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Old Plans, Ongoing Handouts, New Spin

Deciphering the Nuclear Construction Announcement

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In May 2017, the union cabinet approved the construction of 10 more 700 megawatt pressurised heavy water reactors. A careful reading of this largely public relations spin on existing plans suggests that it chiefly hopes to persuade the Nuclear Suppliers Group to accept India as a member and attract capital that aims to profit from supplying components for nuclear power plants. Given our track record, the prospects of it adding to the role of nuclear power in India appear bleak.

On 17 May 2017, the union cabinet gave its approval for the construction of 10 more 700 megawatt (MW) pressurised heavy water reactors (PHWRs) (IANS 2017). These PHWRs will be in addition to four such reactors already under construction. The cabinet secretariat's official press release read like a sales pitch, and claimed that the construction of these 10 reactors would "help transform Indian nuclear industry" and that it would "be a major step towards strengthening India's credentials as a major nuclear manufacturing powerhouse" (Press Information Bureau 2017). The Nuclear Power Corporation of India Limited (NPCIL) and the Department of Atomic Energy (DAE) put out their own press releases, profusely hailing the decision (NPCIL 2017c; DAE 2017).

The reality underlying these announcements is far less spectacular. Plans for building many PHWRs have been enunciated in the past, and have not materialised. A more careful reading of the announcement suggests that it is targeted at persuading the Nuclear Suppliers Group (NSG) to accept India as a member and winning over sections of capital that hope to profit from supplying components for nuclear power plants. This publicity blitz notwithstanding, nuclear power will continue to be an expensive and relatively minor source of electricity for the foreseeable future.

Planning History

The chosen designs for the 10 reactors, the 700 MW PHWR, is one that the Indian nuclear establishment has evolved over the decades, starting with the original 220 MW design imported from Canada (Bhardwaj 2006). Of the 22 nuclear reactors operating in India today, 14 are 220 MW PHWRS and they account for about 3,080 MW of the total installed nuclear capacity of 6,780 MW, which in turn constitutes 2.1% of the total electricity generation capacity in the country. Apart from a few other smaller and older plants, the rest of this total capacity is largely provided by the two 540 MW PHWRs operating in Tarapur, and the two imported 1,000 MW light water reactors (LWRs) at Kudankulam.

The DAE has been planning to build a fleet of 700 MW PHWRs for a long time, and so the government's decision is neither "bold" nor new, and simply constitutes one more step in this direction. In 2007, the DAE announced that as part of the Eleventh Five Year Plan (2007–12), "work on 8 × 700 MWe of indigenous reactors totalling 5,600 MWe capacity" would commence (NI 2007).

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Of these, fourreactors are already under construction—two each at Kakrapar (Gujarat) and Rawatbhata (Rajasthan). Construction of Kakrapar—3 and Kakrapar—4 began in November 2010 and March 2011 respectively (NPCIL 2017a), whereas Rajasthan—7 and Rajasthan—8 began in July and September 2011 respectively (NPCIL 2017b). In December 2012, the government stated in the Rajya Sabha that work on eight more 700 MW reactors would commence during the Twelfth Five Year Plan (2012–17) at Kaiga, Chutka, Gorakhpur, and Mahi Banswara (Narayanasamy 2012). However, none of these projects began during the Twelfth Plan.

Although not mentioned in the official press releases, media reports suggest that these are the very sites targeted for the current approval. This history suggests that the recent announcement is largely a public relations spin on existing plans that had already been set in motion by the United Progressive Alliance (UPA) government.

The Export Story

The government's announcement also recycles other old tropes. For example, it plays up the role of this effort in "strengthening India's credentials as a major nuclear manufacturing powerhouse." This is the latest in a long sequence of efforts by the nuclear establishment to position itself as an exporter of nuclear reactors.

The DAE's rhetorical desire to export nuclear technology dates back to the early 1990s (see, for example, ToI 1990). But claims about the potential for nuclear reactor exports multiplied during the debate over the US–India nuclear deal between 2005 and 2008, and have continued since then.

The rationale for these claims—apart from burnishing the institutional credentials of the DAE—was to persuade members of the NSGto see India as good enough to be admitted to the club. This diplomatic effort, initiated by the UPA government, has been adopted by the Narendra Modi government. Despite its embarrassing failure to do so last year, the government appears to be launching arenewed effort to join the NSG by making claims about exports of Indian PHWRs.

However, the nuclear establishment's efforts at obtaining export orders for its reactors have not been particularly successful.

