ACIL ALLEN

Small-scale technology certificate projections

2024-2030

27 August 2024

About ACIL Allen

ACIL Allen is a leading independent economics, policy and strategy advisory firm, dedicated to helping clients solve complex issues.

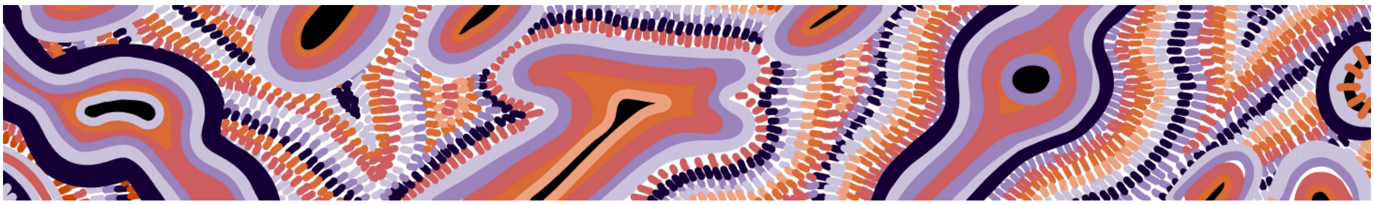
Our purpose is to help clients make informed decisions about complex economic and public policy issues.

Our vision is to be Australia's most trusted economics, policy and strategy advisory firm. We are committed and passionate about providing rigorous independent advice that contributes to a better world.

Report to:

Clean Energy Regulator

ACIL Allen acknowledges Aboriginal and Torres Strait Islander peoples as the Traditional Custodians of the land and its waters. We pay our respects to Elders, past and present, and to the youth, for the future. We extend this to all Aboriginal and Torres Strait Islander peoples reading this report.



Goomup, by Jarni McGuire

Contents

Contents

Tables

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Summary Report

Executive summary

ACIL Allen has been engaged by the Clean Energy Regulator (CER) to undertake annual small-scale technology certificate (STC) projections for the calendar years 2024 to 2030 for:

— small-scale solar PV

— eligible water heaters, which include solar water heaters (SWH) and air source heat pump (ASHP).

We use an econometric model to project the uptake of new small-scale solar PV installations (referred to in this report as solar PV). The projections are largely a function of the payback period of installations. The model is calibrated using historical data in the period January 2015 to October 2023 and for each state/territory and customer type separately. Although data is available for installations up to end of April 2024, installers have up to 12 months to register an installation with the CER. Our analysis suggests solar PV installers typically register an installation within around six months and hence we have omitted installations from November 2023 in the econometric model to avoid skewing the results. We have assumed the 2024-2030 annual replacement[1] installations as a ratio of new installations are similar to the ratio observed to date.

For eligible water heater projections, we used a simpler approach compared to the approach to modelling solar PV installations. The projections of eligible water heaters consider recent historical installation trends and the relative cost of hot water technologies including government subsidies. We have assumed 2024-2030 annual new dwelling and replacement installations as a proportion of eligible dwellings are similar to the proportion in 2023 using historical data up to 31 December 2023.[2]

Solar PV

Figure ES 1 shows historical and projected annual solar PV installations in GW by region for the period 2016 to 2030.

Installations in 2023 have increased from 2022 levels due to lower payback periods compared with recent history. Lower payback periods in 2023 are primarily driven by high retail tariffs.

Installations in 2024 are projected to remain at a similar level to 2023. This is due to offsetting drivers of higher payback periods in the residential sector (resulting in lower residential installations) and lower payback periods the commercial sector (resulting in higher commercial installations). Our analysis shows that the impact of higher retail tariffs is lagged by 2 years in the commercial market, compared to 1 year in the residential sector. This is probably due to the duration of electricity contracts for commercial customers, which can be 2-3 years compared to 1 year or less for residential customers.

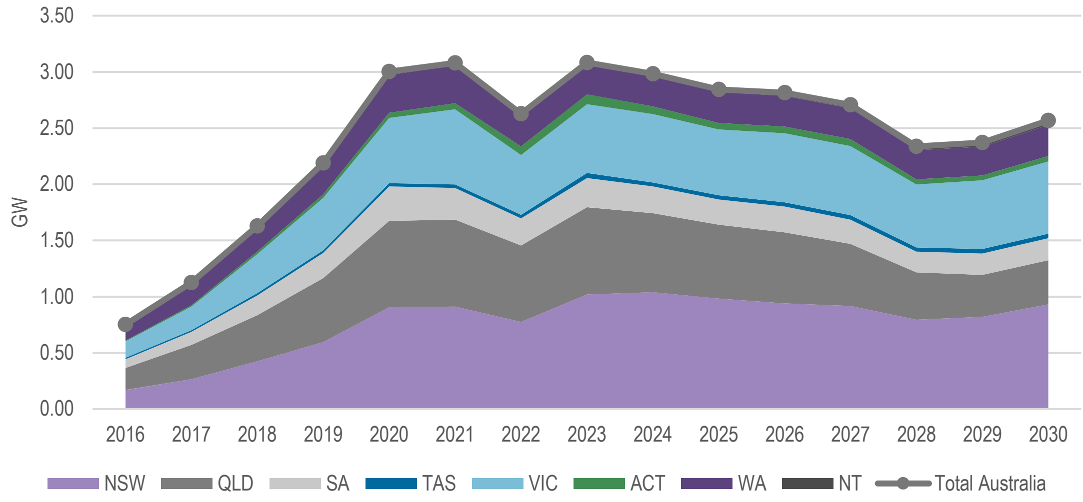
Installations for both sectors are projected to slowly decline between 2025 to 2028 in response to a gradual increase in payback periods. This is due to lower projected retail electricity tariffs driven by the implementation of state-based schemes such as the New South Wales Electricity Infrastructure Roadmap and Queensland Energy and Jobs Plan, and national-schemes such as the expanded Capacity Investment Scheme (CIS) encouraging a strong rollout in utility scale renewable energy and storage projects reducing wholesale electricity prices across these regions and interconnected regions. In effect, the rollout of this new capacity slightly shifts investment in generation from small scale to utility scale.

[1] A projection of replacement installations is required in addition to new installations since replacement installations are eligible to create STCs.

[2] We excluded historical data in 2024 due to the impact of lagged installations, which is historically around 4 months for water heater systems.

Projected installations increase in 2029 and 2030 due to a decline in payback periods because of higher solar buy back rates (or solar feed-in-tariffs) combined with lower installation costs. The solar buy back rates are based on the dispatch weighted price of solar, which are projected to increase after 2028 with the closure of coal-fired steam turbines and commissioning of utility scale storage projects.

Figure ES 1 Historical and projected annual solar PV installations (GW) by region – 2016-2030



Note: Actual installations up to 31 October 2023; projected thereafter and calibrated with available historical data to 30 April 2024. Includes new and replacement installations. Includes residential and commercial installations.

Source: ACIL Allen analysis using CER data

Table ES 1 shows projected annual solar PV installations in GW by region for the period 2023 to 2030.

Table ES 1 Projected annual solar PV installations (GW) by region – 2023-2030

	2023	2024	2025	2026	2027	2028	2029	2030
NSW	1.0	1.0	1.0	0.9	0.9	0.8	0.8	0.9
QLD	0.8	0.7	0.7	0.6	0.6	0.4	0.4	0.4
SA	0.3	0.2	0.2	0.2	0.2	0.2	0.2	0.2
TAS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
VIC	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6
ACT	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.0
WA	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3
NT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Australia	3.1	3.0	2.8	2.8	2.7	2.3	2.4	2.6

Note: Actual installations up to 31 October 2023; projected thereafter and calibrated with available historical data to 30 April 2024. Includes new and replacement installations. Includes residential and commercial installations.

Source: ACIL Allen analysis using CER data

Table ES 2 shows projected number of residential solar PV installations (in ‘000s) by region for the period 2023 to 2030. We have not projected the number of installations in the commercial market segment, instead our projections of commercial installations are expressed in kW terms and included together with residential installations in Table ES 1. In our model, eligible commercial roof space is characterised by kW available, due to the large range of roof size spaces available in this market.

Table ES 2 Projected number of residential solar PV installations ('000s) by region – 2023-2030

	2023	2024	2025	2026	2027	2028	2029	2030
NSW	95	93	83	75	67	55	56	61
QLD	72	60	54	50	41	31	28	28
SA	25	22	19	18	16	13	13	13
TAS	5	4	4	4	3	3	3	3
VIC	62	59	55	55	52	46	50	49
ACT	8	6	5	5	5	3	3	3
WA	32	31	30	29	28	26	25	27
NT	1	1	2	2	2	2	3	3
Total Australia	300	275	251	237	215	180	180	186

Note: Actual installations up to 31 October 2023; projected thereafter and calibrated with available historical data to 30 April 2024. Includes new and replacement installations.

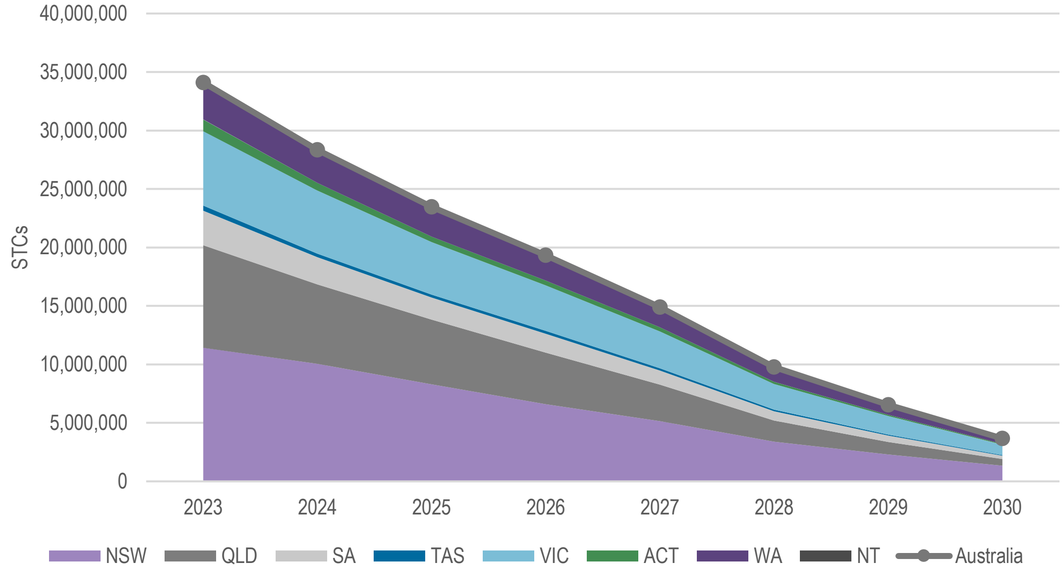
Source: ACIL Allen analysis using CER data

Figure ES 2 shows projected STC creations from solar PV for the period 2023 to 2030. Projected annual STC creations from solar PV decline over the period due to the declining deeming periods.

The model translates the projected installations and capacity of small-scale PV systems into projected STC creations by applying a zonal production factor based on the location of the system (accounting for region and solar zone) and an assumed weighting by zone (Table 2.2).

The calculation of STC creation considers the declining deeming period[3] (Table 2.1), as well as any overhang or creation delays from previous periods, and an assumed creation lag based on analysis of recent creation lags (the difference between installation and creation date).

