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Chile plots path to two-cents solar by 2025

Market update | Chile has long been a strong contender for PV deployment with a growing economy, great solar resources and plenty of land. But as Tom Kenning learns, the market has several challenges ahead on its path to two-cents solar

Chile looked set to become a front-running market for solar investment in 2016, with a transmission law upheaval to combat solar curtailment and the promise of its largest ever power tender. However, the parameters of the power auction meant that PV ended up taking away just 6.8% of the capacity available in a nation where solar resources are pretty much second to none. This was a huge disappointment for the industry, particularly since Chile has launched a national programme to try to reach astonishing solar tariffs of just US\$0.02/kWh by 2025. Even so, the auction did award what was temporarily the lowest ever solar tariff anywhere in the world and Chile remains

the standout market in Latin America, on course to reach 2GW of deployment by the end of this year. This article investigates what went wrong in the auction, but also why the impending completion of major transmission lines might just pave the way for robust, curtailment-proof solar deployments in years to come.

Chile's new energy minister, Andrés Ignacio Rebolledo Smitmans, who succeeded Maximo Pacheco, used his first speech in October to highlight the importance of distributed renewable energy generation for the local electricity markets. This was followed by Spanish firm Acciona Energia connecting the largest solar plant in Latin America, the 246MW El Romero

How solar fits into Chile's energy mix, as of September 2016. *Source CNE*

- Total installed power capacity 20,740MW
- Renewable energy installed 3,607MW
- Installed solar capacity 1,395MW
- Solar generation 223GWh
- Targeting 70% electricity from renewables by 2050
- Targeting 68% reduction in the levelised cost of energy for PV by 2025
- Attracting 100 companies to the solar industry value chain by 2025
- Bringing US\$800 million of private and public sector investment by 2025

project, to the grid. The government then announced plans for a 750MW-1GW solar park complex spanning PV, thermal solar power and energy storage. Clearly, there is

impetus across all the different solar-related segments and technologies.

PV thwarted in auction

Yet, as with many markets, the spearheading solar segment has been utility scale. In August, the Chile National Energy Commission (CNE) enacted the country's largest ever energy tender with 12,430GWh of power on offer. As the auction was 'agnostic' in terms of technologies, there has been a lack of transparency around which technologies won capacity. Endesa, which grabbed about 47% of capacity available, will mostly build conventional power plants, but there are strong indicators that this may also include a small amount of existing wind and solar plants. Indeed it is highly likely that just one new-build solar plant was awarded with Spain-based firm Solarpack to supply electricity at a record breaking low price of US\$0.0291/kWh at its 120MW Granja Solar plant.

Bart Doyle, general manager, Chile, Mainstream Renewable Power, a firm that bid for both wind and solar capacity in the auction, says that the biggest setbacks were in solar and new gas. Gas could not compete against wind, while solar struggled to bid in the 24-hour blocks.

Most capacity was tendered in these 24-hour blocks, but only 1GWh was set aside for projects in separate hourly blocks for day, night and evening categories. With solar all but married to the daytime category, its ability to bid for large capacity was particularly restricted.

"The view is still that you can't bid solar into the 24-hour block," says Doyle. "You are going to be trailing for 16 hours of the day.

"That's a big problem for Chile because it has a much better solar resource than it has a wind resource. PV on the PV belt in Atacama and Antofagasta has a capacity factor of 28-32%, which is a fantastic solar resource and yet only one new project won 4% [of the capacity] and the other 2.8% is for existing solar and that's a disaster for Chile."

Dozens of solar developers were competing for that small capacity available in the daytime block, but Mainstream, which happened to put in the second lowest bid for solar in the auction, still missed out. To add to frustrations, the median price for all technologies in the auction was US\$0.0476/kWh, far higher than the sub-3 cents tariff for the one solar project.

"The Chilean customer is not going to get the benefit of that great solar resource



Credit: ACERA

Finat is confident that the Solar District will help developers deliver on low prices.

and those great solar prices because of the way the tender rules are structured," adds Doyle.

