POWERING NEW ZEALAND

The economic case for solar – A cheaper, cleaner and more cheerful alternative.

August 2025

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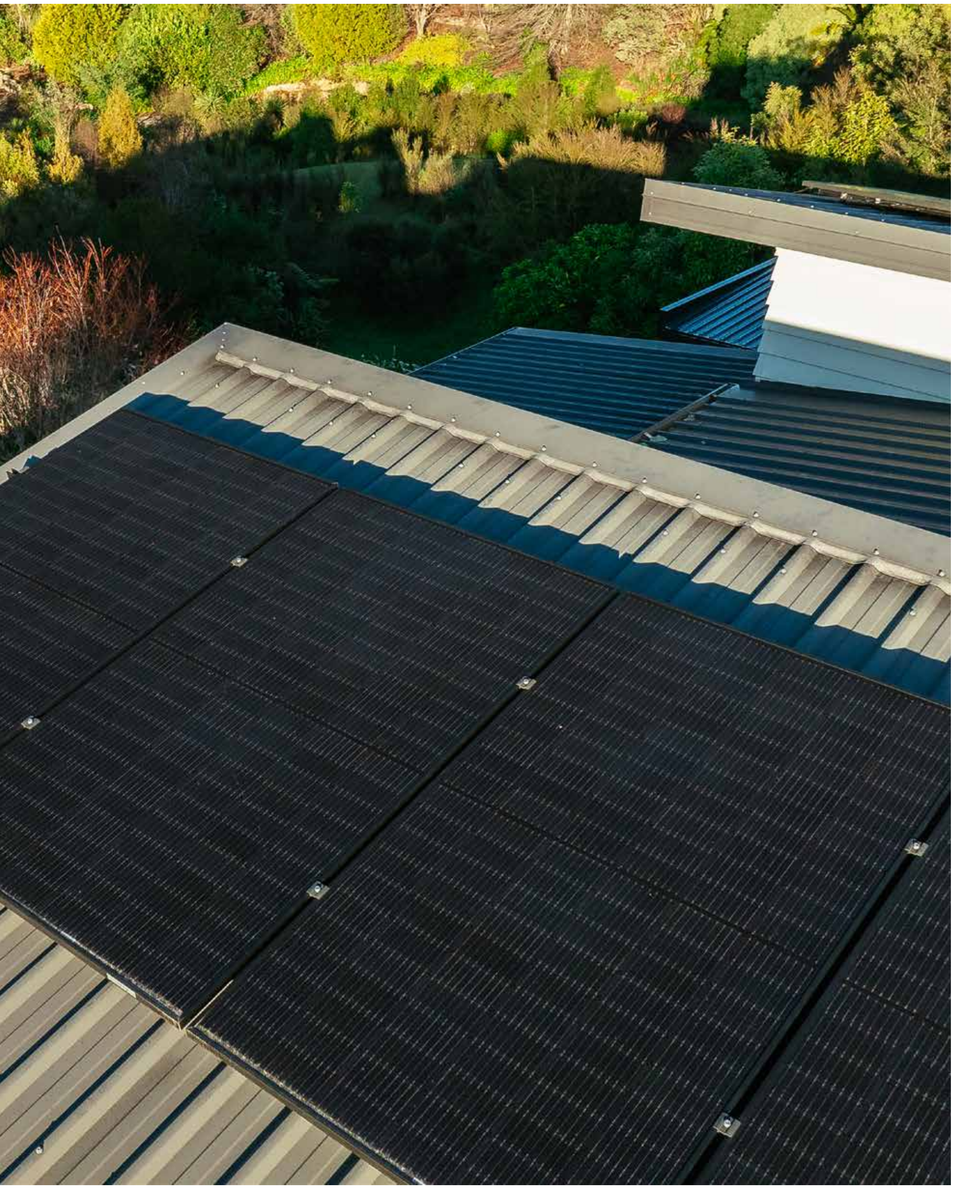

EXECUTIVE SUMMARY

New Zealand will need to dramatically upscale its electricity generation capacity in coming years, with solar set to play a starring role.

And for good reason. Solar is clean, with zero emissions. It is also adaptable. Solar can be installed anywhere and can be configured in many different ways. As such, it not only promotes energy self-sufficiency, but also community resilience to extreme weather and seismic events. It's also cost effective. Upfront capital costs of solar continue to fall, while operating costs remain minimal. Solar also generates co-investment opportunities for a range of landowners and businesses, including Māori and Iwi.

Not surprisingly, we think the outlook for solar is promising. So do others. Work done by MBIE suggests that solar electricity generation could rise ten-fold by 2050, putting it on par with geothermal and wind. As such solar is set to be an important part of the energy mix.

That doesn't mean though that there are not challenges. Regulatory reform has a role to play in encouraging investment in solar to achieve this type of growth. Upcoming changes to the Resource Management Act and the Overseas Investment Act, for example, should help to minimise compliance costs and make it easier for on- and offshore investors to invest in solar power, especially utility-scale solar.

Addressing the intermittency of solar is also important. Battery storage should be the answer. The issue though seems to be cost. While the cost of batteries has tracked lower over time, they remain an obstacle for many.

The national electricity grid needs to be able to handle potential intra-day mismatches between the supply and demand for electricity that can be exacerbated by solar. That should mean more investment in systems that dynamically balance supply and demand for electricity.

Community opposition is also something to consider, especially when it comes to solar farms. Early/ongoing stakeholder engagement and clarifying the benefits of having cheap distributed power is key. Finally, there is the issue of obtaining finance, which can be difficult especially for larger solar farms if there are no power purchasing or off-take agreements in place.

Despite these challenges, we believe that solar power has the potential to transform our energy future, delivering lower cost, lower emissions and more reliable energy solutions for New Zealanders.

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OPPORTUNITIES AND CHALLENGES

Delivering on solar's potential.

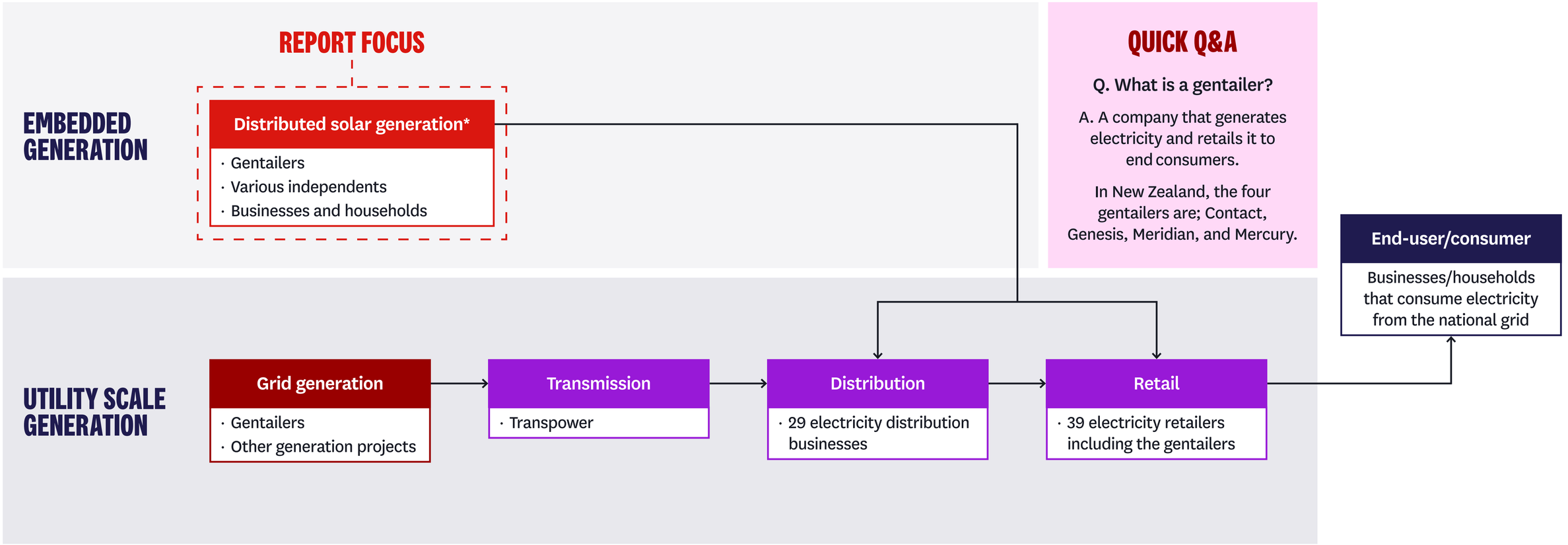
Relevance to type of installation			
	Residential Solar installations purchased by homeowners, typically placed on dwelling rooftops.	**Commercial** Solar panels installed by businesses, typically ground and roof mounted.	**Utility scale** Large ground based installations (solar farms) that feed power directly into the grid.
Opportunities			
Boosting resilience of the national grid		✓	✓
Reduce use of fossil fuels in electricity generation	✓	✓	✓
Expand market participation (selling to the grid, carbon markets)	✓	✓	✓
Shift to smart, responsive grids	✓	✓	✓
Boost local economic development/improve competitiveness		✓	✓
Increase community resilience to adverse weather and seismic events	✓	✓	
Lift property values and optimise land/asset utilisation	✓	✓	✓
Challenges			
Regulation that increases compliance costs/restricts investment		✓	✓
Addressing intermittency through battery technologies	✓	✓	✓
Ensuring the grid can cater for solar power	✓	✓	✓
Community opposition to solar farms			✓
Limited awareness, knowledge and information gaps	✓	✓	
Access to investment finance		✓	✓

