

# Chile reaping the rewards of the desert sun

**Market update** | Recently named as among the cheapest places in the world to develop solar, Chile has emerged as a particularly popular destination for solar finance. But as the country proceeds towards a 100% renewables target, political instability and legacy network issues stand in its way. Molly Lempriere explores how Chile can leap those hurdles on its way to a green grid



Credit: Atlas

Chile boasts some of the sunniest places on earth, with areas like the Atacama Desert in the north of the country getting almost 356 days of clear skies. Coupled with high solar radiation and low humidity this makes it one of the best areas in the world for solar PV.

The country is “blessed” with vast amounts of sunlight said José Ignacio Escobar, Acciona’s director of energy for South America.

“The country has a healthy and stable long-term investment climate as well as a growing and sustained electricity demand, ambitious decarbonisation targets and a heavy dependency on imported fossil fuels. For all of these reasons, Chile is leading Latin America’s clean energy revolution.”

In an effort to diversify its energy sector, to drive decarbonisation and increase security, Chile began to move away from hydro-electricity and thermal generation at the beginning of the decade. In 2008, the government brought in a requirement for energy companies to include at least 5% of their generation from non-conventional

renewable energy sources by 2010.

This first step proved successful, with 7% of the country’s electricity coming from renewables by 2012. From this point it has seemingly gone from strength to strength, with the Chilean government then setting a target of 20% renewable energy by 2025.

As of today, the country has already hit this target, with the total share of wind, solar, biomass, geothermal and run-of-river averaging 20% of the total electric energy produced according to the Asociación Chilena de Energías Renovables y Almacenamiento (ACERA), the country’s renewables trade association. This includes peaks of 45% at certain times of year, driven in particular by the booming solar sector.

Chile is now aiming to be 100% renewable by 2050, but challenges remain, not least with ensuring the energy can reach areas of demand.

## Falling costs, resource wealth and PPAs

Chile’s first solar plant – a 3MW project – was installed in 2012. Now – just eight

## The Javiera solar project, developed by Atlas Renewable Energy, has a 69.5MW output

years down the line – there is 2,945MW of PV operating and a further 2,845 MW under construction, according to ACERA.

This growth has been driven by dramatic reductions in price. Atlas Renewable Energy’s general manager for Chile Alfredo Solar explained that in his experience, when the solar industry first started in Chile nearly a decade ago, the levelised cost of electricity (LCOE) stood at US\$100/MWh. This has fallen to almost US\$20/MWh, a fifth of the price.

That assertion was corroborated by recent analysis by Bloomberg New Energy Finance, which found that the cheapest PV projects in the last six months will be able to achieve an LCOE of US\$23-29/MWh. BNEF continued that in the best solar markets globally, of which in Chile was listed alongside the Middle East and China, projects will be pushing below \$20/MWh before 2030.

While the price of solar the world over has fallen, this dramatic reduction is aided by the northern part of the country having the “best solar resource worldwide”, says ACERA director of studies, Darío Morales.

"According to an estimation made by the Chilean Ministry of Energy and Germany's international cooperation corporation, the Gesellschaft für Internationale Zusammenarbeit (GIZ), the country has a solar energy potential of 1,300GW. This potential, together with the reduction of the investment costs of solar technologies, transformed... PV technology into one of the most competitive [energy] technologies operating today in Chile."

The Chilean market differs from other solar hotbeds such as in Europe as there are no subsidies for any energy technology. This level playing field has led to a highly competitive solar sector, and the technology has become the cheapest form of power generation.

The majority of projects rely on power purchase agreements (PPAs) with large customers and energy distribution companies currently. This has helped avoid price cannibalisation thus far, as solar companies target large-scale industries such as mining companies for offtake agreements.

But Morales adds that due to the competitive nature of solar, it will start to provide an increasing share of the power mix, driving down the cost of energy tariffs from 2021.

The country has now committed to completely phase out coal-powered generation by 2040, further incentivising the push to support solar generation.

### Atlas set to begin colossal 230MW desert sun project

One of the biggest projects under development in Chile is the Sol del Desierto solar plant, which is due start construction at the beginning of May 2020 in the municipality of María Elena in Antofagasta. The colossal 230MW project is Atlas Renewable Energy's third solar site in the country.

The company was set up in 2017 with a specific focus on Latin America by a group of executives who had been working for SunEdison with financial backing from Actis, a private equity firm based in London.