Figure ES 2 Projected annual STCs from solar PV by region – 2024-2030



Note: STC creations are presented by creation year.

Source: ACIL Allen analysis using CER data

[3] This analysis assumes that installers will continue to claim STCs until the end of the scheme.

Eligible water heaters

In this report, we refer to eligible water heaters, which covers eligible hot water technologies under the scheme – solar water heater (SWH) and air source heat pump (ASHP).

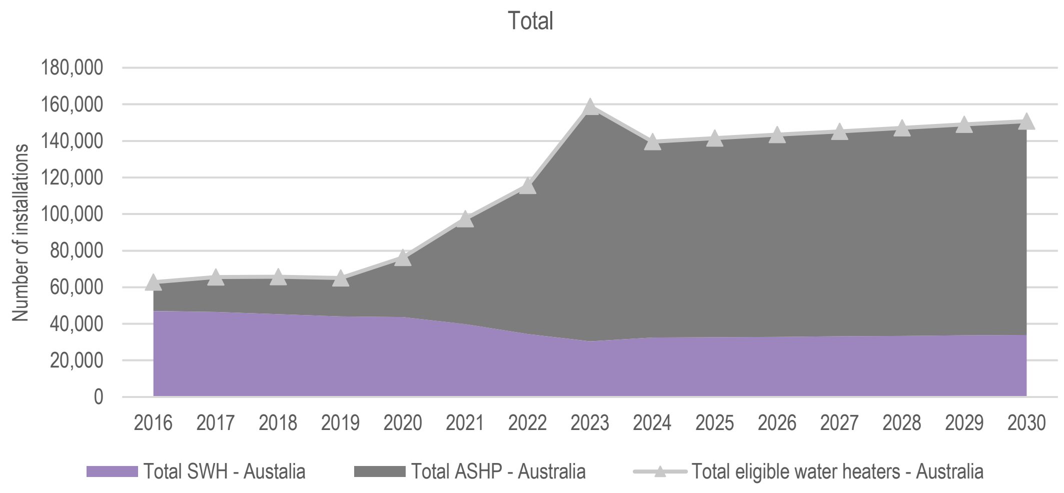
Figure ES 3 shows the historical and projected annual installation of eligible water heaters, by technology type for the period 2016 to 2030.

SWH was the dominant installation technology type for both new and replacement categories until 2020, from which point ASHPs replacing electric water heaters increased noticeably in Victoria. The driver for the sharp increase in uptake of replacement ASHP appears to be the generous financial incentive under the Victorian Energy Upgrade (VEU) scheme and banning of gas connections in new home builds. In late 2022 and continuing into 2023, a notable increase in ASHP replacing existing electric water heaters in New South Wales appears to be a response to financial incentives under the NSW Energy Savings Scheme (ESS).

For the period 2024-2028, we assume that replacement installations as a percentage of eligible dwellings is equal to the percentage in 2023, except for in NSW and QLD, for which we assume the percentage is equal to the average of 2022 and 2023. This is because the incentives in these regions have reduced in 2024 (discussed further below) which may reduce replacement installations in these regions compared to the high level of installations in 2023.

For the period 2024-2028, we assume that new dwelling installations as a percentage of total new dwellings is higher than 2023 because of updates to the National Construction Code to 7-star efficiency from May 2024, which now accounts for the energy usage of household appliances such as hot water systems.

Figure ES 3 Historical and projected annual eligible water heater installations by technology – 2016-2030



Note: Actual installations up to 31 December 2023; projected thereafter.

Source: ACIL Allen analysis

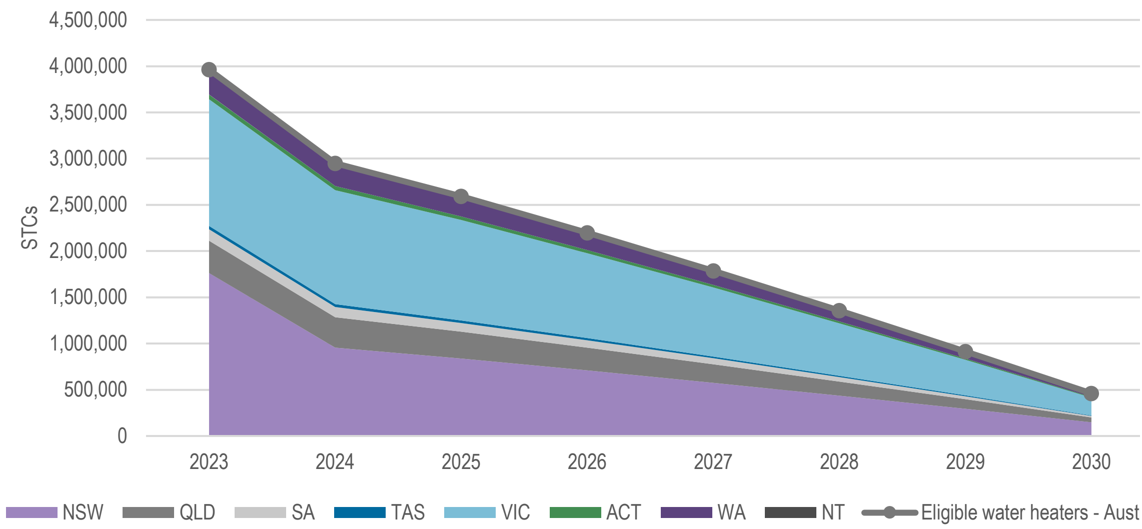
For all regions, we assume that current financial incentives and regulations remain at a similar level over the projection period, except for announced changes such as the increase in co-payments from $30 to $200 for hot water replacements, and the lowering of baselines under the NSW ESS from June 2024, and the updates to the National Construction Code to 7-star efficiency from May 2024. The Climate Smart Energy Savers rebate in Queensland also closed in 2024.

Our analysis of payback periods (refer to Appendix) for eligible water heaters indicates a favourable payback period for ASHP compared to SWH from around 2022 due to higher energy efficiency of ASHP and lower installation costs (including subsidies).

Figure ES 4 shows projected annual STC creations from eligible water heaters for the compliance years 2023 to 2030.

Projected annual STC creations from eligible water heater installations decrease over the period, due to the impact of the declining deeming periods.

Figure ES 4 Projected annual STCs from eligible water heaters by region – 2023-2030



Note: Actual installations up to 31 December 2023; projected thereafter.

Source: ACIL Allen analysis

Total STCs

Table ES 3 shows projected total annual STC creations by creation year for 2023 to 2030.

Table ES 3 Projected total annual STC creations, by creation year - 2023 to 2030

	2023	2024	2025	2026	2027	2028	2029	2030
Solar PV	34,106,763	28,345,955	23,461,393	19,325,632	14,903,065	9,782,618	6,543,246	3,667,079
SHW/ASHP	3,962,614	2,950,267	2,592,094	2,196,946	1,785,175	1,355,702	914,493	461,706
Total STCs	38,069,377	31,296,222	26,053,487	21,522,578	16,688,240	11,138,320	7,457,739	4,128,785

Source: ACIL Allen analysis

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Main Report

1 Introduction

The Clean Energy Regulator (CER) administers the Small-scale Renewable Energy Scheme (SRES) that creates financial incentives for investment in eligible small-scale renewable energy systems. Eligible small-scale renewable energy systems include solar photovoltaic (solar PV), solar water heater (SWH), air source heat pump (ASHP) and other small generation units (SGUs). SGUs are defined as those systems with capacity of no more than 100kW. The number of small-scale technology certificates (STCs) required to be surrendered by liable entities is set each year by the small-scale technology percentage (STP). In setting the STP, the CER, in the past, has considered inputs from qualified external consultants.

1.1 The brief

The CER has engaged ACIL Allen to undertake projections of:

— the number of small-scale installations (up to 100 kW)
— the capacity of small-scale installations (up to 100 kW)
— small-scale technology certificate (STC) creation.

The projections cover calendar years 2024 to 2030 and the following technology types:

— small-scale solar PV
— solar water heaters (SWHs)
— air source heat pump (ASHPs).

The projections are provided for commercial and residential installations for each state and territory in Australia.

In this report, ACIL Allen provides the assumptions, methodology and results of analysing and projecting the uptake of small-scale technology installations.

2 Methodology

Our approach to modelling the uptake of small-scale technology is outlined in the sections below, by technology type.

2.1 Our approach to modelling STC creation by solar PV

We have used our in-house econometric model of small-scale PV uptake to develop projections of STC creation by each state and territory for calendar years 2024 to 2030 for residential and commercial customers.

The projections of new[4] installations are largely a function of the payback period of installations. The model is calibrated using historical data in the period January 2015 to October 2023 and for each state/territory and customer type separately. Although data is available for installations up to end of April 2024, installers have up to 12 months to register an installation with the CER. Our analysis suggests installers typically register an installation within around six months and hence we have omitted installations from October 2023 in the econometric model to avoid skewing the results.

The model uses a logistic function to determine the probability of a new installation based on statistically significant factors drawn from a suite of potential factors such as payback period, interest rates, etc. For residential installations, these projected probabilities are then applied to remaining eligible dwellings to determine the number of new installations. For commercial installations, the projected probabilities are applied to remaining eligible commercial rooftop space in kW.[5]

For residential installations, the capacity of new residential installations is determined by applying an assumed capacity (kW) per installation to the projected number of installations produced by the model. The assumed capacity per installation in 2024 to 2030 is assumed to grow consistent with recent history with a limit of around 14 kW per installation. For commercial installations, we apply the projected probabilities directly to the available commercial roof space, expressed in kW terms, to find the projected new installations in kW terms.

We use population, residential and non-residential dwelling projections from the ABS. The uptake model also considers the recent demand and supply impacts of COVID-19, heavy rainfall, and flooding in parts of Australia, and supply chain bottlenecks, as well recent changes to interest rates and cost of living. The model also considers technical factors of small-scale solar panels like the impact of degradation on energy output.

Additional key inputs for the model consist of system size, system costs, system performance[6] (output) by region, regional retail electricity prices and avoided retail tariffs, deeming period, regional daily consumption profiles and solar exports, government feed-in-tariffs, upfront subsidies, state and territory schemes, and an assumed lag between the timing of these factors and the decision by a household or business to install a system.

Retail electricity price projections are developed using our in-house retail price model, which includes as inputs, projected wholesale electricity prices from our PowerMark wholesale electricity market simulator which has been developed over the past 30 years in parallel with the development of the NEM and WEM, projected renewable energy policy costs, network costs, retailer operating and prudential costs, and retail

[4] We model new installations and then assume a percentage uplift by region which is on average around 25% to the projected new installations to account for replacements based on the recent historical uplift.

[5] Eligible commercial roof space is characterized by kW available due to the large range of roof space sizes in this market segment.

[6] Based on historical data from the CER. The model does not explicitly consider microinverter technology, although it would be implicitly considered to the extent that actual installations adopted microinverters.

