auction and consult with the market about the optional delivery contract pilot to make decisions about any possible changes to the new contract option. Any changes will be communicated to the market well in advance of the next auction.

Safeguard Mechanism Surrender

A total of 58,731 ACCUs were surrendered for the 2018-19 compliance year.[17] This was lower than previous years, in part due to an additional 14 safeguard entities using multi-year monitoring periods (MYMPs), bringing the total number of safeguard facilities under an ongoing MYMP arrangement to 22.[18]

If a facility exceeds its baseline in a financial year, a MYMP can be used to extend the monitoring period up to three years. This gives safeguard entities time to either reduce actual emissions from the facility, or acquire and surrender sufficient ACCUs to get the facility's net emissions to its baseline.

In March 2020, the first tranche of Government-determined prescribed 'production variables' and associated default emissions-intensity values for calculating baselines were made. The Department of Industry, Science, Energy and Resources will continue to work with the industry to set the remaining production variables.

In May 2020, in response to the COVID-19 pandemic, further amendments to the Safeguard Mechanism were made, extending the transition to the mandatory use of default values by a year.

As safeguard entities transition to the new baseline setting framework, the level of ACCU demand from the mechanism will become clearer.

A list of all safeguard entities under different emission management options is provided on the safeguard baselines table.

Voluntary Surrender

Voluntary cancellations totaled over 0.11 million in Quarter 1, almost three times the volume cancelled in Quarter 1 2019. Over half of these cancellations are attributable to the Climate Active Carbon Neutral program.

Voluntary demand is expected to be affected in the short to medium term as businesses work through significant challenges from reduced activities and financial pressures due to COVID-19. More information on the voluntary carbon market is available in Chapter 5 of this report.

Market trading

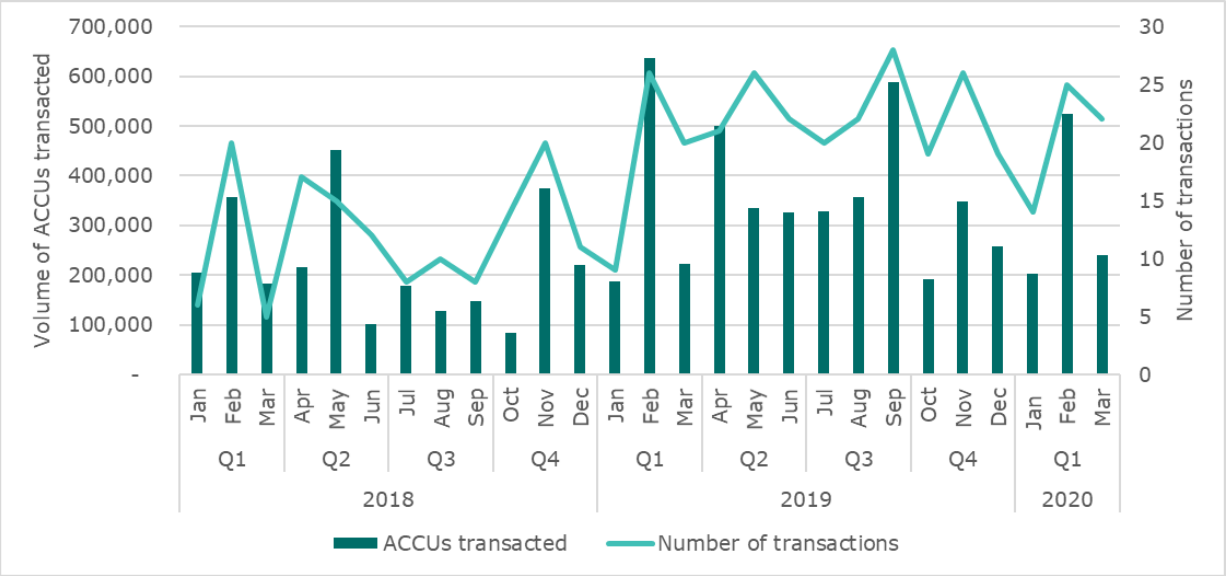
Over Quarter 1 2020, nearly a million ACCUs were transferred through 61 transactions with an average parcel size of 15,400 ACCUs (see Figure 9).

Quarter 1 transactions hold a consistent pattern year on year with the number and volume traded peaking in February driven by safeguard demand before falling again in March.

[17] 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. Including deemed surrenders, total ACCU surrender for 2018-19 compliance year is 190,381 and that for 2017-18 compliance year is 261,328.

[18] For further information see the Clean Energy Regulator's webpage on the MYMP table.

Figure 9: ACCU market transactions (excluding ERF transactions), Q1 2018 to Q1 2020



Spot price

The ACCU spot price moderated from a high of $17.25 at the end of last quarter to $16.40 at the end of Quarter 1 2020 (see Figure 10).

The spot price held early in the quarter as safeguard entities entered the market in low volumes before declining in the absence of strong demand from voluntary market participants.

Voluntary market participants may be impacted by COVID-19. Discussed in the voluntary markets section, Chapter 5 of this report, participants may move to lower priced units to offset their emissions owing to financial pressures.

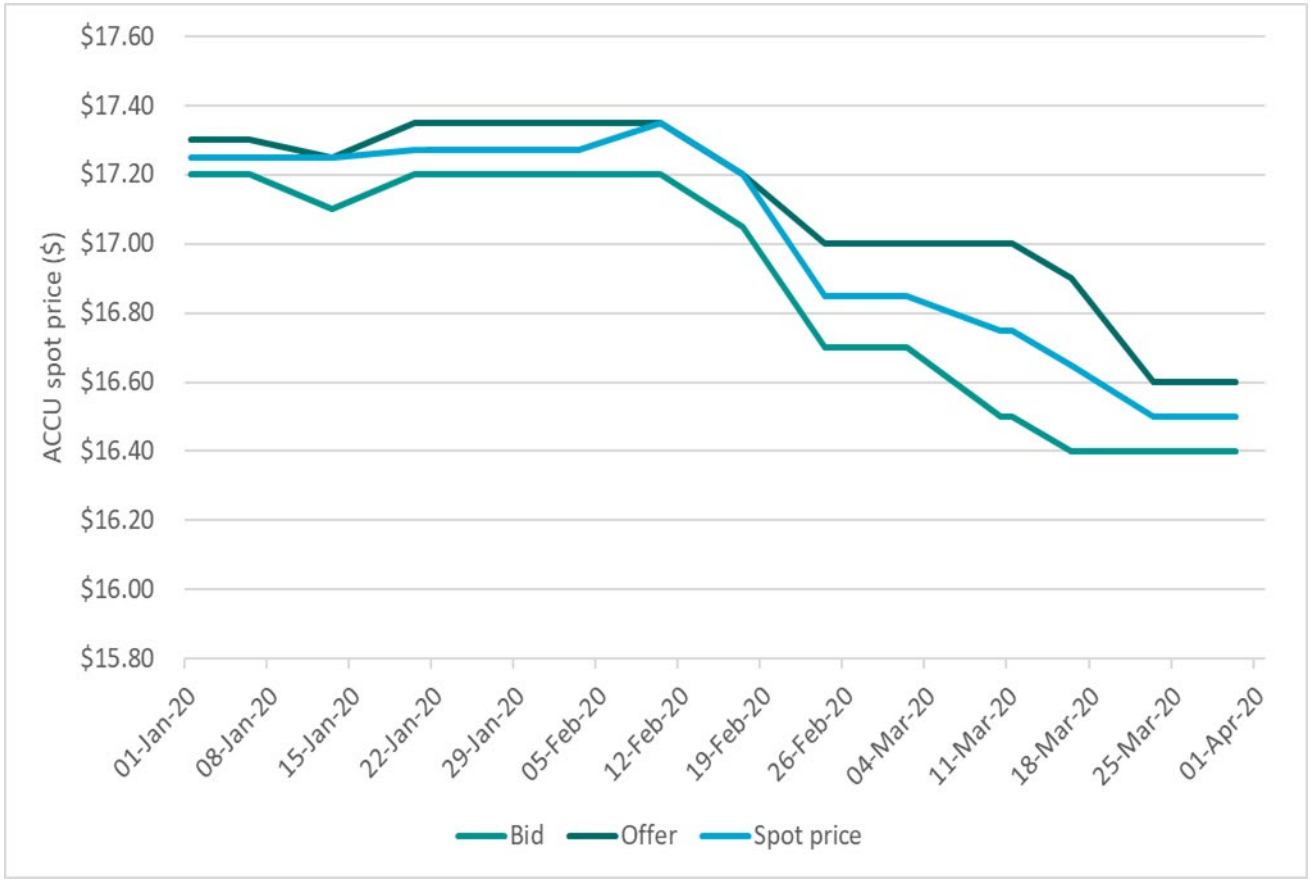
Spot prices appear to be holding up in Quarter 2 with the last three publicly reported trades for immediate delivery occurring at prices of $16.50, $15.95 and $15.90. The Clean Energy Regulator announced that it will continue to monitor developments in the market closely and if the need arises, stands ready to hold an additional purchasing event based on the average price paid at the last auction ($16.14 per tonne of abatement).

Any further decline in price is limited as the ACCU price is underpinned by the Commonwealth as the largest buyer with 95 per cent of market demand. Sellers under fixed Commonwealth contracts may buy ACCUs from the secondary market at prices below their contracts and then deliver those ACCUs to the Commonwealth for a profit. This essentially sets an anchor for ACCU spot price.

Before COVID-19 impacts were priced into the market, a trade of 50,000 ACCUs was agreed with an option to buy in December 2021 for $18.50.[19] Forward prices may assist the market to understand where the price may be heading, however, these trades are very thin and the economic slowdown due to COVID-19 provides additional uncertainty on forward prices.

[19] Data sourced from Jarden.

Figure 10: ACCU spot prices, Q1 2020[20]



[20] Data sourced from Jarden and TFS Green.

1.5. Key dates

Date	Event	Significance
Mid-2020	**Participating in Australia's carbon market to meet corporate climate goals: virtual-conference series**	The seminar series, led by the Carbon Market Institute and Clean Energy Regulator, will be delivered as a series of virtual-conferences. The seminars will provide foundational information about Australia's carbon markets and opportunities for voluntary participation.
September 2020	The eleventh ERF auction	The next ERF auction has been announced for September 2020. Further details, including dates, will be announced soon.
31 October 2020	National Greenhouse and Energy Reporting (NGER) and Safeguard application deadline	Deadline for NGER reporters and Safeguard entities to submit: • 2018-19 NGER data, and • Calculated and production adjusted baseline applications (for baselines commencing 1 July 2019).
2-3 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 Carbon Market Institute's event page.

2. Large-scale generation certificates

- The LGC balance after annual statutory surrender for the 2019 assessment year, on 14 February 2020, was 9.4 million certificates. This was in line with the expectation that material shortfall would be taken.
- The total shortfall taken was double the previous 2018 assessment year at 7.7 million LGCs.
- 678 MW of new capacity was accredited (first generation) and 837 MW of new capacity committed (final investment decision) in Quarter 1– this new capacity is consistent with investment continuing at a substantial level.
- The Renewable Power Percentage (RPP) was set in March 2020 at 19.31 per cent for the 2020 assessment year. This means approximately 33.7 million LGCs are expected to be surrendered on 14 February 2021.
- LGC spot prices decreased 20 per cent to $31 at the end of Quarter 1 2020.

2.1. Surrender for 2019 assessment year

Total LGC liability for the 2019 assessment year was 33.3 million certificates, with 7.7 million LGCs taken as shortfall. After surrender the LGC balance was 9.4 million LGCs.

Liability for the 2019 assessment year was 2.1 million LGCs above the expected level of 31.2 million LGCs. This was due to higher liable electricity demand (up two per cent) and lower Emissions-intensive trade-exposed exemption (down three per cent) from when the RPP was set in March 2019. Carry forward shortfall from the 2018 assessment year also contributed to the higher liability by 0.5 million certificates.

The balance after surrender was assisted by liable entities using the shortfall options allowed under the legislation. Of the 7.7 million LGCs taken as shortfall, 1.3 million LGCs were less than 10 per cent of an entities total liability and will be carried forward to next year's liability. The remaining 6.3 million LGCs were over 10 per cent of an entity's liability and incurred a shortfall charge which can be redeemed by surrendering LGCs within three years.

2.2. 2020 supply and demand balance

An estimated 40.8 million LGCs are expected to be available for the 2020 assessment year. This includes 6.8 million LGCs carried over from previous years and 34 to 36 million LGCs expected to be validated in 2020. This is the first time since 2011, when the scheme was split into the LRET and Small-scale Renewable Energy Scheme (SRES), that supply of LGCs will exceed statutory demand in the year. The RPP has been set at 19.31 per cent, and legislated demand is expected to be approximately 33.7 million LGCs. Liable entities eligible for shortfall refunds may increase demand by 770,000 LGCs. Table 3 shows the LGC balance if no shortfall is taken for the 2020 assessment year with a lower bound estimate of 34 million LGCs.