Any attempt to prevent so many PV firms missing out in future auctions will also be dampened by the fact currently planned tenders are far smaller than the one this year. CNE will soon enact another tender for 3,800GWh to start delivering power in 2023. Another auction of 7,200GWh will take place in 2017, followed by 8,900GWh in 2018.

To vex the solar sector further, wind power also dominated the last tender with at least 45% (5,781.6GWh) of the capacity, despite having inferior resources.

Solar District promise

A governmental plan to develop a brand new 750MW-1GW solar park, however, will have raised the spirits of the industry. The so-called Solar Technology District will have its permits and approvals pushed

through by the government and portions of the park will then be tendered, says Carlos Finat, executive director of the Chilean Renewable Energy Association (ACERA). Connection to the transmission system is part of the offer of the project and economies of scale are expected. Finat also understands that land for the project has already been allocated by the Ministry of Public Lands.

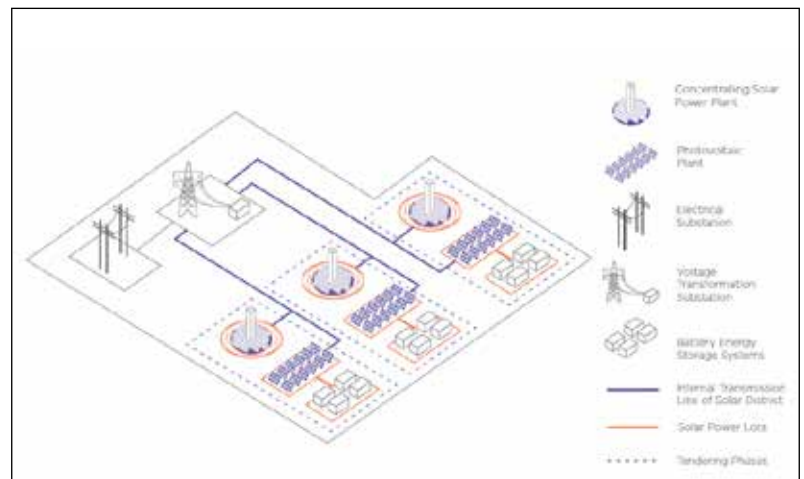
The US\$4 billion park, also involving CSP and energy storage, will require 3,000 construction workers and will mainly power the mining industry in the Atacama region. Mining in the Atacama has been Chile's main productive and economic sector for over a century, since its soils hold the world's largest copper and non-metallic minerals reserve.

The solar district enterprise is part of a bigger initiative that is intended to obtain a very low cost of solar energy in Chile, says Finat. The Programa Energia Solar (PES) will focus on reducing PV costs by 25% using the extremely favourable conditions of the Atacama Desert, aiming to reach prices of just two dollar cents per unit by 2025. However, Chile has competition on the lowest price rankings from the Middle East.

"The world record of Solarpack only lasted for a few days, as a new low happened in an auction at Abu Dhabi," says Finat. "Based on prices that have been seen in other places and on the ever decreasing cost inversion of solar PV, we believe that with the right regulatory and contractual framework, PV projects at low prices will have no problem to be implemented successfully."

Another aim of the PES programme is to adapt and develop new materials, components and O&M services for PV systems that will ensure their durability and performance under the harsh desert climate conditions native to the PV Belt.

The Chilean government has promised a new 1GW 'solar district'



Credit: PES

Transmission cure

Of course, without enough demand or suitable grid capacity, it doesn't matter how cheap solar can go. Both solar and wind projects in the central northern region of Chile have been experiencing curtailment for some time now, since October 2015. One of the main causes is the weak Chilean power system. Previous attempts to resolve the requirements of the transmission system have also experienced major delays.

