Renewable energy in northern Chile: *what oil giveth, greens taketh away*

The Chilean electricity system is primarily structured on two separate geographic subsystems: SING (Sistema Interconectado del Norte Grande) from the northernmost city of Arica to Antofagasta and SIC (Sistema Interconectado Central) from Taltal to Puerto Montt. Both subsystems are to be linked by 2018. Solar energy has good natural conditions in northern Chile; hydroelectricity has its own ones in central and southern Chile.

At the end of the first half of 2015, electric power capacity in the SING system amounted to 4.149 MW, of which wind and solar represented 90 and 91 MW, respectively, while the remaining power capacity was explained by coal, natural gas and diesel based electricity generation units. By the end of this year, solar power will increase by 235 MW. Further south, electric power capacity in the SIC system amounted to 15.530 MW, of which wind and solar represented 805 and 351 MW, respectively, whereas the rest of it was explained by hydroelectricity, coal, natural gas and diesel based electricity generating units. By the end of this year, solar power will increase by 558 MW to 909 MW. As of today, wind and solar energy contribute with 3.5% and 4.5% of total electricity generated in the SING and SIC systems, respectively. Chilean Energy Department (CNE) projects that by 2029 58% of new electric power capacity in Chile, almost 7.000 MW out of 12.000 MW, will be based on solar and wind plants and, to a lesser extent, on geothermal plants.

Present transmission systems are being upgraded by 2018 from southern to central Chile and from central Chile to the northernmost area covered by SIC, from where the link with SING, the other subsystem, is expected to be in operation that same year. Suffice to say, until 2018 there will be no capacity to move excess solar energy to central Chile, consequently depressing spot energy prices in those areas where supplied quantities go beyond daylight consumption needs.

In the short term, in the northern section of SIC, where solar capacity is being expanded at an accelerated rate, electricity power demand is close to 800 MW and mainly supplied with coal based electricity generation units. By the end of this year, there will be wind and solar generation approaching 1.600 MW in power capacity in this area. No wonder daylight spot prices, around midday, will come close to zero. If in past years, before these renewable energies came into existence, SIC system rewarded with a US$ 10 per MWh premium daylight prices with respect to the remaining 16 hours average, nowadays there is a price penalty over US$ 20 per MWh with respect to the same 16 hours average, and has kept increasing, in this oversupplied zone which has no capacity yet to export its energy. Big solar projects structured on spot prices are certainly a non-starter, the more so when coal, diesel and natural gas markets are approaching a new equilibrium with lower prices relative to recently prevalent ones in too stressed energy markets.

How about structural conditions? Present long term electricity supply contracts in the wholesale market, mainly bid during the unexpected cutoff of gas supplies from Argentina while under historically high prices for oil, coal and diesel almost a decade ago, are in the US$ 100 per MWh range, including energy and capacity retribution payments. When considering transportation cost

differences with imported coal and natural gas with respect to the US, these contracts seem overpriced by at least US$ 20 per MWh. A more profound LNG market and bidding processes with longer time to prepare and entice others to participate, along with energy delivery timetables compatible with the construction of new power plants, should put a downward pressure on wholesale electricity prices to level under US$ 80 per MWh, assuming international markets for oil, coal and natural gas remain operating under present conditions, reflected by oil prices that have returned to a US$ 50 - in today´s dollars - per barrel of oil long term average - past 45 years -.

Unless these solar plants, that operate near 30% load factors and have investment costs around US$ 2 million per MW, get a long term contract over US$ 100 per MWh, they will not repay their investment. However, as oil and its substitutes correct their prices downwards and US$ 80 per MWh are reachable under competitive conditions using either hydroelectricity, coal or natural gas based electricity generation, solar investment costs will need to get well under US$ 1.5 million per MW to recoup their investment and remain competitive. As of now,that is a case yet to be proven.

Notwithstanding the above, technologies evolve and past experience is there to witness. But today, these renewable investments ***do not stand on their own.*** They have been made possible primarily due to competitively imperfect contract bidding processes – under correction - along a public policy reluctance, mixed with environmental activism, to big coal and hydroelectricity projects. Subsidies from foreign governments to get their domestic companies to develop these technologies have helped lowering investment costs, duly financed by their own taxpayers. In our domestic arena, there have been complementary public policy interventions such as eliciting a US$ 5 per CO2 ton tax, which amounts to almost a US$ 5 per MWh tax in a coal based generation plant or a US$ 2 per MWh tax in a natural gas based generation plant, and further requiring 20% of electricity to come from renewable energy or be fined with a US$ 25 per MWh tax, which has given birth to a green certificate market where it is traded near US$ 8 per MWh. In other words, an indirect renewable cumulative subsidy amounting over US$ 10 per MWh has been created.

Who will pay for this transition? As always, the consumer, either the foreign one paying for his taxes to enable the “Teslas of the world” or the local one paying higher electricity bills for a cleaner world under renewable energy requirements and CO2 taxes. In a strict sense, what oil – and related energy markets that jointly move as time goes by – has given us in lower prices via returning to long term values has been partially taken away via these renewable subsidies that are expected to internalize global warming effects from fossil fuel based electricity generation.

Long term electricity prices will get lower in Chile, coming from unacceptable expensive values, but not enough given that wind and solar investments – associated with smaller operational costs- continue being more expensive than alternatives. For how long will there be an excess price? That depends on how fast technologies develop and how competitive our wholesale electricity market evolves – and its related but too intertwined oil, natural gas and LPG energy distribution markets -.

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