Shortfall enables liable entities to time shift demand and arbitrage between current prices and lower forward prices. The use of shortfall depends on commercial decisions by large entities. The Clean Energy Regulator expects that shortfall options will be exercised by some liable entities in 2020.

Table 3: LGC supply and demand balance

	Supply	Demand
LGC balance 14 February 2020[21]	+6.8 million	
Expected LGC supply (available for 2020 surrender)	+34.0 million	
Legislated demand		-33.7 million
ACT Government scheme[22]		-2.5 million
GreenPower		-0.5 million
Shortfall charge refunds[23]		-0.7 million
Total balance		**+3.4 million**

2.3. Factors impacting supply

LGC supply

At the end of Quarter 1 2020 there were 12.3 million LGCs registered in the REC Registry.

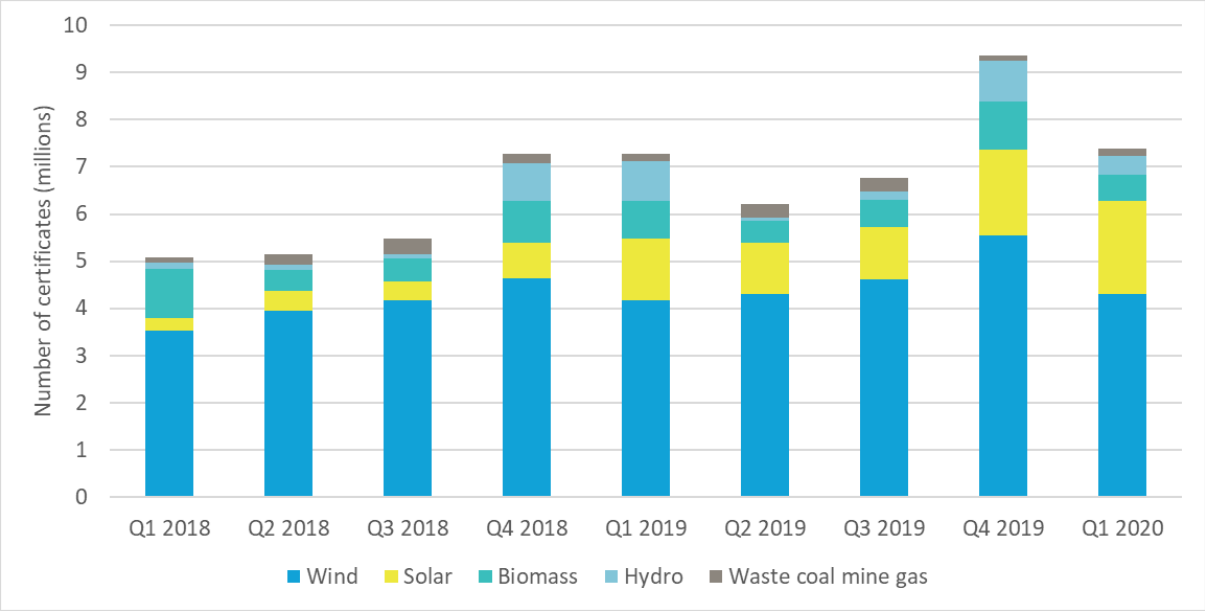
In Quarter 1 2020, 7.4 million LGCs were validated (see Figure 11), a similar level to Quarter 1 2019. This was lower than expected due to a pull forward in certificate validations in Quarter 4 2019, as entities sought to increase the number of LGCs with a 2019 creation vintage in time for surrender.

In Quarter 1, across the National Electricity Market, renewable energy increased by 25 per cent compared with Quarter 1 2019. This increase in generation is expected to continue in the Quarter 2 LGC supply figures.[24]

AEMO released updated final Marginal Loss Factors (MLFs) for 2020-21 in April 2020. These changes revised MLFs down in some regions and up in others. Overall, there was no material impact to total LGC supply compared to previous draft MLFs used to estimate supply in 2020.

[21] 9.4 million LGCs were registered as at 14 February 2020, with 2.6 million 2020 vintage LGCs validated, which is included in the 34 million expected LGC supply.
[22] This is the expected accumulation of LGCs (by end 2020) held by the ACT Government that is not expected to be available for surrender.
[23] 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 there remain an incentive to take further paid shortfall for the 2019 assessment year.
[24] For more information see AEMO's Quarterly Energy Dynamics report for Quarter 1 2020

Figure 11: LGCs by technology type, Q1 2018 to Q1 2020



Accreditation

In Quarter 1 2020, 72 new power stations were accredited totalling over 678 MW of capacity (see Figure 12). At the end of Quarter 1 2020 there was 1.8 GW of capacity under application for accreditation with the Clean Energy Regulator. The Clean Energy Regulator expects to accredit 3.4 GW of capacity in 2020. This is similar to the high levels in 2019.

Three large wind farms in Victoria and Tasmania accounted for a significant proportion of accredited capacity in Quarter 1 2020 (see Figure 13). Combined, these wind farms are expected to generate over 1.5 terawatt hours (TWh) per annum at full generation.

Figure 12: Power station accreditation across the states in Q1 2020

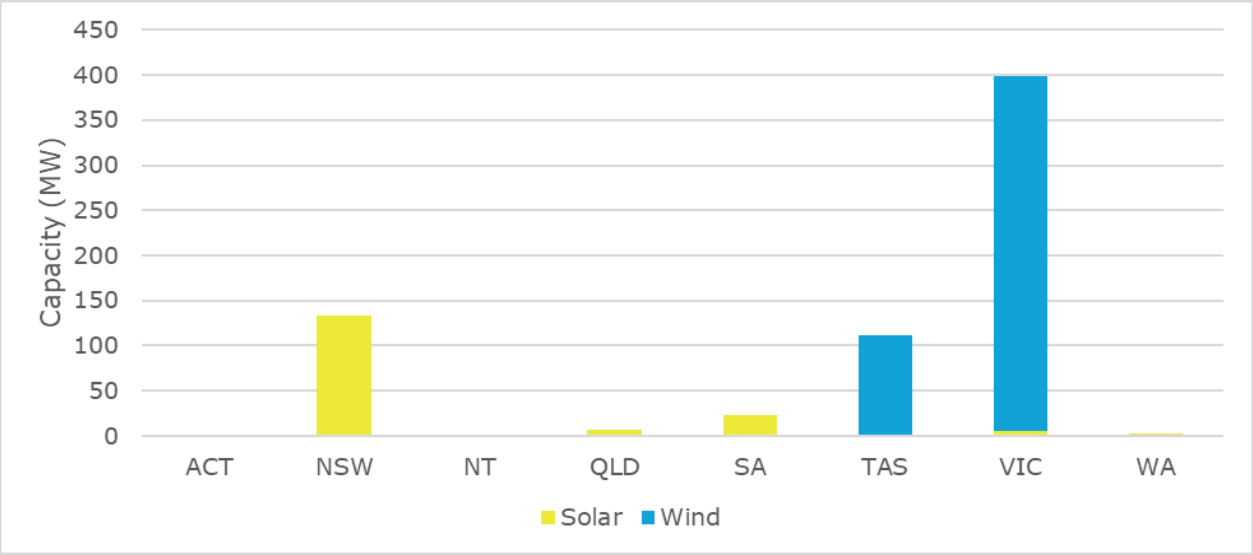
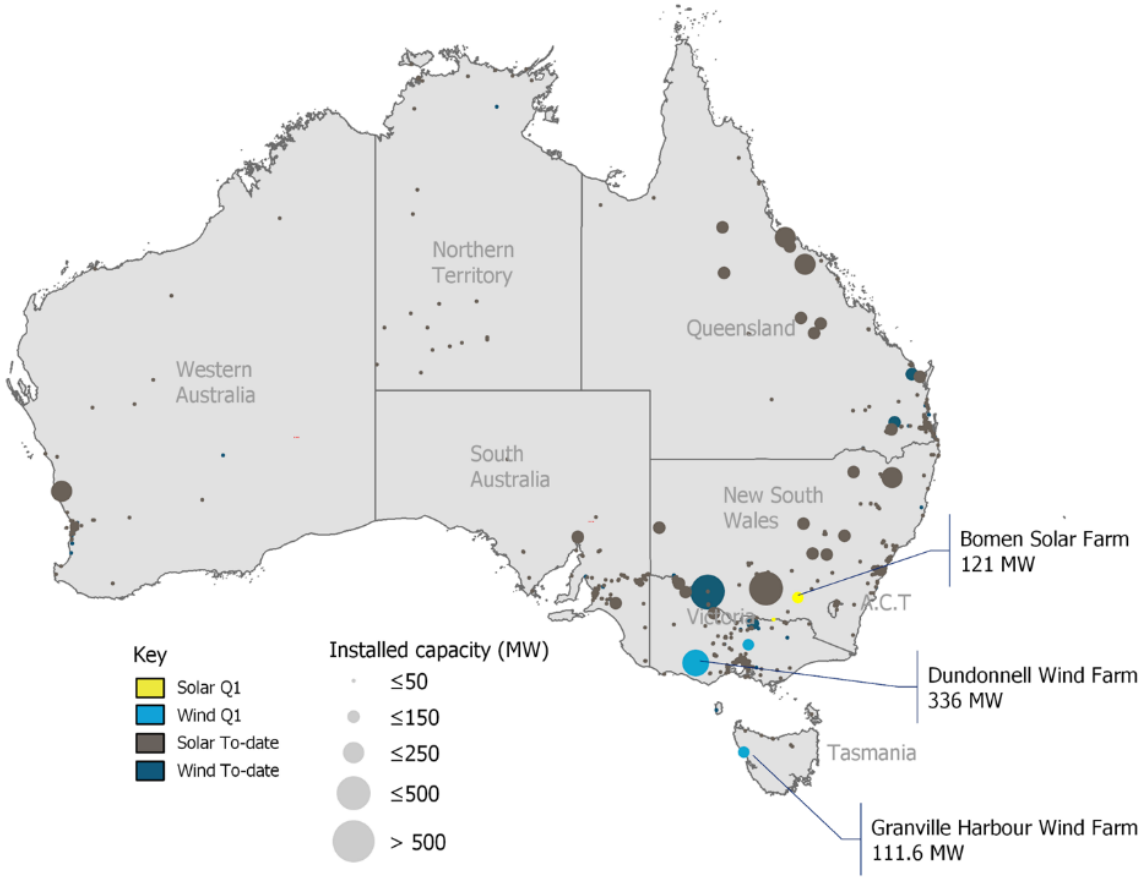


Figure 13: Wind and solar power stations accredited capacity by location, Q1 2020 and scheme to-date



Committed projects

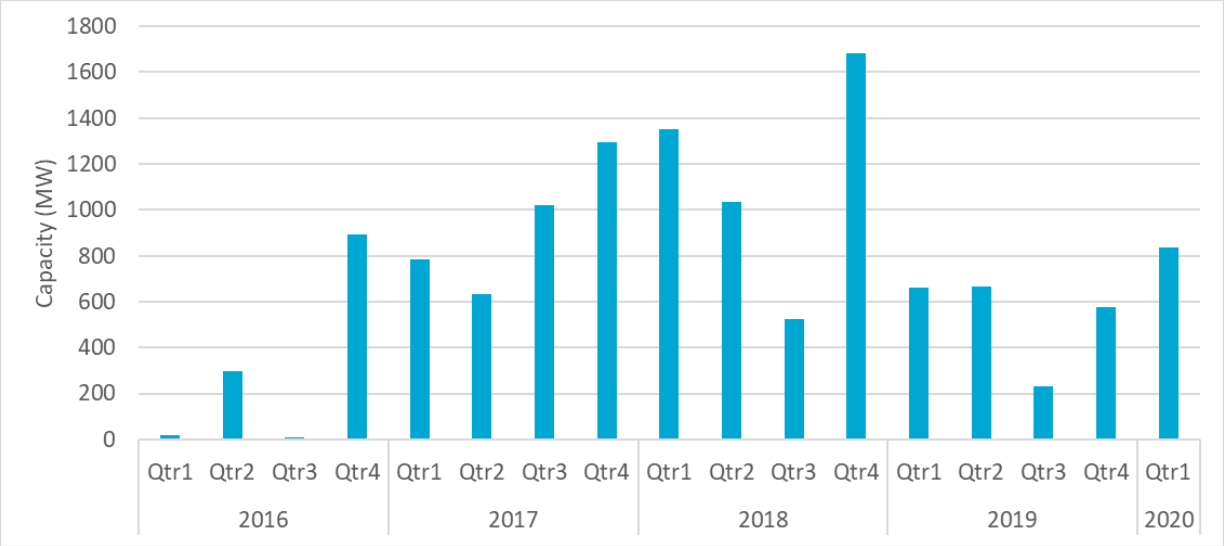
Quarter 1 2020 saw the highest level of committed projects announced since Quarter 4 2018 with 837 MW committed (see Figure 14).[25] This included a large increase in projects associated with off grid and resources regions, discussed in Chapter 7.