Addressing the challenges.

Practical steps to boost solar adoption	Primary responsibility
Continue to reduce red tape and minimise time for consenting processes.	Central/local government, Electricity Authority, Commerce Commission, Māori and Iwi.
Support investment in battery storage to address intermittency, as well as increase the flexibility and resilience of the electricity system.	Central government, Energy Efficiency and Conservation Authority, Battery Industry Group, financial service providers.
Invest in local distribution and high voltage networks so that they can accommodate intermittent and distributed sources of energy. Flexible management options and smart technologies to boost operating efficiencies.	Central/local government, Transpower, electricity distribution businesses.
Leverage international funds/partnerships for large scale infrastructure funding as well as Government backed financial mechanisms that reduce project risks and attract private capital.	Central government, Electricity Authority, financial service providers, onshore and offshore investors.
Standardise processes for connecting distributed solar generation to local distribution networks.	Electricity distribution businesses.
Expand voltage range to allow residential rooftop solar to boost the amount of power that consumers can sell back to electricity retailers.	Central government, Electricity Authority, electricity distribution businesses.
Expand training and apprenticeships to address skills and competency gaps.	Industry participants.
Shift public mindset towards being more accepting of solar farms.	Local government, developers, community leaders.

SCOPE OF REPORT

Focusing on distributed solar power generation.



* The term distributed solar generation refers to generation connected to electricity distribution businesses (EDBs) rather than the high voltage Transpower network.

Note: Electricity from solar is generated by solar farms, businesses and households. While solar farms generate electricity for downstream consumption, businesses and households primarily generate electricity from solar for own use. That does not preclude them from selling excess electricity into the grid for downstream consumption.

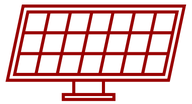
Defining solar.

Two main types of solar
Photovoltaic (PV) solar (focus of this report)
Directly converts sunlight into electricity using panels made of semi-conducting cells.
Solar thermal (outside scope of this report)
Captures the sun's heat using mirrors and angles, converts that into mechanical energy and then into electricity.

Photovoltaic solar features
Scalability and flexibility
Roof mounted installations that serve household dwellings and businesses of all sizes.
Ground mounted embedded installations that serve large commercial and industrial firms.
Ground mounted utility scale installations (or solar farms) that feed into the national grid.
Highly modular - can be expanded or reconfigured by adding or removing solar panels.
Possible configurations[1]
Stand-alone/off-grid without grid power charge (with solar batteries).
Stand-alone/off-grid with grid power charge.
Grid-tied: feed all the solar powered electricity to grid.
Grid-tied: only feed the surplus solar powered electricity to the grid.
Grid-tied with power backup-also known as a grid-interactive system.

QUICK FACTS – SOLAR ENERGY

The PV effect was discovered in 1839 and the first silicon solar cell was built by Bell Laboratories in 1954.



Every hour, almost 100,000 solar panels are installed worldwide.

Source: Wanaka Solar

Just 0.335% of Earth's total surface area is sufficient to power the entire planet with solar.

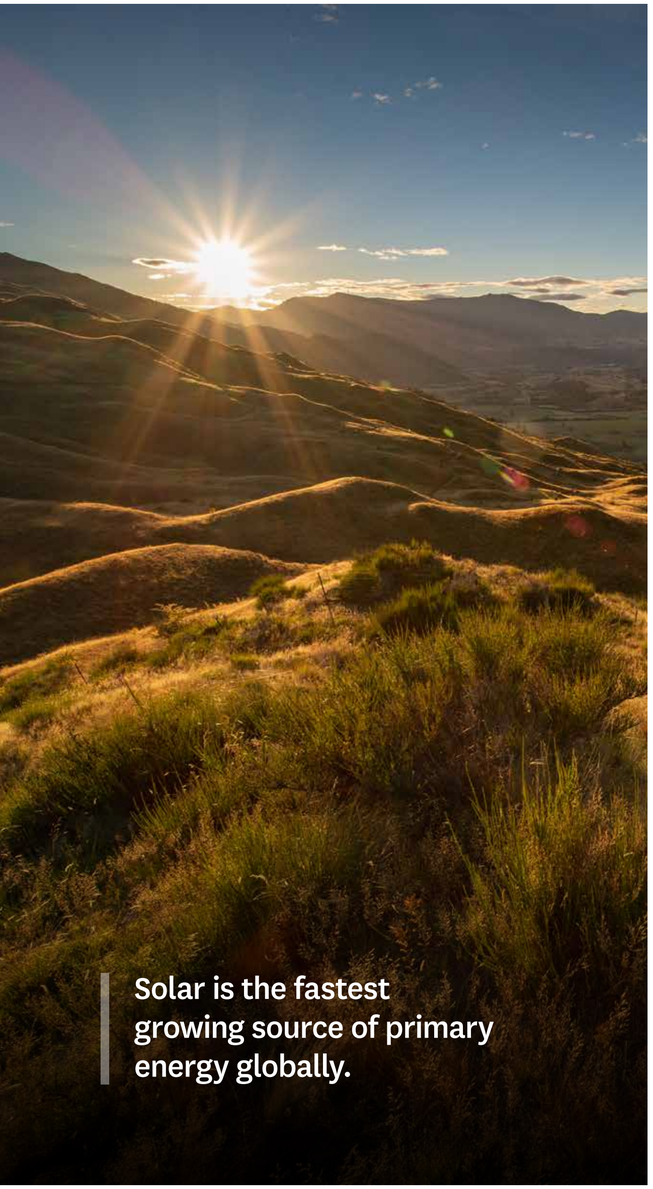
Source: Met Group

Earth receives about 173,000 terawatts of solar energy continuously.

That's more than 10,000 times the world's total energy use.

Source: US Department of Energy

1 Source: **Solar Power Systems in Aotearoa New Zealand: Your Choices | Current Generation**.



TRENDS IN SOLAR ADOPTION

Expanding global solar generation capacity.

