

Operations in the Outback

**Asset Management Learnings from the
First Wave of Australian Solar Assets**

WHITE PAPER

Table of contents

Team Details	P 3.
Nomenclature & Acronyms	P 4.
Introduction	P 5.
The Grid	P 6.
The Market	P 8.
The Maintenance	P 10.
The Weather	P 11.
The Risk Allocation	P 12.
The Technology	P 14.
Closing Words	P 15.
Endnotes	P 16.



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Nomenclature & Acronyms

AEMO	Australian Energy Market Operator
Capex	Capital Expenditure
EPC	Engineering, Procurement and Construction
GW	Gigawatt
IRENA	International Renewable Energy Agency
MW	Megawatt
O&M	Operations & Maintenance
PV	Photovoltaics



Introduction

Utility-scale solar is at something of a crossroads in Australia. After growing sharply, to the point of accounting for 9.3% of all clean energy generated in Australia and 2.2% of total electricity supply in 2019, according to Clean Energy Council figures (2019), investor interest has begun to flag. Investment in utility scale solar more than halved between 2018 and 2019, dropping from USD\$3 billion to \$1.2 billion (AUD\$4.1 billion to \$1.7 billion at today's rates) (Maisch, 2020). Solar asset owners have faced an array of headwinds, from connection delays to curtailment and escalating grid charges.

Notwithstanding the recent slowdown, the fundamental case for renewables in Australia remains persuasive, and Lumi Adisa, lead consultant for market analysis and business development at analyst group Cornwall Insight Australia, says the growth prospects for the market continue to look good.

The country, he says, "is facing a significant energy gap over the coming decade given the impending retirements of huge amounts of coal generation across every mainland state, except South Australia, which has the lowest demand of all four states."

According to some market players 2021 may already see a rebound. The inverter maker SMA, for example, is expecting to install significant new solar capacity in 2021, according to Joshua Birmingham, project sales director. "It'll potentially be our biggest year ever," he says.

But any further market growth must be tempered by recent experience. Problems with the grid and its regulatory framework, in particular, have plagued early projects and threatened the profitability of operators. On top of this there are issues ranging from adverse weather to skills shortages. Overall, it's a market where close attention to asset management is an absolute must. In the run up to Solarplaza's Solar Asset Management Australia virtual journey during November 2020, this white paper reviews some of the main operational challenges that have been identified by industry experts while working with the country's first major wave of utility-scale solar plants.

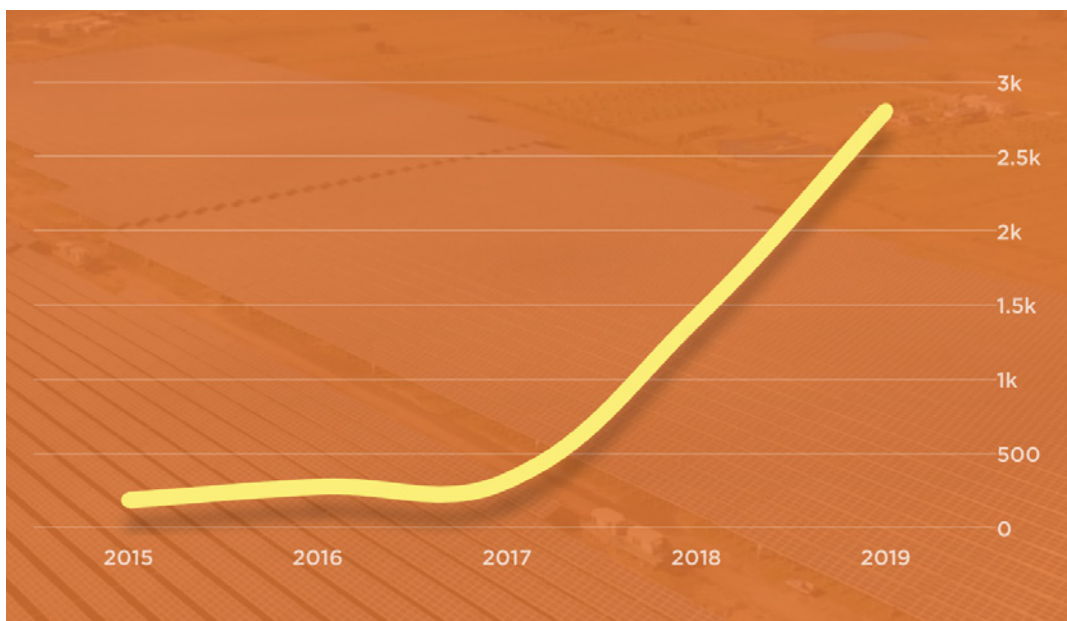


Figure 1: Cumulative installed capacity of utility-scale solar in Australia, in megawatts. Source: Clean Energy Council.