In 2007, for example, the chairman of NPCIL announced that the company was "considering exporting small and medium reactors (220 MW to 700 MW) to countries in the Asian region" and that "Thailand and Cambodia have held preliminary talks with NPCIL for reactors as they are satisfied with NPCIL's safety and operational capabilities" (Wadke and Subramanian 2007). In 2009, it was the turn of a different country and NPCIL announced that a "proposal for reactor sales to Kazakhstan is already on the anvil, with discussions between NPCIL and the Central Asian nation's nuclear utility Kazatomprom at an advanced stage" (Bureau 2009). The same year, DAE Secretary Anil Kakodkar announced that India had made an export version of its advanced heavy water reactor design, called the AHWR–LEU, which would use low enriched uranium (LEU) instead of the plutonium used in the original AHWR design. The target for this reactor design was to be developing countries "with modest industrial infrastructure" (WNN 2009).[1]

None of these countries have so far purchased any reactors from India. Nor is it likely that there will be any sales in the near future. Around the world, nuclear power, as a share of electricity generated, is on the decline, from the historical maximum of 17.6% in 1996 to under 11% in 2015 (BP 2015; Ramana 2016). Although there is much talk of new countries adopting nuclear power, as of 2016, only two new countries were actually building reactors—Belarus and the United Arab Emirates

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(Schneider and Froggatt 2016: 13). Just about every reactor sold in the last decade or more has been a LWR and prospects for the export of Indian PHWRs are bleak.

Corporate Handouts

A second target for the announcement is evidently the various corporations that profit from supplying equipment to nuclear power plants. All of the official announcements specifically mentioned these companies. NPCIL commented on the approval generating "confidence in the Indian nuclear industry about the continuity of business as it would provide orders over a period of time" and how it "would also help the Indian industry evolve, augment its capacities and capabilities" (NPCIL 2017c). The DAE's press release, a statement from a group of retired nuclear bureaucrats, talked about "new enthusiasm and optimism among equipment manufacturing industry", predicting that it "is poised to grow in tandem with our programme, bringing India to the frontline of global nuclear manufacturing and supply chain" (DAE 2017). Most importantly, the government press release talked about "likely manufacturing orders of close to 70,000 crores" being given to domestic industry (Press Information Bureau 2017).

Although there are a number of such corporations, a few of them capture most of the contracts. Historically, some of the prominent companies involved in such supplies are Larsen & Toubro (L&T), Walchandnagar, and Tata Consulting Engineers. Most of these corporate entities naturally welcomed the government's announcement. The director of L&T called the move "bold and historic" (Reuters 2017). Likewise, the chief operating officer of Godrej & Boyce termed it a "visionary" step (Bureau 2017).

Many of these companies had been hoping for major contracts from imported reactors. Take the case of L&T. In 2008, its top official had publicly expressed the expectation that it would get offers of around ₹24,000 crore per year for 10 years (MC 2008). In April 2015, L&T signed a memorandum of understanding (MoU) with French company Areva to carry out some of the manufacture for the EPR reactor planned for construction in Jaitapur (PTI 2015). Kalyani Group company Bharat Forge had earlier signed an MoU with Areva for the manufacture of forgings related to nuclear plants (Staff 2009). Tata Consulting Engineers had signed a preliminary contract with General Electric Hitachi "to collaborate in areas such as workforce skills identification and development, as well as early feasibility design studies, product and project engineering work" (GEH 2010).

In late 2015, in anticipation of reactor imports from the US, the chairman of the Godrej Group, Adi Godrej, excitedly said, "There will be a huge opportunity". And the chief executive officer (CEO) of the Walchandnagar Group was "very hopeful that before the end of the financial year … enquiries [would] start to come in" (Reuters 2015).

Although this bonanza from imported reactors has not materialised, contracts for nuclear plants can still be very large and profitable. For example, in March 2009, L&T received a ₹345 crore order for four steam turbines for Kakrapar—3 and Kakrapar—4, and in September 2009, two orders worth ₹405 crore (Larsen & Toubro 2009a, b). In December 2012, it received an order valued at "over ₹732 crores" (Larsen & Toubro 2012). It is likely that the number of large private—sector companies involved in the nuclear reactor business will expand in the coming years, and the recent announcement should be seen as a strategy to win over those sections of capital.

Cost

Ultimately, the cost of these handouts and efforts to woo NSG members will be paid by the public.

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Each of these 10 reactors will be hugely expensive propositions, as suggested by the ₹70,000 crore figure for manufacturing orders mentioned in the official announcement. Although the government has not so far provided a cost projection, we can come up with a rough estimate on the basis of earlier experience.

We can start with the last two PHWRs under construction, Rajasthan—7 and Rajasthan—8. Construction of these began six years ago and they were estimated to cost ₹12,320 crore or about ₹6,160 crore per reactor (Ministry of Statistics and Programme Implementation 2012). These projects have been delayed by at least two years due to what the government terms "major equipments supply constraints," referring to the inability of commercial manufacturers to manufacture components for these reactors on schedule. This itself suggests that the government's plan to manufacture 10 reactors in "fleet mode" may be overly ambitious.

Delays inevitably lead to an escalation in cost. Although the government has not announced the precise cost escalation at the Kakrapar and Rajasthan projects, even a very conservative estimate using just the additional cost of debt servicing in building the project over seven rather than five years suggests an escalation of about 15% in costs. In addition, the construction cost index for power sector projects has gone up by more than 20% (CIDC 2017). Putting these factors together suggests that even if construction were to be started immediately, each new 700 MW PHWR would cost about ₹8,500 crore, and 10 PHWRs would cost ₹85,000 crore. The true cost is likely to be even higher.