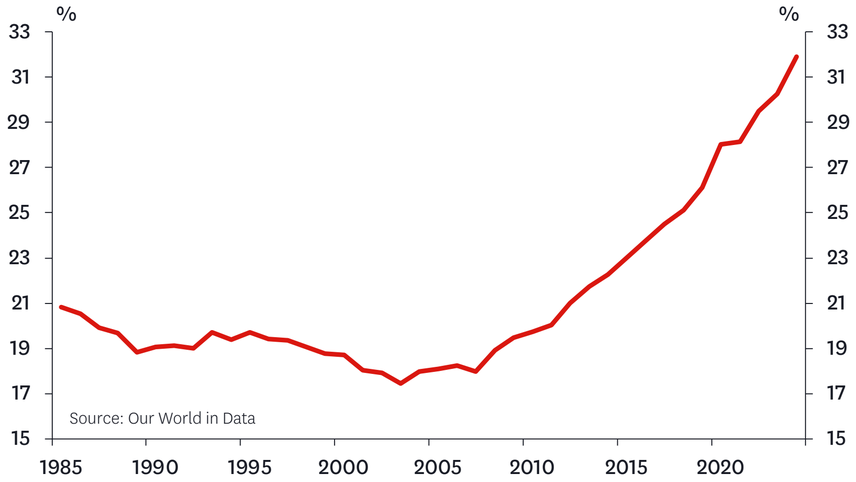
Global renewable use has soared over the past decade.

- The contribution of renewables to global electricity generation continues to accelerate as countries look to transition away from fossil fuel use, satisfy increased demand for electricity and bolster the resilience of their generation capacity.
- Globally, fluctuating energy prices, notably oil, have both encouraged and discouraged the adoption of alternative energy sources.

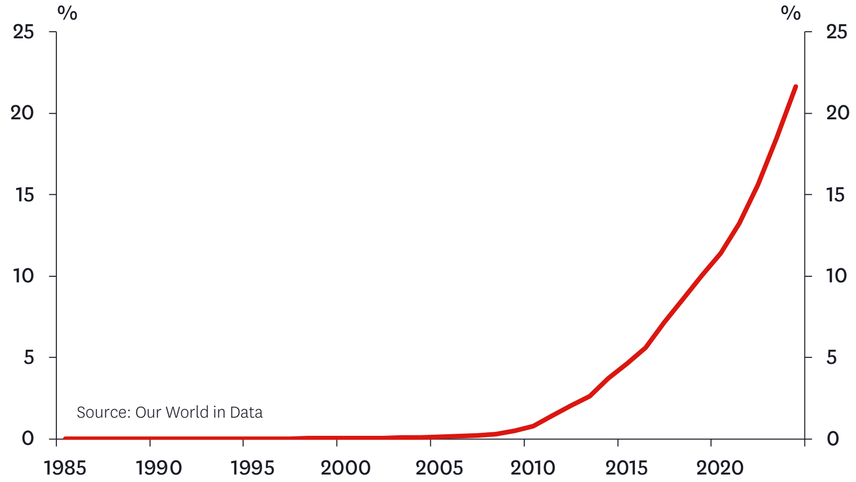
Globally solar has been key in driving use of renewables.

- Solar use globally has grown by an average 28% per year over the last decade, making it the fastest growing primary energy source.
- Uptake has been driven by the need to reduce carbon emissions, declining costs of photovoltaic (PV) panels, increased conversion efficiencies of these panels, very low operating costs, and the inherent modularity of solar.

Use of renewables in global electricity generation.



Solar contribution to global renewable energy generation.

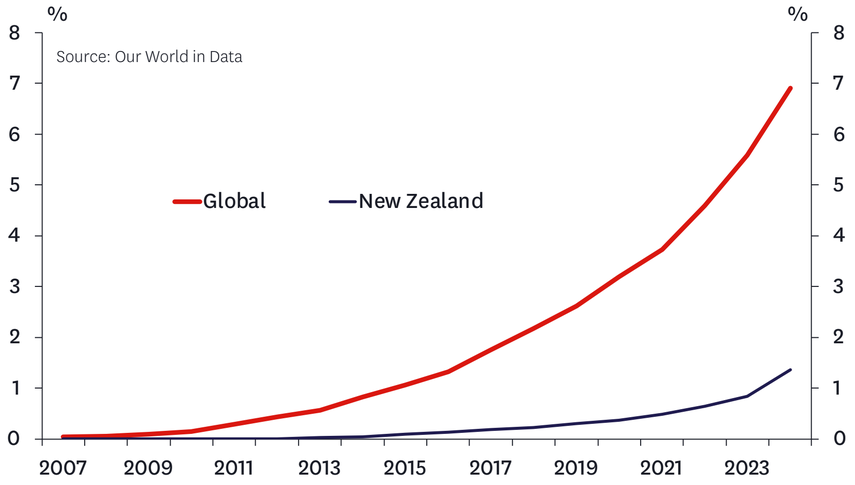


Lagging adoption in New Zealand.

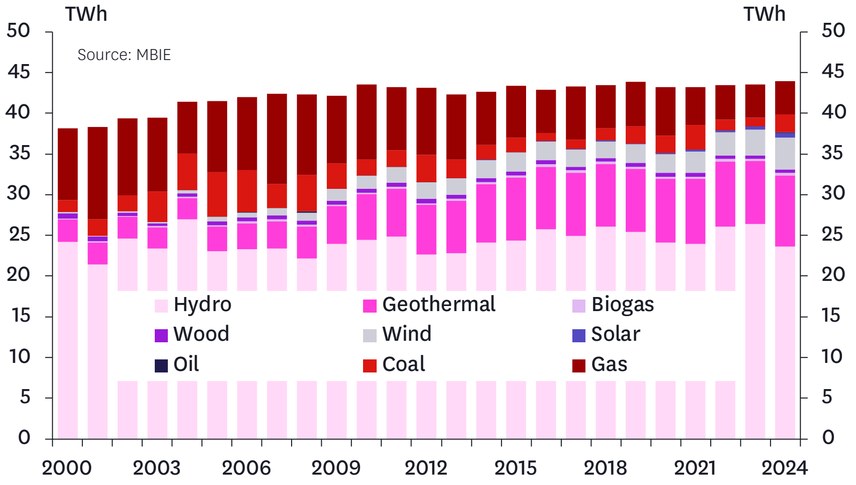
New Zealand has been a follower rather than a leader.

- New Zealand has adopted solar later than its peers. In part that reflects the historical dominance of other renewable energy sources in electricity generation in New Zealand.
- The opposite is true in the EU, US and Australia, where fossil fuels (and nuclear) have historically dominated.
- In many of these countries, solar adoption has been supported by generous government subsidies and support measures that have allowed local manufacturers to gain scale. That was not a consideration in New Zealand.
- Demand in New Zealand tends to peak in the morning and evening, when solar is not available. Contrast that to Australia, which also has a mid-day peak during summer, when solar is most prevalent.
- The accelerated uptake of solar in New Zealand more recently reflects falling costs and the increased viability of installing it, despite a comparatively low average solar irradiance or surface power density.

Relative contributions of solar to total electricity generation.



Annual electricity generation by primary energy source.