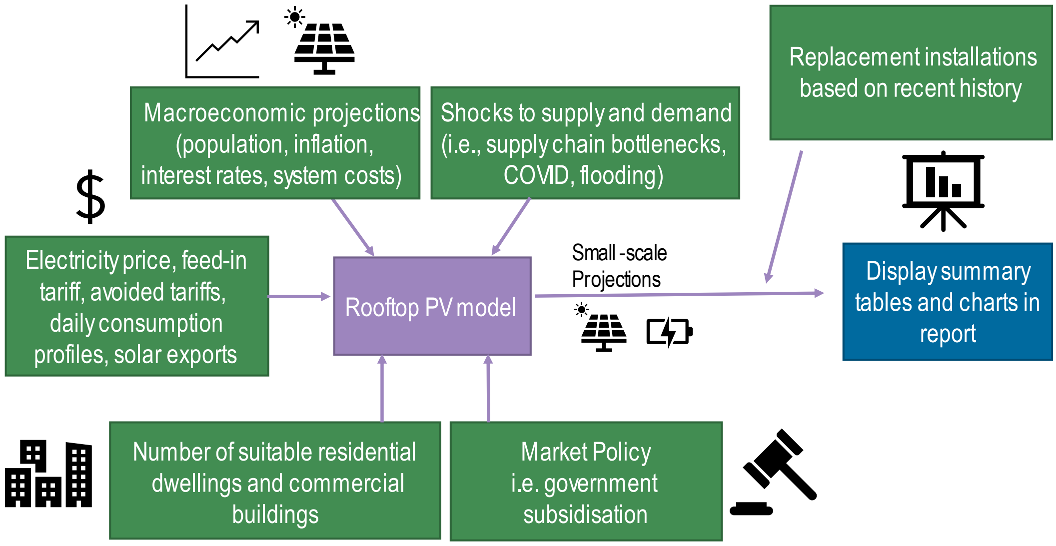
margin. ACIL Allen uses its retail model extensively in simulations and sensitivity analyses conducted on behalf of industry and regulator clients. The retail model also considers tariff reform. As well as projected retail prices, two outputs from the retail model are the costs a household or small business avoids if installing rooftop PV, and the solar feed in tariff for surplus energy exported to the grid.

A detailed table of assumptions used in this analysis is presented in Appendix A.

Our small-scale PV uptake model provides projections of the number of installations, system size, their aggregate capacity and output.

Figure 2.1 presents a high-level diagram of the small-scale solar PV uptake model used in this analysis.

Figure 2.1 High-level diagram of small-scale solar PV model inputs and outputs



Source: ACIL Allen

The model translates the projected capacity of small-scale PV installations into projected STC creations by applying a zonal production factor based on the location of the system (accounting for region and solar zone) and an assumed weighting by zone (Table 2.2).

The calculation of STC creation considers the declining deeming period (Table 2.1), as well as any overhang or creation delays from previous periods, and an assumed creation lag based on analysis of recent creation lags (the difference between installation and creation date).

STC creations are presented by creation year.

Table 2.1 STC deeming period (years) by year of installation

	2024	2025	2026	2027	2028	2029	2030
Deeming period (years)	7	6	5	4	3	2	1

Source: CER

Table 2.2 Locational production factors, by state and territory

	Solar Zone 1	Solar Zone 2	Solar Zone 3	Solar Zone 4	Solar output values by state (MWh/kW)
Zone rating (MWh/kW)	1.622	1.536	1.382	1.185	
NSW	0%	3%	97%	1%	1.38
QLD	0%	2%	98%	0%	1.38
SA	0%	1%	99%	0%	1.38
TAS	0%	0%	0%	100%	1.19
VIC	0%	0%	32%	68%	1.25
ACT	0%	0%	100%	0%	1.38
WA	1%	3%	93%	2%	1.39
NT	13%	86%	1%	0%	1.55

Source: ACIL Allen analysis of CER data

Other SGUs

While STCs can be created by small-scale solar PV, wind or hydro systems, small-scale solar PV systems are historically the dominant technology and expected to remain so.

Other SGUs generating electricity and STCs from wind and hydro comprise only a small proportion of the total number of SGUs. The CER reports that as at 30 April 2024 only 445 installations out of a total of 3,551,111 SGUs were wind and hydro SGUs. In 2023 to date no new wind and hydro generation units have been installed. Given that this category comprises such a small proportion of total SGUs, we have excluded this category from the analysis.

2.2 Our approach to modelling STC creation by water heating systems

Solar water heater (SWH) and air source heat pump (ASHP) systems are generally installed when an existing water heater requires replacement or in conjunction with a new build dwelling.

Therefore, we adopt a simpler modelling approach for projecting eligible water heaters compared to the modelling approach for projecting small-scale solar PV. Our projections of SWH and ASHP are based on two key markets – new installations and replacements.

1. New installation projections of SWH and ASHP are based on the same projections of new residential dwellings and commercial buildings, by region as adopted in the projection of rooftop PV installations.
2. Replacement installation projections of SWH and ASHP are based on the following factors:
   a) relative cost of replacement technology (e.g., SHW or ASHP), including the technology being replaced (e.g., gas hot water or less-efficient electric hot water)
   b) government incentives/subsidies (e.g., state-based energy efficiency schemes and state-based policies for transitioning away from gas use).

To project the number of eligible water heater installations in new dwellings, we have analysed the percentage of new dwellings in each region where an eligible water heater was installed. For the period 2024-2030, we assume that new dwelling installations as a percentage of total new dwellings is higher than 2023 because of updates to the National Construction Code to 7-star efficiency from May 2024, which now accounts for the energy usage of household appliances such as hot water systems. We have used ABS mid case dwelling projections to determine new dwelling growth over the projection period.

To project the number of replacement eligible water heaters, we have analysed the number of replacement installations as a percentage of residential dwellings, which shows an increase in almost all regions over the last 2-3 years. Likely drivers include the introduction of financial incentives under state-based energy efficiency schemes, government incentives to encourage households to replace old gas and electric water heaters, and an increase in retail electricity prices.

For the period 2024-2028, we assume that replacement installations as a percentage of eligible dwellings in each region is equal to the percentage in 2023, except for in NSW and QLD, for which we assume the percentage slightly lower and is equal to the average of 2022 and 2023. This is because the incentives in these regions have reduced in 2024 which may reduce replacement installations in these regions compared to the high level of installations in 2023.

The model translates the projected installations of each eligible hot water system into projected STC creations by applying the deeming period to an assumed average value of STCs per installation per year. The average value of STCs per installation varies by region, technology type, system brand/model and deeming year, with an average value of 29 STCs per installation. Projected STCs decline due to the declining deeming period.

We have assumed no changes to jurisdictional support mechanisms or regulations occur over the projection period.

2.3 Base case

We have modelled a Base case scenario which is consistent with the 2023 ESOO Central scenario narrative – that is, the Draft 2024 ISP Step Change scenario.

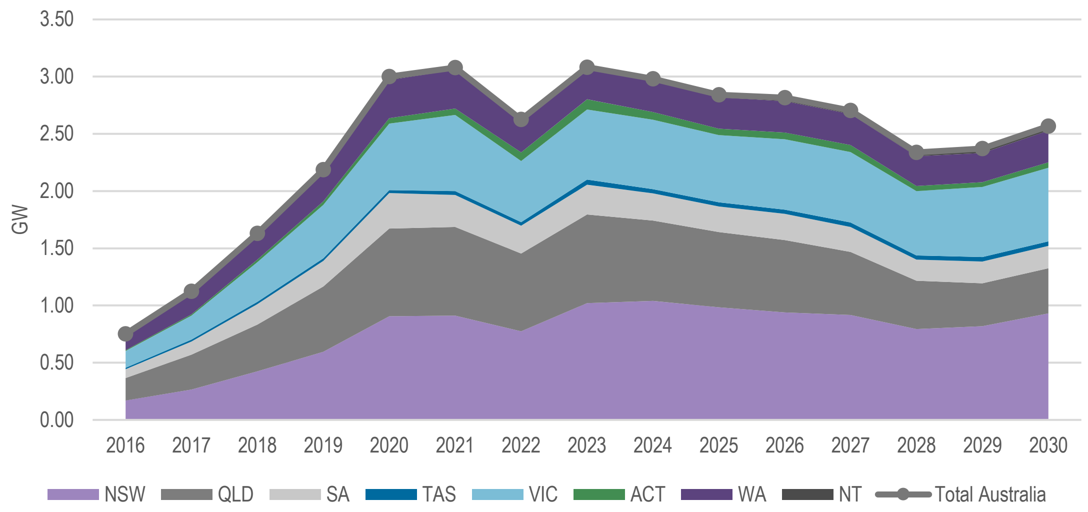
3 Results

This chapter presents historical and projected installations under the SRES scheme.

3.1 STC creation from solar PV SGUs

Figure 3.1 shows historical and projected annual solar PV installations by region. The values are presented on a calendar year basis.

Figure 3.1 Historical and projected annual solar PV installations (GW) by region – 2016-2030



Note: Actual installations up to 31 October 2023; projected thereafter and calibrated with available historical data to 30 April 2024. Includes new and replacement installations. Includes residential and commercial installations.

Source: ACIL Allen analysis using CER data

Installations rose strongly during 2016 and 2017 on the back of rapidly falling PV system costs and continued to rise in 2018 and 2019 due to the lagged effect of higher retail prices which occurred after the unexpected closure of Hazelwood in 2016-17.

Despite payback periods rising in 2020 and 2021, installations rose to record levels in 2020 and 2021 due to the impact of COVID related restrictions which increased spending power and saw a widespread transition of centralised to remote working and learning. Installations declined in 2022 due to rising installation costs.

Installations in 2023 have increased from 2022 levels due to lower payback periods compared with recent history. Lower payback periods in 2023 are primarily driven by high retail tariffs.

Installations in 2024 are projected to remain at a similar level to 2023. This is due to offsetting drivers of higher payback periods in the residential sector (resulting in lower residential installations) and lower payback periods the commercial sector (resulting in higher commercial installations). Our analysis shows that the impact of higher retail tariffs is lagged by 2 years in the commercial market, compared to 1 year in the residential sector. This is probably due to the duration of electricity contracts for commercial customer, which can be 2-3 years compared to 1 year or less for a residential customer.

Installations for both sectors are projected to decrease over the period 2024 to 2028 due to higher payback periods. This is due to a projected decline in retail electricity tariffs driven by the implementation of State-based schemes such as the New South Wales Electricity Infrastructure Roadmap and Queensland Energy and Jobs Plan, and national-schemes such as the expanded Capacity Investment Scheme (CIS) encouraging a strong rollout in utility scale renewable energy and storage projects reducing wholesale electricity prices across these regions and interconnected regions. Most of this new capacity is projected to enter the market between 2027 and 2030 which is projected to have the greatest impact on payback period for rooftop PV installations from 2028 (one-year lagged impact).

Projected installations increase in 2029 and 2030 due to lower payback periods because of more favourable solar buy back rates (or solar feed-in-tariffs) and lower installation costs (including subsidies). The solar buy back rates are based on the dispatch weighted price of solar, which are projected to increase after 2028 with the closure of coal-fired steam turbines and commissioning of utility scale energy storage projects.

Australia wide weighted average payback periods for small-scale solar PV are shown in Appendix A.

Table 3.1 shows projected annual solar PV installations in GW by region for the period 2023 to 2030.

Table 3.1 Projected annual solar PV installations (GW) by region – 2023-2030

	2023	2024	2025	2026	2027	2028	2029	2030
NSW	1.0	1.0	1.0	0.9	0.9	0.8	0.8	0.9
QLD	0.8	0.7	0.7	0.6	0.6	0.4	0.4	0.4
SA	0.3	0.2	0.2	0.2	0.2	0.2	0.2	0.2
TAS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
VIC	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6
ACT	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.0
WA	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3
NT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Australia	3.1	3.0	2.8	2.8	2.7	2.3	2.4	2.6

Note: Actual installations up to 31 October 2023; projected thereafter and calibrated with available historical data to 30 April 2024. Includes new and replacement installations. Includes residential and commercial installations.