Join our live session on 'Updates and priorities for Australia's operating solar base' on November 4. Register now at australia.solar-asset.management.

The Grid

To understand the Australian electricity market, investors must first navigate the challenges of the Australian electricity grid. Grid constraints are the main issue facing the development of solar in Australia, says Adisa. “Solar has faced [or] is facing constraints in the three largest regions: Victoria, New South Wales and Queensland,” he says.

According to Blueshore’s managing director, Mike Rand, almost all of the major challenges faced by existing projects are rooted in issues of electricity grid operation, strength and regulation. “It all falls back to the struggles Australia is having with system strength and reliability,” he says.

Australia’s creaking grid infrastructure means system strength and capacity is increasingly an obstacle to connection, and for those already connected, is a cause of unanticipated curtailments and costs. The most publicised issues have been the marginal loss factors (MLFs), which scale a generator’s market revenues according to the assumed marginal loss of generation between the point of dispatch and point of consumption. For some projects annual changes to MLF have resulted in as much as a 25% to 30% loss of revenue.

But MLFs are far from being the only grid issues that asset owners are facing. According to Blueshore’s

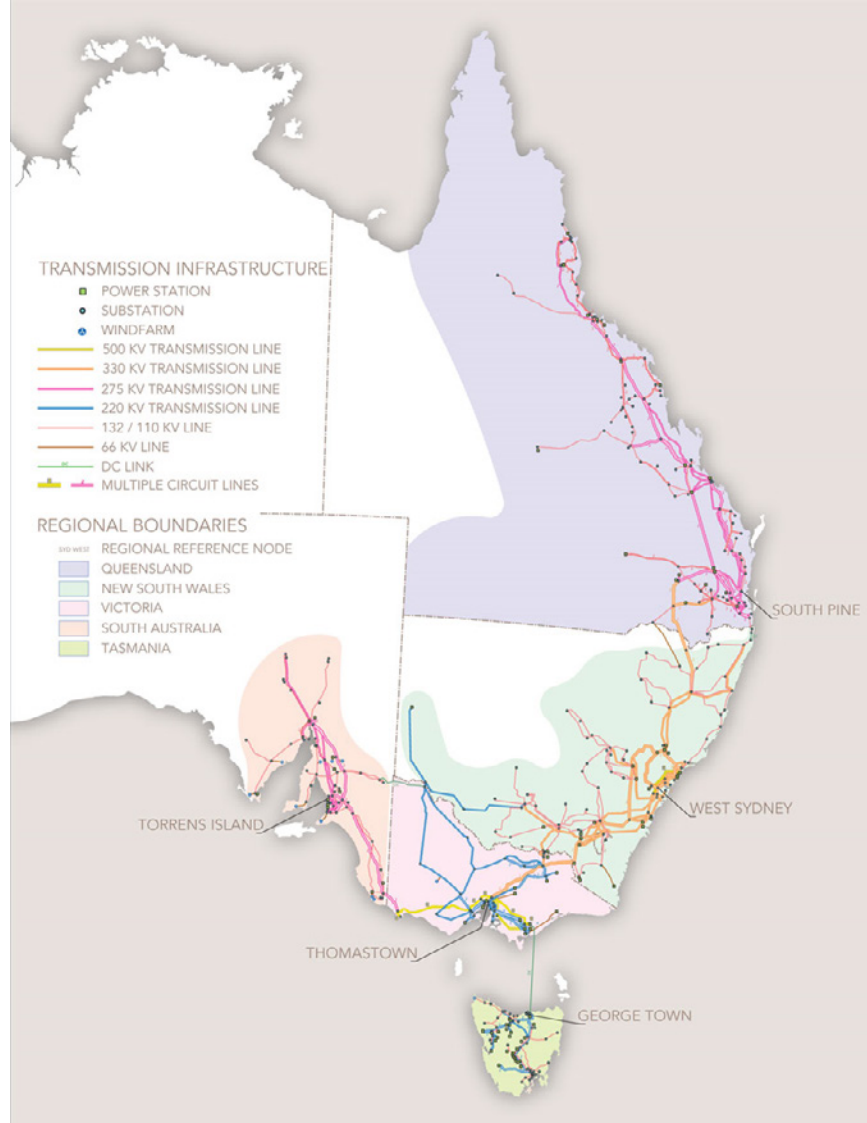


Figure 2:
The Australian National Electricity Market. Source: AEMO, 2020.

Rand, project financial performance is also being impaired by loss of production due to system strength issues, resulting in curtailments, higher costs resulting from AEMO’s recharging of ancillary services and consultancy associated with navigating changing grid standards and regulations.

All this assumes a developer has access to the grid in the first place. Since developers are allocated grid capacity on a first come, first served basis, latecomers can find themselves struggling to find capacity on the electricity network. An example is the case of Belectric, which is building a 349 MW PV plant in Balranald, New South Wales and had to race against another solar developer to secure a grid connection. Now, capacity limitations could cause problems for the other plant.

Grid-related issues will come under the spotlight in our session on ‘Grid stability’ on November 18. To make sure you don’t miss out, register for Solar Asset Management Australia now at australia.solar-asset.management.

The Market

Closely associated with grid stability are problems in making money on the Australian National Energy Market, which covers Queensland, New South Wales, Victoria, South Australia and Tasmania. Australia has the highest per-capita rate of rooftop solar installations in the world (Deign, 2020), which in some regions, combined with utility-scale PV, is leading to increasing incidents of negative pricing. This results in generators that are bidding above zero pricing being unable to dispatch during periods that would otherwise be peak solar production hours.

Blueshore's Rand notes that since the retirement of large thermal generators will inevitably be lumpy, this short-term oversupply is an inevitable prerequisite to a smooth transition to avoid shortfalls when coal is shut down. The current market dynamics may also be accelerating this transition as coal generators find it harder to justify life extensions as average energy prices fall.