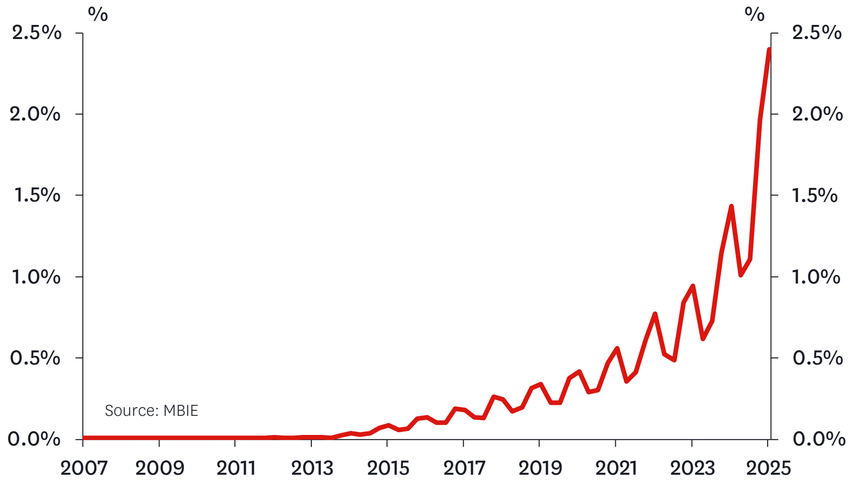


Growing pace of adoption in New Zealand.

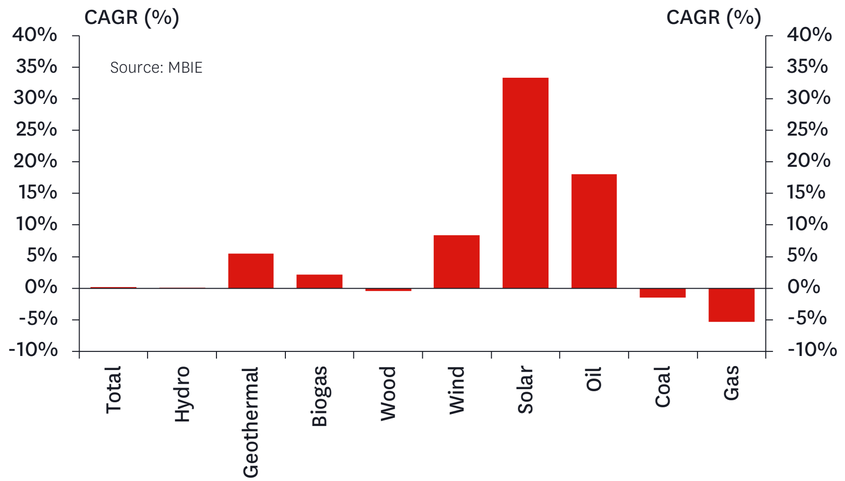
Solar adoption in New Zealand is picking up pace.

- New Zealand's foray into solar may have started later than its peers, but the pace of uptake has increased sharply in recent years.
- We estimate that the compounded annual growth rate of solar adoption in Zealand for the period 2007 to 2024 was far higher than that of other primary energy sources.
- According to Our World in Data, solar accounted for 1.3% of electricity generated in New Zealand in 2023. MBIE data suggests that this has risen to over 2% in 2025 Q1.
- Growth of adoption in New Zealand reflects declining costs, rapid advances in solar technology, and our ongoing efforts to reduce carbon emissions.

Quarterly electricity generation from solar in New Zealand.



Average annual growth rate of energy adoption in New Zealand.



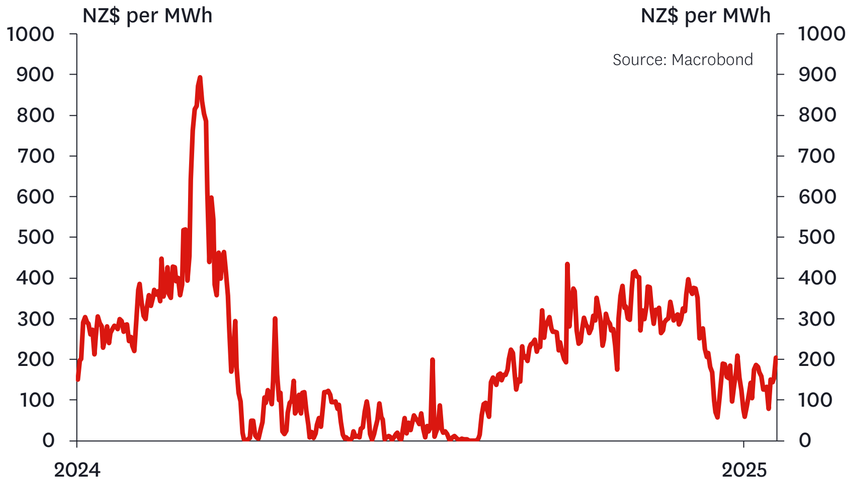
SOLAR GENERATION DEMAND DRIVERS

Clarifying strategic intent.

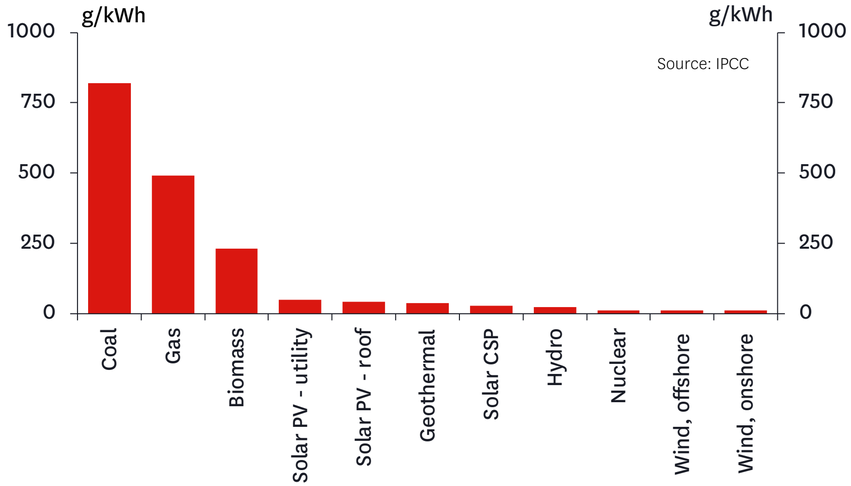
Strategic considerations drive solar adoption in New Zealand.

- Adopting solar increases the resilience of the electricity system and supports the government's strategic goal of ensuring energy security, and achieving decarbonisation.[2]
- Solar also reduces the country's reliance on fossil fuel imports, resulting in a lower exposure to volatile energy markets.
- Increasing diversification of energy sources allows for better electricity supply management, resulting in greater wholesale price stability.
- Solar is critical if New Zealand's electricity system is to cater for an expected ramp up in demand, as transportation and heating electrifies and new industries, such as hyperscale data centres expand.
- Using solar will help to diversify from other energy sources, potentially resulting in lower emissions[3] from electricity generation and a meaningful contribution to New Zealand's climate goals.

Daily wholesale electricity prices in New Zealand.



Average life-cycle CO_2 equivalent emissions globally.



2 Source: **Energy strategies for New Zealand | Ministry of Business, Innovation & Employment**.

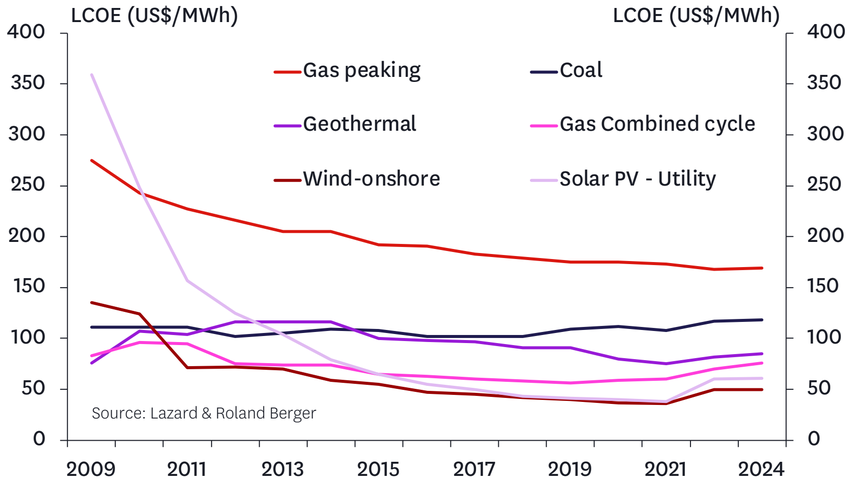
3 Most of the lifecycle emissions associated with solar are tied to the process of manufacturing panels and are offset by clean energy production within the first three years of operation. (Source: solar.com).

