

The Stakes in The India Nuclear Energy market

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Reactors under construction and approved for construction

- Construction of a Prototype Fast Breeder Reactor (500 MW) has been completed and is now under commissioning. It is proposed to construct 2x600 MW FBR at the same site and 4x600 MW at a new site to be identified.
- Four PHWRs, 700 MW each, are under construction, two at Kakrapar and two at Rawatbhata. Both sites already have operating PHWRs.
- Two PHWRs, 700 MW, Gorakhpur, Haryana were sanctioned earlier and foundation stone has been laid. NPCIL is moving towards first pour of concrete.
- Ten PHWRs, 700 MW were approved on 17.06.2017 and construction of all ten is scheduled to be completed in about 12 years.
- KK-3&4, 1000 MW each approved for construction at Kudankulam.
- KK-5&6, 1000 MW each, GFA signed on June 1, 2017

Structure of nuclear industry in India

Nuclear Supply Chain (Adapted from a WNA report)

- Tier 1: Technology vendor
 - Tier 2: System integrators
 - Tier 3: Original equipment manufacturers
 - Tier 4: Sub-component suppliers/ distributors
 - Tier 5: Processors/ fabricators
 - Tier 6: Raw material suppliers/ miners
- NPCIL is an integrated company. It owns and operates nuclear power plants.
 - For PHWRs, it is also the designer and the constructor, and owns the technology. It, thus, combines the role of Tier 1 and Tier 2.
 - Bhavini performs similar roles for fast reactors. Similar structure exists for fuel cycle facilities.
 - R&D support is provided by research centres of the DAE.

Construction of Reactors by NPCIL

- In the beginning of the nuclear power programme, capability of Indian industry was limited. Therefore, NPCIL had to procure material and equipment through a large number of purchase orders. Erection was carried out through several works contracts. All this required large resources (manpower and procedural efforts) spread over several work centres.
- Over the years, Indian industry has grown in size and has acquired needed expertise. Therefore, for construction undertaken in this century, the earlier approach has been replaced by work package concept wherein responsibility of Engineering, Procurement and Construction is given through EPC contracts.
- In future, there will be movement towards managing entire construction through less and less number of EPC packages.
- With regard to construction of IPWRs, there will be similar evolution. (Work on the development of forging for the reactor pressure vessel has been initiated.)
- Many more reactors are planned to meet the target of 63 GW by 2032.

In conclusion

- NPCIL, Bhavini and fuel cycle facilities have an integrated structure. Therefore, separate profit centres do not exist and overall capital cost of reactors based on indigenous technology is on the lower side.
- Anyone trying to sell reactors to India has to factor this reality and organise work break-up and its implementation so as to be competitive. I repeat what I said earlier today that any vendor trying to do business has to remember that the offer to buy from other countries is subject to arriving at **technical terms and conditions that are mutually acceptable and enable a viable tariff regime for electricity generated.**

Thank you