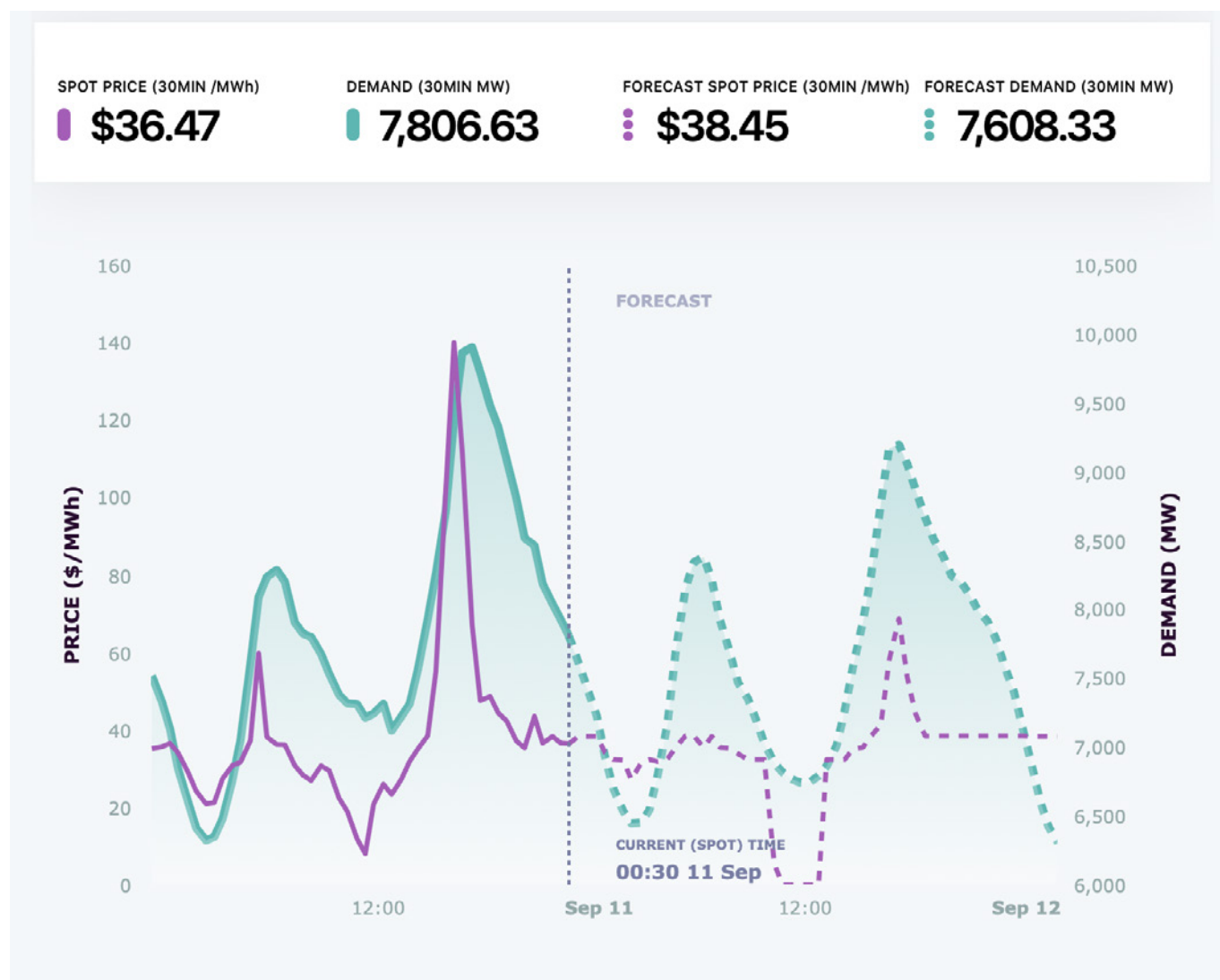


Figure 3: A snapshot of the New South Wales energy market. Note the spot price dropping to zero within the forecast period. Source: AEMO, 2020a.

Energy market bosses are well aware of these challenges and moves are afoot to help the market adjust to a more distributed, carbon-free model. September 2020, for example, saw the Australian Energy Market Commission and the Energy Security Board both publishing consultation papers on future market design. And there is already an ongoing debate about how to introduce market-strengthening tools such as demand programmes and increased incentives for energy storage technologies (Deign, 2020a).

However, solar industry insiders fear the pace of market evolution is not quick enough. While change is happening, it's too slow and it's rapidly being overtaken by events, says Alex Rogers, Australian operations director for the intelligent solar tracker maker Nextracker. "We will see big batteries, small hydro and various other things taking up some of the slack," he says, "but when the government's response is to put billions of dollars into [integrated hydro power supplier] Snowy Hydro, it makes it hard for people to invest money in truly commercial solutions."

**For more on the Australian energy market, don't miss our November 25 session on 'Market bidding and the dynamics of navigating the electricity market'.
Register for Solar Asset Management Australia now at australia.solar-asset.management.**



The Maintenance



Remote locations, unexpected encounters with wildlife, drought - there's multiple challenges that make O&M in Australia unique. Especially with microgrids on the rise, like here with Agnew Renewable Energy Microgrid. (Nexttracker, 2020)

When it comes to Australian solar O&M, two things stand out: the remoteness of some project sites and the potential for skills shortages in certain areas. Distance to sites is not only a challenge to project contractors but also to original equipment manufacturers, which can have implications for spare parts provision. It's a two-day process to get to solar farms in North Queensland or remote parts of Western Australia and South Australia, observes Birmingham at SMA.

This remoteness means it can be hard to find experienced technical experts, both for O&M and for construction. Furthermore, EPC contractors such as Downer have pulled out of the solar market (Maisch,

2020 (2)), highlighting a further challenge that might affect upcoming projects. Experienced EPC contractors are in short supply. Although this is more a problem for project development than for asset management, it implies that some solar plants may be built by contractors that are going through a learning curve, with consequent risks for long-term operation and maintenance.

Australia also has some unique challenges. For example: parrots are partial to cables. Cockatoos have already caused significant damage to Australia's broadband network (BBC, 2017) and the cabling on solar plants is just as prone to this particular threat.