Improving absolute and relative cost efficiencies.

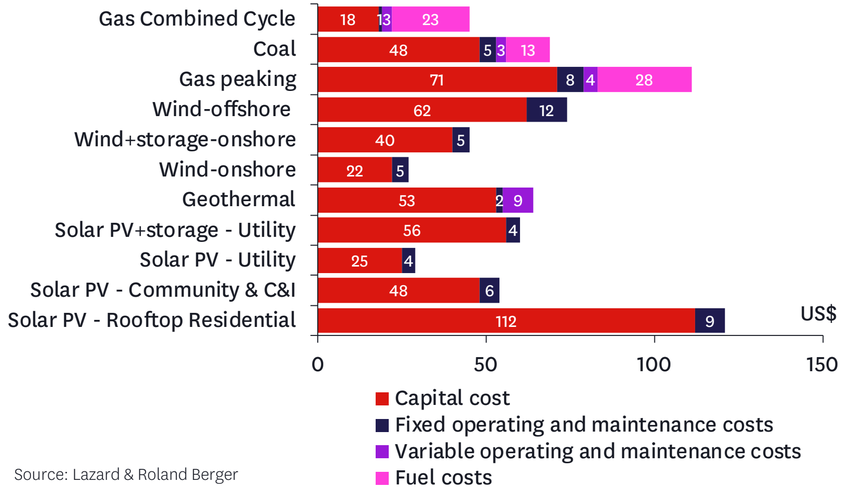
The cost of solar continues to fall.

- Solar is modular and has an unrivalled ability to adapt and expand by integrating additional units/components without having to redesign the entire system. This makes it so much easier to build than other forms of generation.
- Solar is becoming increasingly cost efficient. The levelised costs of electricity provision (LCOE) for solar, which spreads the net present value of the direct cost of electricity over the volume of electricity generated over the lifetime of the generating system, is lower than most other energy sources.
- The average LCOE for utility scale solar PV in the US fell from US$359 per MWh in 2009 to $61 in 2024. However, that does increase when battery storage is included.
- While there are some capital and fixed operating costs associated with solar, unlike other energy sources it does not incur variable costs or fuel costs. By contrast, non-renewable sources of energy incur both.

Average levelised cost of electricity by primary energy source (US).



Comparative average levelised cost by component (US).



Source: Lazard & Roland Berger

> New technologies and industry scale are lowering capital and operating costs.

Changing customer preferences – Case study.

Households are increasingly seeing the benefits of solar.

Recent surveys of US householders suggest the adoption of solar is mostly driven by energy independence and cost savings. While similar surveys do not exist in New Zealand, Westpac customers that we talked to are saying very much the same thing.

"Reducing our power bills was definitely our main motivation for getting solar panels. We've had them installed for about a month at the worst time of year to be producing solar power and have already halved our power usage from the grid."

"We'll need a whole year to see how it pans out, but it's been a great start, and we're looking at big long term cost savings, as well as having an asset on our roof adding value to the property."

"The process of obtaining a Westpac Greater Choices home loan top-up and then getting the panels installed was really easy. We'd encourage people to consider solar as an option if they can."

Dave and Becky Price, Westpac customers, Wellsford

2-3% of New Zealand households have installed solar, suggesting the market is in the early adoption phase.

SOLAR GENERATION SUPPLY DRIVERS

Inherent natural advantages and expanding financial incentives.

Solar generation capacity is a function of sunlight, land availability and financial incentives.

- The power of sunlight reaching New Zealand, typically referred to as solar irradiance, is not particularly high at between 3.5 to 4.5 kWh/m^2/day.
- Many countries have introduced measures to incentivise solar adoption, make investments more profitable, and encourage more efficient technologies.
- Measures include feed-in-tariffs, which offer energy producers a set price for electricity they supply to the grid, thus reducing risk and making solar a more attractive proposition.
- Land can be a constraint for larger utility-scale installations. Issues include land access rights (purchase vs lease vs licensing of the land), consent under the Overseas Investment Act, land use resource consent, and the availability of grid connections.
- Agriculture/forestry activity has impeded the growth of large-scale solar utility generation. However, farmers are increasingly becoming aware of the lower energy costs and/or additional revenue that can be generated from using, selling and/or leasing often marginal land for solar.

Top countries ranked by quality of sunlight.

Rank	Country	Average solar irradiance (kWh/m^2/day
1	Yemen	6.5
2	Chile	6.3
3	Australia	6.2
4	Namibia	6.1
5	Saudi Arabia	6.0
6	Egypt	5.9
7	South Africa	5.8
8	Mexico	5.7
9	United States	5.6
10	India	5.5
15	Iran	5.0
20	Italy	4.5
25	Vietnam	4.0
30	United Kingdom	3.5

New Zealand ranks in this range

Source: Global Solar Atlas

Overcoming technical challenges.

Addressing technical challenges is key to solar generation.

- The national electricity grid needs to be able to match the supply of electricity to demand in real-time. This task becomes more challenging when an increasing proportion of electricity supply comes from an intermittent energy source, such as solar.
- Among other things that could mean more investment in smart grids and demand response systems, which can dynamically balance the supply and demand for electricity. Examples include smart meters, Internet of Things (IoT) sensors, data analytics and automation systems that enable operators to better manage grid stability and efficiency.
- It also means more investment in lithium-ion/lead-acid and flow batteries. As solar makes an ever larger contribution to electricity generation in New Zealand, utility scale storage is likely to become increasingly important in delivering overall system flexibility.
- Battery costs have fallen as much as 100% over the past three decades. Even so, the return on investment period for batteries can be long, depending on energy use and electricity prices, and that can dampen investment in this area.

QUICK FACTS – SOLAR ENERGY STORAGE

The global solar energy storage market is worth US$5.3bn and forecast to rise to $19.1bn by 2032.

Source: **Rated Power**

New Zealand's first grid scale battery began charging and discharging into the grid in 2024.

Source: **Electricity Authority**

Solar batteries typically last 5 to 15 years and are usually recycled at the end of their life.

Source: **SAE Group PTY LTD**

Lithium-ion batteries - price and installation

Year	Price per KWh (USD)	Installed capacity (MWh)
1991	$7,523	0.13
1992	$6,035	1.55
2016	$244	78,000.00
2018	$181	-

The relationship between price and cumulative installed capacity is called the 'learning curve'.

On average, the price of lithium-ion batteries falls 18.9% for every doubling of capacity.

Accessing and converting factor inputs.

Solar generation reflects the availability of inputs and efficiency of conversion into outputs.

- Sunlight is an intermittent resource.
- The amount of usable energy contained per unit of solar is low. Petrol, for example, is estimated to have 10 quadrillion[4] times more energy density than solar radiation.
- The efficiency of converting solar energy into electricity is relatively low, but is improving as technology advances.
- Upfront capital and fixed/variable operating costs for utility scale solar installations are typically lower than for other primary sources of energy.
- There is competition for human capital with the requisite skills and competencies - electrical engineers, grid technicians, and solar battery installers.
- Energy return on Investment: Utility scale solar installations have a competitive EROI given very low operating costs and decreasing upfront capital costs. This is likely to increase as technology leads to improvement in conversion efficiencies.

Solar competes well on cost, with performance improvements set to make it more attractive.

