

Chile, a case of market-driven transition to renewables

Carlos Eugenio Finat Díaz Executive director – ACERA

December 3 2015



Chile has seen an astonishing surge in renewable energy production. Key factors underlying this success: an abundance of natural resources, an open energy market and a robust regulatory framework, combined with a proactive state policy programme. The Chilean experience is a highly instructive one – showing that subsidies are not always the right solution.

Chile's capacity of non-conventional renewable energy (NCRE)¹ has developed very rapidly in the past few years: total installed capacity at the end of 2013 was 980 MW, 1,000 MW were added during 2014, and at least further 1,000 MW are expected to come on line in 2015 (CIFES, Ministry of Energy, 2015). This has happened in the context of a fully liberalized market, and one in which NCRE receive no subsidies. Chile enjoys an energy context favorable to such development: a combination of world-class renewable energy sources, high power prices, an open market and a simple but effective regulatory framework. These fundamentals are not new, so the recent increase in the competitiveness of NCRE is the most likely reason for the boom. Nonetheless, a few simple, market-driven regulations focused on NCRE have helped.

As Chile could be an inspiration to others, exploring the reasons for this development and its implications is worthwhile. Furthermore, the continuation of the transition to NCRE raises a number of issues – its burden on the transmission network being the most immediate, while further thinking is needed to fully integrate the consequences of this change in the energy system.

Chile's energy landscape

Chile's diverse climatic and geographical conditions pose energy-supply challenges, exacerbated by the country's lack of fossil fuel reserves. Chile relies on fossil-fuel imports – 60% of its power comes

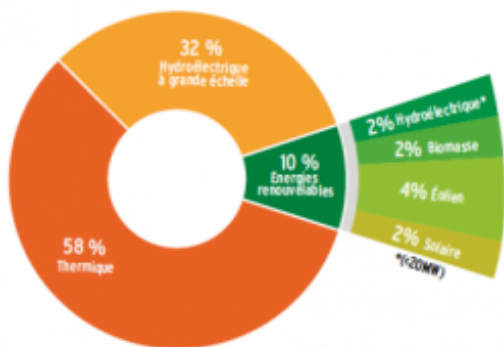
from thermal plants - leading to high and volatile prices. Furthermore, limited investment in transmission infrastructure and a lack of competition in the power-generation market affect energy prices, and Chile's competitiveness - an average energy price of USD 150/MWh for industry is twice that of Peru, a close competitor of Chile's mining industry (Climatescope, 2014).

Renewable energy is, however, readily available, with a Energy Ministry report (2015) identifying the availability of 1,864,809 MW of solar thermal, solar photovoltaic (PV), wind and hydro potential - more than 100 times Chile's current installed generation capacity, and there is more potential from geothermal generation.

Chile's electricity framework was laid down in the 1980's. The system is fully liberalised, with regulation limited to a few specific aspects. Private companies own all generation, transmission and distribution installations, with regulation affecting expansion and tariffs for core segments of the transmission and distribution system. On the generation side, the private sector is free to investment in capacity, while connection to the transmission network is governed by the principle of open access. Regarding users, consumers with less than 0.5 MW installed capacity must buy from a distribution company at regulated prices; those with 0.5-5 MW may either buy at the regulated price or negotiate a contract with a generator; while those with more than 5 MW buy power at prices set by bilateral negotiation or private tender.

The Chilean Congress approved the first law promoting NCRE in 2008 with a target of 10% of energy to be generated by NCRE by 2024, and requiring generators to increase the percentage of NCRE in supply contracts each year from 2015 to 2024. It also allows generators to buy NCRE credits from others, if their own production is insufficient to meet their legal obligations. In 2013, with strong congressional support, a new law raised the target to 20% but delayed the date to 2025. To put this in context, total power generation for 2014 was 70,000 GWh, of which 8.7% came from NCRE plants (Figure).