Atlas now has 2,000MW of contracted projects in Latin America. This includes 1,000MW that is already under operation, and 1,000MW under financing or construction throughout Chile, Uruguay, Mexico and Brazil.

Sol del Desierto will be the company's biggest to date in Chile, with construction planned over the course of 18 months. Atlas has secured a PPA with French utility giant Engie for the project, with the

### Co-location in Chile

Energy storage could help Chile fully capitalise on its solar resource and reduce transmission constraints. According to Morales, it will play a "fundamental role" in the energy system, providing balancing services, reducing system congestion and supporting the participation of more distributed generation, such as solar.

At a roundtable hosted by the Ministry of Energy last year, the National Power Coordinator suggested that 3,000MW of storage will be developed in Chile over the next 20 years.

But there is currently very little solar-plus-storage in the country due to prohibitively expensive prices. "Everyone is waiting for batteries to reduce in price, and we expect this to happen in three or four years," says Atlas' Solar. "At that moment, the combination of solar plus storage will be the most practical, but we're not yet there."

This is beginning to change, with an increasing number of storage projects coming online to support the grid such as NEC Energy Solutions' 2MW/2MWh battery energy storage system commissioned in 2019.

There are also solar and storage projects moving forwards, like Valhalla's 561MW solar PV plant which features a 300MW pumped hydro storage system. The project received financing from the Green Climate Fund in July 2019 and is expected to reach final close. If successful, the plant will be built by 2025, and help to provide baseload power.

Along with pumped hydro, lithium-ion battery systems are increasingly popping up as the country seeks to bolster its energy system and take advantage of its mineral wealth. Already Engie Chile is pursuing projects and AES Gener has three operational projects. With the success of such, it seems sure that solar-plus-battery-storage cannot be far away.

company taking 80% of the power that will be generated at the site.

Spanish conglomerate Acciona celebrated the completion of its Almeyda solar project at the end of 2019. The 62MWp facility uses 187,620 modules in fixed structures with horizontal tracking, which will allow the company to maximise the capture of solar radiation for energy generation. While these technologies are commonplace in the Chilean solar sector, Acciona says what sets the project apart is its operations in the region.

"The key differentiator, from our point of view, is how solar plants are operated, and how to integrate these plants in the economic, social and environmental fabric of local communities," says Escobar. "We consider these factors to be Acciona's main strengths."

The project, which sits in the municipalities of Chañaral and Diego de Almagro within the Atacama Desert, covers 150 hectares. It has an estimated annual generation capacity of 167.5GWh. Acciona Energía signed an electricity supply contract with National Mining Company to take the power generated by the project, choosing a PPA to ensure security as Atlas has.

The project is Acciona's second in Chile's Atacama region, following the El Romero Solar project. Up until 2019, the project

was considered the largest in South America, boasting a capacity of 246MWp and covering 280 hectares.

### An evolving transmission system

One of the key challenges that remains for Chile's solar sector lies in the country's transmission network. While there is abundant solar resource in the north of the country, transmitting the power to the capital Santiago and other demand hubs is challenging.

In 2017, the country inaugurated the Sistema Eléctrico Nacional, a nationwide electricity transmission system. Up until this point, Chile had two separate networks, the Central Interconnected Systems (SIC) and the Northern Interconnected System Grid (SING). This system made it increasingly hard for the country to take advantage of the burgeoning solar generation, with periods such as in June 2016, where electricity was given away for free as there was too much generation and too little accessible demand. The new system covers 3,100km and connects 97% of the population. It formed a key part of then-President Michelle Bachelet's government's focus on the energy sector.

Despite the unified transmission network easing the challenge, more work will need to be done to develop the system.

"If Chile wants to reach a 100% renewable energy mix in the coming decades, the country will need to establish a robust, flexible and modern transmission system that can easily adapt to new generation technologies as they appear," says Acciona's Escobar.

The inability of the transmission grid to truly meet the needs of the growing solar industry is partly because of the country's previous reliance on large-scale hydroelectric plants. In the 1990's, environmental concerns coupled with the impact of drought on energy security and increasingly cheap gas from Argentina, however this thermal generation has also been hit by insecurity.