Source: ACIL Allen analysis using CER data

Table 3.2 shows projected number of residential solar PV installations (in '000s) by region for the period 2023 to 2030. We have not projected the number of installations in the commercial market segment, instead our projections of commercial installations are expressed in kW terms and included together with residential installations in Table 3.2. This is because eligible commercial roof space is characterised by kW available, due to the large range of roof size spaces available in this market.

Table 3.2 Projected number of residential solar PV installations ('000s) by region – 2023-2030

	2023	2024	2025	2026	2027	2028	2029	2030
NSW	95	93	83	75	67	55	56	61
QLD	72	60	54	50	41	31	28	28
SA	25	22	19	18	16	13	13	13
TAS	5	4	4	4	3	3	3	3
VIC	62	59	55	55	52	46	50	49
ACT	8	6	5	5	5	3	3	3
WA	32	31	30	29	28	26	25	27
NT	1	1	2	2	2	2	3	3
Total Australia	300	275	251	237	215	180	180	186

Note: Actual installations up to 31 October 2023; projected thereafter and calibrated with available historical data to 30 April 2024. Includes new and replacement installations.

Source: ACIL Allen analysis using CER data

Figure 3.2 shows projected annual solar PV installations in GW by market segment (residential or commercial) and by region.

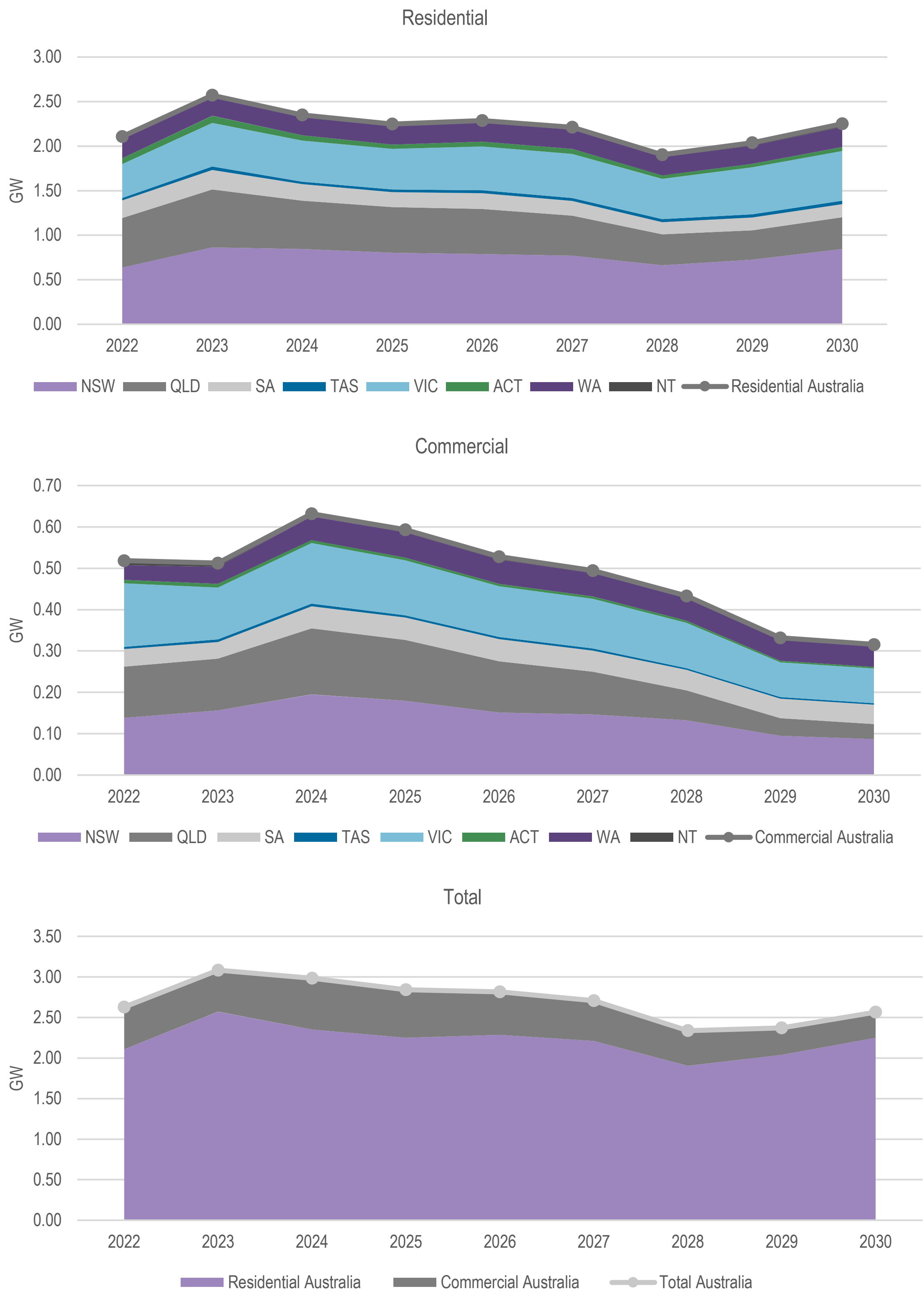
Residential installations are projected to decline in 2024 to 2028 due to higher payback periods because of a projected decline in retail electricity tariffs.

Projected installations increase in 2029 and 2030 due to lower payback periods because of more favourable solar buy back rates (or solar feed-in-tariffs) and lower installation costs (including subsidies). The solar buy back rates are based on the dispatch weighted price of solar, which are projected to increase after 2028 with the closure of coal-fired steam turbines. The solar buy-back rate does not drive commercial installations as strongly as residential installations because of commercial customer electricity consumption patterns which tend to be more skewed to daylight hours resulting in lower PV exports.

Commercial installations in GW are projected to increase in 2024 due to lower payback periods. Our analysis indicates that the impact of higher retail tariffs is lagged by 2 years in the commercial market, compared to 1 year in the residential sector. This is probably due to the duration of electricity contracts for commercial customer, which can be 2-3 years compared to 1 year or less for a residential customer.

Commercial installations are then projected to decline in 2025-2030 due to higher payback periods over this period. This market segment has a higher sensitivity than the residential sector to payback periods. This is likely due to commercial customers being more actively engaged in consideration of future electricity tariffs. Interest rate levels were considered in this analysis but were not a significant driver. Other factors that may drive commercial installations in the future, such as ESG pressures, have been considered but not included in this analysis due to limited or unavailable historical data.

Figure 3.2 Historical and projected annual solar PV installations (GW) – 2023-2030



Note: Historical data up to 31 October 2023; projected thereafter and calibrated with available historical data to 30 April 2024. Includes new and replacement installations.

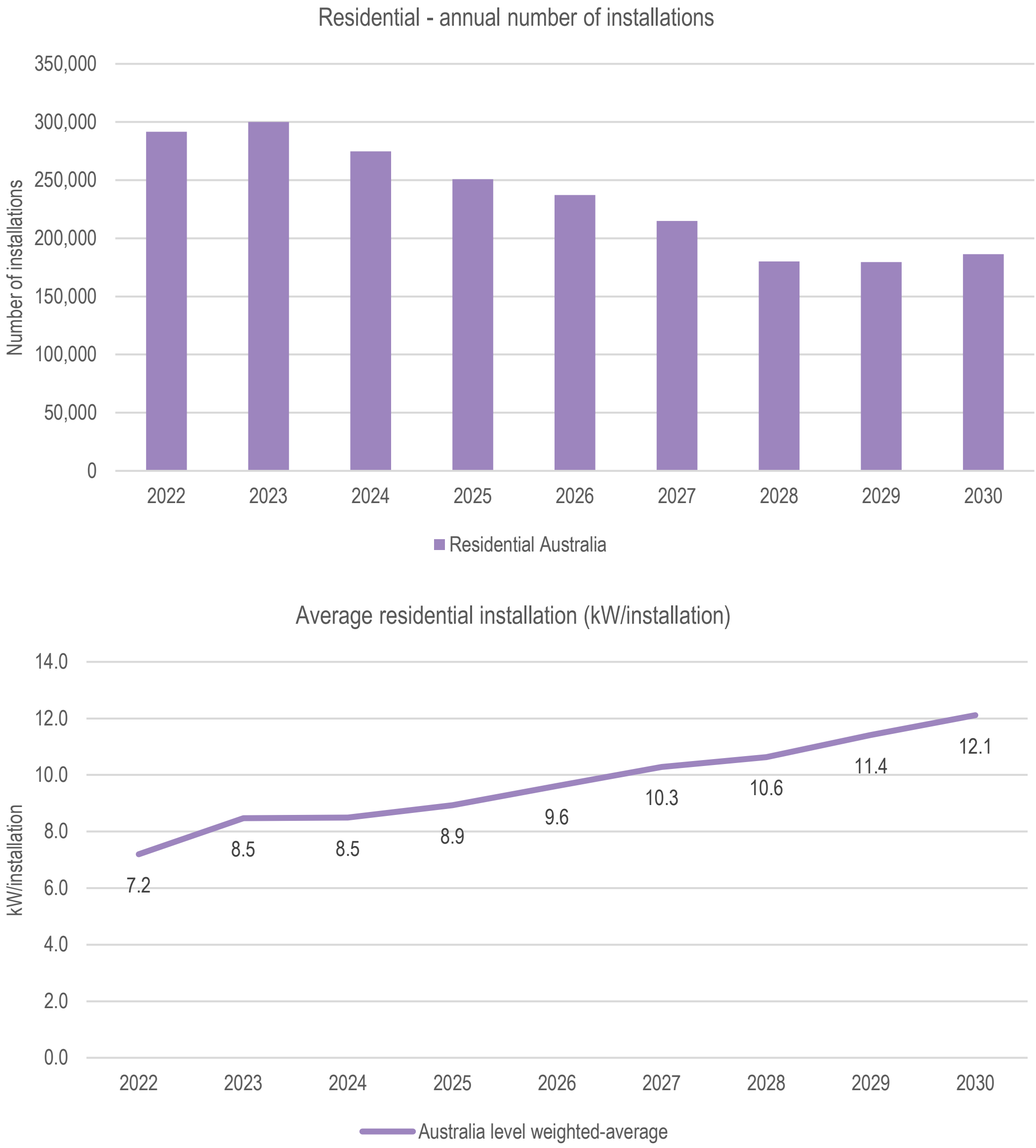
Source: ACIL Allen analysis

Figure 3.3 shows the historical and projected number of installations and the average size of installations for the residential segment.

Projected installations from the model are multiplied by the assumed regional average installation size to arrive at installation capacity in kW terms.

Australia level weighted-average residential installation size is assumed to continue to increase from approximately 8.5 kW in 2023 to 12.1 kW by 2030.

