

The Future of Energy Generation: A Realistic Vision

Very soon, Chile will require great investments in thermoelectric and hydroelectric plants to respond to the increasing electric energy demand; a request which non-conventional energy sources can only satisfy in a small percentage. This fact must be taken into account in the decisions concerning future developments.

Even though the interruption of the thermo-electric project located at Barrancones was applauded by those who considered it a threat to the natural ecosystem, we must be concerned about the consequences arising from this fact. The former is not only related to the Executive's direct intervention in a project that had fulfilled the country's standards requirements but, deep down, with those issues that we should expect for the country's energy development, inserted in a context of growing opposition to different projects.

The recent past (2004-2009) left us various lessons on energy matters, since Chile had to face a combination of different factors – the interruption of gas supplying from Argentina, a dry season, the upward price of hydrocarbon and failures of generation plants- that demonstrated the energy system's vulnerability. Both the authority and the private sector's answer to the crisis were positive since electric rationing was avoided.

In spite of this adjustment and motivated by past adverse conditions, the situation and future of the electric energy generation are not solved. Actually, the permanent protests reveal that there is no general consensus in the public opinion about the country's development and energy matrix composition for the next years. Moreover, the answer is not as easy if we consider the multiple factors that conjugate at the moment of defining the energy generation development. In fact, considering the need of promoting a low cost production to avoid further increases in the electricity prices and to enhance a better competitiveness for the country, we should take into account other relevant issues as safety matters, energy diversity, contaminants' reduction and environment protection, among others.

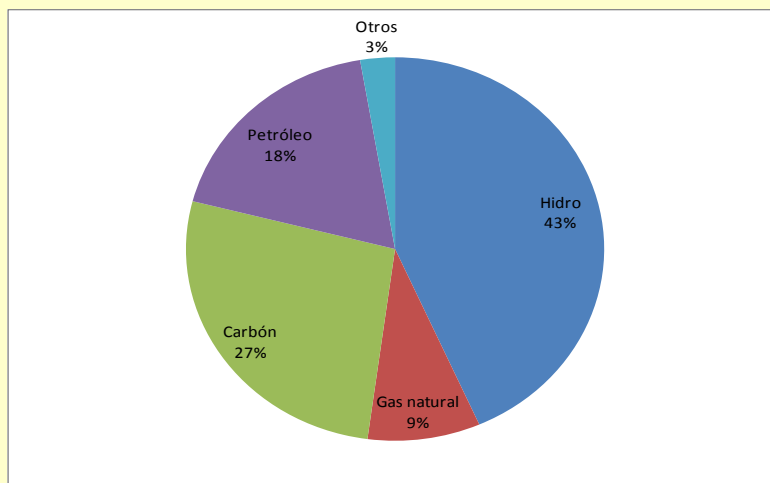
The current government committed itself to foster a pretty ambitious plan: to attain by 2020, 20% of electric energy generation based on non-conventional renewable energy sources. This is even more demanding than the amounts fixed by the law and approved during the previous administration, which obliges the generating plants to offer 5% of renewable energy to its customers. This percentage will be increased gradually up to 10% in 2024. The renewable energy does not consider the hydroelectric power plants over 20MW; hydroelectricity of any dimension is renewable, non-contaminant and produces low environmental impact, and, if this limit is eliminated, we will be able to double the fixed goal.

Realism versus Idealism

During 2009, the electric energy generation in the main systems of the country (SIC and SING) [Electric Energy System of Norte Grande & Central Interconnected System] was mainly based on hydro sources (43%), coal (27%) and fuel oil (18%), while natural gas had a lower share (9%) and renewable sources accounted for only 3% (Aeolian and biomass energy).

