

# Managing Supply Chains for Indian Nuclear Power Projects.....

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# Present Nuclear power scenario in India

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- 22 Reactors operating under NPCIL- an installed capacity of 6780 MWe (TAPS 1-4, RAPS 2-6, MAPS 1&2, NAPS 1&2, KAPS 1&2, KGS 1-4 & KKNPP 1&2)
  
- 8 Reactors are under construction
  - 2X700 MWe at KAPP 3&4 Gujarat
  - 2X700 MWe at RAPP 7&8 Rajasthan
  - 2X700 MWe at GHAVP 1&2 at Haryana
  - 2X 1000 MWe at KK NPP 3&4 Tamilnadu

6700 MWe



# Journey of NPCIL ...

NPCIL always built largest capacity plant in country



1969 TAPS 1&2 start commercial operation  
49 years of successful operation,

**FUTURE PROJECTS**  
700 MW



1970s  
TECHNOLOGY  
DEMONSTRATION



RAPS-1&2

1980s  
INDIGENISATION



MAPS-1&2

1980s  
STANDARDISATION



NAPS-1&2

1990s  
CONSOLIDATION



KAPS-1&2

2000s  
COMMERCIALISATION



RAPP-3&4



KAIGA-3&4



KGS-1&2

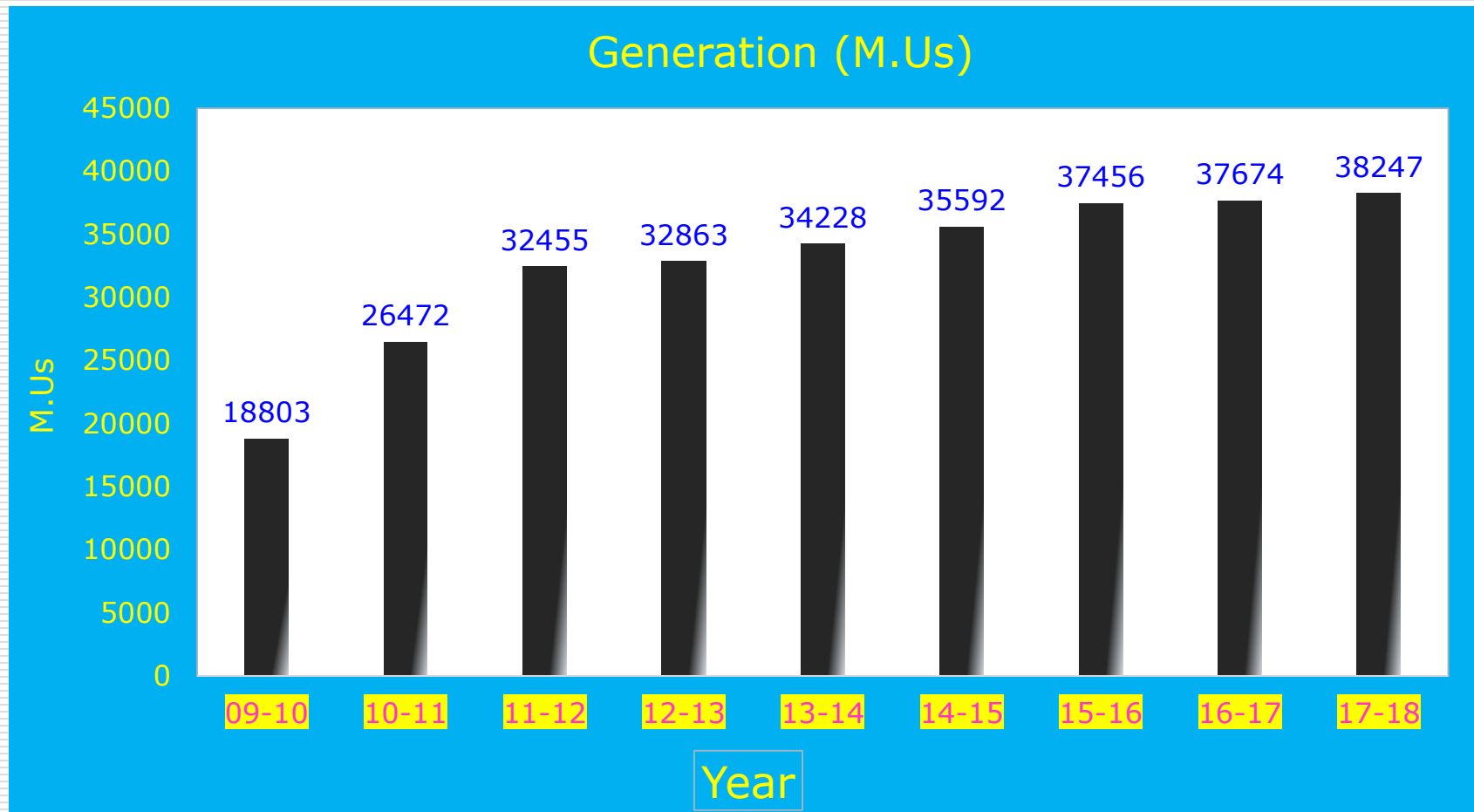


RAPP-5&6



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# Performance-Electrical generation ...



# Rapid growth planned in Nuclear Power Sector....

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- Government of India has sanctioned plants to be built in **fleet mode** - pressing speed button
- Government of India has also sanctioned large size **additional LWRs**
- Government of India has also laid down expectations in the form of **24 LWRs** through import route



# Fleet mode construction of plants

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- 10 PHWR type Reactors of 700 MWe each – 7000 MWe
- 2 LWR type reactors of 1000 MWe each – 2000 MWe