Figure 3.3 Historical and projected number of residential installations (top panel) and average installation size (lower panel) – Australia

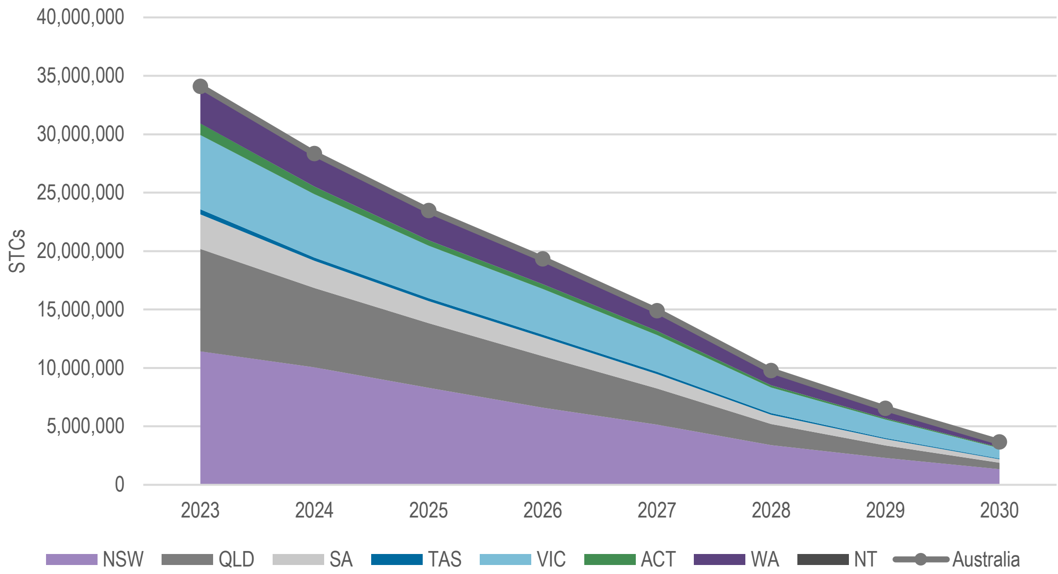


Note: Historical data up to 31 October 2023; projected thereafter and calibrated with available historical data to 30 April 2024. Includes new and replacement installations.

Source: ACIL Allen analysis

Figure 3.4 and Table 3.3 show the projected annual STC creations, by creation year, from solar PV for the 2023 to 2030 compliance years. Projected STC creations are the product of the projected solar PV system size in kW from Table 3.3, the postcode zone rating in Table 2.2, and the deeming period in Table 2.1. The calculation of STC creation incorporates any overhang or creation delays from previous periods, and an assumed creation lag based on analysis of recent creation lags (the difference between installation and creation date).

Figure 3.4 Projected annual STCs from solar PV by region – 2024-2030



Note: Includes residential and commercial STC creations. STC creations are presented by creation year.

Source: ACIL Allen analysis using CER data

Total STC creations from solar PV are projected to decline across the projection period due to the combination of the drivers of declining installations described earlier and the falling deeming period.

Table 3.3 Projected annual STCs (millions) from solar PV, by creation year – 2023-2030

	2023	2024	2025	2026	2027	2028	2029	2030
NSW	11.4	10.1	8.3	6.6	5.1	3.4	2.3	1.3
QLD	8.8	6.8	5.5	4.4	3.1	1.8	1.1	0.6
SA	2.9	2.3	1.9	1.6	1.2	0.8	0.5	0.3
TAS	0.4	0.3	0.3	0.2	0.2	0.1	0.1	0.1
VIC	6.4	5.4	4.5	3.9	3.2	2.2	1.6	0.9
ACT	1.0	0.7	0.5	0.4	0.3	0.2	0.1	0.1
WA	2.9	2.6	2.3	1.9	1.5	1.1	0.7	0.4
NT	0.2	0.2	0.2	0.2	0.2	0.2	0.1	0.1
Australia	34.1	28.3	23.5	19.3	14.9	9.8	6.5	3.7

Note: Includes residential and commercial STC creations. STC creations are presented by creation year.

Source: ACIL Allen analysis

3.2 STC creation from eligible water heaters

Figure 3.5 shows the historical and projected annual eligible water heater installations by installation reason and technology type.

New dwelling installations have historically tracked along at a consistent annual level, with ASHP growing in market share. We project new dwelling installations of eligible water heaters based on recent installation rates as a percentage of new dwellings. Likely drivers include the recent update to the National Construction Code to 7-stars which now accounts for the energy usage of household appliances such as hot water systems. The percentages adopted for new dwellings, which vary by region, average 12% of eligible dwellings for ASHP and 5% for SWH.

ASHP replacement installations have increased significantly between 2020 and 2023, with the majority of ASHP installations replacing existing electric water heaters. Likely drivers include the introduction of financial incentives under state-based energy efficiency schemes, government incentives to encourage households to replace inefficient water heaters, and an increase in retail electricity prices.

For the period 2024-2028, we assume that replacement installations as a percentage of eligible dwellings is equal to the percentage in 2023, except for in NSW and QLD, for which we assume the percentage is equal to the average of 2022 and 2023. This is because the incentives in these regions have reduced in 2024 (discussed further below) which may reduce replacement installations in these regions compared to the high level of installations in 2023. The percentages adopted for replacements, which vary by region, average 0.06% of eligible dwellings for ASHP and 0.01% for SWH replacements.

For the period 2024-2028, we assume that new dwelling installations as a percentage of total new dwellings is higher than 2023 because of updates to the National Construction Code to 7-star efficiency from May 2024, which now accounts for the energy usage of household appliances such as hot water systems.

For all regions, we assume that current financial incentives and regulations remain at a similar level over the projection period, except for announced changes such as the increase in co-payments from $30 to $200 for hot water replacements, and the lowering of baselines under the NSW ESS from June 2024, and the updates to the National Construction Code to 7-star efficiency from May 2024. The Climate Smart Energy Savers rebate in Queensland also closed in 2024.

Our analysis of payback periods (refer to Appendix) for eligible water heaters indicates a favourable payback period for ASHP compared to SWH from around 2022 due to higher energy efficiency of ASHP and lower installation costs (including subsidies), which is why our projections reflect a higher proportion of ASHP installations.

More detailed information on regional subsidies for eligible water heaters are provided in the Appendix.

Figure 3.5 Historical and projected annual eligible water heater installations, by installation reason and technology type – 2016-2030

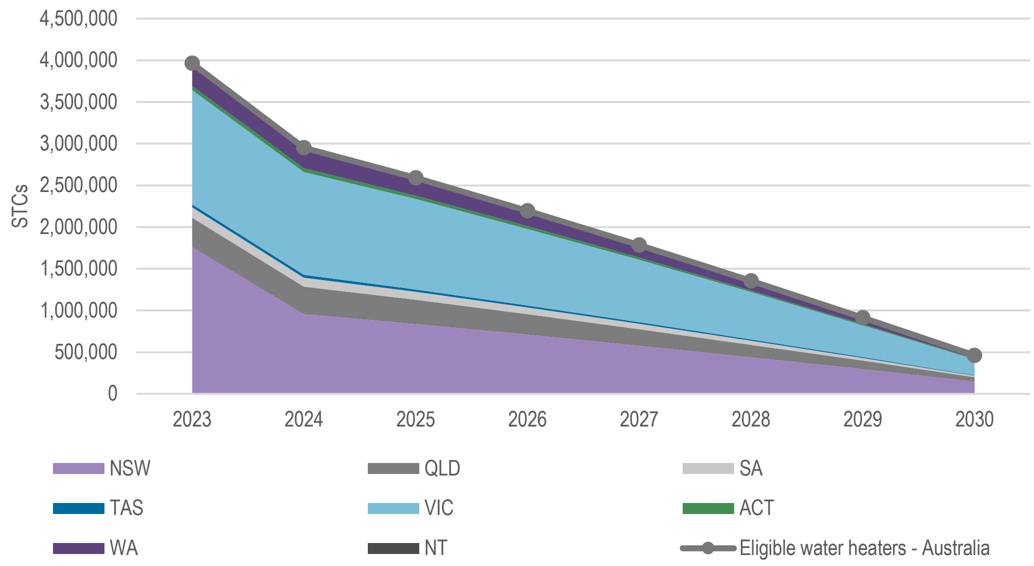
Note: Historical data up to 31 December 2023; projected thereafter.

Source: ACIL Allen analysis

Figure 3.6 and Table 3.4 show the projected annual STC creations from eligible water heater installations for the 2023 to 2030 compliance years.

The model translates the projected installations of each eligible hot water system into projected STC creations by applying the deeming period to an assumed average value of STCs per installation per year. The average value of STCs per installation varies by region, technology type, system brand/model and deeming year, with an average value of 29 STCs per installation. Projected STCs decline due to the declining deeming period.

Figure 3.6 Projected annual STCs from eligible water heaters by region – 2023-2030



Note: Actual installations up to 31 December 2023; projected thereafter.

Source: ACIL Allen analysis

Table 3.4 Projected annual STCs (millions) from eligible water heater installations – 2023-2030

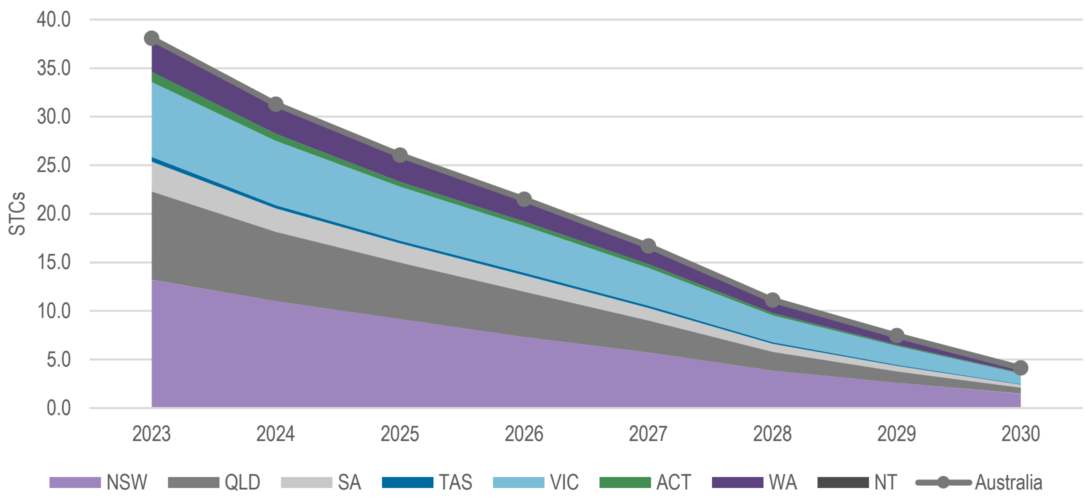
	2023	2024	2025	2026	2027	2028	2029	2030
NSW	1.76	0.95	0.84	0.71	0.57	0.44	0.30	0.15
QLD	0.35	0.33	0.29	0.25	0.20	0.15	0.10	0.05
SA	0.13	0.11	0.10	0.08	0.07	0.05	0.03	0.02
TAS	0.03	0.03	0.03	0.02	0.02	0.01	0.01	0.00
VIC	1.37	1.23	1.08	0.92	0.75	0.57	0.38	0.19
ACT	0.05	0.05	0.04	0.03	0.03	0.02	0.01	0.01
WA	0.25	0.23	0.20	0.17	0.14	0.11	0.07	0.04
NT	0.02	0.01	0.01	0.01	0.01	0.01	0.00	0.00
Australia	3.96	2.95	2.59	2.20	1.79	1.36	0.91	0.46

Source: ACIL Allen analysis

3.3 Total STC creation

Figure 3.7, Table 3.5and Table 3.6 provide projected total STC creations by creation year for 2023 to 2030 compliance years, which are the sum of projected STCs from solar PV and eligible water heater installations.