**Don't miss our O&M forum on November 25.
Register now at australia.solar-asset.management.**

The Weather

Summer bushfires have become a staple of Australian news headlines in recent years but have barely dented solar operations. Instead, says Barry Bennett, managing director at Belectric UK, one of the more severe issues is wind, which can cause trackers to distort.

Nextracker's Alex Rogers confirms that wind can cause significant damage to solar farms, with some projects having been almost completely destroyed by storms.

Nextracker's products in Australia are built to withstand high winds and have not been affected by wind events, he says. "We have a very conservative approach towards engineering our designs and our design is also inherently by far one of the strongest when it comes to wind," he says.

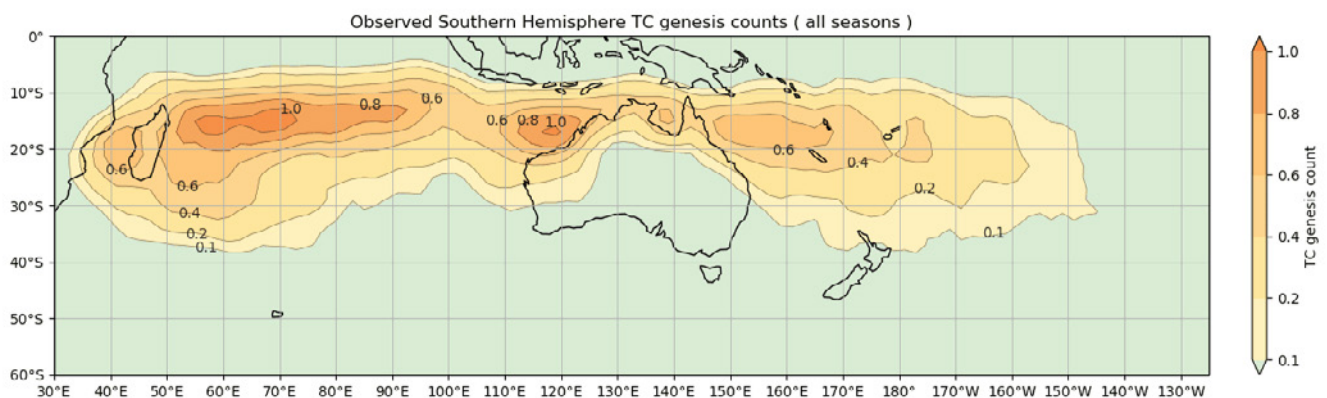


Figure 5: Formation of tropical cyclones (sustained winds of 63 km/h or greater with gusts in excess of 90 km/h) across the Southern Hemisphere. Source: Australian Government Bureau of Meteorology, 2020.

Related to wind events, some plants can be affected by sandstorms that can cause significant soiling and abrasion. Dealing with these requires watertight maintenance contracts without which there is a risk of days of outages due to lack of cleaning, says Bennett.

High temperatures are another potential problem area. "Temperature management for equipment is key and often not prioritised," says Rand at Blueshore.

"We have seen plenty of equipment where temperature regulation has been incorrectly set or is not functioning, leading to potential breaches of manufacturer requirements."

The risk of outages associated with weather events is exacerbated in many cases by the time it can take maintenance teams to get on site and carry out repairs or cleaning.

Our live session on 'Extreme weather' is on November 11. To make sure you don't miss it, register for Solar Asset Management Australia now at australia.solar-asset.management.