FIGURE : CAPACITE INSTALLEE AU CHILI PAR SOURCE D'ENERGIE, 2015



Source: CNE, 2015

The renewables' success

The rapid expansion can be explained by such factors as the high availability, high quality and low cost of renewable energy production; the fact that conventional energy projects face strong public opposition; and the pivotal role of a stable and efficient regulatory framework. With a seemingly ever-decreasing levelized cost of energy (LCOE)² from renewable sources, it was only a matter of time before NCRE would reach grid parity. The most striking example of this is the cost of PV plants: the capital expenditure of fixed-tilt PV plants has fallen from USD 3.42/W in 2010 to USD 1.61/W in 2012 - a reduction of more than 50 % in just two years could be seen as a sufficient reason for expansion (Bloomberg, 2015). This fall, plus improvements in efficiency that have been experienced in both PV panels and wind turbines, has been passed on, making the NCRE competitive in the Chilean market. Recently, national public opinion has become a force. Communities are especially

active, as they often believe they will suffer the environmental costs of new generation or transmission infrastructure, while others, elsewhere, benefit. Indeed, in the past few years, three projects, a large hydro project and two coal-fired power plants, facing strong public opposition, have been cancelled or had their approval rejected by the environmental authorities.

Today, any new coal-fired plant, still the most competitive way of producing electricity in Chile, is likely to face local and legal opposition, with resolution taking several years. This clearly affects the appetite of the private sector for such investment; in contrast, no utility-sized NCRE project has met opposition, let alone had its approval been rejected or cancelled.

But competitive costs and the availability and quality of the resources are not enough. Given the high capital intensity of NCRE, securing investments is key. Chile, however, is internationally recognized as having an attractive investment system for clean energy companies and projects. The 2014 Climatescope report³ that rates countries on their ability to attract clean-energy investment⁴ ranked Chile 5th among the 55 countries, after China, Brazil, South Africa and India, while the latest edition Ernst & Young's renewable energy country attractiveness index (Ernst & Young, 2015) confirms Chile's favourable investment environment, ranking the country 11th out of 40 countries analyzed. Alongside Chile's growth and stability, the 2014 Energy Agenda, introduced by Minister Energy Maximo Pacheco and currently being implemented, has helped as it recognizes renewables as a means of improving competition, reducing prices and moving to a sustainable energy matrix. This support for NCRE has been key in unleashing Chile's potential and, in particular, it means that investors can expect the authorities to work on the few hurdles that hamper the development of NCRE, such as weaknesses in the transmission system.

Finally, the speed of the NCRE development can be explained by the unregulated nature of Chile's electricity system: as new generators do not need the blessing of a central planner to build and connect their plants, they can react to rapidly changing market conditions. This might become a weakness as the fast integration of NCRE is starting to saturate some parts of the transmission system, the expansion of which, although planned, has been delayed.

The flexibility of the Chilean system was tested in a public tender launched by distribution companies for up to 13,000 GWh/year conducted in the second half of 2014. It was the first to include sub-blocks suited to variable renewable sources as they allowed bids for three hourly blocks, so wind and solar producers would not be exposed to spot-price risks at times when naturally they could not generate. The tender was a success – it was the first to break the trend of increasing prices, a result of the competition created by the participation of NCRE generators and new conventional-energy players – renewable generators won almost a quarter of the supply. Additionally, the average weighted price from the successful renewable generators was USD 8/MWh below offers from conventional generators, and prices as low as USD 79.9/MWh from solar-PV generators were seen, USD 30/MWh below those from liquefied-natural-gas-based conventional generators. An analysis conducted by the Chilean Association of Renewable Energies (ACERA) estimated that this will save regulated customers about USD 360 million over the 15 years period of the contracts (ACERA, 2014).

This clearly demonstrates that feed-in tariffs or subsidies are not always the best solution: in the case of Chile where NCRE was ready to compete effectively, the mere adaptation of a public tender was enough.

Challenges and prospects

There are, however, challenges, with the bottlenecks that occur in the transmission system probably the most important. Even though new infrastructure and the connection between the north and the central systems are planned, the next few years, before they become operational, will be critical. Then there is the uncertainty about the ability of conventional generators to inter-operate with solar-PV and wind-power plants whose generation can vary sharply.

Furthermore, it is important to consider the spot-price risk for those that decide to sell their energy on the wholesale market. This comes from both the variability and the lack of predictability of the spot price, and is increased when cheaper NCRE is injected into the grid. The rapid development of NCRE is thus raising concerns about the medium-term evolution of spot prices, and it is increasingly difficult for NCRE projects without fixed-price power purchase agreements (PPAs) to access funding.

