Power generation using nuclear energy is cheaper and safer

MD SHAFIQUL ISLAM

SINCE the very inception of the Rooppur Nuclear Power Plant (RNPP) project, the corresponding unit cost of generating electricity—per kilowatt-hour (kWh)—has been a subject of much speculation. I have yet to see someone come up with deterministic quotes backed up by a convincing economic and financial analysis. From financial and technical standpoints, the RNPP project is the largest megaproject in the history of Bangladesh. It is, therefore, very important to evaluate the economic feasibility of this project.

A total of 2,400MW of electricity from the two VVER-1200 reactor units of the power plant is expected to be added to the national power grid by 2024. Russia is funding 90 percent of the total investment cost of USD 12.85 billion, which is about USD 11.38 billion. This state credit is to be repaid over a period of 28 years along with an interest rate of Libor plus 1.75 percent, and capped at four percent. And there is a provision to extend the period for another 10 years, if necessary. Bangladesh will bear the remaining 10 percent of the project cost, i.e. USD 1.26 billion.

To analyse the economic aspects of this project, the service period of the two units has been fixed at 60 years. The construction period is six years. The inflation rate is expected to change at a steady rate of six percent per year against the local currency. For the US dollar, the inflation rate changes at a steady rate of two percent and at a tariff rate of 25 percent. The exchange rate of one US dollar has been fixed at Tk 80. A linear depreciation rate has been considered for the total economic lifetime of the two plants. The discount rate has been fixed at 10 percent considering the growing economy of Bangladesh. The fuel cost and the operation and maintenance cost are capped at USD 11.2 and USD 14.5 per megawatt-hour (MWh), respectively, with the lower limits set at USD 4.5 and USD 7.82 per MWh. In comparison, the global average rate for the fuel cost is USD 6.28 per MWh, and the operation and maintenance cost is USD 12.79 per MWh.

Given the international practices, the cost for waste management and decommissioning of the reactor units is estimated to be nine percent of the total investment, which amounts to about USD 1 billion. The plant capacity factor of the two plants has been varied from a minimum of 50 percent to a maximum of 90 percent. The average plant capacity factor of thermal power plants in our country is 50 percent. On the other hand, the average plant capacity factor of nuclear power plants is 90 percent and the plant capacity factor of VVER-1200 reactors is 93 percent.

A total of nine case studies have been conducted with the plant capacity factors of 50 percent, 75 percent, 80 percent, 85 percent, and 90 percent. These are subject to change between the high fuel cost of USD 11.2 and the low fuel cost of USD 4.5, as well as between the high operation and maintenance cost of USD 14.5 and the low cost of USD 7.82. The case studies have been modelled using the FINPLAN tool developed by the International Atomic Energy Agency (IAEA). Analysis of the results shows that the minimum selling price of electricity per unit (1 unit means 1kWh) stands at 8.25 cents (Tk 7) under the maximum fuel cost, maximum operation and maintenance cost, and minimum plant capacity factor of 50 percent. The minimum selling price per unit is 4.38 cents (Tk 3.72) under the minimum fuel cost and operation and maintenance cost, and the maximum plant capacity factor of 90 percent. On the other hand, if the maximum fuel cost and the highest operation and maintenance cost are considered with the plant capacity factor of 75 percent, the selling price per unit stands at 6.38 cents (Tk 5).

From the case studies with a fixed discount rate of 10 percent, the internal rate of return (IRR) is found to be 13-20 percent. As the IRR is higher than the discount rate, this makes the RNPP project economically attractive. The main reason is due to the low interest rate of four percent and the low operation and maintenance cost per megawatt-hour of USD 8-14. It should be noted that the operation and maintenance cost is estimated close to the global average.

Now, let's see how the cost of generating electricity from nuclear energy fairs against other energy sources. According to the Bangladesh Power Development Board (BPDB) sources, the selling price of per unit electricity generated using gas is 3.31 cents, while it is 10.31 cents for coal-fired power, 21.70 cents for furnace oil-fuelled power, 28.43 cents for diesel-fired power, 6.83 cents for electricity imported from India, and 15.23 cents for solar power. The unit generation cost of electricity from gas is the lowest, followed by nuclear power. It is further observed that the cost of electricity generation using coal is almost double than that of using nuclear power, and the cost of electricity generation from diesel is the highest. Electricity generation from solar energy can be done at an affordable cost, compared to furnace oil and diesel. In the cases of independent power producers (IPPs), rentals and quick rentals, the costs of power generation per unit is even higher.

A trailer carries a reactor pressure vessel, to be installed at Rooppur Nuclear Power Plant, out of a factory in Russia in August 2020. PHOTO: COLLECTED

Next, let's look at the international context in relation to the cost of generating electricity from our nuclear power plant. Russia is building two reactors in Belarus and Hungary that are similar to the reactors in the RNPP project, with almost similar investment and loan terms. The minimum unit selling prices of electricity in Belarus and Hungary are 8.3 and 7.28 cents, respectively. In this case, it is seen that generating electricity from nuclear energy in our country is cheaper than in Belarus and Hungary. The average unit selling price of electricity from nuclear power in Bangladesh is 6.32 cents, which is about 37 percent less than the global average selling price (10 cents). The economic analysis shows that power generation from the RNPP project is economically competitive at both national and international levels, and is less risky in terms of investment. However, if the construction period is more than six years, the favourable condition may deviate. If the currency exchange rate is Tk 85, the cost of power generation per unit will not increase much. If the lifespan of the two units is taken to 20 years more, it is possible to get electricity at a lower price.