Total of 9000 MW nuclear capacity sanctioned



# Future Nuclear capacity addition planned

□ 24 Reactors of LWR technology as additionality through import route –

□ 6X 1650 MWe at Jaitapur, Maharashtra

□ 6X 1208 MWe at Kovada, Andhra Pradesh

□ 6X 1000 MWe at Mithivirdhi, Gujarat

□ 6X 1000 MWe at Haripur West Bengal

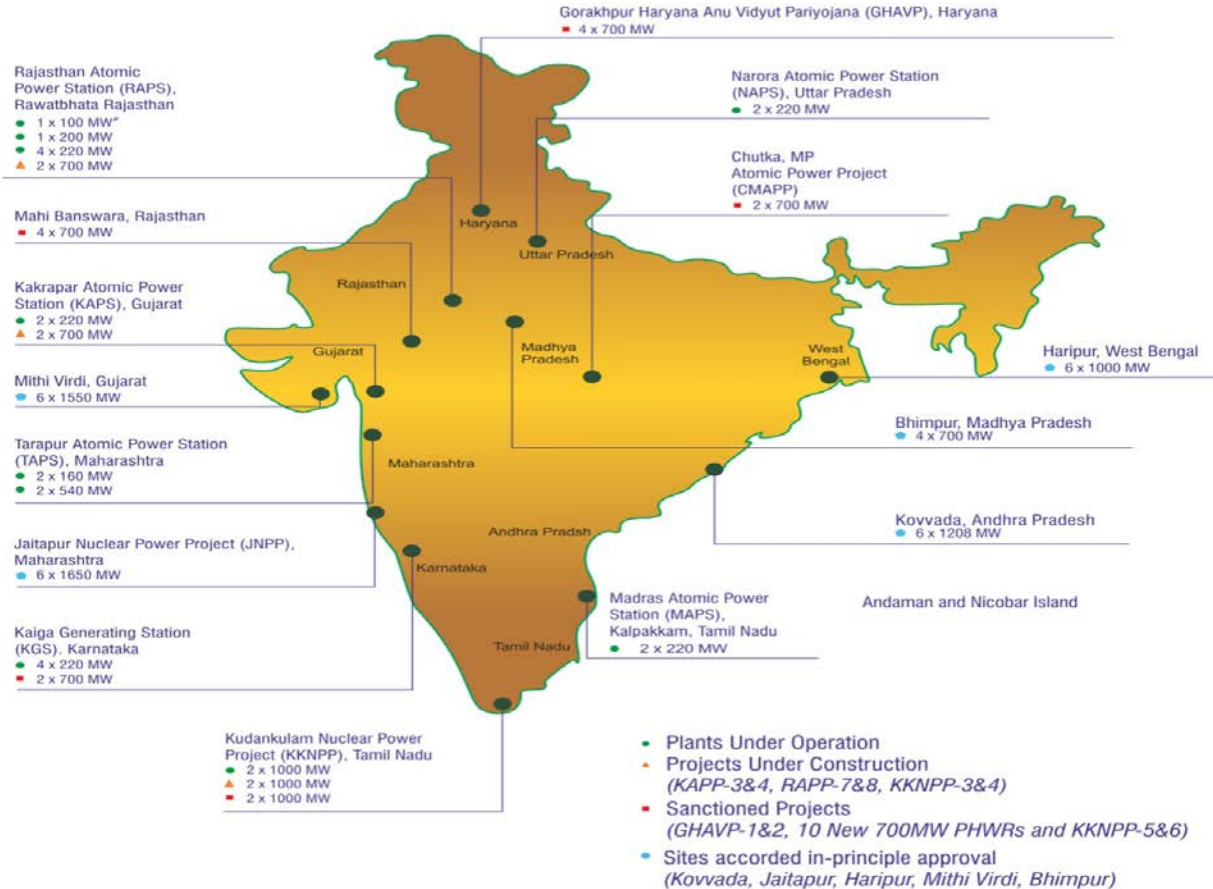
} 29.000 MWe

Total of 29,000 MW nuclear capacity



# Nuclear Power Plant Sites in India

## NUCLEAR POWER PLANTS & SITES IN INDIA



\* RAPS-1 (100MW PHWR), owned by DAE and managed by NPCIL, is under long shutdown since October 2004

Map for representation only. Not to scale.



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# Managing Supply Chains for Indian PHWR Projects.....

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- ❑ Design is standardised for 2 x 700 MWe PHWR projects. Also the procurement policy is standardised
- ❑ All major Nuclear Components are directly procured by NPCIL. Remaining items are procured through various EPC packages / Site Contracts
- ❑ There are approx. **25 nos.** of Supply Packages; **10 nos. of** EPC Packages and **04 nos.** of major Site Contracts.
- ❑ Five Years (60 Months) Construction Schedule is considered from First Pour of Concrete (FPC) to Criticality



# Managing Supply Chains for Indian PHWR Projects.....Cont'd.

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## **25 nos. of Supply Packages.**

- End Shield Package
- Calandria Assembly
- End Fittings and Associated Components
- C.V Top Hatch Beams & Deck Plate Assembly
- Air Lock Doors (MAL & AAL)
- Zircoloy Package
- Crane Package
- Hoist Package
- Drive Mechanism (AR, CR & SR)
- Stand Pipe Thimble Package



# Managing Supply Chains for Indian PHWR Projects.....Cont'd.

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- ❑ Bellow Package
- ❑ Lifting Table
- ❑ D<sub>2</sub>O Heat Exchanger Package, PDHRS-CD & ECCS
- ❑ Pressuriser and Bleed Condenser
- ❑ Reactor Header Assemblies
- ❑ Steam Generator
- ❑ Phosphor Bronze Wire-mesh supply
- ❑ Primary Pump, Blowers & Compressors Package
- ❑ Primary Coolant Pump Package
- ❑ Distillation Column for D<sub>2</sub>O Upgrading Plant