The first two issues have been identified in the discussion about new regulations and should soon be solved or mitigated. The spot price issue should be improved by 2018, once the interconnection between the north and the central systems is operational, while the fact that NCRE now has access to PPAs with the distribution companies will also make many projects bankable.

Future tenders for energy for the distribution companies (regulated customers) are expected to include sub-blocks suited to variable renewables sources, which should allow the steady development of NCRE. Furthermore, the demand from non-regulated customers is likely to grow at about 4% a year, driven by new mining and industrial projects.

Grid parity has already been reached and the market is open to all renewable-energy technologies. Their installed base is growing, creating a demand for services to support them. While the construction and commissioning of most of Chile's initial NCRE projects relied on qualified foreign personnel, the development of local capabilities is seen by the industry as a way of obtaining further cost reductions. This has also attracted the attention of the authorities who are sponsoring public-private development programmes, such as the National Strategic Programme on Solar Energy, the main objective of which is to reduce the cost of solar energy.

In addition, for many companies, including global players such as ENEL Green Power or SunEdison, Chile has proved to be a good regional base to access the power markets of most of the southern cone of South America. In the long term, studies show that the target of 20% of NCRE could be met by 2020, four years ahead of the deadline - meaning that there will be an excess of NCRE credits, and that NCRE projects will be competitive without them. In a longer term, studies suggest that Chile could generate up to 40% of its energy from NCRE sources by 2030. A comparison of least-cost development scenario of the power system until 2035 with a scenario with no new coal based capacity showed that there was no material difference between the two (Carvallo et al., 2014).

A real renewable energy boom operated in Chile the last years. Key success factors for the fast development of NCRE in Chile are: high quality and diversity of renewable energy resources, an open market that allows power generation companies with different technologies to enter and compete and market rules that have been adapted in order to avoid barriers and level the market risk for the different sources of energy for power generation.

But which factors that have enabled the recent boom in NCRE in Chile are relevant to other countries? The high quality and diversity of Chile's resources is structural and thus independent to policy. However, NCRE-technology R&D being conducted worldwide is bringing an increasing number of countries to "grid parity" with renewable technologies. The equivalents to Chile's open market, with rules that avoid barriers and level market risk, can be successfully exported to countries that want to transition to a sustainable power generation market, with a progressive ability to diminish or abolish subsidies or feed-in tariffs. For Chile itself, the challenge is to enable investors, developers, power producers, consultants, equipment and services suppliers, etc. to gain market share.

Footnotes:

1 Sources of NCRE are geothermal, wind, solar, biomass/biogas, wave/tidal and run-of-river hydro generating less than 20 MW.

2 The LCOE is an economic assessment of the average total cost to build and operate a power-generating asset over its lifetime divided by the total power output of the asset over that lifetime.

3 The Climatescope is a joint initiative by the Multilateral Investment Fund (MIF), a member of the Inter-American Development Bank, the UK Department for International Development, Power Africa and Bloomberg New Energy Finance.

4 The index is made as a composition of four factors that include Enabling Framework, Financing & Investment; Value Chains and GHG Management.

References / ACERA, 2014. Utilización de bloques horarios en licitación de suministro a distribuidoras: caso licitación sic 2013/03 - 2º llamado. Available online: <http://www.acera.cl/wp-content/uploads/2015/02/Minuta-Acera-20122014b.pdf> // **Bloomberg, 2015.** Q4 2014 global PV market outlook, Bloomberg New Energy Finance. // **Carvallo, J.P., Hidalgo-González, P., Kammen, D.M., 2014.** Imaginando un Chile Sustentable. Available online: <http://www.acera.cl/wp-content/uploads/2014/10/10172014-Imaginando-un-Chile-sustentable-FINAL.pdf> // **CIFES, Ministry of Energy, 2015.** Programa Estratégico Nacional en Industria Solar-COFRO. Available online: http://cifes.gob.cl/blog/custom_landing/programa-estrategico-nacional-en-industria-solar-corfo/. // **Climatescope, 2014.** Available online: <http://global-climatescope.org/en/>. // **Comision Nacional de Energia, 2015.** Database. Available online: <http://www.cne.cl/estadisticas/energia/electricidad> // **Ernst & Young, 2015.** The renewable energy country attractiveness index (RECAI). Available online: <http://www.ey.com/GL/en/Industries/Power—Utilities/Renewable-Energy-Country-Attractiveness-Index>

© 2015 - Private Sector & Development