Given the fluctuation in its generation profile, the transmission network has struggled to be sufficient for the country's needs. But as old thermal generation in particular becomes obsolete, Escobar continued, there are increasing opportunities for new transmission networks for solar, wind and other renewables as part of a modernised energy sector.

"Regarding distribution, Chile's new regulatory framework is currently under

discussion," he adds. "The new framework will aim to modernise the sector, promote energy efficiency and self-consumption and easily adapt to new emerging technologies, such as electric vehicles and smart meters."

As the country looks to grow its renewable energy sector a more modern, flexible grid capable of coping with intermittent generation from more distributed sources will be the next big requirement. This will most likely need to be coupled with storage, to ensure Chile can make the most of sunny periods without having to fall back on gas generation.

### Political unrest, international investment and the stabilisation fund

Concern for the sector's continued success was raised in 2019, when Chile descended into political unrest. The country has attracted a lot of international investment and development from companies like Acciona, partially because it is one of the most stable countries in South America.

However, in October last year protests around a planned 3% increase to metro fares in Santiago escalated into widespread unrest. The protests spread throughout the country, and by the end of the month, 18 people had died in the violence while 7,000 people had been arrested in the most unsettled period the country has seen in decades.

The demonstrations shone a light on the inequality within Chilean society, in particular given a recent spate of corruption cases involving businessmen and the country's federal police force along with the leadership of billionaire president

Sebastián Piñera, who himself was hit with a demand for unpaid land taxes in 2019. While many in the country have benefitted from the country's wealth of natural resources, in particular copper, many protestors felt this wasn't fairly distributed as they faced rising transport and utility costs.

With unrest spreading, there was concern that the solar sector could become less attractive, hurting further expansion for the sector. This is not something that concerns the ACERA however, thanks to a stabilisation fund introduced by the government.

"Because of the existence of old and expensive PPAs with distribution companies and the US Dollar/CLP exchange rate, the energy tariffs to the final customer were supposed to dramatically increase from January 2020 and to naturally decrease from 2021, mainly because of the PPAs signed with renewable energy companies," explains Morales. "To avoid these fluctuations, and due to the social unrest situation, the government passed a law that created a stabilisation fund of US\$1,350 million that has to be paid by all the generation companies."

Morales continued that renewable energy companies that fund their investments through project finance schemes had to find ways of funding additional costs following the unrest. While much of this is private, "conversations between companies and investors have gone well, despite the fact that the COVID-19 crisis imposes new challenges," he continues.

Indeed, projects such as Atlas' Sol del Desierto solar plant, announced following the unrest, seem to confirm the appetite

for solar investment has not been quelled by the unrest.

### 'No doubt' Chile will go 100% renewable, but when?

Chile has undoubtedly taken huge steps towards greening its energy sector, supported by the phenomenal resource base and positive governmental policy. Despite challenges therefore, it looks sure that the country will reach its 100% renewable target.

"A few years ago, the discussion was whether or not it was economically feasible to have high shares of renewables energies," says Morales. "Today, the discussion is about when we are going to achieve a 100% of renewable energy share. The most optimistic states that is going to be in 2030 and the less optimistic say that by 2050. We believe that, with the right set of public policies, 2040 is achievable."

This optimism is shared by Escobar, who says: "There is no doubt in my mind that Chile has the potential and determination to achieve a 100% renewable energy mix by 2040."

Such declarations are supported by the tendering process, with all of the energy tenders in the last couple of years going to renewables. This is significant according to Atlas' Solar, and highlights a positive shift in the country's trajectory. He added that there will still likely be natural gas in some capacity on the system for moments when renewables cannot provide power for a while, suggesting a similar transition to Spain with gas becoming a back-up technology could be likely.

To truly become 100% renewable, the country must move on from such systems, says Escobar. "On a whole, we believe many more topics need to be addressed, such as the closure of natural gas and diesel facilities, which are today considered as back-up sources of power in the system.

He continues: "On top of this, progress is also needed in regulation for sustainable energy storage and electricity system flexibility. And last but not least, a new and ambitious green tax revision is urgently needed in Chile, which would allow the country to correct the negative externalities of fossil fuel generation."

Seemingly the biggest challenge for renewables in Chile is not the renewables themselves, but the transmission system. Flexibility, broader and more modern networks, and storage to manage intermittency are the next steps for a truly renewable energy sector. ■



The Quilapilun solar farm was connected by Atlas in 2017