This high—cost implies that the electricity from these reactors is likely to be more expensive than electricity from competing sources of energy—even if the comparison is restricted to so—called base load sources, such as coal, natural gas, and hydroelectric power. Renewable energy sources such as wind and solar power have also declined in cost. As we have discussed earlier (Raju and Ramana 2013; Ramana 2007), the government's tariff model for nuclear power hides several indirect costs. These include an inconsistent accounting of the time—value of the equity invested in nuclear plants, and significant subsidies for the heavy water that is used in PHWRs. We will explore this issue in a forthcoming article.

Evaluation

Announcements are, of course, easier than delivery. There has been a history of the nuclear establishment setting ambitious targets and making tall claims. A particularly relevant example dates back to 1984, when the DAE announced that it would be constructing a number of PHWRs (CAG 1999). That plan involved building 12 235 MW PHWR units and 10 500 MW units by 2000, which were to bring the country's nuclear power generation capacity to 10,000 MW by the turn of the century (Ramanna 1985). That did not happen. Instead, as the Comptroller and Auditor General (CAG) found in 1999, the "actual additional generation of power" from this plan "was nil in spite of having incurred an expenditure of ₹5,291.48 crore." Installed nuclear capacity at the end of 2000 was 2,720 MW, less than a third of the target.

Plans to import LWRs from France and the US have also failed. Plans for imported LWRs were announced at the beginning of the decade as part of a new target of 20,000 MW by 2020 (Chidambaram 2001). But these import plans did not, for the most part, become serious till the 2008 decision by the NSG to lift the ban on nuclear trade with India. At that time, NPCIL assumed that construction of the first imported LWR would start in 2008 and the reactor would start operating in 2014 (Thakur 2008: 62). But,as of May 2017, there has been no reactor imported as a result of the NSG waiver.

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Nuclear power targets have also fallen. Following the 2008 NSG waiver, nuclear power targets swelled and, in 2010, the DAEsecretary announced a target of 35,000 MW by 2020 (PTI 2010). By 2015, the target was a mere 14,600 MW by 2020–21 (Sasi 2015). Considering that the current official capacity is 6,780 MW, and that only the Rajasthan and Kakrapar projects and the prototype fast breeder reactor are likely to be completed by then, total nuclear capacity will probably touch 10,080 MW by 2020.

The fruitless pursuit of imported LWRs suggests that it would be fallacious to assume that all the 10 PHWRs will be constructed. It is almost certain, going by history, that they will not be constructed on time. The four 700 MW PHWRs under construction have all been delayed. The initial commissioning dates were December 2015 for the two Kakrapar units and December 2016 for the Rajasthan units (Ministry of Statistics and Programme Implementation 2012: 32). As of December 2016, Unit 3 at Kakrapar was expected to become critical by November 2017, and Unit 4 is expected to start six to seven months later (IANS 2016). The Rajasthan units are expected to start about a year later (Chaffee 2016). Practically all reactors constructed by the DAE and NPCIL have suffered delays and cost overruns (Ramana 2012).

Changes in the Power Sector

While nuclear power has been suffering delays and overruns, an important change has occurred on the supply side of India's power sector—a rapid increase in renewable energy. For many years now, wind and solar power have delivered more electricity to the grid than nuclear energy. The Central Electric Authority (CEA) reports that between April 2016 and March 2017 renewable energy sources together generated 81.9 TWh, more than twice the 37.9 TWh generated by nuclear power.

According to the CEA, renewable energy is expected to contribute about 20% and 24% of the total energy requirement in 2021–22 and 2026–27 respectively (Central Electric Authority 2016: 6.13). Even if these figures do not come true, the direction in which renewable energy is heading is clear. In contrast, the CEA projects that the share of nuclear energy will stay roughly constant, around 2% of all electricity generated in the country. Nuclear power, then, will continue to be a minor source of electricity for India.

Conclusion

In its press release, NPCIL declared that its mission was to "produce nuclear power as a safe, environmentally benign and economically viable source of electrical energy to meet the increasing electricity needs of the country" (2017c). The reality, however, is that nuclear power is neither safe nor environmentally benign, given the risk of catastrophic accidents and the production of radioactive waste. The high costs involved in generating nuclear energy imply that it cannot be an economically viable means of meeting the electricity needs of the millions in India without access to power.

The announcement about building 10 PHWRs fits a pattern, often seen with the current government, where it trumpets a routine decision to bolster its "bold" credentials. Most of the plants that were recently approved have been in the pipeline for years. Nevertheless, there is good reason to be sceptical of these plans given that similar plans to build large numbers of reactors have failed to meet their targets, often falling far short. Neither is there a high likelihood of reactor exports. The media hype surrounding this announcement, and the effort and the expense invested in it, is a revealing indicator of the style of functioning of the Modi government.

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Note

1 The purpose of the plutonium or the LEU is to provide the initial fission reactions to produce neutrons that would go on to converting the thorium into uranium—233, which would then undergo fission reactions and produce energy.

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