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Getting a buy-in from the public on Kudankulam

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Nuclear power is vital for India, and the government needs to be more transparent in presenting the attendant risks, while explaining that Kudankulam's safety features are superior to those of Fukushima.

The recent accident in the Fukushima Daiichi nuclear reactors has ignited a fierce debate about the future of nuclear power. Belgium and Germany have decided to phase out nuclear power. Back home, construction of the Kudankulam nuclear plant has come to a grinding halt following determined protests by residents of surrounding villages. The debate about nuclear power is not new; however, the focus has changed. Till recently, the commonly expressed concerns were: "economics, safety, proliferation and waste disposal". Now, it is "safety, safety, and safety". The key question is: "Is the engineering design robust enough to withstand a major accident caused either by human error or natural disaster?"

There is no doubt that given recent events, the public concerns of safety are genuine, especially those of people living in the vicinity of nuclear power plants. The common public perception is that the consequences of a nuclear accident in Kudankulam would be similar to that of Chernobyl or Fukushima. This is not surprising, given the severity of destruction caused by these accidents. The Department of Atomic Energy (DAE) on its part has tried its best to explain that the reactors are safe; however, people are not convinced.

Let us discuss the safety aspect of nuclear reactors. Are the Kudankulam reactors "safe"? In engineering design, there is no such thing as a 100 per cent safe design. The safety of engineering design is based on a thorough study of probabilities of various failure modes; however, no design can plan for a catastrophe. Therefore, design is a trade-off between safety considerations and economics.

There have been three main accidents in the history of civilian nuclear power: Three Mile Island (1979), Chernobyl (1986) and Fukushima (2011). The first two were attributed to human error, and the last to natural disaster. In Fukushima, an earthquake of a very large magnitude occurred about 180 km from the reactor complex and tsunami waves reached the reactors within 40 minutes. The damage caused by the earthquake was minimal. However, tsunami waves flooded the reactor complex, damaging the diesel generators and leading to a station blackout. Consequently, even though the reactors were shut down following the earthquake, the lack of cooling led to core meltdown.

It is important to realise that technology undergoes continuous refinement following each accident, major and minor. That is why there is a gulf of difference between the Kudankulam reactors and the vintage models of the Chernobyl and Fukushima reactors. For instance, the Chernobyl reactor had graphite, which led to a major fire in a reactor open to the sky that lasted for several days following core meltdown. The Kudankulam reactor uses water, which eliminates the possibility of a graphite fire.

Unlike in Chernobyl and Fukushima, the reactors in Kudankulam are surrounded by a one meter thick pre-stressed concrete wall, which in turn is surrounded by an RCC structure. This type of containment is robust enough to withstand a hydrogen explosion within, and even an aircraft crash on the outside. Moreover, the reactor has numerous passive devices to provide cooling in the critical hours after shutdown and to reduce the probability of radioactive leakage. In the case of Three Mile Island, the molten fuel remained in the reactor vessel and despite hydrogen build-up, the containment structure helped prevent any significant radioactive release to the environment.

Nuclear power plants are built close to the sea, as they require large amounts of water for cooling. This makes them vulnerable to under-sea earthquakes and

tsunamis. The southern Indian region arguably has much less seismic activity than Japanese coastal areas, and the probability of a major earthquake at sea occurring within a short distance of the coastline is rather low. The reactor is designed to withstand an earthquake with sufficient margin compared to a postulated earthquake close to the reactor site.

Further, the Fukushima experience suggests that there should be foolproof systems in place to avoid station blackout, so that reactor cooling and safety systems continue to function even in the worst case of a tsunami. We understand that the reactor design takes this into consideration. However, it would help if the department or the regulator makes available data to substantiate the above claim. Further, it would be helpful to communicate this information in a manner appealing to the common man. For instance, innovative visual simulations and models are powerful mechanisms to communicate the planned response to a major disaster like Fukushima.

The other main public concern arises from radiation exposure. Some modest degree of release of radiation from an operating reactor is inevitable. However, this release is limited by regulations of the Atomic Energy Regulatory Board (AERB), so that the resulting exposures do not exceed the annual natural exposures we receive on average.

Nuclear power is too important a source of electricity for India to be disregarded. Unlike Belgium and Germany, which are planning for very small annual increase in power generation, we need to double or treble our capacity over the next decade or two. A 1,000 Mw reactor can supply electric power to almost two million households. However, there is an urgent need to develop public acceptance. This requires the department and the regulator to be more transparent in their presentation of the risks of nuclear power. There is also scope to examine innovative options for public acceptance. To allay public apprehensions, annual medical examinations of communities in the neighborhood could be considered.

Cancer registries could be set up in the district to establish a reference database for epidemiological studies. The zoning regulations could be revisited in consultation with district authorities, especially the restriction on construction within a five km sterile zone. This was based on the desire to minimise the number of people who may have to be evacuated in an emergency. However, improved infrastructure such as roads, transport and communication assist in faster evacuation. Another possibility is to ensure that villages within a certain distance from the reactors receive uninterrupted electricity from the power plant.The regulatory structure needs to be strengthened to make sure that safety is not compromised by economic considerations.

The Kudankulam protests help to raise the bar for a national debate on nuclear power. Sensitive and transparent handling of the situation would augur well for the country, which is poised for a major expansion in nuclear power.

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