Figure 3.7 Total projected annual STCs, by region – 2023-2030



Note: STC creations are presented by creation year.

Source: ACIL Allen analysis

Table 3.5 Projected total annual STCs (millions) by region and creation year – 2023-2030

	2023	2024	2025	2026	2027	2028	2029	2030
NSW	13.2	11.0	9.1	7.3	5.7	3.8	2.6	1.5
QLD	9.1	7.1	5.8	4.7	3.3	2.0	1.2	0.6
SA	3.1	2.4	2.0	1.7	1.3	0.8	0.6	0.3
TAS	0.5	0.3	0.3	0.2	0.2	0.2	0.1	0.1
VIC	7.7	6.6	5.6	4.8	3.9	2.8	2.0	1.1
ACT	1.0	0.7	0.5	0.4	0.4	0.2	0.1	0.1
WA	3.2	2.8	2.5	2.1	1.7	1.2	0.8	0.4
NT	0.3	0.2	0.2	0.2	0.2	0.2	0.1	0.1
Australia	38.1	31.3	26.1	21.5	16.7	11.1	7.5	4.1

Note: STC creations are presented by creation year.

Source: ACIL Allen analysis

Table 3.6 Projected total annual STC creations (millions), by creation year - 2023 to 2030

	2023	2024	2025	2026	2027	2028	2029	2030
Solar PV	34.1	28.3	23.5	19.3	14.9	9.8	6.5	3.7
SHW/ASHP	4.0	3.0	2.6	2.2	1.8	1.4	0.9	0.5
Total STCs	38.1	31.3	26.1	21.5	16.7	11.1	7.5	4.1

Note: STC creations are presented by creation year.

Source: ACIL Allen analysis

Appendices

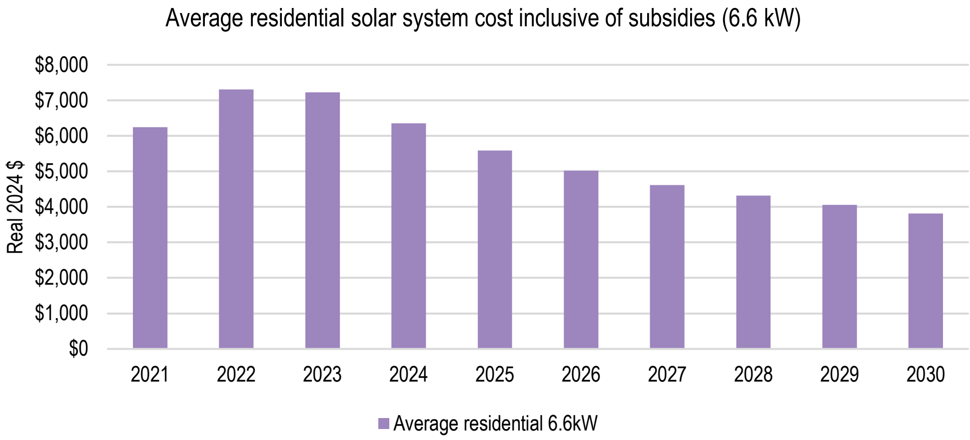
A Assumptions

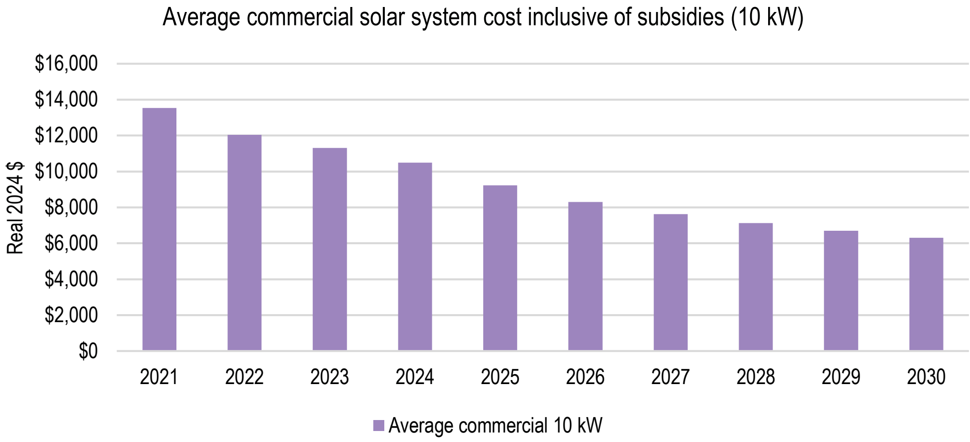
The key assumptions underpinning the projections are outlined in this Appendix.

A.1 Installation costs

Historical solar PV installation costs are sourced from Solar Choice, are inclusive of subsidies, and are used as a starting point in 2024 for the projections. We assume installation costs experience a decline based on learning rates from CSIRO's GenCost reports (ranging from 12% decline in 2025 to 6% decline by 2029), outweighing the decrease in revenue from the declining deeming period.

Figure A.1 Average solar system cost inclusive of subsidies (Real 2024 $)





Source: ACIL Allen analysis of Solar Choice data

Hot water installation costs in 2024 are sourced from manufacturer websites, with adjustments made for STC subsidies, state-based subsidies, and the appliance price index (to adjust to pre-2024).

The higher cost in 2022 is because of an increase in the unsubsidised price of systems and a reduction in the STC subsidy due to declining deeming period. The reduction in 2023 is due to several state-based subsidies. The higher cost in 2024 and 2025 is due to the reduction in the STC subsidy due to declining deeming period and the reduction in some state subsidies. The decline in unsubsidised costs in the period after 2025 outstrips the impact of the declining STC subsidy.

Figure A.2 Average eligible water heater cost inclusive of subsidies (Real 2024 $)

Source: ACIL Allen analysis of hot water system manufacturer prices

A.2 Electricity prices

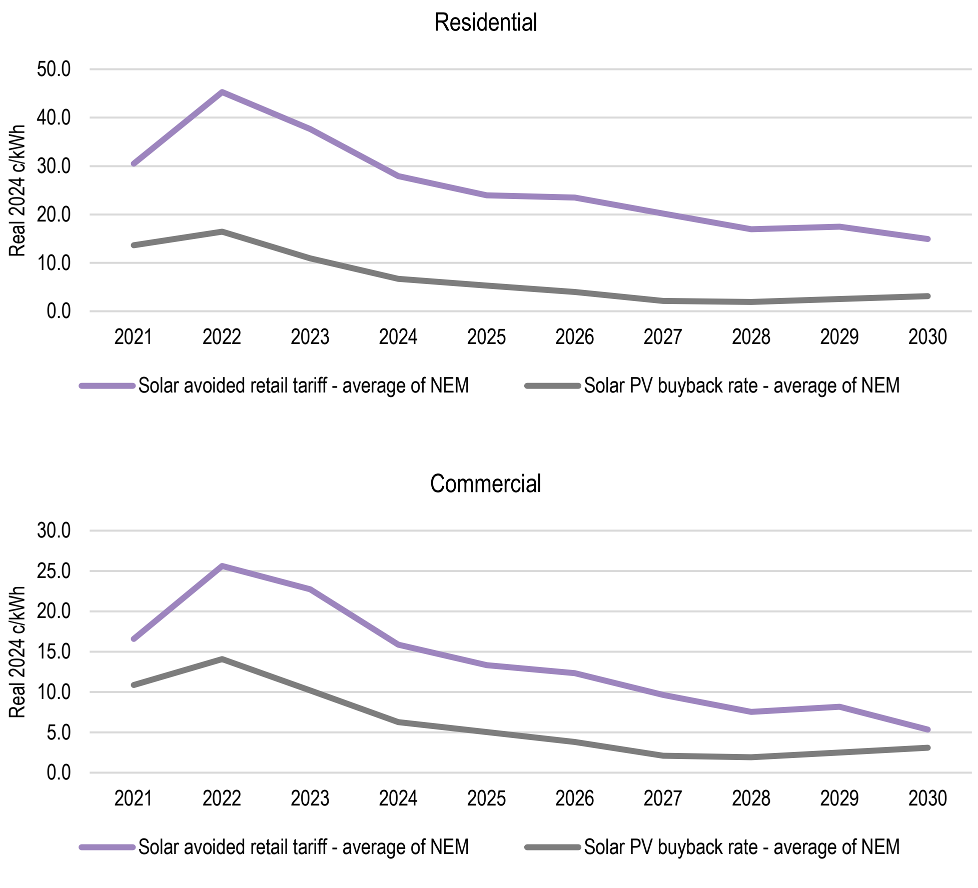
Retail tariffs include wholesale, network, environmental, and retailing costs. Wholesale electricity costs are modelled using our in-house PowerMark market simulator.

Network, environmental and retailing costs are based on data from publicly available sources such as the AER determinations regulator determinations and AEMO.

Projected prices decline over the period because of assumed build out of significant renewable and storage capacity, incentivised by state-based schemes such as the NSW Roadmap and the Queensland Energy and Jobs Plan and Australia-wide schemes such as the expanded Capacity Investment Scheme (CIS). Solar avoided tariffs (or retail tariffs) include the variable network component only.

Solar buyback rate (or the solar feed-in tariff) reflects the projected generation-weighted price of solar PV. This is projected to decline over time because of assumed build out of significant renewable capacity. After 2028, the solar buyback rate is projected to increase with the expected closure of large amounts of steam turbine capacity (coal-fired and gas-fired).