Performance benchmarking of primary energy sources.

Primary energy source	Energy conversion efficiency (%)*	Upfront capital costs (per kW)**	Operating and maintenance costs (per kW per year)	Energy return on investment (%)*
Coal	33-40	US$2,000 to US$3,500***	US$40 to US$60*	30
Natural Gas	50-60	Combined cycle: US$900 to US$1,200***	Combined cycle: US$20 to US$30*	10
Hydro	90+	US$1,500 to US$5,500*****	US$10 to US$60*****	30-100
Wind	35-45	Onshore: US$1,200 to US$1,700**	US$30 to US$50*	16-20
		Offshore: US$3,750 to US$5,750**	-	-
Solar (PV) - Utility scale	15-25	US$850 to US$1,400**	US$10 to US$20****	8-34^^
Solar (PV) - Residential		US$2,500 to $4,000*******		6-12
Biomass	20-25	US$2,000 to US$5,000******	-	5-10

Best performer Worst performer

Source: *Wikipedia, **Statista, ***EIA, ****NREL, *****the pricer.org, ******epa.org, *******consumer affairs.com.

Note: ^^the EECA estimates that Solar (PV) has a EROI of between 2-10%. The EROI for solar continue to rise as new technologies lead to higher conversion rates.

4 Source: **International Journal of Green Energy**.

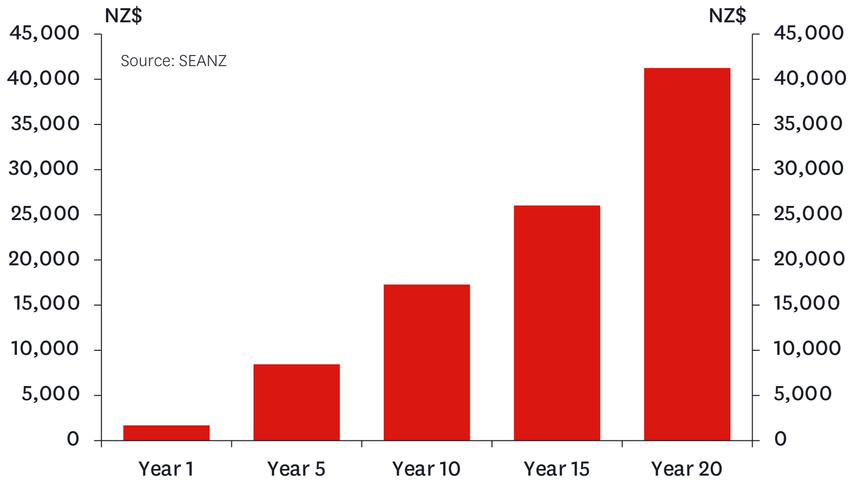
CONSIDERATIONS

Growing affordability of residential solar.

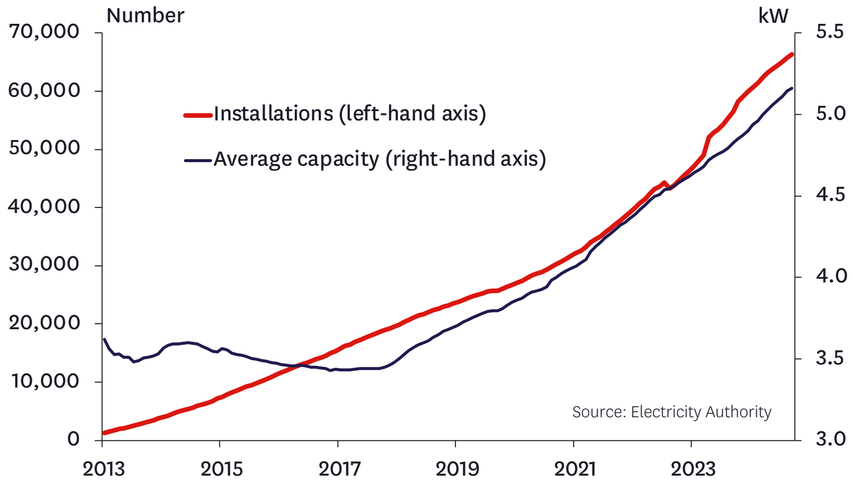
Residential solar is set to become more affordable.

- The cost of residential installations continues to fall, but at around $12k for a 5KW system, it's still expensive for most households.
- However, electricity prices have risen by an average 23% since 2019 with the average New Zealand household now paying $2.4K per year. That means that the payback for solar has now fallen to between 5 to 7 years.
- According to Rewiring Aotearoa,[5] borrowing against a mortgage to install solar means the average household will pay 13c/kWh.[6] That falls to 7c without a mortgage. By comparison, the wholesale price of electricity is about 17c/kWh.
- Falling upfront installation and declining battery costs should make solar more attractive to households. How much though depends on whether wholesale electricity prices rise or fall.
- Other factors include buy-back rates for surplus electricity sold back into the grid. These currently range from 8c per kWh to 17c depending on the electricity retailer, but should rise with the introduction of new rules by the Electricity Authority.

Typical savings scenario – 5kW residential solar system.



Residential solar – installations and average capacity.



According to the Energy Efficiency & Conservation Authority, as at the end of 2024, there were 63k residential solar systems in New Zealand.

5 Source: **New research shows 84% of New Zealand's ten million fossil fuel machines ready to go electric | Rewiring Aotearoa**.

6 It is not clear whether these figures include the costs of battery storage.

Expanding utility scale solar generation.

Utility scale capacity is expanding off a low base.

- In addition to the 63k residential solar systems, at the end of 2024 there are about 4k mostly roof-top commercial installations as well as a small, but growing number of utility scale solar farms.
- By the end of 2024, New Zealand had 573 MW of grid-connected PV solar power installed, of which 199 MW (35%) was installed in 2024.
- Large utility scale plants generated about 601 GWh of electricity in 2024 – that's about 1.4% of total electricity generated.
- That contribution is expected to grow, with several solar farms having come on line recently, including a 47MW solar farm at Lauriston just north of Ashburton.
- At the end of 2024, 65 utility scale projects were being progressed. Of these, 38 have been proposed, 18 were being consented and 9 were in the construction phase.
- At time of writing, Stage 1 of the 400MW Te Rahui facility had been consented with construction possible later this year. Construction of a 130MW plant at Ruakākā is set to start in August 2025.

Solar farms currently operating in New Zealand

Name	Region	Operator	DC capacity (MW)
Kohirā	Northland	Lodestone Energy	32.0
Te Puna Mauri ō Omaru	Northland	Northpower	24.0
Ardmore	Auckland	KAL	13.0
Te Herenga o Te Rā	Bay of Plenty	Lodestone Energy	42.0
Rangitaiki	Bay of Plenty	Lodestone Energy	32.0
Te Ihi o te Ra	Gisborne	Eastland Generation	5.2
Ashburton solar farm	Canterbury	PCR Green	7.2
Lauriston	Canterbury	Genesis	63.0

Solar farms under construction in New Zealand

Name	Region	Operator	Project capacity (MW)
Twin Rivers	Northland	Rānui Generation	31.0
Papareireiā	Northland	Tupu Tonu	21.0
Pukenui	Northland	Far North Solar Farm	20.8
Tauhei	Waikato	Harmony Energy	202.0
Pāmu Rā ki Whitianga	Waikato	Lodestone Energy	32.0
New Plymouth Airport	Taranaki	-	10.0
Rānui	Marlborough	Rānui Solar	12.6
Kōwhai Park	Canterbury	Christchurch Airport	168.0
Clandeboye	Canterbury	Lodestone Energy	28.0

Source: Industry participants, Other

Growing involvement of Māori.

Iwi and Māori are involved in all aspects of solar development.