- ❑ Fuel Handling System Items



# Managing Supply Chains for Indian PHWR Projects.....Cont'd.

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- 10 nos. of EPC Packages.**
- Primary Piping Package
- Common Services Package
- Plant Water Package
- Turbine Island Package
- Transformer Package
- Diesel Generator Package
- Main Plant Electrical Package
- Nuclear Instrumentation Package
- Control Centre Instrumentation Package
- Field Instrumentation Package



# Managing Supply Chains for Indian PHWR Projects.....Cont'd.

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## **04 Nos Major Site Contracts.**

- Main Plant Civil Works
- NDCT & CCW Package
- IDCT Package
- Miscellaneous Civil Package



# Challenges in supply chain....

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- For Nuclear Energy to be sustainable:
  - The Nuclear Energy shall be cost competitive
    - Timely Project completion, low down time and long plant life is essential for the Nuclear Energy to be cost competitive in current environment
    - This needs reliable & diverse supply base (specially for Nuclear Grade Material), who are tuned to the Nuclear requirements
    - Products shall meet the specification requirements
  - Localization of Supply chains is essential
    - to ensure cost effective supplies
    - to ensure self reliance
    - to maximize the social /economic benefits



# Challenges in supply chain....cont'd

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- ❑ Continuous efforts spanning over 50 years have resulted in domestic suppliers maturing into supply of almost all Nuclear components for PHWR Projects.
- ❑ We have very good industry base and most of the Industries in the manufacturing sector are following ASME codes.
- ❑ Many international players also have set up manufacturing facilities in the country either through tie-up or collaboration with Indian Industries.
- ❑ ‘Make in India’ is a national policy today to encourage others to manufacture in the country.
- ❑ Due to long gestation period of Nuclear Projects & wide time gap between the projects, retaining talents in the Industry was a big challenge.