Figure A.3 Solar avoided retail tariffs and solar buyback rate in the NEM (real 2024 c/kWh)

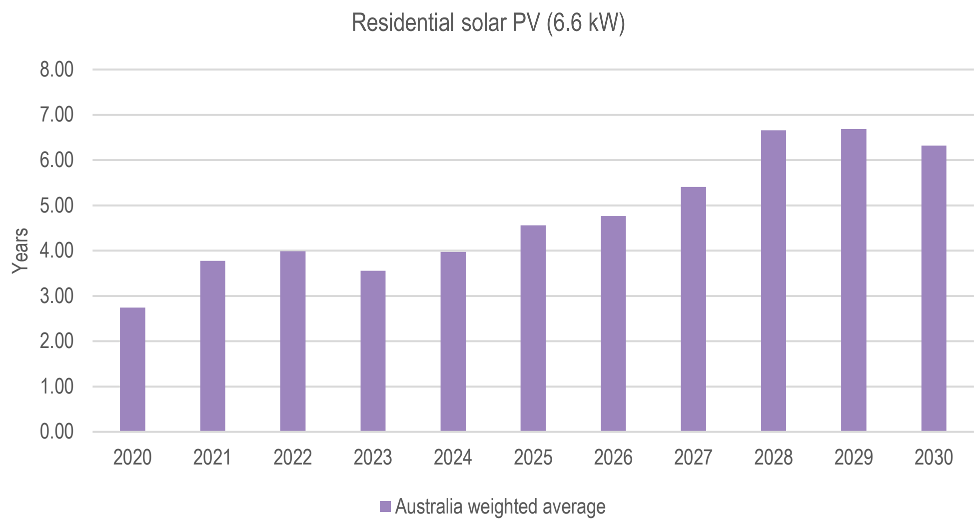


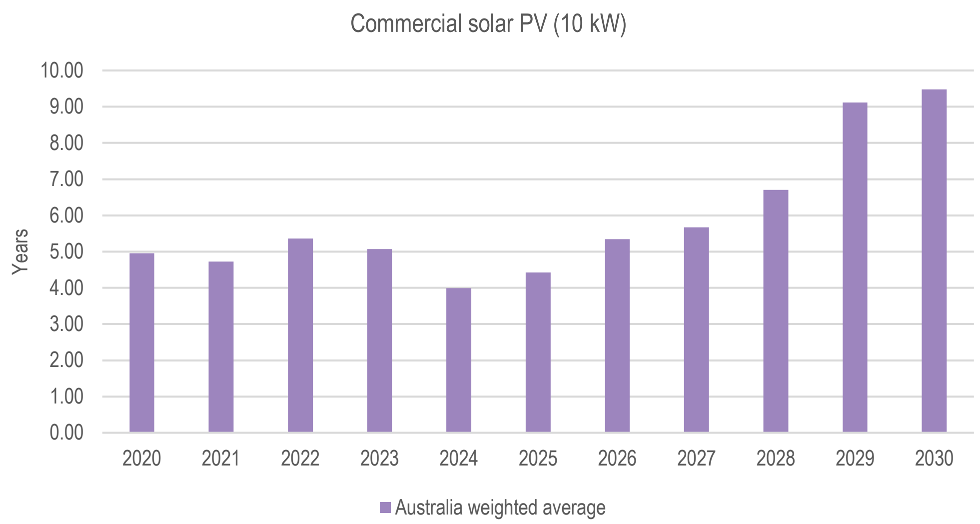
Source: ACIL Allen analysis

A.3 Payback periods

Average payback periods for small-scale solar installations are a function of the upfront installation cost, and the future value of avoided electricity expenditure and the revenue received from PV exports. The model takes account a lagged impact of electricity prices on installation rates and is already considered in the payback periods shown below. The projected increase in payback periods is driven by the projected decline in retail electricity tariffs and solar feed-in-tariffs, which offsets the impact of declining installation costs. The slight decline in payback periods for residential PV in 2029 and 2030 is due to the projected increase in the solar buy back rate, as discussed earlier.

Figure A.4 Average payback periods for solar PV





Source: ACIL Allen analysis

Average payback periods for eligible hot water systems are a function of the upfront installation cost, and the future value of avoided electricity expenditure. There is no lag assumption for the impact of electricity prices in the payback periods for eligible hot water systems. This reflects that replacement decisions generally occur soon after the failure of an existing hot water system or are tied to the timing of construction of a new dwelling. From 2022, ASHP payback periods are lower than SWH, which reflects higher energy efficiency and lower installation cost of ASHP.

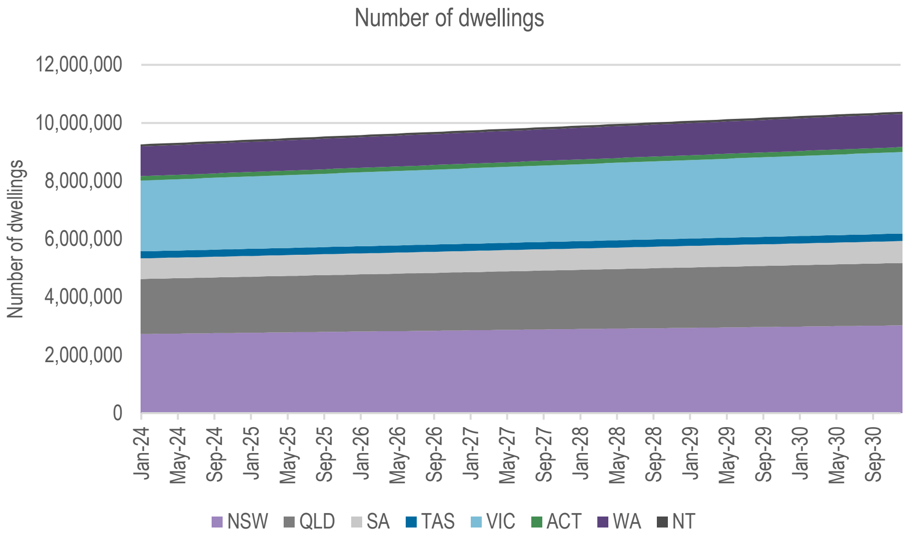
Figure A.5 Average payback periods for eligible water heaters

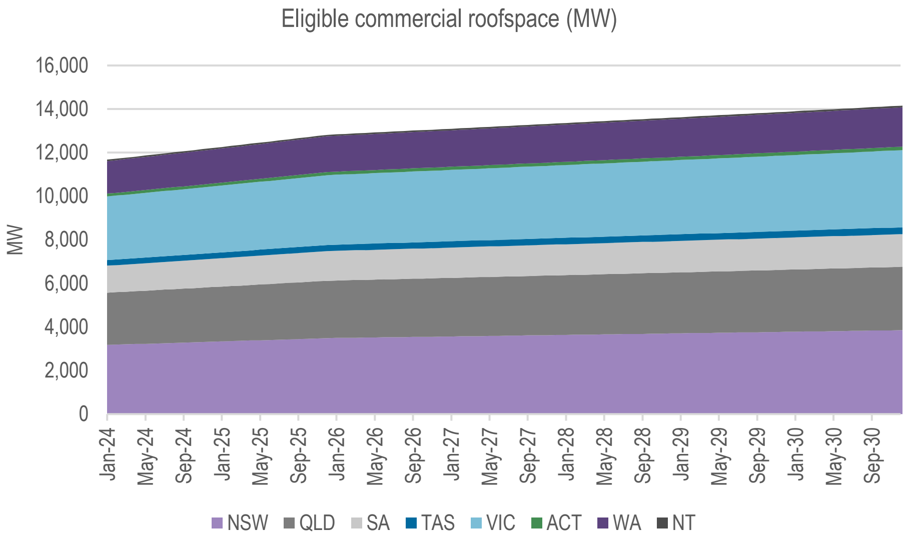
Source: ACIL Allen analysis

A.4 New dwellings and commercial roof space

Figure A.6 shows assumed eligible dwellings (for residential installations) and commercial roof space for (commercial installations). Commercial roof space is characterised in MW terms rather than numbers of buildings because of the large roof size range in this market segment.

Figure A.6 Eligible dwellings projection (top panel) and eligible commercial roof space MW (lower panel)



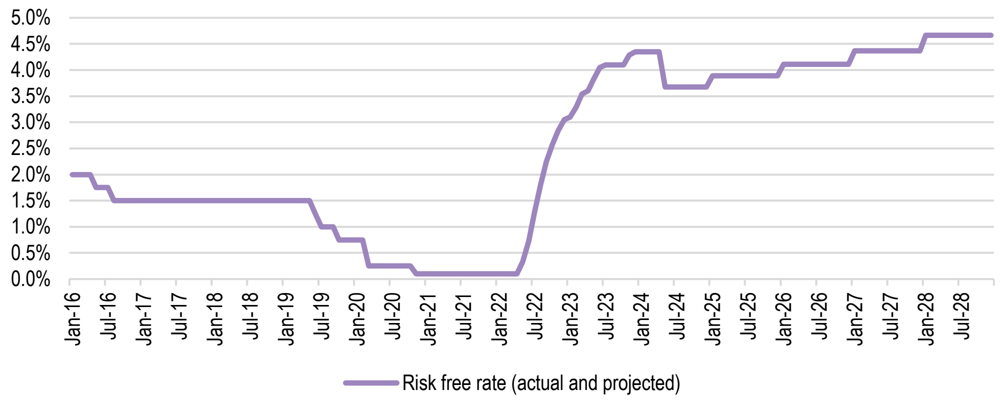


Source: ACIL Allen analysis of ABS and Institute for Sustainable Futures data

A.5 Interest rates

ACIL Allen has used 10-year government bond data from the RBA to represent the risk-free rate. We assume projected rates continue at current levels, increasing slightly to converge to a long-term view of 5.5%.

Figure A.7 Historical and projected risk-free rate



Source: ACIL Allen analysis of RBA data

A.6 Government subsidies

Current government rebates and energy efficiency schemes are assumed to remain at similar levels throughout the projection period. Assumed subsidies are detailed in Table A.1.

Table A.1 Government subsidies for ASHP and SWH

States	Rebate programs	SWH or ASHP	Details	Conditions	Residential /Business	Source
VIC	Solar homes program	Both	Households: 50% on SWH or ASHP or up to $1,000. In combination with rebate on solar panel possible.	The hot water system to be replaced is at least three years old from the date of purchase	Residential and small business	Households: https://www.solar.vic.gov.au/hot-water-rebate
VIC	Victorian Energy Upgrades	Both	Households and business can receive Victorian Energy Efficiency Certificates (VEECs) upgrades. Households: Replacing electric hot water for heat pump ($1,050) and replacing gas water heater for heat pump or solar hot water ($490) Business: Replacing electric hot water for heat pump or solar hot water ($900) and replacing gas water heater for heat pump ($420)	Replacing an inefficient electric or gas hot water system (Households) replacing an electric or gas hot water system for a more efficient system (Business)	Residential and small business	Households: https://www.energy.vic.gov.au/for-households/victorian-energy-upgrades-for-households/hot-water-systems Business: https://www.energy.vic.gov.au/for-businesses/victorian-energy-upgrades-businesses/hot-water-systems

States	Rebate programs	SWH or ASHP	Details	Conditions	Residential /Business	Source
NSW	Energy Savings Scheme Rebate	Both	Cost of $33 to join the program. This will increase to $200 from June 2024. This program does not provide a rebate but allows you to benefit from the creation of ESCs. The number of ESCs will be reduced by around 30% from July 2024. The installer of the hot water heater needs to be an Accredited Certificate Provider and can create certificates based on the expected reductions.	Replacement of existing electrical or gas hot water heater to solar water heater or heat pump	Residential and small business	Households https://www.energy.nsw.gov.au/households/rebates-grants-and-schemes/household-energy-saving-upgrades/upgrade-your-hot-water Business https://www.energy.nsw.gov.au/business-and-industry/programs-grants-and-schemes/business-equipment/hot-water
QLD	Climate smart energy savers rebate (CLOSED in 2024)	Both	Standard rebate for ASHP and SWH is $800, low-income rebate is $1,000 (NOW CLOSED in 2024).	Must replace another appliance	Residential	https://www.qld.gov.au/housing/home-modifications-energy-savings/climate-smart-energy-savers/about
SA	-Retailer Energy Productivity Scheme -Adelaide City	Both	REPS: Amounts vary depending on models ($348 on YESS, $847 on Adelaide heat pumps) Adelaide City: All residential properties can replace a hot water system with a 50% rebate up to $1,000. Commercial replacement of hot water system can receive a rebate of 50% up to $5,000. Adelaide City: For residential tenants and concession card holders, a top up on the REPS from Adelaide city of 25% or up to $500	Replacement existing water heaters. There are no conditions that state that the REPS and Adelaide city rebate can't be used together. Household can only apply to one type of REPS rebate, so if a household has already used it for another energy efficiency system it can't access this. Residents of Adelaide can also apply for the Adelaide City top up.	Residential and small business	https://www.escosa.sa.gov.au/industry/reps/faqs/households-businesses https://www.cityofadelaide.com.au/about-council/grants-sponsorship-incentives/incentives-for-sustainability/#Incentives_5831394

States	Rebate programs	SWH or ASHP	Details	Conditions	Residential /Business	Source
ACT	Energy efficiency improvement scheme Home energy support rebate for concession holders ACT Government's Business Energy and Water Program	Both	The scheme is enacted by different retailers like the Energy-efficient electric water heater upgrade from ActewAGL. ActewAGL provides a rebate of $500 of the purchase price of a new hot water heat pump for ACT Residents (only for ActewAGL customers). Concession holders can also get a 50% rebate up to $2,500 for a hot water heat pump. For business that want to increase energy efficiency by installing a new hot water system, they can get a rebate up to $5,000 on a 50/50 contribution basis.	Only for replacement of gas or electric hot water heater.	Residential	https://www.climatechoices.act.gov.au/policy-programs/energy-efficiency-improvement-scheme https://www.climatechoices.act.gov.au/policy-programs/home-energy-support-rebates-for-homeowners
TAS			No rebates available.			
NT			No rebates available			
WA			No rebates available			

Source: Various government websites

A.7 Data sources

Table A.2 summarises the key input assumptions and data sources used in this analysis.