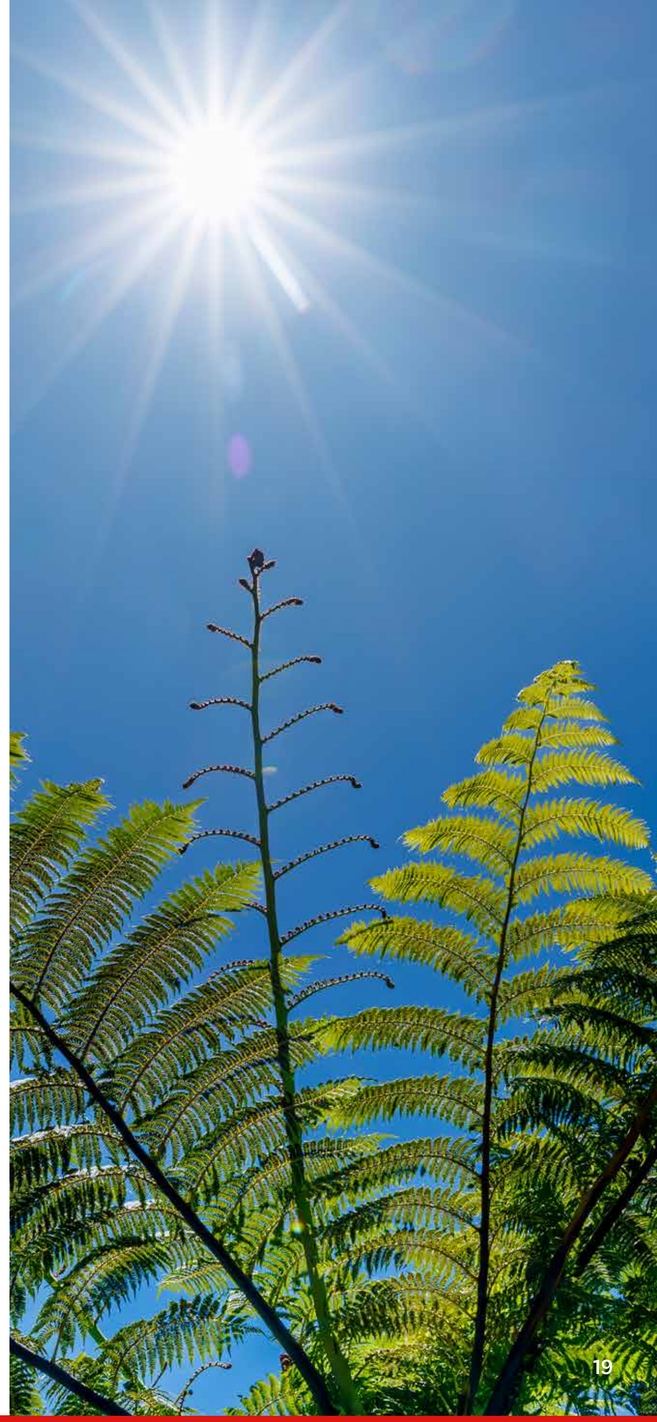
- Iwi - including hapū, marae, and Māori Land incorporations and trusts - involvement in utility scale solar has broadened to include commercial investments, project development and land partnerships.
- In addition, many have launched smaller solar localised initiatives that provide a viable affordable energy option for remote communities. Examples include the partnership between The Lines Company and Te Nehenehenui, the Post Settlement Governance Entity (PSGE) on behalf of Maniapoto (and inclusive of all within Te Nehenehenui), who together with Aotahi Limited have developed a marae-based solar project for communities in the South Waikato.
- For some Māori entities, solar is not just seen as an economic tool, but rather a way to enact self-determination and environmental stewardship.
- With access to long-term capital and a commitment to sustainable outcomes, Iwi and Māori businesses, land incorporations and trusts, are well-positioned as future co-owners and investors in major solar infrastructure.

> Successful marae-based solar projects are sparking wider interest in energy solutions created “by Māori, for Māori”.

Iwi-involved solar projects (2019–2024)

Iwi/Māori entity	Project	Location	Involvement
Mangatawa Papamoa blocks	Solar shared energy	Bay of Plenty	Landowner and partner
Te Rarawa	Kohirā Solar Farm	Northland	Cultural Kaitiaki
Tauhara North No.2 Trust	Lodestone Phase 1	Several	Equity investor
Pōtahi Marae	Micro grid	Northland	Developer/owner
Te Huata Solar LP	Te Kaha Micro grid	Bay of Plenty	Developer/owner
Ngāti Wai Trust Board	“Te Rangi Paki” Marae Solar Network	Coastal Northland to Auckland	Iwi/Marae partnership
Rangitāne o Tamaki-Nui-ā-Rua	Solar Farm	Central Hawkes Bay	Developer
Ngāti Maniapoto Marae Pact Trust	Maniapoto Mini-Hydro & Solar	King Country	Developer

Source: Westpac

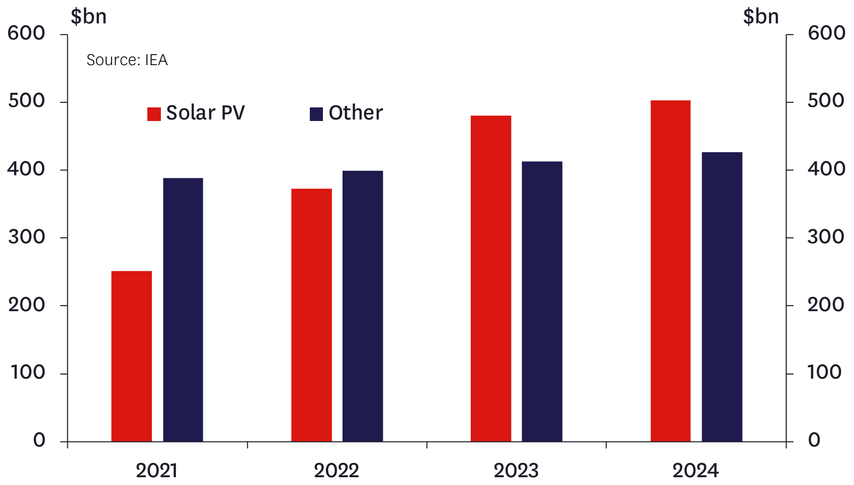


Increasing investment in solar.

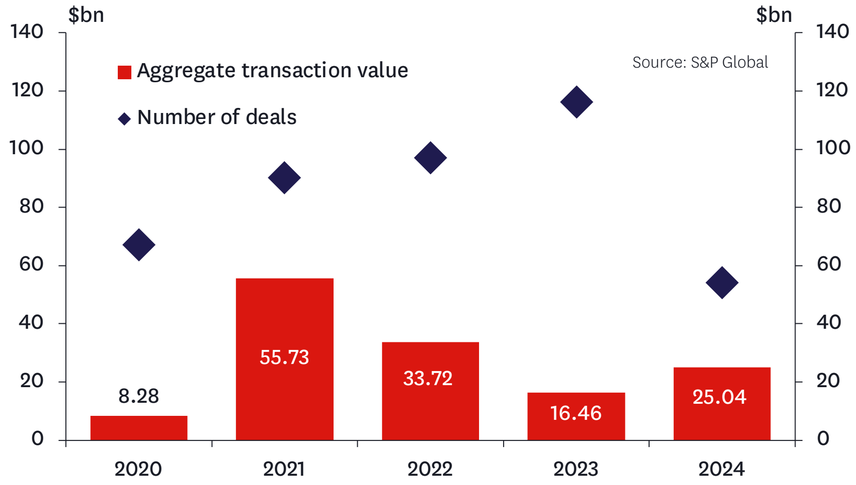
Despite headwinds, investment in solar in New Zealand is both targeted and growing.