There was also a substantial increase of 640 MW to the Clean Energy Regulator's probable list of projects, for projects that that have either reached partial financing or have signed a PPA with development approvals, but yet to make a final investment decision. There is 1.9 GW of capacity on this list, including the first stage of the 1 GW MacIntyre wind farm (stage 1 540 MW) in south-east Queensland.

The Quarter 1 results mean that Australia remains on track for between two to three GW of newly announced committed projects in 2020– so investment is continuing at a substantial level.

[25] Committed projects refer to large-scale energy projects that have received all development approvals and reach financial close according to the commercial understanding of the term. Beyond this committed pipeline, market intelligence suggests possible projects with development approval or in planning stages are estimated to be 50 GW.

Figure 14: Capacity committed per quarter, Q1 2016 to Q1 2020[26]



2.4. Factors impacting investment

Good progress was made in early 2020 on the grid and interconnector work to unlock a new wave of renewables investment. Key developments included:

- AEMO announced system constraints would be lifted on five solar power stations in the Victoria and New South Wales' West Murray zone on 24 April 2020.[27] This announcement allows around 1300 MW of projects to now connect in this region progressively over the next 6 months.
- The AER approved new and upgraded interconnectors investments between New South Wales and South Australia, and Queensland and New South Wales.
- New South Wales announced the planned development of its first renewable energy zone in the Central West. This zone intends to unlock up to 3,000 MW of new generation by the mid-2020's.[28]

The release of AEMO's 2020 ISP in mid-2020 will provide further clarity on the development of Australia's electricity grid. See Chapter 4 for an examination of the risks of underestimating renewable investment.

Potential impact of COVID-19

The economic slowdown created by COVID-19 may impact on the rate of announced new projects reaching financial close in the short to mid-term. It is possible that a slowdown may affect decisions to proceed with investments and willingness of investors and financiers to proceed with new projects. However, such an effect has yet to emerge in new project announcements.

[26] Committed projects in Quarter 4 2019 has been revised down by 200 MW, as one project was moved to Quarter 1 2020 and two projects were back dated to Quarter 4 2019.
[27] AEMO is still clarifying where the boundaries are for West Murray zone.
[28] For more information see the New South Wales Government's webpage on Renewable Energy Zones

2.5. Legislated and other demand

On 10 March 2020, the Clean Energy Regulator announced the 2020 RPP at 19.31 per cent. Liable entities will be required to surrender approximately 33.7 million LGCs to meet their Large-scale Renewable Energy Target obligations for 2020.

In addition to the legislative target there is an additional 2 million certificates from last years carried forward shortfall (1.3 million) and previous shortfall charges (0.77 million).The value of certificates from the shortfall charge in consolidated revenue is $725 million, with $50 million eligible to be refunded to liable entities this year.

Voluntary Demand

There is continued demand for LGCs from GreenPower, states and territories, desalination and corporates in Quarter 1 with a total of 324,766 LGCs voluntarily surrendered.

Market trading

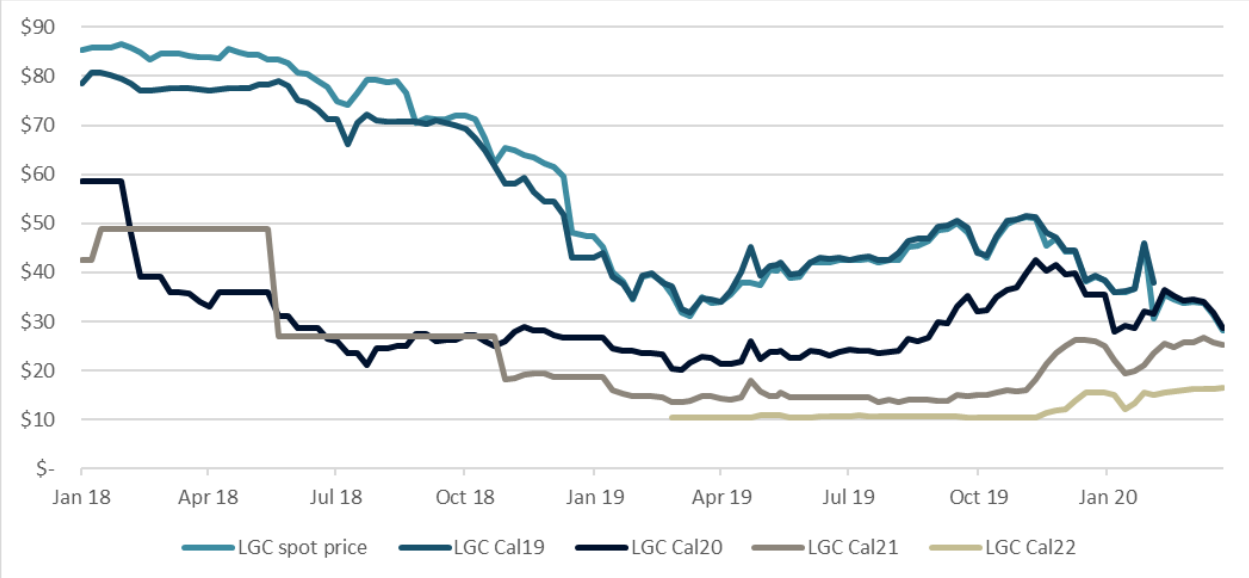
Over most of the first quarter of 2020 the LGC spot price sat below $40, before peaking at the end of January at $46 and then dropping to $28.20, its lowest value since mid-2014 (see Figure 15).

The peak in the LGC spot price was due to high demand as the surrender deadline approached, and only traded at this price for a short time.

After surrender there is an additional requirement for entities participating in the GreenPower scheme to have their estimated LGCs available in their GreenPower account by 31 March. This explains the late drop in LGC spot price close to the GreenPower milestone, as most entities would have sourced their LGCs before 31 March.

The most recent forward contracted LGCs show LGC prices are expected to reduce, from $28.60 for LGCs created in 2020, to $9.60 for LGCs created in 2023.

Figure 15: LGC spot and forward prices, Q1 2018 to Q1 2020[29]



[29] Sourced from TFS Green.

2.6. Key dates

Date	Event	Significance
14 February 2020	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 2020	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.
Mid - 2020	**Participating in Australia's carbon markets to meet corporate climate goals: National Seminar Series & Webinar 2020**	The 2020 webinar and seminar series, led by the Carbon Market Institute and the Clean Energy Regulator, will be held in Melbourne, Sydney, Brisbane, Perth, and Adelaide. The series will provide foundational information about Australia's carbon markets and focus on opportunities for voluntary participation in these markets.

3. Small-scale technology certificates

- Total installed small-scale solar PV capacity for the quarter was 609 MW, an increase of 33 per cent compared to Quarter 1 2019.
    - Average small-scale solar PV system size and installations increased by 9 and 22 per cent respectively on Quarter 1 2019 to 7.6 kilowatts (kW) and 75,000.
- 2020 capacity from small-scale solar was tracking towards circa 2.7 GW for the year after Quarter 1. A watch point will be any moderation in added capacity owing to impacts from COVID-19.
- The STC balance after Quarter 4 statutory surrender for the 2019 assessment year, on 14 February 2020, was nine million certificates.
- The 2020 STP was set at 24.4 per cent, around 42.6 million STCs, the Quarter 1 2020 surrender requirement due on 28 April 2020 was 14.9 million STCs. There was a balance of 3.6 million STCs following surrender.
- The STC spot price increased from $37.40 at the end of Quarter 4 2019 to $39.50 at the end of Quarter 1 2020, despite strong STC creation rates of an average 3.2 million STCs per month.

3.1. Surrender for 2019 assessment year

Total STC demand for the 2019 assessment year was 38.2 million certificates, with 6.4 million STCs being required to meet Quarter 4 surrender obligations. The STC balance after the Quarter 4 surrender obligation was met was 9.5 million STCs.

A surplus of 3.6 million STCs was available in the market post surrender for Quarter 1 2020 on 28 April 2020.

The 2020 STP of 24.40 per cent was announced on 10 March 2020. Liable entities will be required to surrender approximately 42.6 million STCs to meet 2020 surrender obligations. The average weekly STC creations at the end of Quarter 1 2020 were 790,000, which is 10 per cent higher than the rate required by the STP (see Figure 19).

3.2. 2020 Supply and demand balance

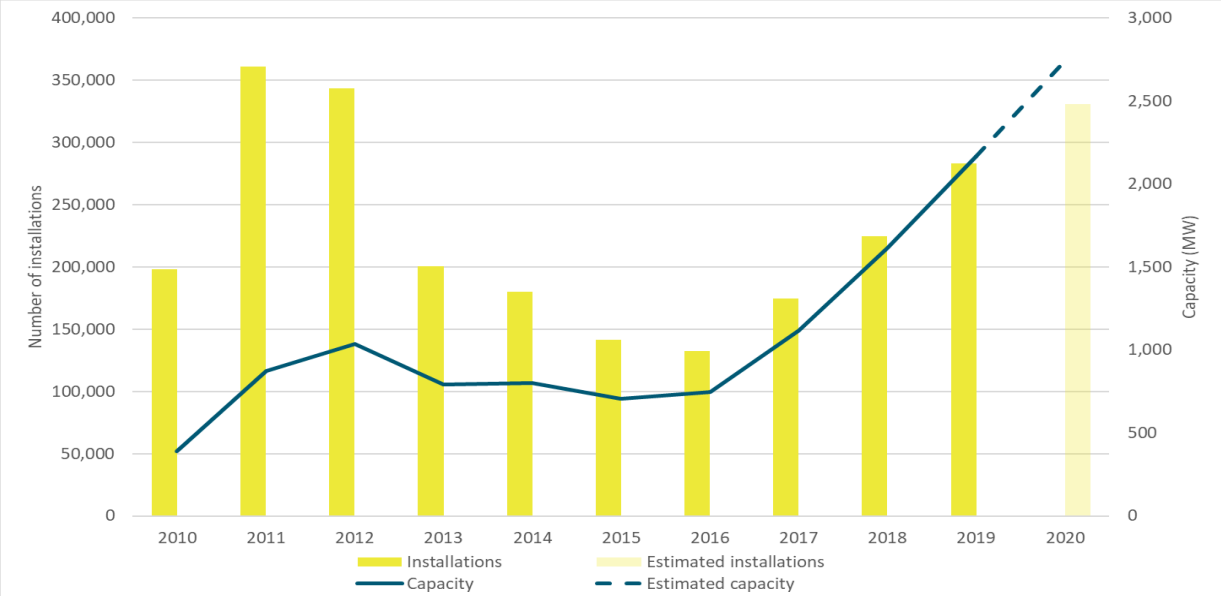
At the end of Quarter 1 2020, over 15 million STCs were registered in the market, of which 310,000 were pending clearing house sale. Approximately 14.9 million STCs (35 per cent) were required to be surrendered for Quarter 1 2020 on 28 April 2020.

An increase in installs compared to Quarter 1 2019 contributed to the higher Quarter 1 2020 STC creation rates. Although the supply outlook from Quarter 1 2020 is positive, economic pressure from COVID-19 may impact the supply and demand for STCs throughout 2020. The impact of COVID-19 is explored in more detail below.

Total estimated installed small-scale solar PV capacity for the quarter was 609 MW, an increase of 33 per cent compared to Quarter 1 2019.[30] Installed capacity would be expected to grow to 2.7 GW by the end of 2020 if current trends continued (see Figure 16).[31] However, most in the industry are expecting some moderation and the watch point is whether 2020 can still exceed the 2.2 GW record set in 2019.

In total, 10.6 GW of capacity has been installed under the SRES since its inception, with 99.9 per cent of capacity coming from small-scale solar PV and the remaining from small-scale wind and hydro.[32]

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



[30] It is worth noting that Quarter 1 2020 installs and capacity declined from their levels in Quarter 4 2019, this is discussed in more detail in section 3.3 Factors impacting supply below.

[31] For more information on capacity and installation trends by state (including postcode data), see postcode data for small-scale installations on the Clean Energy Regulator website.

[32] For this reason, capacity in this section relates only to small-scale solar PV.

Potential impact of COVID-19 on the SRES

The supply side of the market for STCs may be sensitive to the impact of COVID-19, as small-scale solar PV is mainly a consumer product. The SRES is therefore more susceptible to influences in the broader economy such as consumer sentiment and factors that may affect system pricing.