Chart Nr 1

ELECTRIC ENERGY GENERATION 2009 (SIC & SING)

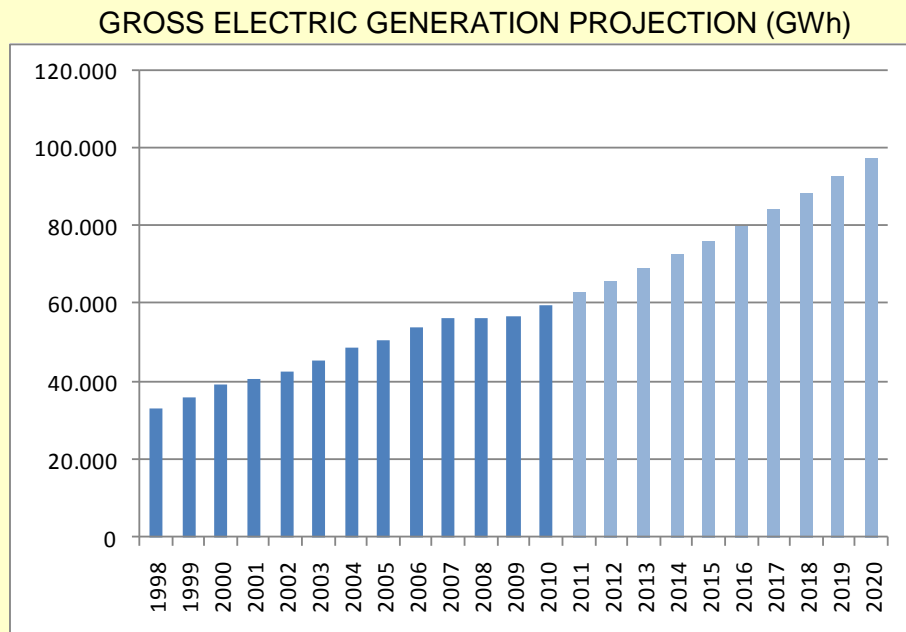


Source: Synex

Until December 2009, the gross electric energy generation for Government Services was 57,000 GWh (99.3% accounting for SIC and SING), figure that should grow at a rate of 5% annually during the next ten years. The increase of the electric energy demand is unavoidable, mainly in a country that wants to keep growing and which seeks to attain such development level as to uproot poverty and increase the life quality of its inhabitants.

In this perspective, the energy efficiency (that assumes a consumption decrease without sacrificing its benefits) could partially reduce the future energy demand, but will not avoid its growing demand. Thus, some experts estimate that in order to become a developed country we need to double the production as well as the consumption of electricity in the next 14 years, which compels the administration to guarantee an energy provision enough to avoid becoming an obstacle for the country's social and economic development.

Chart Nr 2

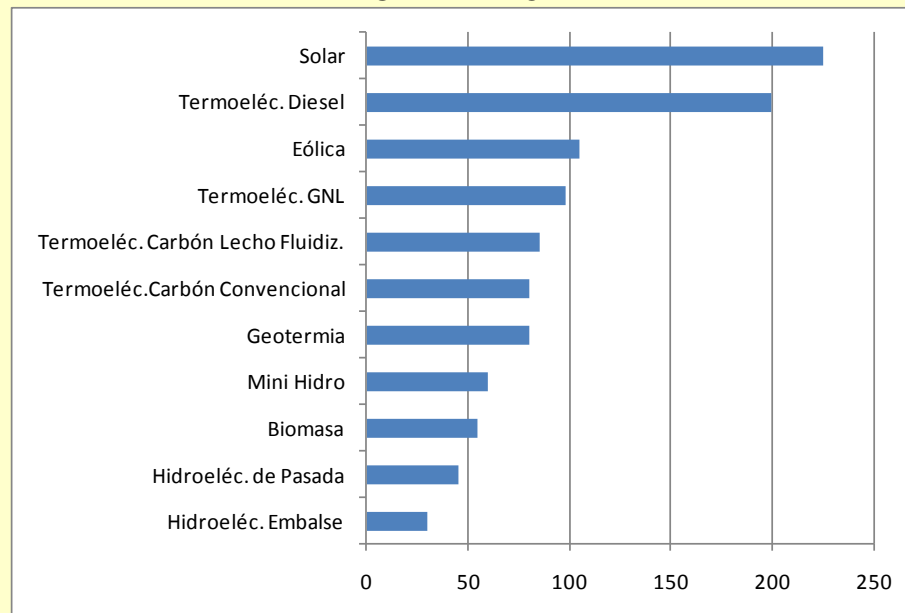


Source: Historical data: Comisión Nacional de Energía
Projections: Own preparation.