The Risk Allocation

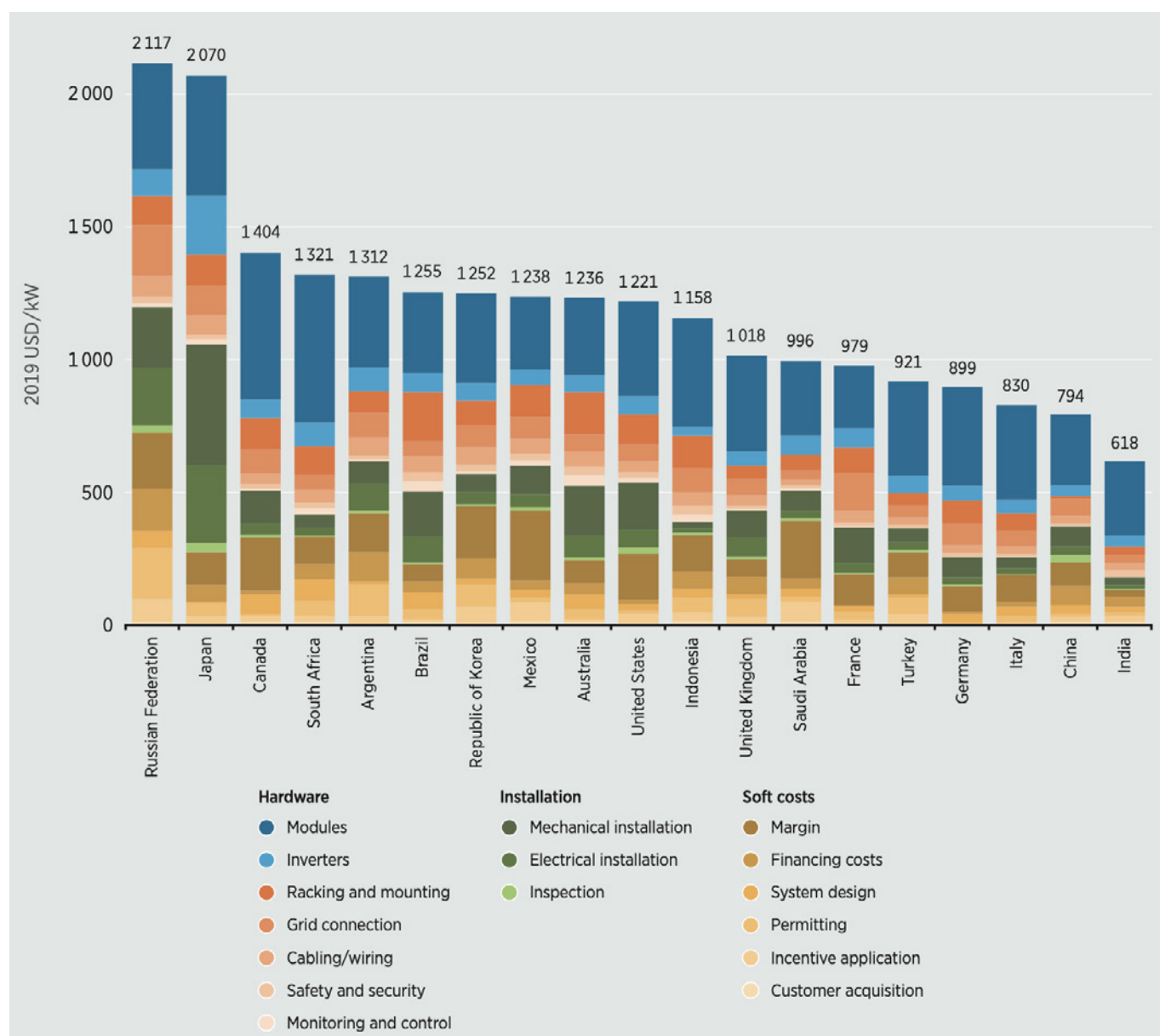


Figure 6: Detailed breakdown of utility-scale solar PV total installed costs by country, 2019. Note the relatively high installation costs and narrow margin compared to many other solar markets. Source: IRENA Renewable Cost Database, 2020.

The uncertainties inherent in the Australian solar market mean asset owners and managers must be careful in evaluating risks and allocating resources. There are many unforeseen risks that have become evident over the past couple of years, particularly around connecting to the grid, says Rogers at Nextracker.

The grid risks “have been vastly underestimated by all proponents throughout the whole development stack, from the owners through to the EPCs,” he says. “That allocation of risk has been pushed down from the developers onto the EPCs, who in many cases have taken on these risks without appreciating quite how significant and serious they are.”

Another challenge, particularly for companies new to the market, is labour costs. The cost breakdown of building and maintaining solar in Australia is heavily skewed towards labour and that has been underestimated by many of the foreign

entrants to the Australian market, asserts Rogers. “That’s led to all sorts of difficulties. We’ve seen a large number of EPCs and mechanical constructors, from small ones to some of the giants in the industry, go under as a result of running up against some of those problems—running into massive costs, massive delays and ultimately going bankrupt.”