COVID-19 Market sensitivity analysis

Hypothetically, a reduction of 10 per cent from current installation levels from May 2020 onwards would mean there would still be sufficient STCs to meet the 2020 STP. In the scenario of supply reduction by more than 20 per cent over the same period, there may not be enough certificates available and liable entities would need to access regulator created certificates in the STC clearing house at the clearing house price of $40 or pay the non-tax effective shortfall charge of $65 per certificate. These two scenarios are outlined below in Table 4.

Any supply reductions resulting from COVID-19 may be partially mitigated by demand reductions from companies applying for revised quarterly surrender requirements. The Quarter 1 to Quarter 3 surrender requirements are typically based on the previous year's electricity acquisitions/sales. However, liable entities expecting a fall in their electricity acquisitions/sales may apply to reduce their quarterly surrender requirements. A two and a half per cent reduction in STC demand has been applied to Scenario 2 below.

There is limited data currently available to satisfactorily assess the potential impact of current economic conditions on the small-scale solar market. This is because order books on the supply side have been quite long and overall installations have been strong past the first quarter; also, for liable entities it is too early for most to determine the potential fall in their acquisitions/sales in order to apply to reduce their surrender requirements.

Table 4: STC market sensitivity analysis summary (million STCs)

STC Balance	Forecast (million STCs)	Scenario 1 (million STCs)[a]	Scenario 2 (million STCs)[b]
Q1	3.6	3.6	3.6
Q2	3.0	2.0	1.3
Q3	3.5	1.4	(0.1)
Q4	5.3	2.3	0.4
Total supply	48.1	45.1	42.1
Total demand	42.6	42.6	41.5

Source: Clean Energy Regulator analysis

[a] Scenario 1 is based on a supply reduction of 10 per cent

[b] Scenario 2 is based on a supply reduction of 20 per cent and a demand reduction of two and a half per cent

Installations – Supply of STCs

The economic pressure arising as a result of COVID-19 has had broad effects on the economy although the duration and scale is uncertain. There are likely to be effects on small-scale solar installations but the pattern of consumer demand and possible constraints in component supply chains is somewhat complicated. For consumers, there is reduced total income for many households but, on the other hand, there is anecdotal evidence that those with jobs and working from home are lifting spending on home improvements. At an earlier point in the pandemic there were significant concerns about potential manufacturing or shipping constraints on parts sourced from overseas, particularly as a large majority of components area sourced from China. The Clean Energy Regulator has monitored this point closely and it does not appear that earlier fears have been borne out Installation companies mostly continued business through the COVID-19 period as did the building industry as a whole. At an aggregate level (towards the end of May 2020) there has not yet been significant drop off in STC issuances.

Electricity Use – Demand for STCs

AEMO's Quarter 1 Quarterly Energy Dynamics report indicated that there was no discernible overall reduction in electricity consumption directly attributable to COVID-19 in Quarter 1 2020. However, AEMO has observed some early trends in the pattern of electricity consumption related to COVID-19. Notably, reductions in and a delay of the morning peak demand.

As a result, COVID-19 did not have a material impact on demand for STCs during the Quarter 1 surrender period. However, a small number of liable entities chose to surrender short by 52,000 STCs. They likely face a non-tax effective shortfall charge of $65 per certificate after they report their annual acquisitions by 14 February 2021. The alternative they had was to purchase through the Clearing House at a tax effective $40 per certificate.

A decline in electricity consumption may result in liable entities applying for a reduced STC liability under section 38AF (or 38AG for new liable entities) of the Renewable Energy Act 2000. A small number of entities made such an application for Quarter 1 and may also do so for Quarter 2 and Quarter 3 if electricity demand were to fall.

Market trading and spot prices

The number of clearing house trades over Quarter 1 2020 had was broadly been relatively consistent with previous years in the early parts of the quarter. However, throughout March, the number of STCs traded through the clearing house increased somewhat, with 60,000 STCs being bought and sold. This growth in clearing house use is largely attributable to the high STC spot prices (not being much lower than the $40 Clearing House price) and participants holding certificates to meet future obligations which reduces the liquidity of the market. This may be related to expectations of future supply constraints arising from COVID-19.

3.3. Factors impacting supply

Solar PV and installations

Solar PV capacity and installations are still growing strongly when compared to Quarter 1 2019, leading to increased supply of STCs in the market (see Figure 17).

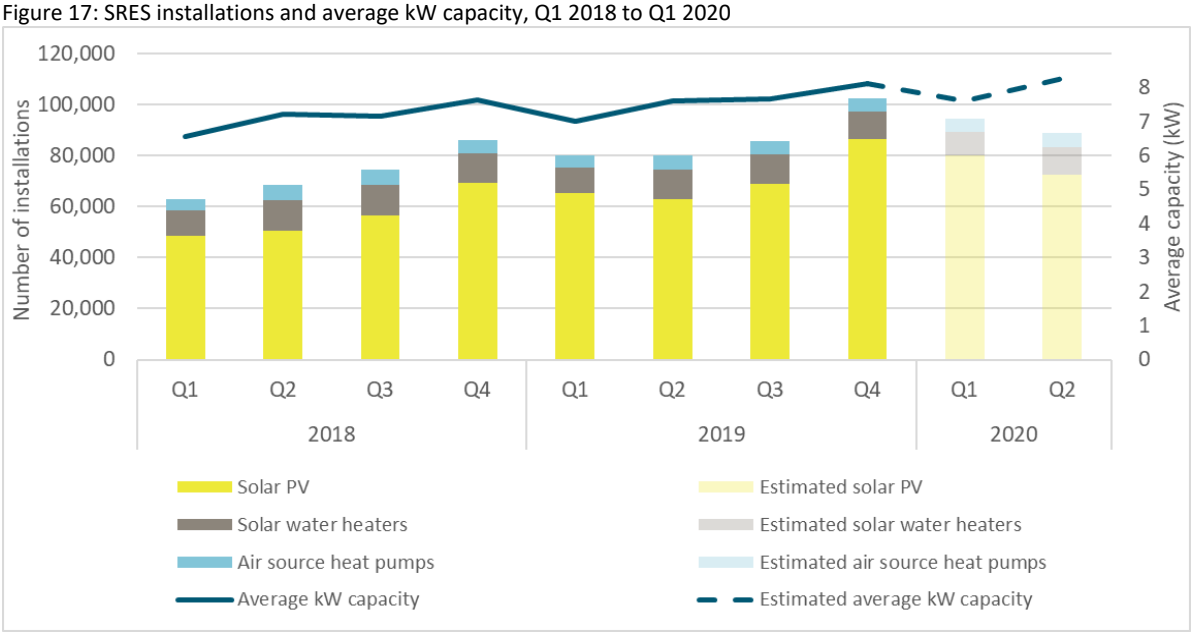
Quarter 1 2020 has seen a significant year on year increase to installations and capacity, up by 22 per cent and 33 per cent respectively. This growth observed throughout Quarter 1 2020 continued to be driven by pre-COVID-19 factors such as consumer sentiment, low interest rates, short payback periods and state-based incentive schemes.

The majority of installations over Quarter 1 2020 were in New South Wales and Queensland. Table 5 outlines estimated capacity installed by state for Quarter 1 2020.

Table 5: Estimated rooftop solar PV (<100 kW) capacity by state, Quarter 1 2020[33]

	Estimated capacity (MW)
ACT	8
NSW	169
NT	6
QLD	166
SA	66
TAS	6
VIC	107
WA	81
Total	609

Figure 17: SRES installations and average kW capacity, Q1 2018 to Q1 2020



[33] State capacities do not sum to total due to rounding. State capacities have been updated from original version of report.

System size

The average small-scale solar PV system sizes are expected to continue to increase in 2020 (see Figure 18). This is being driven by growth in the 5-100 kW capacity systems.

The particularly strong trend in 6.5-7 kW systems, driven by economies of scale and ease of network connection noted in previous QCMRs, has continued in 2020. This band accounted for 45 per cent of new Quarter 1 2020 capacity.

Growth in the 7-15 kW capacity band has continued, with 65 per cent more capacity being installed and validated in Quarter 1 2020 compared to Quarter 1 2019.

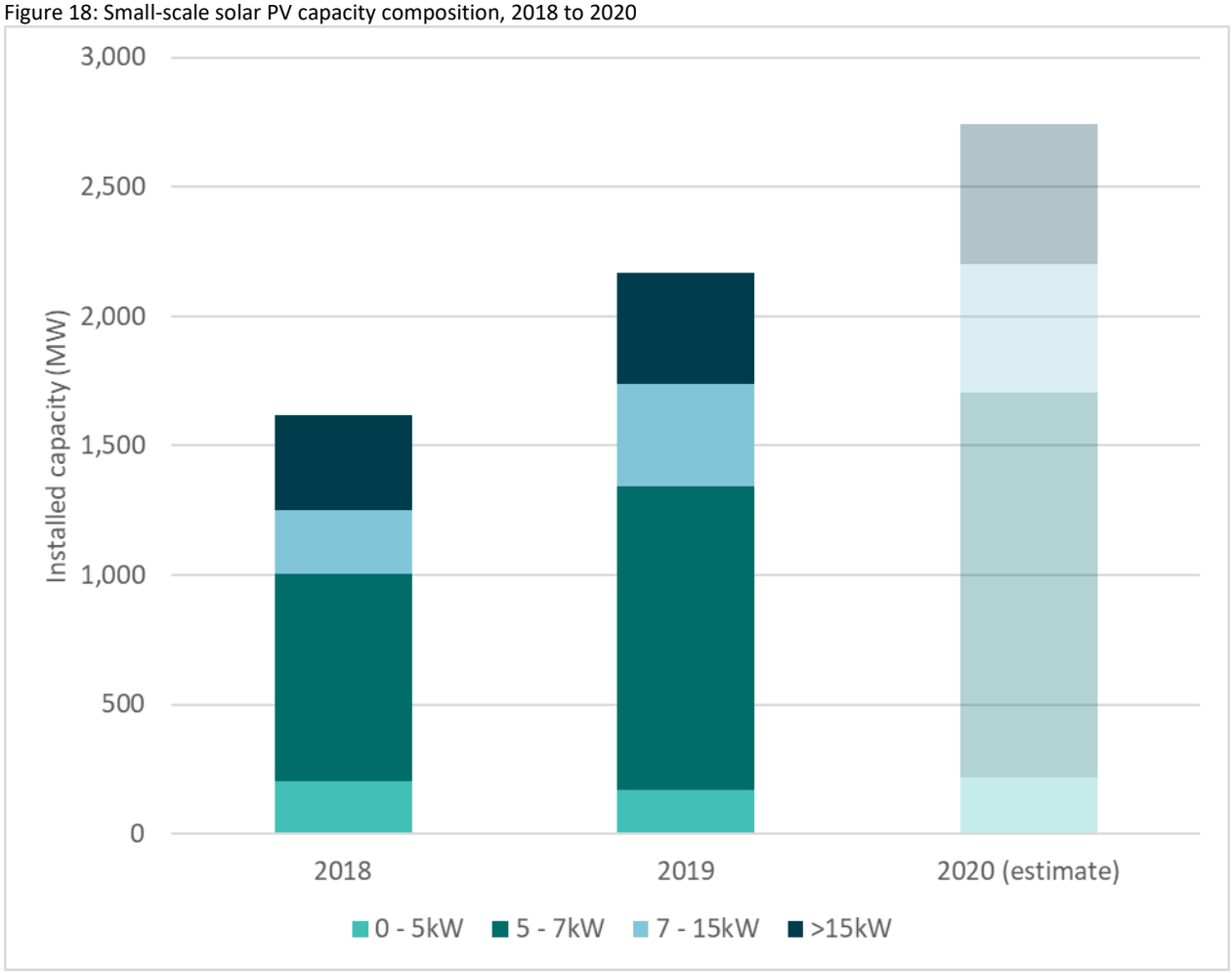
STCs coming to market faster

The Clean Energy Regulator has observed increased creation rates for STCs over Quarter 1 2020, with 3.2 million STCs being created each month on average. These high creation rates are partially driven by a decrease in the average lag time between the installation and validation of STCs. There has been a reduction in the average number of days between installation and REC creation, which over March has been around 24.8 days. This is around 6 days shorter than the average install to creation lag observed over Quarter 1 2019.

There has also been a reduction in the average validation audit processing time, from 7.5 days since the SPV initiative started to 4.9 days in March. A total of 36 per cent of STC claims in Quarter 1 were validated within 24 hours, providing a swifter cash flow to business. This is closely related to the increasing uptake of the SPV method for registering small-scale solar PV systems.

SPV uptake has increased making up 25 per cent of all claims in Quarter 1 up from 10 per cent in Quarter 4, 2019. There are four free SPV apps available representing 18 manufacturers. The Clean Energy Regulator expects the trend in SPV uptake to continue as it is simpler and reduces industry cost.