Thus, a question arises concerning not so much the greater amount of energy required, but rather the composition of this generation. The latter has a direct influence on the matrix diversification, the country's reliance on the different supplying sources (external or internal), the level and variability of associated costs and the environmental impact of the new technologies which are going to be used.

Chart Nr 3

AVERAGE COSTS OF DIFFERENT ALTERNATIVES FOR ELECTRICITY GENERATION *



Source: Own estimation.

*Considers the standard plant dimensions and the average cost estimated for this type of projects.

The first issue to be considered in the electric energy matrix in our country is the importance that given to the renewable energies in the future. The truth is that, considering all the benefits associated – a clean energy source, allow the diversification of the energy matrix and reduce the dependence from external sources- technically they cannot sustain the energy development. This explains why no country has really considered this alternative.

It is important to notice that the International Energy Agency (IEA) estimated that in 2050, 47% of the world energy will be generated by coal-fired power stations and 28% by natural gas fired power plants; while the renewable energies will account for only 6% at global level. That is, the current sources will continue leading the power production worldwide.

The reason for the slow expected development in the electric power generation based on renewable energies is that, currently, there are few alternatives that are economically cost-effective, since they involve high

financing costs, greater instability in the production (intermittence), a low capacity factor, a relative small development scale and connection difficulties with the electric systems. All these factors make it difficult for them to participate more significantly in the energy matrix during the next decade.

In Chile, the possibility that renewable energies develop massively is very low. The mini-hydro may constitute an interesting contribution as well as biomass and, to a certain degree, geothermal energy, but their development scale is reduced and possibly the total installed capacity of these 3 technologies will not represent more than 6% of the total energy production by 2020. The idea that we become a country with great solar and tide-power electric capacity, due to our geographical conditions, seems to be a mere utopia. Particularly, tide-power has been developed as a trial only in France and Russia and the experience has not been imitated again nor by France or Russian nor by any other country in the last 50 years. On the other hand, solar energy is much more expensive than other alternatives, it functions intermittently and it has high financing costs.

The Aeolian energy is close to attain competitive costs, but its production is intermittent and it has a capacity factor that does not overcome 30%, which compels to maintain diesel fired plants or to rely on hydro-electric dams that can accumulate the electricity produced.

Biomass energy generation is quite competitive, mainly at self-production level in the cellulose industry, but its local development imposes some limits in regard to the Government Services market share. Meanwhile, geothermal energy may have some development possibility since it has low operating costs and a high output factor, but it has high costs and high risks during the exploration period. So it is probably that among renewable energies, the energy based on mini-hydro plants will prevail, since it has a higher output factor and lower production costs, as well as in biomass and geothermal, along with a certain development of Aeolian energy plants.