- The International Energy Agency estimates that investment in solar PV exceeded US$500bn in 2024.
- Key areas for investment are in firms that a) develop new solar technologies, b) deliver solar storage solutions; c) develop and install solar systems, especially solar farms.
- Cumulative investment in solar projects in New Zealand amounts to about NZ$1.5bn.[7] Most of this is locally funded.
- In 2023, private sector investment in solar energy in New Zealand rose sharply to between NZ$800m to $1bn.[8] For comparison, investment in Australia was close to NZ$8bn.
- That said, there are major headwinds facing new solar farm developments in New Zealand. The biggest of which relate to difficulties in concluding power purchasing agreements, which make it difficult to get finance (debt and equity).

Global investment in solar vs other energy types.



Global PE/VC investment in solar energy.



Opportunities for investing in solar continue to expand as viability increases.

7 Source: New Zealand Trade and Enterprise

8 Source: **Generation investment data and dashboard – now and in the future | Electricity Authority**, **Energy in New Zealand 2023 | MBIE**.

Changing face of solar generation.

Solar is providing opportunities for a range of different businesses.

Installing solar generation capacity for residential and commercial use is dominated by small to medium-sized contracting firms. According to ENF Solar, there are currently 345 firms that install solar panels in New Zealand.

Examples include: SolarKing, Lightforce Solar, Solarcity, Harrisons Energy Solutions, GridFree, Clear Energy, YHI, ZEN Energy Systems.

Developing, installing and operating utility scale solar farms was initially dominated by medium-sized independent firms. Unhindered by legacy infrastructure, these innovative firms were well positioned to respond to increased market demand for solar energy. There are two main models; *Ready to build (and then sell)*, and; *Build and then own*.

Ready to build (and then sell) examples include: Far North Solar Farm, HES Aotearoa.

Build and then own examples include: Lodestone Energy, Nova Energy, Lightsource bp, Lightyears, Ranui Generation.

By contrast, New Zealand's four large gentailers took longer to get involved in solar generation. For the most part that was because of historic investments in other renewables, the already established dominance of these renewables, uncertainties relating to the future of New Zealand Aluminium Smelter (NZAS) – our largest individual electricity consumer – and what were better returns from other primary energy sources.

Examples include: Meridian (which is about to start construction of its Ruakākā facility); Contact Energy (which has a joint venture with Lightsource bp); Genesis (which has a joint venture with FRV Australia). Mercury Energy is exploring solar as an option but has thus far not yet entered the market.

Improving EROI – mainly due to falling capital, maintenance and operating costs, and technology advances – have encouraged large gentailers to invest in utility scale solar capacity. Typically this has been in partnership with independent firms.

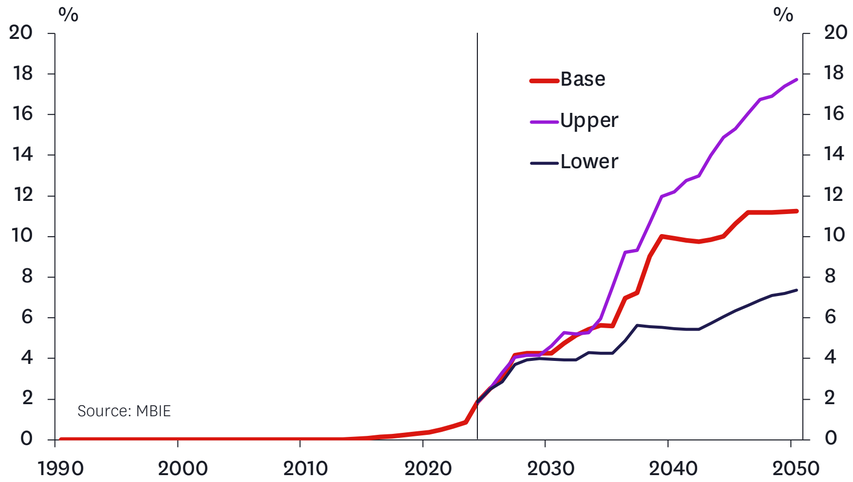
OUTLOOK

Expanding role of solar in coming decades.

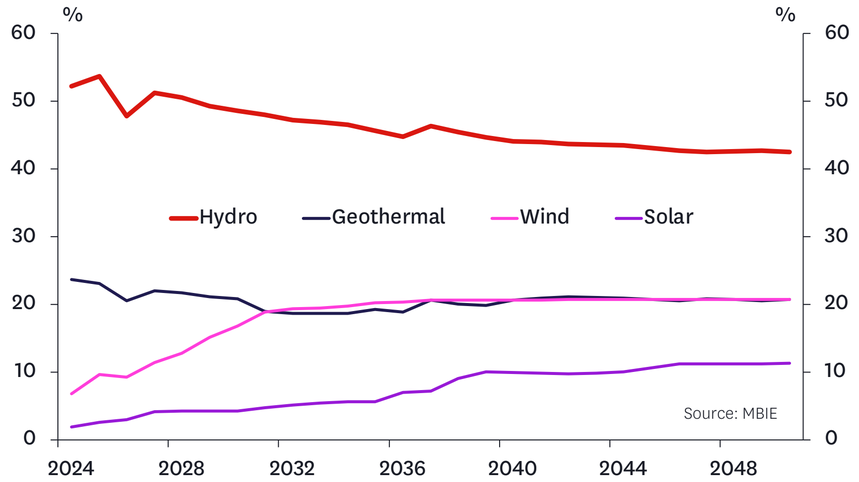
Solar's contribution to electricity generation in New Zealand will grow strongly over coming decades.

- Work undertaken by MBIE suggests that by 2050, solar generated electricity will increase by 825% under its base scenario, and this will rise to 1,600% under a growth scenario. Unlike most other forms of primary energy, solar is undergoing rapid innovation, which makes it difficult to assess how the economics of solar even 5 years from now will compare with today.
- These differences in electricity generation capacity reflect different assumptions about economic activity, population demographics, the price of carbon, the needs of large energy users, and the rate of innovation.
- Solar's contribution to electricity generation is expected to rise to 11% under MBIE's base scenario. It is expected to take some of hydro's share in a growing market, although no hydro generation will be replaced.

MBIE scenarios: Solar to total electricity generation.



Contributions to electricity generation under MBIE's base scenario.



Solar will be an integral part of a future electricity generation capability, which will be critical for a thriving New Zealand.

Ensuring solar reaches its potential.

Solar is here to stay and will become an increasingly important part of New Zealand's generation mix. But for solar to reach its potential, several things need to be in place.

Conducive legislative/regulatory environment.

Solar adoption will thrive in an environment that supports a well-functioning market, spells out the rules of engagement, encourages investment, both from offshore and onshore, and doesn't impose unnecessary compliance costs. Responsibility for delivering such an environment lies within the ambit of central/local government, the Electricity Authority and the Commerce Commission.

Address intermittency.

Using battery storage to address intermittency issues will become more important as the contribution of solar to the electricity mix increases. While returns on investment in batteries is expected to increase as costs fall, the Government and the Electricity Authority have a role in creating the conditions necessary to encourage adoption. We also think that the financial services sector should develop innovative solutions to lift investment in rapidly evolving battery technologies.

Upgrade the national grid.

The national electricity grid needs to be able to handle intra-day mismatches between the supply and demand for electricity as solar increases its contribution to generation capacity. Among other things that requires a) interventions that encourage investment in battery storage; b) initiatives such as the proposal by the Government to expand voltage ranges to allow rooftop solar to return more power to the grid; and c) increased use of smart grid technologies, which allows the national grid operator to dynamically balance the supply and demand for electricity.

Community buy-in.

Community opposition is particularly relevant to utility scale solar farms. Early stakeholder management is critical, with responsibility for espousing the benefits of cheap distributed energy being shared between local government and developers.

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