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



3.4. Factors impacting demand

Quarterly surrender

Liable entities are required to surrender approximately 42.6 million STCs in 2020. The Quarter 1 2020 surrender requirement was approximately 14.9 million STCs (35 per cent). The post-surrender surplus for Quarter 1 was around 3.6 million STCs (see Figure 19).

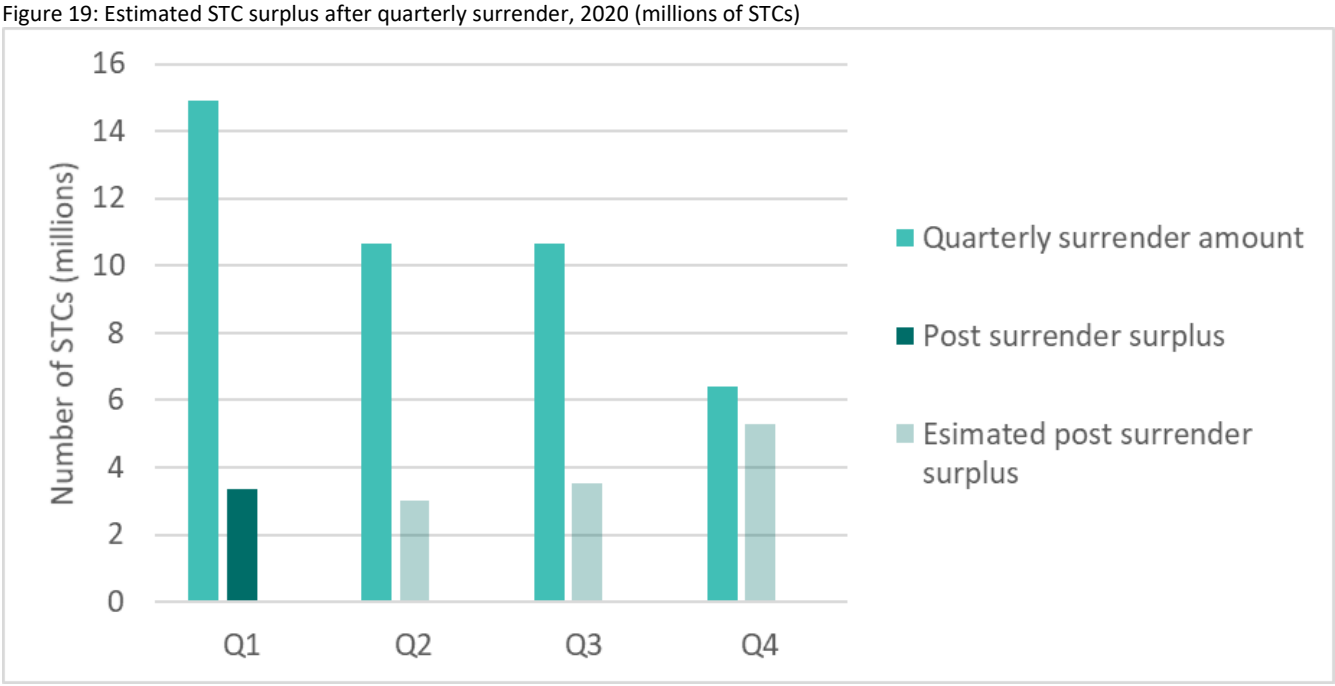
The STC liabilities for Quarters 2 and 3 are 10.6 million STCs (25 per cent), then the final Quarter liability is 6.4 million STCs (15 per cent). However, these quarterly surrender liabilities may be revised if section 38AF applications are approved to reduce relevant electricity acquisitions/sales (discussed in more detail in section 3.2 on the 2020 Supply and demand balance above).

3.5. Market trading

Over Quarter 1 2020, 23.8 million STCs were traded on the open market through 3,000 transactions with an average transaction size of 7,800 STCs (see Figure 20). The average number of STCs per transaction has increased slightly over Quarter 4 2019 numbers. Only 0.4 per cent of the 23.8 million STCs traded occurred through the STC clearing house.

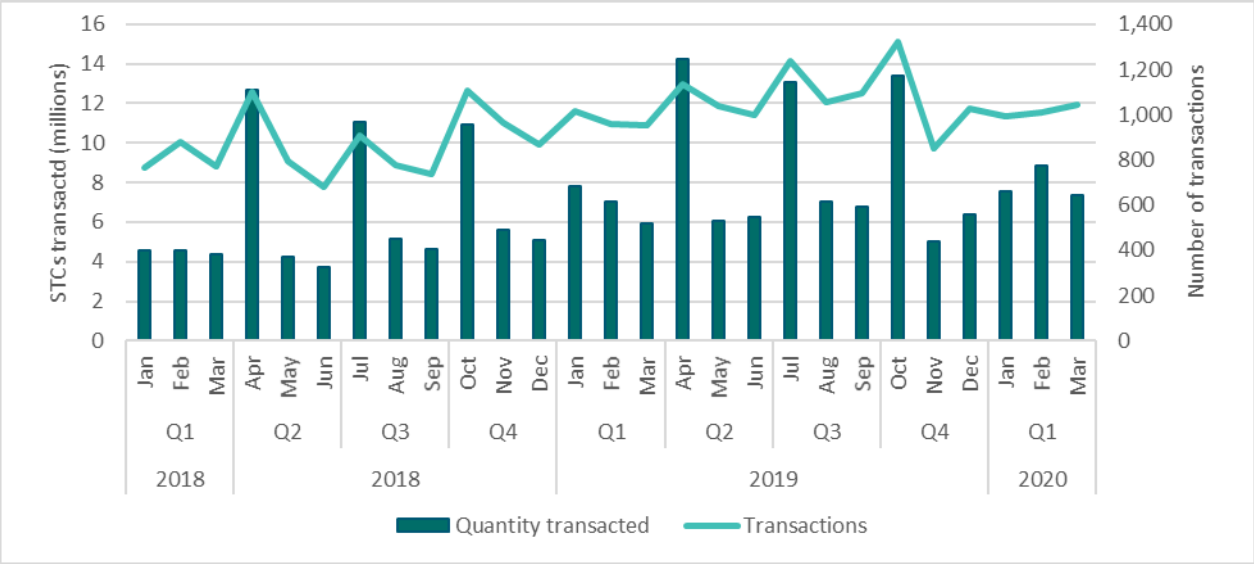
Although the clearing house is being used, the market is still in surplus and based on the Quarter 1 creation rate is expected to remain in surplus throughout 2020. Unless there is a very significant fall in the level of installations as a result of COVID-19.[34]

Figure 19: Estimated STC surplus after quarterly surrender, 2020 (millions of STCs)



[34] For more information see the STC sensitivity analysis in section 3.2 on the 2020 supply and demand balance above.

Figure 20: STC market transactions, Q1 2018 to Q1 2020



3.6. Spot price

Spot prices were relatively steady over January and February, averaging around $37.70. However, the price followed an upward trend over the month of March, growing by $1.45 to a close of $39.50 (see Figure 21). Spot prices are now the closest they have been to the clearing house price since early 2017.

Figure 21: STC spot and clearing house prices, Q1 2018 to Q1 2020

3.7. Key dates

Date	Event	Significance
15 February – 28 April 2020	Quarter 1 surrender period	A liable entity must surrender 35 per cent of liability for the year in the REC Registry for this quarter.
30 March 2020	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 – 28 July 2020	Quarter 2 surrender period	A liable entity must surrender 25 per cent of liability for the year in the REC Registry for this quarter.
15 April 2020	Required surrender amount calculated	The Clean Energy Regulator provides each liable entity with an estimate of required surrender amounts for quarters one to three for the SRES
29 July – 28 October 2020	Quarter 3 surrender period	A liable entity must surrender 25 per cent of liability for the year in the REC Registry for this quarter.
30 September 2020	38AF applications due date	A liable entity intending to submit a 38AF form to reduce their relevant acquisitions must submit on or before this date.
29 October 2020– 14 February 2021	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 2020	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: risks of underestimating renewables investment

Australia continues a rapid transition to renewables with a 25 per cent increase in grid-scale renewable generation in the National Electricity Market (NEM) from Quarter 1 2019 to Quarter 1 2020. This rapid transition to renewables is not without challenges. Variable renewable generation needs to be complemented by flexible capacity such as pumped hydro, battery, gas peaking generation plants, faster ramping of coal plants, demand management and enhanced transmission networks.

In recent years renewables investment has run well ahead of most modelled predictions (see Figure 22). This figure includes for the first time the Clean Energy Regulator's short to medium-term estimates to the end of 2022 including data from the known pipeline of large scale projects and the mid-point estimate for modelling to set the 2020 STP. [35]

For example, the current level of capacity was not predicted to occur in some of these forecasts until into the second half of the decade. This is likely to have led to an under appreciation of the need for transmission investment or other system improvements.

The consequences of delayed transmission investment have become evident in some regions with curtailment and connection delays.

Some analysts predicted that renewables investment would fall markedly after it was clear that the RET would be met and most modelling assumed this. That view proved to be incorrect with around 6 GW of additional capacity beyond the target now under construction or built and still more to come.

The total rooftop solar PV industry has continued to see record-breaking capacity delivered every year since 2016 notwithstanding the progressive phase out of SRES support over the period which will continue to 2030.

Again, no modelling predicted total added rooftop capacity in 2019 would be three times what was added in 2016.

Underestimation of renewables investment may increase the likelihood of further transmission limitation. If transmission grid upgrades are planned assuming a low rate of renewables entering the grid, it is likely the current issues facing the renewables industry will continue for future renewables projects.

The economic impact of late system investment has been seen in several areas of the NEM. Connection delays and constraints on wind and solar generation have emerged in the West Murray region and in north Queensland.[36] Additionally, over recent years South Australian wind farms have been constrained due to system strength requirements, with gas fired generation required to operate at certain levels. Synchronous condensers are now being installed in South Australia to improve system strength without the need for specific generation.

This could be contrasted with the risk of early transmission investment, using the assumption of a higher investment rate of renewables, which may carry a lower consequence given the 50-year life of the investment. Any excess capacity will likely be taken up in the future with greater electrification of sectors such as transport. Some modest economic impact on prices which is not material over the lifetime of the transmission investment compares favorably to significant negative impacts on the renewables market and investors as well as potential security, reliability and price impacts if investment is late.

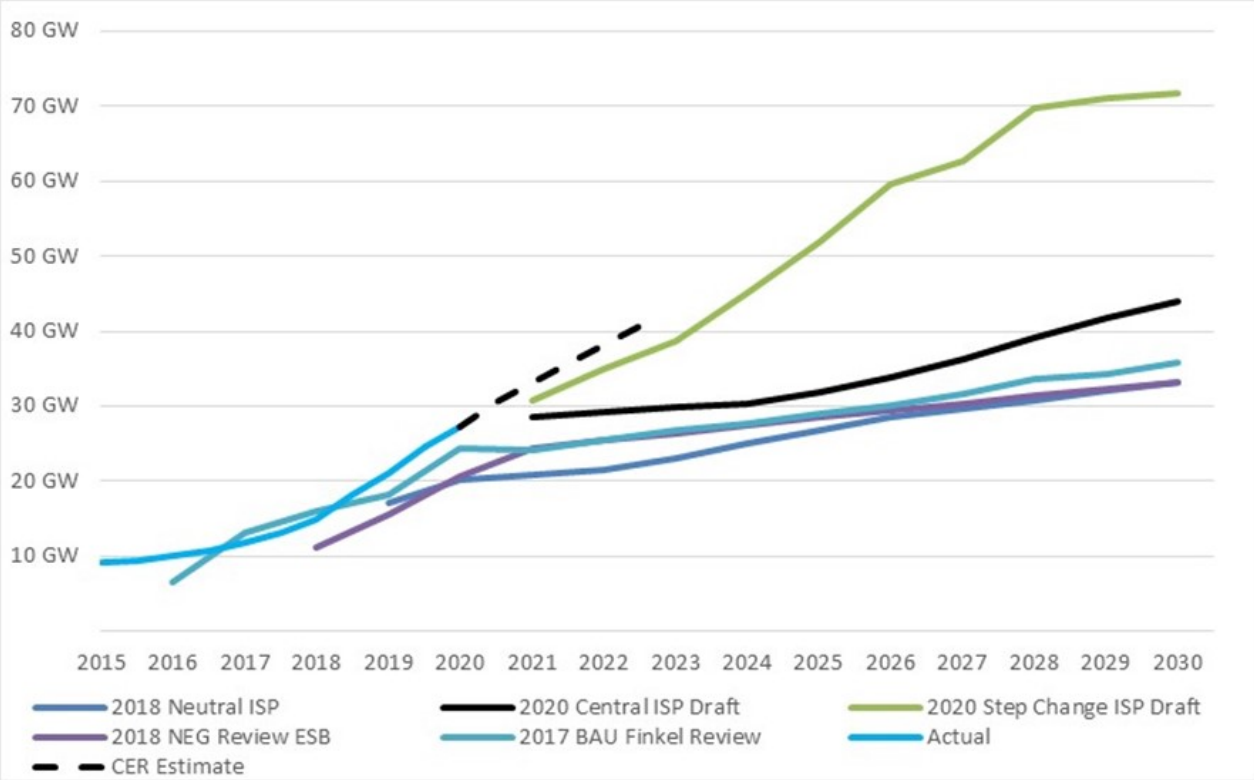
[35] The Clean Energy Regulator only estimates up to 3 years in advance based on current trends and pipelines. 2020's estimate has a high level of confidence as it is based on utility projects currently under construction and the current year's rooftop PV estimates is based on the current trends and modelling. While 2021/22's estimates are based less certain utility projects and rooftop PV modelling.