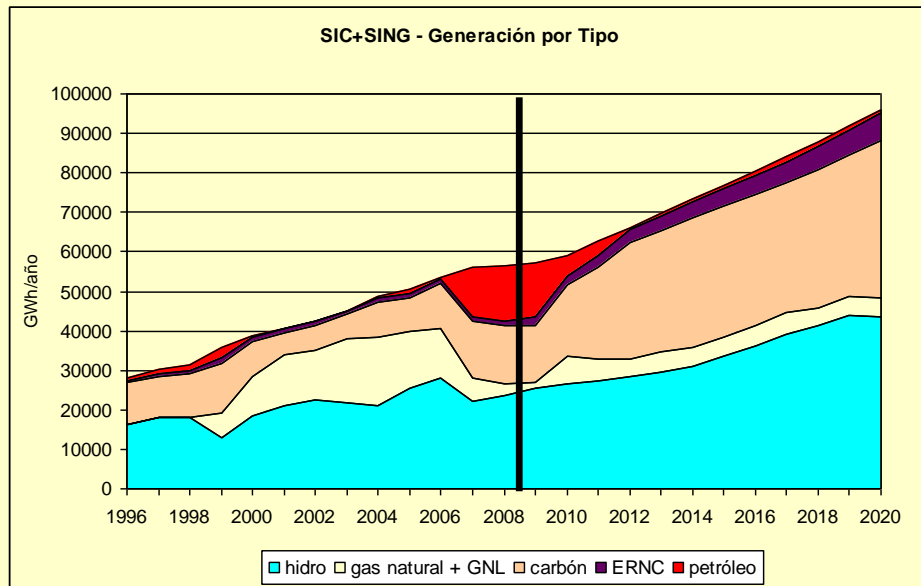
Therefore, we must not forget that the potential limits on CO₂ emissions will mean a better competitiveness of these resources or, in other words, an additional cost due to the electric generation based on more contaminant sources. In consequence, the contribution of renewable energies to the future electric energy matrix of the country, although it will be delimited, should be promoted. In a certain way, this is already happening because many of these projects have obtained the Low Emission Certificate, which constitutes an important benefit for the energy generation.

Nevertheless, foreseeing that the relative importance of the renewable energies in the electric matrix will be lower, it is evident that the alternatives based on traditional generation will prevail in the future of our country. Probably, the electric energy matrix of 2020 will be composed mainly by hydro-electric power (about 45%) due to the abundance of the resource in

the country, while non-conventional will share about 6-8%. The rest of the electric power will be constituted by thermo-electric power (about 45%), with a greater contribution of coal-fired plants. Coal is an input with high availability at international level and with multiple suppliers. Natural gas and liquefied natural gas represent only 5% of the matrix, due to their higher costs and the high price volatility at international level.

Chart Nr 4

PROJECTION OF ELECTRIC GENERATION BY TYPE (SIC & SING)



Source: Synex.

As we mentioned above, hydroelectric power, which has met a great opposition, is a renewable and non-contaminant energy source. In consequence, it is important to recognize that the Chilean electric energy matrix is very clean and highly concentrated in renewable energies, mainly when it is compared with the rest of the world (18% according to the World Economic Outlook for 2006). The most modern thermoelectric plants have developed technologies with low contaminant levels, even though they contribute to the CO₂ emission, an issue that must be dealt with in the long-term.

Nevertheless, the high price of the thermoelectric generation and the gradual exhaustion of hydrological sources oblige us to consider the future input based on nuclear energy, whose cost is not higher than the thermoelectric plants, when operating in big scale, and do not introduce

urban pollution or greenhouse effects. There are 440 nuclear plants in operation worldwide and more than 30 plants are being constructed. They comply with rigorous safety standards which allow projecting their construction in a country like ours.

Nevertheless, the energy situation in Chile is relatively settled until 2015 with the ongoing projects, but the absence of new projects shows that the future may get complicated after that date. This is particularly serious if we consider the start-up terms for any generation project. In fact, a hydroelectric generation project may take 7 to 10 years to be operative, while a thermoelectric plant takes 6 to 7 years.

In consequence, it is important to avoid the intransigent opposition from certain pressure groups who only tend to delay the necessary progress in energetic matters that the country requires.

Conclusion

We must look into the future with a planning that guarantees an efficient, competitive and sustainable development in electric energy generation. Any future development program must include an efficient use of energy, an increase in production that allows satisfying the future electric energy requirements at a minimum cost, the promotion of the matrix diversification to reduce vulnerability and an electric energy development that takes care of the environmental patrimony.

Chile will require great investments in thermoelectric and hydroelectric plants to respond to the increasing electric energy demand; a request which non-conventional energy sources can only satisfy in a small percentage. This fact must be taken into account in the decisions concerning future developments.

Moreover, in this process of strategic planning no generation type must be excluded *a priori* from our electric matrix, as nuclear electric generation, since all sources together will allow increasing diversification as well as offering energetic supply. To postpone those decisions may have non-dimensioned consequences for the country's social and economic progress.