Changes in the Uruguayan energetic matrix by the incorporation of non-conventional energies

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The main sources of energy in Uruguay have been oil and its derivates, which were usually 60 % of the useful energy in the country. Secondly, the hydraulic and woods with less than 20 % each other. However, in 2005 this number began to decrease to 50 % with the incorporation of biomass and biodiesel fuels. However, the use of eolic energy in the windy states of the country gives more than 20 MW of real energy. BID project gave in 2008 the possibility to study the incorporation of hydrogen, methanol or natural gas fuel cells in three main aspects: rural neighborhoods, vehicles and addition of energy to the Electric Network at prime hours.

In this sense, the tendency beneath the 2010-2030 period will change substantially with the incorporation of other sources of energy such as compressed natural gas (CNG) and of course hydrogen, from biomass reforming or specially from water electrolysis.

The firewood or logs as main autochthon fuel, could play a role for the nowadays levels of actual forestations. These fuels can be used as a substitute of oil derivates for industrial incomes. However, they will be favored or not depending on the international prices and the availability of the fuel not used for other purposes, such as cellulose and pulp conversion to paper in our new industries.

For the long-term estimations we are considering the incorporation of renewable sources of energy. In this case, we are specially taken the cases of eolic sources because of simpleness, solar thermal and photovoltaic devices since they are reliable for summertime, hydrogen and methanol fuel cells for the rural villages and vehicles (for the latter gas natural reformat is also considered). We are not considering the use of nuclear energy since the Uruguayan legislation forbid its application, however, this is still in consideration.

It is important to notice that the contribution of renewable sources of energy such as eolic and solar they are not going to give a large input into the energetic market since they are mainly

non-firm energy sources. They are able to compete with other primary sources (hydraulic) but in our country is not possible yet to consider that they are going to substitute them for complete.

We believe that the technological developments will point to auxiliary technologies to support the renewable energies in a way also to co-generate. In this aspect, the new developments in the fuel cell advances specially converting the primary sources of energy such as natural gas, reformed methane, reformed biodiesel, etc. will support to add energy of ca. 10 MW to the Electric Network of the country during prime time hours.

Table 1. Percentage distribution for short and long periods estimated considering the Energetic Balance of Uruguay of 2007, total value of 2570 ktep

EnergeticSource	**Hystorical Period**	**2010 - 2015**	**2020 – 2030**	**Variability coefficient**
	%	**%**	**%**	**± %**
Oil-derivates	60	40	30	10
Hydraulic	23	25	25	5
Firewood	15	15	20	5
CNG	1	15	20	5
Others (eolic, solar and fuel cells)	2	5	10	4

We are going to discuss in our conference the possible variables in a short period of time taking the following suppositions to change the uruguayan energetic matrix;

Holding of the mean level of PBI growth and the energy demand according to the tendency of the country.

New supports of CNG as a new energy source either as a primary source or a vehicle purpose. The first one will lead to the deadlock of hydraulic energy as a main source.

Economic growth to the short term will lead to the increase in the energy demand that will be consider to be supplied by fuel cells or the chemical combustion of their main products. After then, the new devices will satisfied the demand of the secondary and tertiary sectors such as the domestic ones, leveling the energies requirements of the country.

New energy networks with Brazil and Argentina for gas and hydraulic energy sources, and also the increase in the distribution network and the variability of the energetic merchandising (contract systems and spot market).
During the first period up to 2015 and surely during the second (2030) large industries will be installed again in our country due to the security in bank transactions and economic stabilities. It is expected that this industries will co-generate energy and maybe nuclear energy will be installed in the MERCOSUR region.

The country will promote new energy sources with clean technologies such as the hydrogen economy as a consequence of the BID Project. The distributed generation with the knowledge of ecological and social consequences of the "old" thermal technologies will be considered. A change in the prices to the "clients" will be the economical consequence of working with this economy with low environmental impacts.

With the long-term expectations of the energy matrix in the country, a large variability has to be considered since the energy demand in Uruguay has been an oscillation curve instead of a slow or large increasing tendency in both the utilization and generation. Two main tendencies are considered; 1 % per year of generation because of increasing new efficient methodologies and environmental restrictions, and 3 % per year of economic and social welfare for unsatisfied domestic demands before 1999.

Therefore, we are going to take a 2 % of mean annual value because of the concepts of initial developments for the passage to the secondary level and the growth of the distribution. In other words, the domestic consume is still in the development stage and is meanly lower than the annual growth, that is, first the economic growth and then the uses and expenses.