[36] For more information see AEMO's webpage regarding West Murray, Renew Economy's news article regarding north Queensland, and the Clean Energy Regulator's December Quarter 2019 Quarterly Carbon Market Report.

A difficulty with some of the modelling used for planning purposes is that generation investment decisions are assumed to consistent with participants making investment decisions on system cost optimisation basis. However, investment decision makers do not in fact face system optimised investment incentives for a variety of reasons.

Further detail can be found in The Clean Energy Regulator submission to the AEMO 2020 ISP consultation.

Figure 22: Comparison of cumulative renewable projections[37][38]



[37] The dotted line shows the projection based on the current installation trend, currently at 4.2 GW annually (2 GW under 100 kW, 200 MW between 100 kW and 5 MW, and 2 GW above 5 MW). All data and forecasts are NEM only. Clean Energy Regulator national data has been adjusted downwards to cover the NEM. Clean Energy Regulator for calendar year 2020 are shown across the 2019-20 and 2020-21 financial years. Aside from the 2020 ISP step change scenario, each projection is based on the policy settings current at the time. Both the 2018 ISP and the National Energy Guarantee review do not publish values of the mid-scale commercial and industrial solar uptake.

[38] Please note, the models are not perfectly comparable due to differences in capacity methodology, either AC or DC and treatment of panel capacity degradation, the CER does not include a degradation factor whereas ISP forecasts do.

5. Voluntary, state and territory government markets

The severe bushfires across south eastern Australia, drought, and increasing prudential requirements to address climate risk have contributed to an increase in voluntary ambition to reduce and offset emissions.

Notable announcements in Quarter 1 include:

- Telstra announced renewed ambition to become carbon neutral from 2020 in addition to ongoing commitments to reduce emissions from its operations by 50 per cent and switch to 100 per cent renewable energy by 2025.
- Several multi-national companies– including BP, Shell, and Microsoft– pledged to further their net-zero emissions targets to include scope 3 emissions (incorporating supply-chain and downstream emissions). These commitments represent sizable reductions: BP's commitment for net-zero emissions by 2050 represents an estimated 415 Mt CO_2-e globally in 2019 (almost equivalent to Australia's current emissions), more than 80 per cent of which are scope 3 emissions.[39]

It is anticipated that new demand may be muted in the short to medium term for some businesses as they work through significant challenges from reduced business activities and financial pressures due to COVID-19.

5.1. COVID-19 impact on the voluntary market

A short-term decrease in overall voluntary demand could be expected for businesses, due in part to a reduction in the volume of emissions reported by businesses for the 2019-20 financial and 2020 calendar years. However, any reduction in offset demand is likely to appear later in 2020 and into 2021.

More immediate financial pressures faced by businesses may also see changes to the type of units purchased. A range of domestic and international units are eligible for use with Climate Active, including Certified Emissions Reductions (CERs), Verified Emission Reductions (VERs), Verified Carbon Units (VCUs), ACCUs and LGCs. While many participants in the past may have had some preference for domestic offsets (ACCUs), including those with associated co-benefits, there is the potential that a larger portion of lower-priced units may be sought in the short-term.

Optional delivery Commonwealth government contracts under the ERF may be a viable option for some ERF project proponents to reduce risks associated with selling ACCUs directly into the voluntary market. Project proponents can continue to sell to voluntary participants at market prices, while ensuring they have the security of a Commonwealth contract to protect them from potential volatility in the voluntary market. If voluntary demand falls, then some volume of the yearly delivery of these options may be exercised before they expire each year. Whether optional delivery contracts play a role to stabilise the market in these circumstances depends in part on the scale and length of any decrease in voluntary demand and relative prices.

[39] For more information see BP's published emissions data for 2019, which states 360 Mt CO_2-e are scope 3 emissions.

5.2. Domestic carbon market

A record 269,000 LGCs were surrendered in Quarter 1 2020, more than 13 times the number of LGCs voluntarily surrendered in Quarter 1 2019. Additionally, the voluntary surrender of ACCUs has nearly tripled, with 115,000 ACCUs surrendered in Quarter 1 2020 compared to 39,000 in Quarter 1 2019 (see Figure 23).

Of note in Quarter 1 2020, there has been a seven per cent increase in the surrender of LGCs from Climate Active participants compared to Quarter 4 2019, when the first surrenders occurred (see Figure 23). This demonstrates continued commitment from businesses to voluntarily surrender LGCs to offset scope 2 emissions (associated with electricity use). Quarter 1 2020 also saw the largest surrender of LGCs from desalination plants, with more than 117,000 LGCs surrendered, accounting for 44 per cent of the total this quarter (see Figure 23).

Businesses and state and territory governments have been increasingly entering PPAs with renewable energy developers to secure competitive renewable energy prices and LGCs in line with targets to power all or parts of their operations with renewables. This is facilitating an increase in the voluntary surrender of LGCs. For example, Quarter 1 saw the largest surrender of LGCs from state and territory governments.

More than half (61 per cent) of voluntary ACCU surrenders are from Climate Active participants, having surrendered approximately 70,000 ACCUs in Quarter 1 2020, nearly 10 times the number surrendered in Quarter 1 2019 (see Figure 23). Additionally, surrenders from state and territory governments have increased by approximately five per cent in Quarter 1 2020 compared to Quarter 1 2019. This increase is associated with states and territories purchasing domestic units to offset emissions for fleet vehicles.

The majority of ACCUs are sourced from vegetation projects, having almost 60 per cent market share (see Figure 24). A further 25 per cent are from savanna burning projects, down 10 per cent from the previous quarter.

Account holders are now able to identify the origin or provenance of ACCUs in the registry (ANREU), making it easy to verify that ACCUs purchased match requirements, including delivery of co-benefits, location and project proponent, increasing the transparency of the market.

Figure 23: Voluntary, state and territory government demand for ACCUs and LGCs, Q1 2018 to Q1 2020

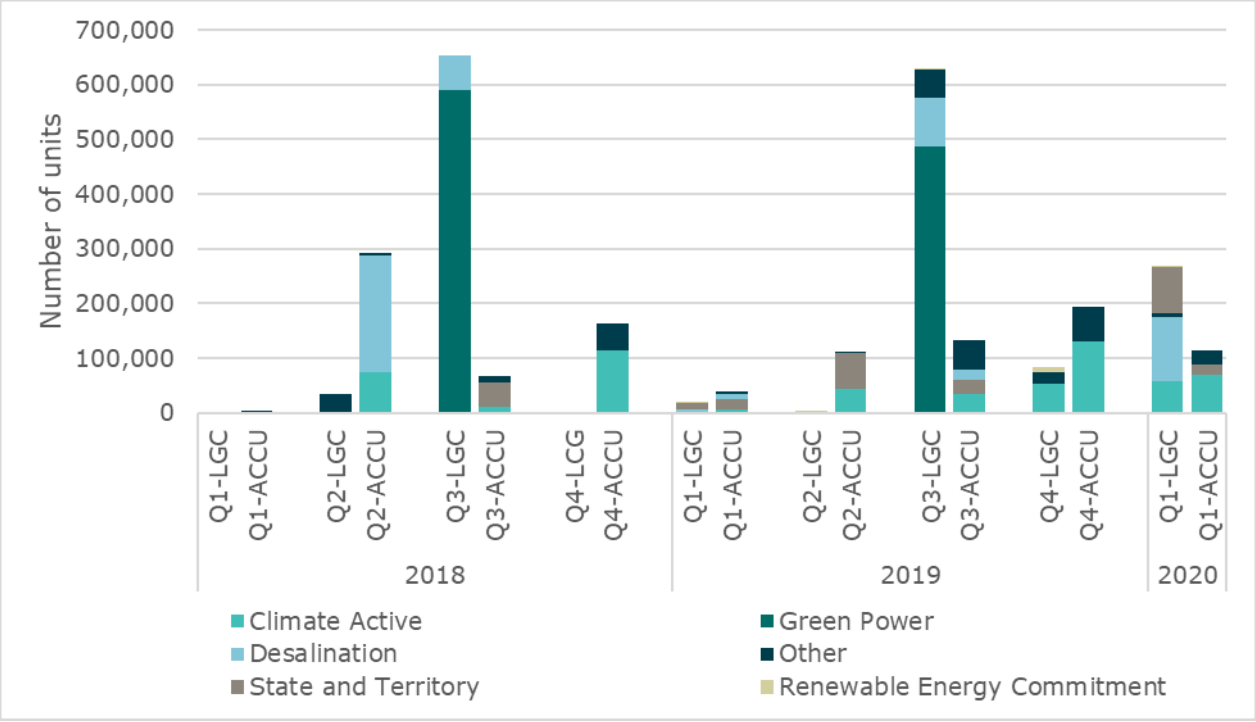
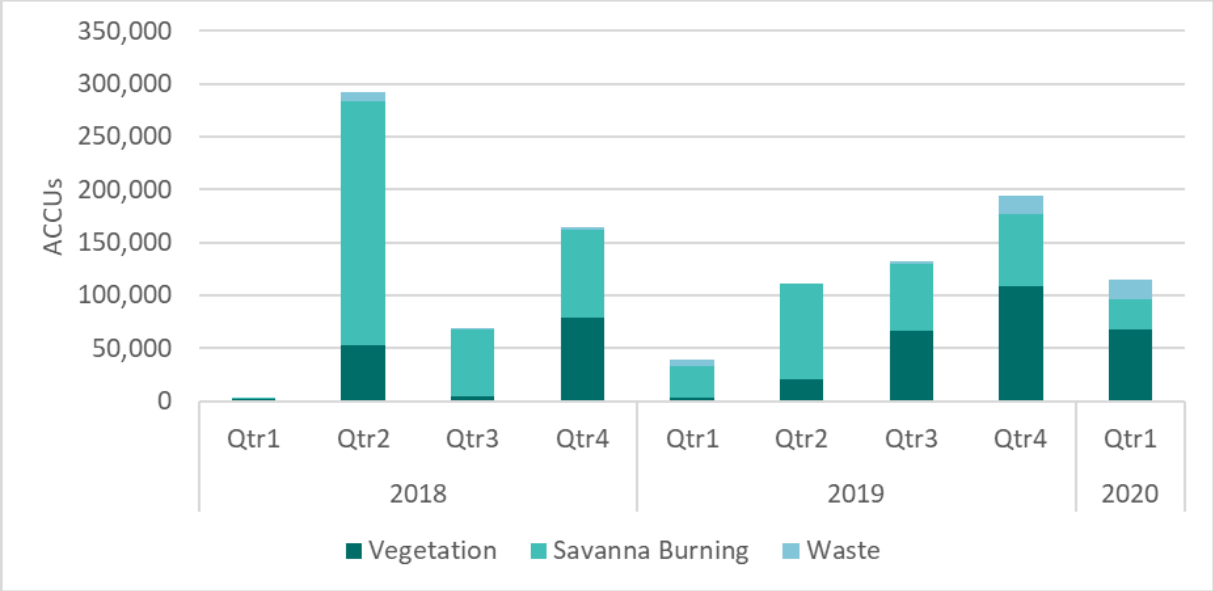


Figure 24: Voluntary, state and territory government ACCU demand by method type, Q1 2018 to Q1 2020



5.3. Other units

The economic pressures owing to COVID-19 have been observed in some international carbon markets, with many units in compliance markets decreasing in price, as shown in Table 6. In Europe, there has been a substantial reduction in emissions, reducing the demand for European Union Allowances (EUAs).[40] Consequently, the price of EUAs has decreased by more than 30 per cent, falling from a high of $41.52 in February to $29.42 at the end of the quarter.[41] The decrease has also been attributed to a large increase in the supply of EUAs as businesses liquidate surplus holdings.[42]

Similarly, in New Zealand, New Zealand Carbon Units (NZUs) decreased in price as participants sold off surplus units, dropping to a low of $21.76, before returning to $23.28 at the end of Quarter 1.[43]

In contrast, there has been a slight increase in the price of CERs late in the quarter.[44] This increase is in part linked to the recent announcement by the International Civil Aviation Organisation that certain CERs will be eligible for use with the Carbon Offsetting and Reduction Scheme for International Aviation (CORSIA), which enters its pilot phase in 2021.[45] More demand for CERs in Australia may arise if businesses seek lower price units owing to financial pressures as a result of COVID-19. Note that the quarterly change in the price of CERs shown in Table 6 is also partly due to the exchange rate, as the Australian dollar weakened against the Euro in Quarter 1. The Australian dollar has since recovered in Quarter 2.

