

Wind Energy in Armenia and possible alternatives to replace Armenian NPP

Electricity consumption in Armenia in 2009 was around 5.6 billion kWh. The share of the Armenian NPP's (current 400MW unit under operation) in overall generation mix was about 45%. Today, the ultimate goal is to replace the out-aged operating nuclear unit of the Armenian NPP with a new nuclear unit with capacity of 1000MW.

Construction of the new nuclear plant is foreseen by means of state and private investments. Based on the information of mass-media as well as official press-releases of the Ministry of Energy and Natural Resources, the construction of new nuclear unit will cost from 5 billion USD to 6 billion USD, of which about 40% is expected to be financed by Russian and Armenian sides. In the light of the nuclear plant accident at Japanese Fukushima NPP and reaction of the international community on safety issues of nuclear power plants and additional design requirements to ensure safety of nuclear power plants (in terms of seismic, radiation, physical, fire safety as well as physical safety – to withstand potential terrorist attacks) one can expect the cost of construction of new nuclear power plants will significantly increase.

Taking into account the safety issues and the fact that the construction of the new Armenian NPP will be financed by private investment, it is obvious, the expected high tariff for electricity generation by the nuclear power plant will be paid by the general public. Considering additional expenses will be needed to shut down the old plant, store the used fuel, purchase and transport new fuel, the tariff of electricity generated at nuclear power plant will be significantly high comparing to the existing tariff.

As it is mentioned above, the key issue associated to the construction and operation of the new nuclear power plant is its safety. Some scientists assure that in terms of seismicity the Armenian NPP is not safe as it is located at high seismic zone near a tectonic crack. While others consider it as rather safe and that no earthquake over 9 scale is possible in Armenia; such a categorical statements rise certain doubts. The fact is that the Armenian NPP is located at high seismic zone, at less than 40km from the capital city of Yerevan, where about 35% of the all population of the Republic of Armenia lives, where the most government offices, hospitals, main critical infrastructures as well as international airport are located.

Transportation of nuclear fuel and used fuel is also associated with certain risks in terms of ecological, technical and terrorism safety. Location of the Armenian NPP and used fuel storage near Ararat valley, where most of agricultural products are grown, impose a risk of soil and underground water resource contamination and pollution during even a small accident. Finally, concentration of a half of country's generation capacities in one location is not the best strategic solution in terms of energy and national security.

Today Armenia has significant electricity generation capacity that can meet even 20%-30% more demand. Half of the generation is based on Armenian NPP (400MW unit under operation). It is not an easy task to make precise forecasting of what the demand for electricity will be in Armenian in 5-10 years, when in any case the country will have to shut down the old nuclear power plant, but one cannot expect significant economic growth that will push the demand. As such, it is expected that in coming 10 years, taking into account growth in demand, the electricity generation capacities in Armenia should have possibility to cover about 3.5 billion kWh electricity consumption. This generation volumes can be

ensured by construction of a new nuclear plant (after closure of the old unit), or commissioning of the Hrazdan Unit 5 TPP, and/or partially, by utilizing renewable energy resources, such as wind, solar and others. The potential for energy saving and energy efficiency is also significant.

A theoretical potential of wind energy in Armenia, according to various estimates, is over 10,000MW, while only 10% of that can be technically and economically feasible to utilize for utility scale plants. Experts assess that wind energy plants with total capacity of 1000MW built in different perspective regions of Armenia can generate over 2 billion kWh electricity annually. The construction cost of wind energy plants in Armenia is assessed to be around 2.2 million USD per 1MW of installed capacity. Thus, construction of wind energy plants with total capacity of 1000MW could cost about 2.2 billion USD. In other words, to replace the current generation of the nuclear energy unit under operation would cost about 2.2 billion USD. Certainly, the nuclear energy plant provides basic power, and high penetration of wind energy plants can arise some technical problems related to remote grid upgrades and for power dispatching. At the same time, experience of countries with high wind energy penetration of over 20% indicates that there are technical solutions to overcome these problems.

Today, commercial development of wind energy in Armenia is hardly possible due to low feed-in tariff (less than 9 US cent/kWh); but at tariff of 11 US cents/kWh many investors would get interested in investing and developing utility scale wind energy plants in Armenia. Benefits that wind energy development in Armenia can offer are:

- ecologically clean and safe electricity generation
- distributed energy over the territory of the country
- independent on imported fuel and international prices energy
- no need to use water for energy generation (such as for cooling of reactors, etc.)
- energy security and diversification of generating capacities.

These benefits can compensate the public and the state in general an attractive for investors wind energy tariff.

It is worth to mention that wind energy today compete with nuclear power in many countries. This is explained by the fact that nuclear power requires high costs for risk mitigation and safety measures to protect environment and human health, as well as costs associated with insurance, and this makes tariff for electricity generated at nuclear power plants high.

In conclusion, significant renewable energy, energy saving and energy efficiency potential in Armenia should frame out a new strategy for energy sector development in the country - to look for safe and environmentally sound alternatives as well as implementing corresponding government policy to support development of such alternatives. In 5-10 years we will have to pay for high electricity tariff in any case, so why not pay that for a safe and independent energy.

A.Lalayan