Looking at the numbers, Jacopo Buongiorno, a distinguished professor at the Massachusetts Institute of Technology (MIT) in the US, commented that nuclear power generation in Bangladesh was nothing short of interesting and internationally competitive. He added that although the initial cost is a bit higher, the four percent interest rate and the operation and maintenance cost of USD 8-14 per MWh has helped make the project cost-competitive internationally.

Here, I would like to mention a relevant issue. After a comparative analysis of the technical and financial aspects between Russia's Generation-3 (VVER-1000) and Generation 3+ (VVER-1200 and VVER-1300 TOI) reactors, I had given my opinion to select the VVER-1200 model—which has the highest proven safety features—at a technology selection policy-making seminar on July 5, 2015. In this regard, I published an article titled "How should the reactor of Rooppur be?" (*Prothom Alo*, August 2, 2015). The reason for mentioning this is that the financial matter is closely related to reactor technology. Generating electricity from nuclear energy is very environmentally-friendly and economic. The Gen-3 + VVER-1200 reactor with modern safety features is extremely unlikely to fail like Chernobyl or Fukushima. Now it is necessary to complete the construction work on time with the ancillary infrastructure, and adapt the technology by creating skilled manpower.

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How Nepal has managed to double its tiger population

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AMONG the 13 tiger range countries in the world, Nepal is heading towards becoming the first country to meet the goal of doubling its tiger population—termed TX2 (Tigers times two)—by 2022. In 2009, Nepal had roughly 121 wild tigers, but according to the 2018 census reports, now it has 235 of these magnificent wild cats, which indicates a 94 percent increase within 10 years.

On the contrary, despite Bengal tigers being an inextricable part of our identity, Bangladesh has shown little progress in reaching the TX2 goal by 2022. As reported by the 2018 tiger census, Bangladesh is now home to 114 Bengal tigers—an insignificant leap from the 2015 census where the tiger count stood at 106.

Nepal has shown such tremendous progress over the years that now it has more Bengal tigers than the entire Bengal region, after which these big cats are named. Currently, the Bengal region, consisting of Bangladesh and the state of West Bengal of India, has 203 tigers in its forests, a number which is nowhere near to Nepal's booming tiger count.

The Nepal model

Despite being one of the poorest countries in the world, Nepal has put an extraordinary effort in increasing the tiger population in its forests since the 2010 Tiger Summit. It has taken multiple initiatives involving both political entities and local communities that ensured a sharp rise in the tiger count.

To begin with, Nepal first identified the factors that are responsible for the decline in tiger population. It effectively reduced tiger poaching and apprehended the ringleaders involved with the global network of tiger poaching. In 2014, it was the only tiger-range country in the world with zero poaching. It even used unmanned aerial vehicles (UAVs) to stop poaching of tigers and other near-extinct animals. It established more than 400 citizen-centric anti-poaching units across the country to prevent poaching by monitoring important wildlife corridors.

In addition, Nepal has pioneered in functional and robust habitat management. It has expanded the border of key tiger habitats, clearing the way for the tigers to roam around freely with a tolerable tiger density. Nepal has also strengthened its forest authority's capacity to help them play a vital role in meeting the TX2 goal by allocating more budget, manpower, and modern equipment. In order to decrease human-tiger conflict, the country worked with the local communities to voluntarily relocate villagers from the protected forest areas, and put commendable effort in decreasing dependency on forest products. The country has also empowered the local people to take steps on their own to protect the nearby forests, and has left 28 percent of its forests to the local communities to manage, which resulted in a peaceful co-existence between the tigers and the humans.

Furthermore, realising the importance of a stabilised prey base, Nepal took measures to ensure suitable habitat for key prey species. Nepal built dozens of ponds in strategically important locations, set up solar technology-based freshwater courses, and established new reserved forests to maintain linkage between major tiger and prey habitats.

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Bangladesh could use the Nepal model to raise its own wild tiger count. FILE PHOTO: STAR

A learning scope for Bangladesh

Over the past 20 years, Bangladesh has lost 38 tigers to poaching activities, tiger-human conflicts, and other issues. The Nepal model can be handy in dealing with these issues. By following the Nepal model, Bangladesh should be able to create effective local anti-poaching units and initiate campaigns to help the rural population avoid tiger-human conflicts.

A 2010 study found that the tigers on the Bangladesh side of the Sundarbans were about half the weight of other wild Bengal tigers, indicating a lack of sufficient prey species in the Sundarbans. The Nepal model may help address this issue as well. Besides, this model may also help Bangladesh in ensuring an effective habitat management for both the tigers and the prey species.

At present, Bangladesh has a tiger density of 2.17, which is much lower than its actual carrying capacity, which signifies that Bangladesh has a scope for bumping up its tiger population without creating new habitats.

The Bangladesh Tiger Action Plan 2018-2027 (BTAP) has a goal of reaching a tiger density of 4.50 within 2027. Although, geographically, Bangladesh is different from Nepal and is facing climate change challenges, there is a wide scope for the country to utilise the Nepal model in its quest to reach the goal set by the BTAP.

A rise in the tiger population will not only imply saving the tigers from extinction, but it would also indicate having a healthy and balanced ecosystem with thriving biodiversity. Thus, our government and relevant stakeholders should prioritise increasing the tiger population in Bangladesh. While working towards that goal, we should look up to the Nepal model and apply the proven measures in our own way.

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