[40] Independent Commodity Intelligence Service analysts estimate emissions in the EU ETS will decrease by approximately one quarter in 2020.
[41] Data sourced from ICE Futures.
[42] Reported by Reuters.
[43] Data sourced from Jarden and TFS Green.
[44] Data sourced from ICE Futures.
[45] International Civil Aviation Organisation announced eligible offsets on March 13, including CERs.

Table 6: Domestic and international carbon market spot prices

Product	Spot price AUD (31 March 2020)[46]	Quarterly trend	Change in Price
ACCU	$16.40	Down	-$0.85
LGC (tCO_2-e)	$37.25	Down	-$14.25
ESC	$28.40	Up	$5.10
VEEC	$35.25	Up	$4.75
CER	$0.56	Up	+$0.21
EUA	$29.42	Down	-$10.94
NZU	$23.28	Down	-$4.91

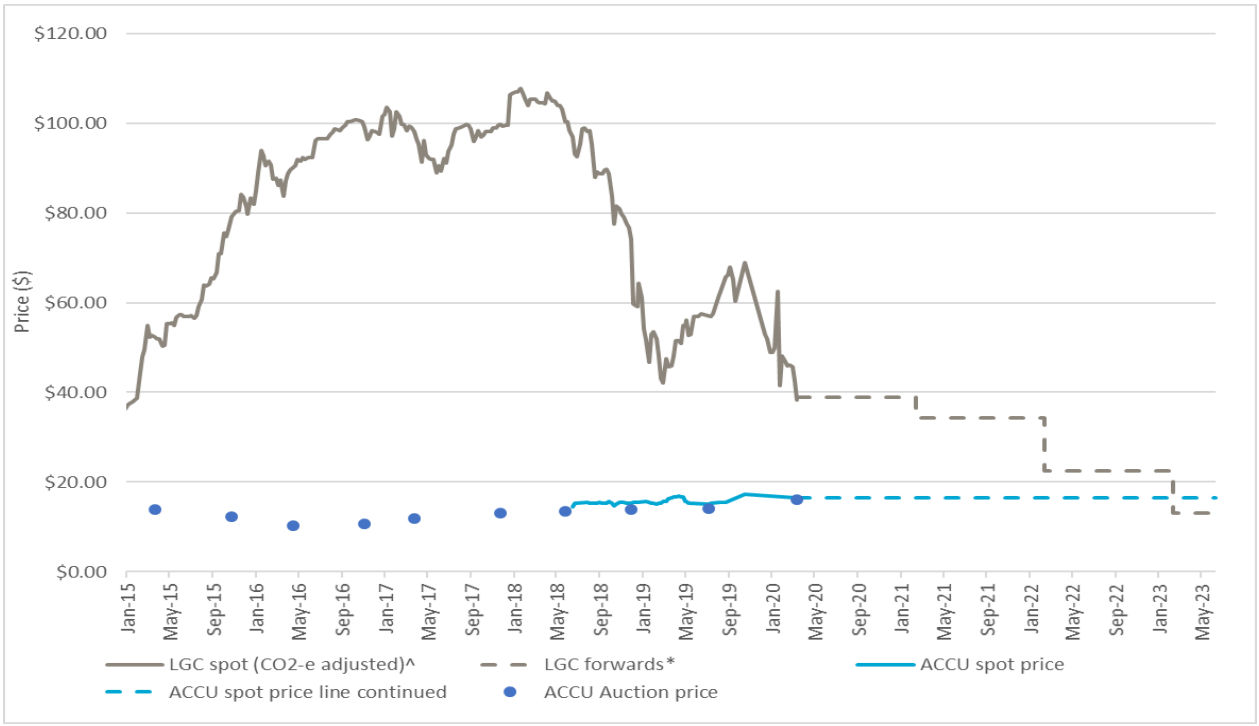
CERs - Certified emissions reduction units (CERs) are issued through the Clean Development Mechanism.
EUA - European Union Allowances (EUAs)
NZU - New Zealand Carbon Units
ESC - Energy Saving Certificates (NSW)
VEEC - Victorian Energy Efficiency Certificates

5.4. Prices

The impact of COVID-19 on the ACCU spot price is muted in comparison to some international carbon units. This is largely because the Australian Government is the dominant source of demand for ACCUs (approximately 95 per cent of demand), and the auction prices provide an anchor price in the market.

The LGC spot price fell 29 per cent over Quarter 1 2020, reaching a low of $27.75 in late-March. As discussed in Chapter 2, forward LGC prices have similarly decreased as supply is expected to increase further in future years while statutory demand remains constant. Hence, the Clean Energy Regulator expects the LGC price to continue to decline to a point of potential price convergence between ACCUs and the implicit carbon content of LGCs estimated around early-2023 (see Figure 25).

Figure 25: ACCU and LGC price convergence, 2015 to 2023



[46] Data sourced from Jarden, ICE Futures, TFS Green and Thomson Reuters.

6. Carbon abatement

6.1. National abatement

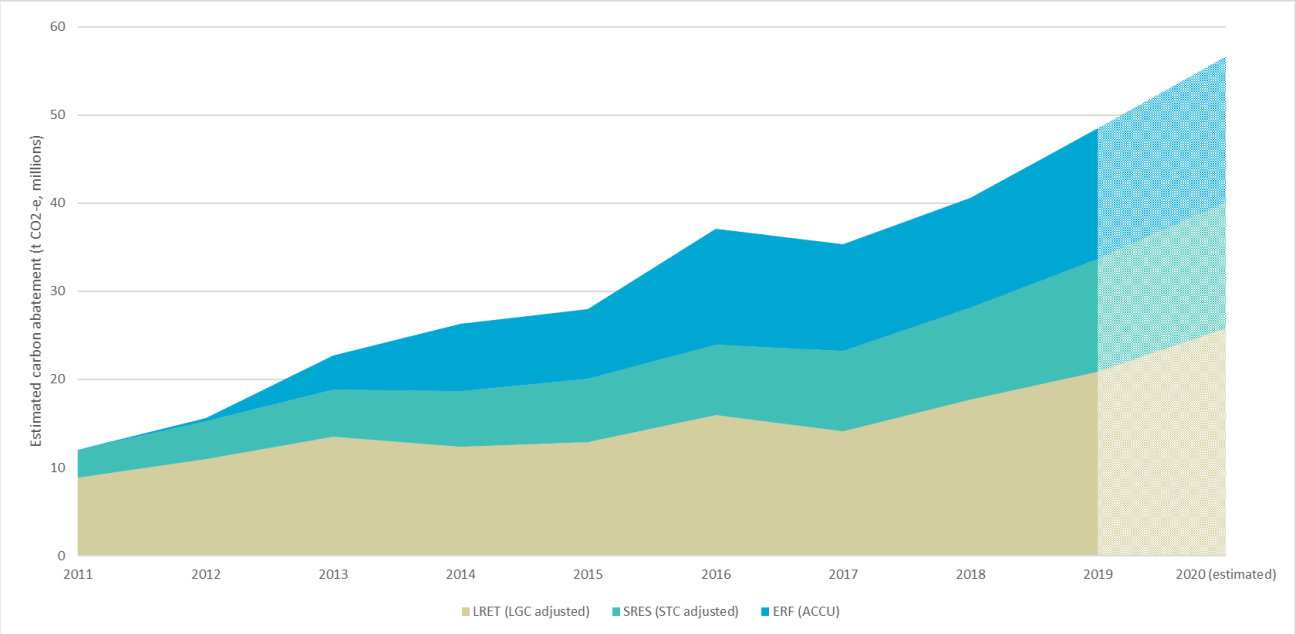
The schemes administered by the Clean Energy Regulator appear to have held up relatively well in the context of COVID-19.

The Clean Energy Regulator's best estimate for scheme-based carbon abatement in 2020 is 57 million tonnes of CO_2-e (see Figure 26).[47]

Of this, 26 million tonnes are estimated to come from the LRET and 14 million tonnes from the SRES, an increase of 23 per cent and 12 per cent respectively from 2019.[48] Abatement generated in the STC and LGC schemes is driven by two opposing effects. At present, increased generation drives up abatement and still dominates the other effect arising from the falling average grid carbon intensity that drives down measured abatement. At present the grid emissions intensity factor is falling quickly due to flat demand and the transformation in the generation mix.

The ERF is on track to deliver over 16 million tonnes of abatement in 2020, an increase of 12 per cent from 2019.

Figure 26: Estimated carbon abatement from ERF and RET, 2011 to 2020[49]



[47] The carbon abatement is estimated based on all ACCUs at the time they are issued as well as emissions reduction from all the RET eligible generation from renewables, regardless of the source of demand for the units and certificates. The estimate therefore includes ACCUs that are not contracted to the Commonwealth. In order to convert the renewable generation into a carbon abatement equivalent value, it has been multiplied by the emissions intensity factor of the Australian electricity network. This is considered a conservative estimate. The alternative approach would use the weighted average emissions intensity of the coal and gas generation displaced by renewables, including self-generation of rooftop solar, which would be higher. Further details on the calculation methodology are set out in the accompanying workbook.

[48] These abatement estimates for 2020 are slightly different from those reported in the previous QCMR due to updated emissions intensity factors.

[49] These carbon abatement estimates for 2020 are based on the current grid emissions factor (NEM Quarter 1), which was 0.74 over 1 tonne of CO_2-e per megawatt-hour of generation (t-CO2/MWh) in 2019. This is a conservative estimate as renewable energy is more likely to push out non-renewable generation, which often has an emissions factor of over 1 t-CO2/MWh.

6.2. Abatement by regions

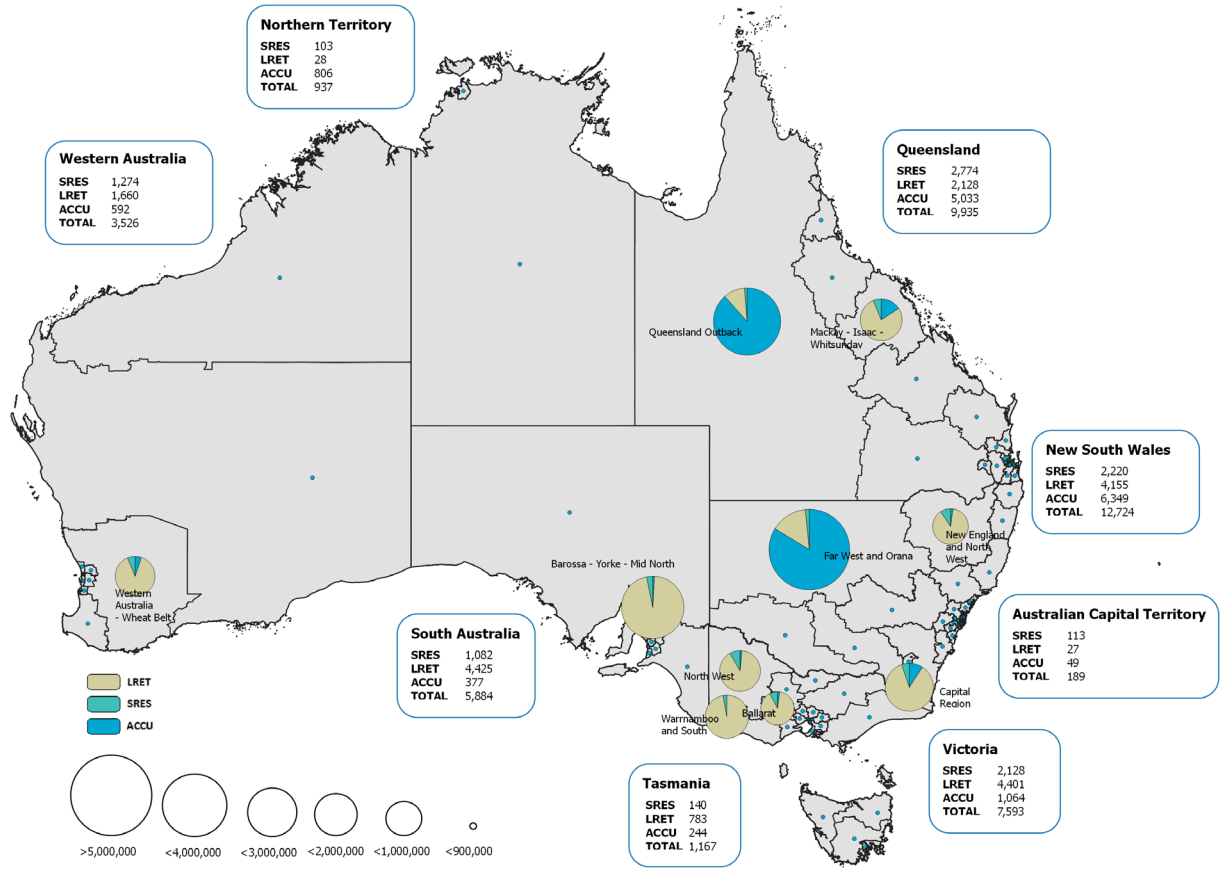
Regional Australia is playing a key role in carbon abatement. Unlike in urban centres, the inherent geographical advantage and lower population density in regional areas have favoured them to host large-scale renewables power stations and land-based ERF projects.

