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Energy Report:

"Nuclear Energy Projects in the Gulf States"

By

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Introduction:

The Gulf countries face a major challenge as a result of the large increase in the consumption of electricity due to several reasons, including the increase in population, high temperature, increasing costs of water desalination and low electricity rates compared to the rest of the world. Since the construction of their first electricity grids, the Gulf states relied mainly on their gas and oil resources as source fuel for the generation of electricity. However, the Gulf states have begun to realize that they cannot afford to continue exhausting their natural resources in this manner as this will have serious economic consequences in the long term, and does not help the goals of sustainable development that these countries aspire to achieve. Furthermore, the diversification of the energy mix requires the use of modern power-generation techniques and technologies and as such it increases the reliability of the power grids.

Nuclear Energy Projects in the Gulf:

For these reasons, the Gulf States decided in 2006 to develop a joint nuclear program, but the disastrous meltdown of the Fukushima nuclear reactor in Japan in 2011 prompted Bahrain, Kuwait, Qatar and Oman to withdraw from the program. Furthermore, nuclear proliferation in the Middle East is a major security concern as it means bringing in sensitive nuclear materials that can be used for military purposes such as enriched uranium and plutonium fuel. Of course, the level of risk varies from country to country, depending on who will control the activities of the nuclear fuel cycle, and the quality of technical safety arrangements put in place. The cycle of nuclear fuel begins with the mining of uranium followed by enrichment and then using it in the nuclear reactor and finally disposing of the depleted uranium. For example, Russia offers the option of supplying the nuclear fuel, enriching the uranium and then retaking back the depleted fuel. This is the option chosen by Iran for the Bushehr reactor.

Manufacturers of nuclear reactors look to the Middle East as a promising market for their products, especially after the fall in demand in other markets. Rosatom, a company owned by the Russian government, is a front runner in the competition race for the region's business and uses light water technology. It supplied and built Iran's Bushehr reactor, signed four agreements with Turkey to build 1,200-megawatt reactors, entered into serious negotiations with Jordan to build its first nuclear plant and signed an agreement with Egypt in November 2015 to build a nuclear reactor in El Debaa area. In the Arabian Gulf, the UAE chose the Korean technology (Kepco) as it was more flexible for its requirements.

The market with the greatest potential is Saudi Arabia. However, it has not yet decided on building nuclear plants because of the abundance of the oil and gas resources used now in the fossil-fuel power plants. Nevertheless, Saudi Arabia has taken steps towards the use of nuclear energy. In 2012, it announced plans to build 16 reactors by 2040, and in the same year signed a nuclear cooperation agreement with China. In June 2015, Saudi Arabia and France signed a letter of intent "to study the feasibility of building two nuclear reactors". The kingdom then abandoned the plan to build 16 nuclear reactors, and opted for two reactors only using South Korean technology. A number of researchers opine that electricity generated by solar energy in Saudi Arabia is gradually becoming less expensive than that generated from nuclear energy. However, this does not preclude investment in nuclear energy as the diversification of the energy mix increases the reliability of the power grid, especially that the technology used to generate electricity through nuclear fuel is more mature than the uses of solar energy.

Use of Nuclear Energy in Water Desalination:

In addition to the generation of electricity, nuclear plants offer great potential for water desalination, which helps meet local needs. Nuclear plants produce thermal energy of varying temperature degrees, which makes them suitable for many of the technologies used in water desalination. The world has a cumulative experience of over 150 years in using nuclear plants for water desalination, mainly in Japan, India and Kazakhstan. Desalination is a useful solution to the cyclic fluctuations in the demand for electricity generated by nuclear reactors. Desalinated water is easier to store than electricity when produced from the same plant. When the demand for electricity generated by a nuclear plant falls during off-peak periods, the thermal energy of the nuclear plant can be diverted to desalinate water. As such, the excess heat produced by the plant is used in the desalination process, and thereby the production capacity of the plant will continuously be utilized instead of wasting it.

Economic Challenges to Nuclear Energy:

One of the main obstacles to expanding the use of nuclear energy is the high cost of building the reactor itself. Feeding the reactor with uranium, operating the plant, handling of radioactive waste and the security and environmental safety of the plant do not cost as much, but these cannot be determined in a precise manner. Therefore, the main costs are incurred before starting generating electricity. This explains why nuclear reactors are not widely used around the world to generate electricity.

According to a famous MIT study, nuclear technology has become uneconomical, mainly because of the high capital costs needed to build nuclear reactors. The risk of cost overruns increases in cases of uncertainty, and historical data show considerable differences in the cost of the construction and operating of nuclear reactors. Another problem relates to delays in the construction of such projects which again leads to cost overruns. Indeed, the cost of nuclear reactors has increased in recent years in comparison with the data on which the MIT study was based. The study was based on the initial cost of building a nuclear reactor in the state of Georgia of $ 2000/kW while recent data show the current cost at $ 6100/kW. This is a 2.5% increase, taking inflation into account.

Finland gives us another clear example of cost overruns and construction delays. In late 2003, Finland approved a project to build a 1,600 MW nuclear reactor at a total cost of Euros 3 billion, with scheduled opening in 2009. The reactor cost now runs into more than Euros 8.5 billion, equivalent to $7000/kW, and the completion of the project was rescheduled to late 2019.

In Britain, the cost of the Hinkley Point plant amounted to Euros 19.4 billion, equivalent to $8000/kW, and the government had to provide guarantees for 80% of the loans and sign a contract to buy the production of the plant at preferential prices for 35 years, in order to ensure the successful completion of the project.

The UAE Barakah nuclear power plant faced the same problems that we mentioned above. The long-term purpose of South Korea's involvement in the UAE nuclear project was to introduce and market its nuclear energy technology in the Gulf states. For this reason, experts estimate that the contract to construct the Barakah nuclear power plant was 20% below the average cost of a similar project. Future nuclear projects in the Gulf region are not likely to receive the same preferential treatment in terms of cost. The UAE project faced some technical problems that caused delays to the construction of the reactors and the contractor had to pay fines of $420 thousand a month.

Recommendations:

1. To diversify the energy mix in the GCC countries to include more than one of power generation source in order to increase the safety, reliability and flexibility of GCC energy systems.

2. To increase coordination between the Gulf states when planning new nuclear projects; in order to reduce capital costs and maximize the benefit of these projects by benefiting from the transfer of knowledge and technology from the manufacturing countries to the Gulf States.

3. To benefit from international experiences in nuclear energy and that of the UAE in particular; being the first experiment among the Gulf countries. To consider expanding the use of nuclear energy to include water desalination projects.