However, the Chilean Congress passed a major law on electricity transmission in July, which is expected to benefit the entire power sector while speeding up the connection of Chile's main grids – the SING in the north and the SIC in the south. Solar projects tend to be concentrated in the north of the country near the Atacama Desert, which has world-beating levels of irradiation, but lacks transmission infrastructure and demand. The grid interconnection will allow solar power generated in the Atacama region to power the major electricity demand centres such as Santiago in the centre.

Another key connection, the Cardones-Polpaico transmission line, is also being constructed by Colombian utility Interconexión Eléctrica (ISA), again helping to alleviate any PV overcapacity on the grid.

Several solar energy developers have gone ahead with developing projects in the central northern region in the full knowledge that curtailment is happening, says Finat. Meanwhile, others that are already experiencing curtailment would have factored it into their business plans. This is because they will have anticipated the SIC and SING grid interconnection and will expect to benefit from the exchange of energy between the two grids once complete.

"I would say that almost all the companies that have won energy blocks in the last two tenders in Chile and will build new renewable energy power plants, are trusting that the new transmission infrastructure will be available on time," says Finat. "It's progressing as per the schedule that was committed by the government and the dates established in the law itself."

However, he stresses that the interconnections must be completed together to help solve curtailment. There is also no way of speeding up the process. GTM Research reports that the SIC and SING connection is more than 60% complete.

Under the new law, Chile has also appointed five directors for the board of its Independent Coordinator of the National

Electric System. Finat says this is critical to ensure transparency, independence and technical adequacy of the operation of the electric system.

At the time of the law passing, minister of resources Victor Osorio said: "The main objective of the bill is to ensure that the transmission favours the development of a competitive market, to facilitate the transport of energy from clean sources to consumption centres, and to contribute to lower energy prices for households and businesses, allowing more competition and the incorporation of new players."

Ultimately, strong solar resources and the various initiatives to improve solar technology and attract investment make Chile a market to watch out for, but Finat insists that until energy storage becomes competitive, the capacity to introduce high levels of PV will continue to be limited by transmission capability. If grid interconnections are completed on time in 2018, curtailments could be drastically cut with room for plenty more deployment, but the framework of the power tenders will need to be more accommodating for solar to win big. ■

A philosophical manoeuvre for Chilean transmission

Bart Doyle, general manager, Chile, Mainstream Renewable Power, explains the paradigm shifting transmission upheaval:

"The transmission law helps wind and solar particularly because for the first time, it allows renewable generation to be factored into transmission planning. It is not something the Chileans really did before; they allowed the market to look after transmission lines.

"They did not build new transmission lines specifically for new renewable energy projects before. Renewables were a tag-on to an almost purely conventional or thermal-based system. With the new law the government will make more of an intervention, identifying which zones could cater for a lot of generation, be that hydro, wind, solar or conventional power and then planning the transmission lines in advance for those areas.

"That is a big philosophical change in how they run their market with the Chile National Energy Commission (CNE) taking a more active role in future transmission planning. It is also recognition that it wasn't working before. Renewable energy plants take two years to build, while transmission lines take up to 10 years to build. There was a big mismatch there.

"There used to be two system operators, one for the northern grid, SING, and one operating southern grid, SIC. They have now been made into a single entity controlling the whole system and the directors have to be independent. Previously all of the directors were management people from incumbents. This made things challenging if you had a dispute with a connection for example.

"The two systems, SIC and SING, will also be interconnected from mid-2018. Even if it is delayed another six months or a year it will still be finished well before the offtake day for the last PPAs. Winners of the latest power auction are not expected to provide energy for consumers connected to the SIC and SING grids until 2021.

The Cardones to Polpaico connection, a 500kV upgrade from Santiago right up to the top of the SIC, will also be crucial. If you don't have that in place, the SIC and SING interconnector hasn't got that much value because the power just gets stuck at the top of the SIC. There would not be enough capacity to get the power down to Santiago. You really need both projects completed at the same time and definitely before 2021."



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There is optimism that the degree of grid network planning can smooth the path for greater PV deployment