Over 50 per cent of all abatement in 2019 came from ten regions in Table 7.[50] All of them are located around regional centres (see Figure 27).[51] Not surprisingly, the ERF and large-scale renewables projects dominated the abatement in these ten highest regions.

Vegetation projects were the primary ERF methods used in these regions and they contributed to 52 per cent of Australia's total ERF abatement in 2019. Further, the top ten regions respectively accounted for 62 and 15 per cent of all abatement sourced from large-scale wind and solar projects in Australia last year.

At a state-level, New South Wales reported the most abatement from RET and ERF projects, respectively contributing 6.4 and 6.3 million tonnes in 2019. The most abatement from the SRES came from Queensland.

Figure 27: Carbon abatement from ERF and RET by regions (t CO_2-e,'000), 2019[52]



[50] This analysis excluded 318,273 ACCUs that did not specify a region, State or Territory under commercial in-confidence or legislated privacy provisions.

[51] Consistent with the Australian Bureau of Statistics' (ABS') definition of Statistical Areas Level 4, the map in Figure 25 shows 89 regions, including disaggregated metro areas. Urban agglomerations are summarised in Table 8 below.

[52] Regional abatement analysis will not sum to total abatement calculated by year for Figure 26. Locational data is not available for all projects under scheme administered by the Clean Energy Regulator.

Table 7: Top 10 abatement regions across STC, LGC and ACCU markets (t CO_2-e, '000), 2019[53]

	Region	State	SRES	LRET	ERF	Total Abatement
1	Far West and Orana	NSW	89	809	4,731	5,629
2	Queensland - Outback	QLD	50	385	3,492	3,927
3	Barossa – Yorke – Mid North	SA	106	3,178	29	3,313
4	Capital Region	NSW	103	1,620	185	1,908
5	Warrnambool and South West	VIC	47	1,556	1	1,604
6	North West	VIC	118	1,269	21	1,408
7	Western Australia – Wheat Belt	WA	86	1,203	71	1,360
8	New England and North West	NSW	102	959	24	1,085
9	Ballarat	VIC	73	851	20	944
10	Mackay - Isaac - Whitsunday	QLD	94	533	243	870
Total abatement from top 10 regions			868	12,363	8,817	22,048

Note: Numbers may not sum due to rounding. Full analysis of all regions is included in the March Quarter workbook.

Urban centres in Table 8 accounted for 18 per cent of all abatement in 2019.

Rooftop solar dominated carbon abatement in all city areas except greater Sydney and Hobart in 2019. ERF projects driven by landfill gas and other waste methods delivered the most abatement in Sydney and Hobart.

Carbon abatement from urban large-scale renewable energy projects was driven by electricity generated from biomass and waste methods that, on average, accounted for 73 per cent. Not surprisingly, most of the urban centres also had a considerable large-scale solar component (19 per cent of all abatement from urban large-scale renewables energy projects). This can largely be attributed to the recent surge in the uptake of above-100 kW solar PV systems by commercial and industrial participants such as shopping centres.

[53] Regional abatement analysis will not sum to total abatement calculated by year for Figure 26. Locational data is not available for all projects under scheme administered by the Clean Energy Regulator.

Table 8: Carbon abatement from urban centres (t CO_2-e, '000), 2019[54]

	SRES	LRET	ERF	Total Abatement
Adelaide	751	94	311	1,156
Brisbane	597	20	222	839
Canberra	113	27	49	189
Darwin	71	10	51	132
Hobart	50	-	84	134
Melbourne	1,218	34	910	2,162
Perth	953	14	338	1,305
Sydney	814	28	933	1,775
Total from major cities	4,567	227	2,898	7,692

6.3. National greenhouse and energy reporting data release

On 28 February 2020, the Clean Energy Regulator published the annual NGER data for 2018-19.[55] Corporations reported in total 338 million tonnes of scope 1 greenhouse gas emissions, 88 million tonnes of scope 2 emissions and 3931 petajoules of net energy consumed for 2018-19.[56]

Compared to the 2017-18 reporting year, Australia's scope 1 emissions increased in 2018-19 by 0.4 per cent, caused by a surge in liquified natural gas (LNG), oil and gas production in Western Australia and the Northern Territory.

Queensland led Australia's scope 1 emissions accounting for 28 per cent of all emissions in 2018-19, followed by New South Wales (26 per cent) and Western Australia (21 per cent). Tasmania's contribution was less than one per cent.

While emissions from electricity generation decreased by 2.9 per cent from the previous reporting year largely due to increased renewables driven by falling costs and scheme incentives, it remained the largest emitting sector in 2018-19 accounting for 49 per cent of all scope 1 emissions. Mining and manufacturing sectors contributed to the total by 28 and 15 per cent respectively. Transport accounted for five per cent.

[54] Regional abatement analysis will not sum to total abatement calculated by year for Figure 26. Locational data is not available for all projects under scheme administered by the Clean Energy Regulator.

[55] Under the National Greenhouse and Energy Reporting Scheme, Australian corporations are required to report their emissions and energy information to the Clean Energy Regulator. For more information see the Clean Energy Regulator's 2018-19 published data highlights.

[56] Scope 1 emissions are those produced as a result of an activity at a facility level such as emissions from manufacturing processes or electricity production by burning coal. They are referred to as 'direct emissions. Scope 2 emissions are produced from the indirect consumption of an energy commodity.

7. Market spotlight: Resources sector and off-grid renewable generation

Renewable electrification in the resources sector is a growing market in Australia, particularly at off-grid mining sites. Quarter 1 saw major announcements by Shell, Fortescue Metals Group and Rio Tinto for new large-scale solar installations.[57]

The Clean Energy Regulator is tracking 371 MW of renewable energy projects that are at various stages of completion. Of these, 270 MW were newly committed in Quarter 1 2020, making up 33 per cent of the total newly committed capacity for Quarter 1 (see figure 28 below). These power stations have the potential to offset up to 750,000 tCO_2 per year.[58]

Data collected by the Clean Energy Regulator from the NGER Scheme indicates that across Australia, for 2018-19 there was 6,500 GWh of electricity being generated and consumed off-grid. Of this, approximately 477 GWh (seven per cent) was generated by solar, wind and biomass. The Clean Energy Regulator estimates there is potential for additional renewables of up to 2.1 GW of utility-scale solar to replace this existing generation.

Currently tracked projects are predominantly solar PV. This could be a result of the greater consistency and predictability of solar generation, which may make it preferable to wind in off-grid environments. However, this is still an emerging market and it is unclear whether this trend will persist in the long run.

Drivers behind off-grid renewable generation projects

The development of technology to integrate high renewable penetrations with stable supply at off-grid sites has been in progress for a number of years. The Australian Renewable Energy Agency (ARENA) has been supporting the development of these integration strategies through sponsoring numerous hybrid technology and off-grid renewable energy projects since 2011. The recent increase in committed projects using this technology is a strong indication that it is becoming commercially viable and effective and uptake should continue to accelerate.

As existing generation begins to reach end of life and when new mining site power stations are proposed, solar and wind generation is generally becoming a more economical investment than LNG or diesel generation.[59] Furthermore, the switch away from thermal generation leads to a reduction in scope-1 emissions at the generation sites helping corporations meet their emissions reduction goals.

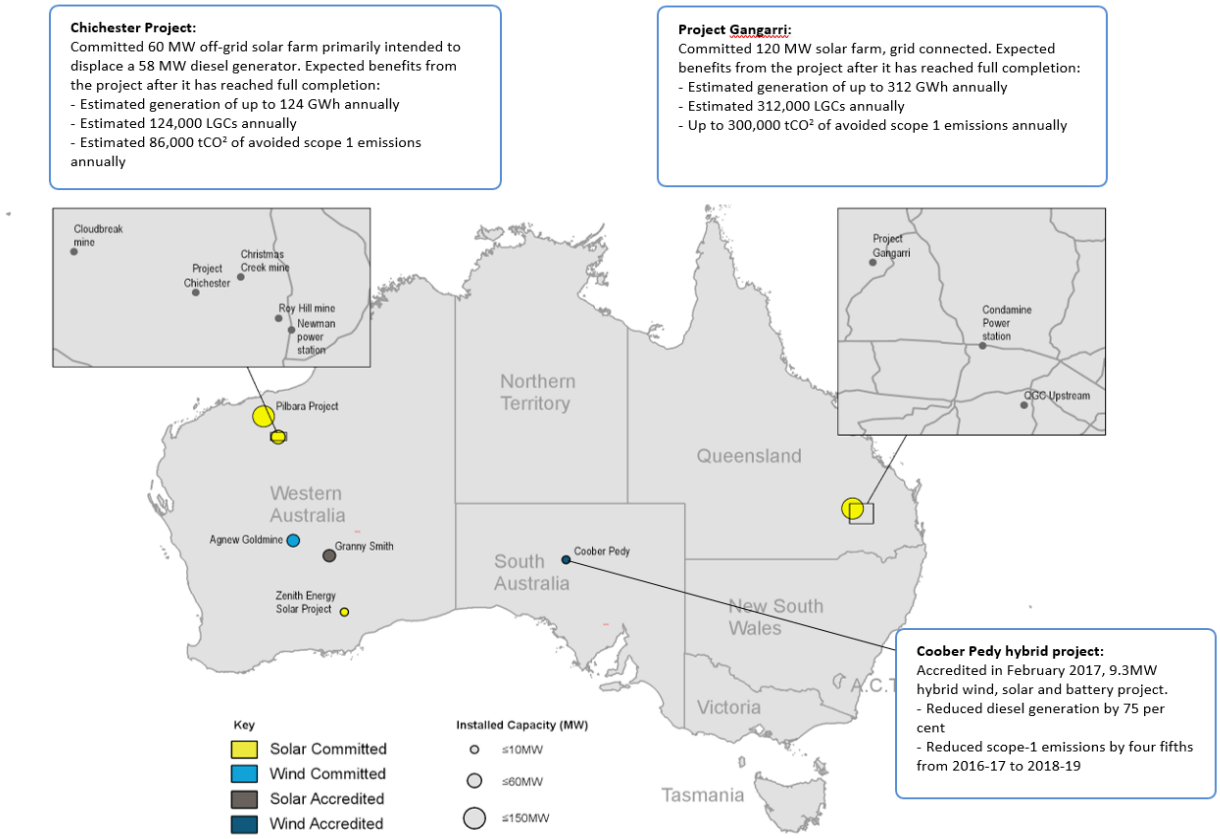
While all new renewables are eligible to earn LGCs and can do so through to end of the scheme in 2030, some facilities that displace non-renewable generation with solar and wind have the option to alternatively apply under the ERF as a fuel switching activity, discussed in more detail in the ACCU section, Chapter 1 of this report.

[57] Please note, Rio Tinto's Koodaideri is not currently tracked on the Clean Energy Regulator's renewable projects pipeline. However, it will be added if and when it begins construction or announces financial close on the project. Shell's Project Gangarri is located on the fringe of the grid in western Queensland.

[58] Emissions calculation assumes 90 per cent of the potential solar generation displaces LNG generation and the remaining displaces diesel.

[59] See BloombergNEF's New Energy Outlook 2019 or CSIRO's GenCost 2019-20: preliminary results for stakeholder review paper for more information.

Figure 28: Off-grid and resource based renewable generation pipeline



Note: Generation is based on an estimated capacity factor of 23.62 per cent for Chichester and 29.71 per cent for Gangarri.[60] Chichester's carbon abatement is based on the generation estimate, assuming it all displaces diesel generation, with an emissions factor of 0.69 t-CO2/MWh.[61] Gangarri's carbon abatement is based on Shell's media announcement.

[60] Capacity factors are based on Clean Energy Regulator analysis of solar irradiance and weather patterns within each region.
[61] This is the average emissions intensity of Western Australian diesel generators reported in the Greenhouse and energy information for designated generation facilities 2018-19 available here.

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
Climate Solutions Fund	CSF
Emissions Reduction Fund	ERF
Energy saving unit	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 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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