Some foreign EPCs, says Rogers, have been guilty of winning business with ultra-low bids and then hoping to make a margin by squeezing subcontractors, which isn’t a sustainable way forward.

The picture is changing, though. “There are a couple of existing EPCs who have weathered all of these storms and continue to bid professionally and build professionally and have really grown to understand the Australian market,” Rogers says. “I think they will be successful going forward.”



Don't miss 'Balancing risk along the value chain' on November 24. Register for Solar Asset Management Australia now at australia.solar-asset.management.

The Technology

Although proposed changes to Australia's energy market may ultimately go a long way towards resolving some of the most pressing issues facing utility-scale solar, asset managers will have to rely on technology fixes to get around problems such as grid constraints and regulation in the short term. One obvious answer to grid constraints, for example, is to install batteries that can provide greater control over when energy is delivered to the network.

However, despite ongoing price reductions batteries remain expensive and may not be an option for many projects where the business case is already marginal. Plus, they pose asset management challenges of their own, albeit that O&M is relatively straightforward. Nevertheless, there are other technologies that can help. SMA, for example, has helped a group of five solar farms, totalling 750 MW, to overcome crippling levels of curtailment in the West Murray region of Victoria and New South Wales.

"There were a number of solar farms that were constrained, at up to 50% output," explains SMA's Joshua Birmingham. "This was related to system strength. All of them were SMA farms. We came up with a firmware solution that allowed those plants to come back on at 100%."

AEMO had been concerned about voltage fluctuations on that part of the West Murray network, it turned out. SMA's firmware fix enabled the plants to control voltage at the inverter level, providing a level of stability that the market operator was happy with. A similar technology fix has been introduced by Nextracker. The company has launched a combined hardware and software package called TrueCapture, which continuously refines the tracking algorithm of each individual solar array to deliver between 2% and 4% more energy.

These kinds of technology fixes have only become available in recent years but are now well placed to help asset managers overcome the kinds of problems that have emerged in the first wave of utility-scale PV plant production in Australia.



Figure 7: Wemen Solar Farm, featuring Nextracker's NX Horizon smart solar tracker, in Victoria. Source: Nextracker, 2019.

Closing Words

Australia's utility-scale solar market today is far from easy, with onerous grid requirements, significant MLF losses, a growing risk of curtailment and increasingly low energy prices. But the fact remains that there is still a huge opportunity for utility scale solar in Australia's energy future. The energy mix in Australia is about to go through a massive structural shift, points out Rand at Blueshore. "Coal is tapering down from where it was," he says. "Now it's something like 60%, 65%. It's going to be close to negligible in 20 years' time and renewable is going to pick up that slack.

"So, you're investing in an energy play. There's some uncertainty around how it gets there, but in the end it is increasingly recognised that the renewable industry has the winning technology."

To get by in the short term, more thorough due diligence needs to be encouraged with a broader scope of the investigation, says Adisa at Cornwall Insight. "The market is changing, and many changes are yet to come," he says. "A good understanding of what these grid and market design changes could mean for new assets is vital for assessing future risk, and issues. Asset managers are also encouraged to speak with the network and market operators as soon as they can during their project development process."

What is clear is that utility scale solar in Australia requires razor-sharp asset management. This is increasingly a tricky landscape for novice players, and it will be vital for market participants to share knowledge and best practice for the benefit of the sector as a whole. With the lessons learned from over 1 GW of the first wave of utility-scale solar, Blueshore says that it aims to bring this experience to assist new asset owners to navigate the choppy waters of the current landscape as renewable generators increasingly occupy pole positions in the burgeoning market to come.

And that market will likely extend well beyond Australia's frontiers. As coal's export potential diminishes, Australia is looking to new energy products, such as hydrogen, to sell to overseas customers. Nextracker's Alex Rogers is optimistic about the future. "I think our potential here in Australia is absolutely enormous, particularly when you get into the energy export side of things," he says. "I think we're only starting on the potential for what we can do."

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Upcoming events



Solar Asset Management North America

Virtual journey

28 Sept - 6 Nov 2020



Solar Asset Management Mexico

Virtual journey

19-30 October 2020



Solar Asset Management Australia

Virtual journey

2-30 November 2020



Solar Asset Management Europe

Frankfurt, Germany

11-12 November 2020



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