Table A.2 Key assumptions and data sources

Key input assumption	Data source
Population, residential dwelling projections, inflation	ABS 'mid' case projections
Commercial roof space	Institute for Sustainable Futures report on available roof space for solar PV in Australia assessed at: chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/https://apvi.org.au/wp-content/uploads/2019/06/isf-rooftop-solar-potential-report-final_.pdf
Interest rates	RBA
Retail electricity prices	Wholesale energy costs from ACIL Allen Reference case projection, renewable energy costs from the CER, retailing costs from regulatory reports, network costs from regulatory determinations
PV system costs	Historical costs from Solar Choice; projected based on latest ISP Step Change scenario
Hot water system costs and energy efficiency ratings	Current costs from Choice and various hot water system manufacturer websites; projected based on similar decline rate of solar PV system costs.
Historical SRES installations	CER
Deeming periods	CER
Locational production factors	CER
Government incentives/subsidies/schemes	Various State Government and Regulator websites
Uplift factor to account for replacement installations relative to new installations (for example, from the data, 80% of installations are new, so therefore, projected total installations are new installations divided by 80%).	ACIL Allen analysis of CER data
Lag between installation and STC creation	ACIL Allen analysis of CER data

Source: ACIL Allen

A.8 PowerMark wholesale electricity market modelling assumptions

ACIL Allen maintains a Reference case projection of the National Electricity Market (NEM), which it updates each quarter in response to supply changes announced in the market in terms of new investment, retirements, fuel costs, and plant availability.

Projected electricity prices used in this analysis are based on our March quarter 2024 Reference case projection settings which, in the short term, are closely aligned with AEMO's Integrated System Plan (ISP) and ESOO. Table A.3 summarises the key assumptions adopted in the Reference case that are pertinent to the period to 2030.

Table A.3 Overview of National Electricity Market Reference case assumptions

<table>
<tr><th>Assumptions</th><th colspan="4">Details</th></tr>
<tr><td>Macro-economic variables</td><td colspan="4">– Exchange rate of AUD to USD converging to 0.75 AUD/USD.
– Inflation of 2.5 per cent per annum in the long-run.
– The brent crude oil price is assumed to converge from current levels to USD65/barrel by the mid-2020s and remain at this level in the long-run.
– International thermal coal prices are assumed to converge from current elevated levels of about USD$130/t to USD$80/t by 2030.</td></tr>
<tr><td>Electricity demand</td><td colspan="4">The demand forecast used in the wholesale electricity market modelling is based on the AEMO Draft 2024 ISP Step Change scenario (energy and POE50 peak demand).
Projected uptake of rooftop solar PV, home battery systems and electric vehicles are based on outputs from ACIL Allen’s modelling.</td></tr>
<tr><td>Federal greenhouse gas emission policies</td><td colspan="4">– Economy-wide 43% reduction in GHG emissions below 2005 levels by 2030 and a net zero emissions target by 2050.
– National target of 82% renewable energy generation by 2033 (see note on Capacity Investment Scheme below).</td></tr>
<tr><td rowspan="2">State based schemes</td><td>NSW
NSW Roadmap capacity of:
– 12 GW renewables by 2032 within designated Renewable Energy Zone (REZ)
– 2 GW long-duration storage by 2030</td><td>QLD
Powering Queensland Plan:
– CleanCo has been mandated to contract for a total capacity of 1 GW
Queensland Energy and Jobs Plan (QEJP):
– QRET target of 50 per cent renewable energy generation by 2030
–</td><td>TAS
TRET target of 15,750 GWh (150 per cent) of renewable energy by 2030</td><td>VIC
VRET targets of 40 per cent by 2025, 50 per cent by 2030.

Victoria energy storage targets:
– At least 2.6 GW storage capacity by 2030
Offshore wind capacity target:
– 2 GW of offshore wind capacity by 2032</td></tr>
<tr><td colspan="4">SA</td></tr>
</table>

<table>
<tr><th>Assumptions</th><th colspan="3">Details</th></tr>
<tr><td rowspan="2"></td><td colspan="3">The government has indicated a 100 per cent net renewable energy ambition by 2030. The SA government announced its Hydrogen Jobs plan in December 2022. It includes the development of a 250 MW electrolyser, a 200MW hydrogen-fuelled power generator and a hydrogen storage facility by the end of 2025.</td></tr>
<tr><td colspan="3">All NEM states: Economy-wide net zero emissions by 2050; interim targets of 50 per cent reductions by 2030.</td></tr>
<tr><td>Capacity Investment Scheme (CIS)</td><td colspan="3">The Capacity Investment Scheme (CIS) aims to:
– deliver 32 GW of new capacity nationally, made up of 23 GW of renewable capacity and 9 GW of clean dispatchable capacity; the Reference case assumes about 17 GW renewable and 6 GW of dispatchable capacity is developed in the NEM (with the remaining capacity allocated to non-NEM grids)
– fill expected reliability gaps in the energy network as ageing coal-fired power stations exit
– deliver the Australian Government’s 82% renewable electricity by 2030, however the Reference case stretches out the rollout of the scheme by three years, meaning that the 82% target is met by 2033, reflecting a more realistic/achievable timetable of investment.</td></tr>
<tr><td>Electricity supply (beyond new supply driven by state-based schemes)</td><td>Committed projects
– Named new entrant projects are included in the modelling where there is a high degree of certainty that these will go ahead (i.e., project has reached financial close)
– Includes the Federal Government’s Snowy 2.0 by 2030.</td><td>Assumed new entry and closures
– 200 MW of corporate PPAs across New South Wales and Victoria entering from mid-2026 to reflect the continued appetite by larger corporates to demonstrate their green credentials as well as reduce electricity costs ahead of the rollout of the various state-based schemes
– Committed or likely committed generator closures included where the closure has been announced by the participant (Torrens Island B in 2026, Yallourn in 2028, Eraring in 2029, Bayswater and Stanwell in 2033, Tarong and Tarong North in 2034, Loy Yang A and Kogan Creek by 2035).</td><td>Projected new entry and closures
– Beyond committed and assumed projects, only commercial generic new entrants are introduced within the modelling.
– Closure of existing generators where the generator is projected to be unprofitable over an extended period of time or the generator’s expected closure year as indicated to AEMO – whichever is earlier.</td></tr>
<tr><td>Gas prices into gas-fired power stations</td><td colspan="3">– The East Coast Gas Market (ECGM) is modelled by ACIL Allen’s GasMark model, which produces projections of seasonal gas prices delivered into the NEM’s gas fired generators.
– Gas prices for mid merit CCGTs are projected to:
  – commence the projection at around $9-$15/GJ (summer – winter)</td></tr>
</table>

<table>
<tr><th>Assumptions</th><th colspan="3">Details</th></tr>
<tr><td></td><td colspan="3">— gradually increase to about $13-25/GJ by the mid-2030s when demand for GPG peaks with the closure of coal plant
— Gas prices for peaking OCGTs are assumed to:
— commence the projection at around $16-$26/GJ (summer – winter)
— gradually increase to between $15-$40/GJ by the 2030s</td></tr>
<tr><td rowspan="2">Coal prices into coal-fired power stations</td><td colspan="3">ACIL Allen's in-house understanding of the cost of thermal coal to the NEM's coal-fired power stations, based on existing contracts with domestic mines and the plant's exposure to the international export market. However, between 2023 and 2027, export coal prices are capped at AUD$125/t as part of the Government's response to high electricity prices.</td></tr>
<tr><td>New South Wales
The delivered marginal coal prices in NSW are assumed to be linked to export parity and therefore follow the assumed movement in export coal prices. However, from FY24 coal prices are capped at AUD$125/t.
Marginal coal prices decline from $9/GJ in 2023 to $5/GJ by 2025 under the coal price cap, to about $4/GJ by 2030 with the assumed decline in ex[ort coal prices.</td><td>Queensland
There are four types of coal supply arrangements across the Queensland fleet, with most generator's fuel supply not linked to export pricing.
Marginal coal prices range from $1.10 to $3.70/GJ for the entire projection period.</td><td>Victoria
Coal mined for power generation in Victoria is unsuitable for export and hence not affected by fluctuations in export prices.
Marginal coal prices range from $0.28 to $0.78/GJ, representing marginal mining costs.</td></tr>
<tr><td>Coal & gas price caps</td><td colspan="3">A gas price cap of AUD$12/GJ and a coal price cap of AUD$125/t have been introduced. This Reference case applies the gas and coal price caps starting from 2023. The caps are expected to end when market prices for export coal and gas fall below cap levels. Based on our assumptions, the coal price cap is in place until 2027, whereas the gas price cap is binding until mid-2025.</td></tr>
<tr><td>Interconnectors</td><td>Existing interconnection
Assumed transfer capabilities updated to reflect recent history and known constraints (e.g., related to planned outages as part of upgrade works).</td><td colspan="2">ISP committed and actionable projects included:
– QNI minor (July 2023); QNI connect (Jul 2029)
– EnergyConnect (Jul 2026)
– Heywood upgrade (Jul 2026)
– VNI Minor (Sep 2022)
– VNI West (Apr 2029)
– Marinus Link (750 MW) (Jul 2029)</td></tr>
<tr><td>Marginal loss factors</td><td colspan="3">ACIL Allen's projections of average annual marginal loss factors (MLF) by generator DUID, developed using commercial power flow software. Our latest calibration with AEMO's forecast has shown over 95 per cent of connection point values deviating by no more than 0.02 from the latest AEMO values for 2023-24.</td></tr>
</table>

Assumptions	Details
Constraints	– Thermal constraints which impact renewable energy zones in Western Victoria, South West New South Wales and Central New South Wales and result in generator curtailment greater than five 5 per cent are included in the Reference case modelling. Stability limit constraints which have a material impact on QLD-NSW and VIC-NSW flows and regional prices during peak periods are also included. – Certain constraints are disabled once upgrades are installed. .

[a] ACIL Allen's modelling considers battery storage technologies of varying duration – the eight-hour batteries are the most prevalent duration option in our modelling results.

Note: Unless stated otherwise, all dollar values in this table are presented in real 2024 AUD.

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