# Challenges in supply chain ....cont'd

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- Despite having very good manufacturing base in the country, we are still depending on import route for some of the specialized items like:
  - Heavy Forgings for SGs, Turbine components, Rotors/Stators etc for 700 MWe
  - Main Steam Safety Relief Valves (MSSV)
  - SS seamless pipe above 10” (required for manufacturing of large dia pipe fittings also)
  - Specialised Tube fittings (we are still using only Parker / Swagelok fittings only in Nuclear tubing)
  - Hydraulic Snubbers, He compressors, Custom Bends in main reactor loop etc
  - RO/EDI membranes for DM plant
  - Specialised Electrodes
  - Specialised Instruments like Analysers, Transmitters
  - Specialised cables like Coaxial cables / Super screen Cables etc
  - Radiation Resistant Camera, Radiation Resistant Terminal Blocks etc.





# Challenges in supply chain ....cont'd

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- ❑ Efforts are being put in to develop domestic manufactures for manufacturing of these items
- ❑ Facilities are being developed even with JV between state owned NPCIL and Private industries
- ❑ For some of the items (like PCP, BFP, Turbines, Specialised instruments etc) we have only limited domestic sources; may have to depend on import route also for meeting our increased demands for our Fleet mode reactors.
- ❑ Through 'Make in India' programme of GOI also thrust is being given to identify such items for domestic manufacturing with Technology Transfer.



# Challenges in supply chain....cont'd

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- Challenges in the manufacturing sector
  - Shortage of skilled engineers and technicians
  - Cash flow issues resulting in delayed supplies
  - Quality issues on the Products due to depletion of talents
  
- Challenges in Construction Sector
  - Inability to take up large scale construction activity on a challenging schedule
  - Weak financials of the contractors affecting the site progress
  - Shortage of skilled engineers and technicians



# Addressing the challenges by GOI.....

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- Fleet mode construction of Reactors announced by GOI (10 x 700 MWe + 2 x 1000 MWe to be constructed in next 12 years; in addition to 2 x 700 MWe and 2 x 1000 MWe already under construction) broadly addresses some of the issues:
  - To assure industries continuity on the job & assured business
  - To encourage industries to invest in infrastructure & resources
  - To retain trained talents
- Focussing on import substitutes & Technology innovations
  - Technology Development Group (TDG) of NPCIL is constantly putting efforts for indigenous development of import substitute items for use in Reactor systems – which will help cost competitiveness and self reliance
  - TDG also interact closely with Indian industries for Technology innovations & development of new products with a view to simplify the systems & reduce cost.



# Vendor Selection Process....

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- Tenders are floated on Public tender process with well defined Pre-Qualification criteria
  - To encourage new players to participate and at the same time to ensure the existing players quoting responsibly (cost competitive)
- Sub-vendors are identified in all major supply packages as well as EPC packages through a very strict vendor qualification process, commensurate with the technical requirements of the tender.
  - The main vendor can suggest new sub-vendors – to be considered by NPCIL through the vendor evaluation process
- Continuous assessment of performance of these listed sub-vendors.
- The list is modified in every tender based on the performance of the listed vendors
- We are also aiming for Vendor rating based on continuous assessment in near future.



# Quality Assurance in Supplies...

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- ❑ Items are procured for the Projects / stations following well defined Quality Assurance Plans (QAP). All critical components are procured through stage wise inspection starting from Raw material Stages upto final inspection & testing stages.
- ❑ Continuous Quality surveillance by well qualified NPCIL QA engineers
- ❑ Any critical stage of the item NPCIL QA gets involved for clearance
- ❑ We always insist on ASNT/ISNT L-II/ L-III qualified inspectors from vendor side. The quality inspectors of Vendors are evaluated by a team of NPCIL Engineers before they are deployed on the Job.
- ❑ Quality being ensured by fool proof systems in the shop floor / Construction sites by the Industry alongwith NPCIL QA engineers.
- ❑ Insist Industry to build robust internal QA system and Focus on **First time correct approach.**
- ❑ Digital equipment / components containing software are subjected to IV & V (independent verification & Validation) process before the items are supplied to Site.



# Quality Assurance in Supplies...Cont'd

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- Any non-conformance / deviations observed are subjected to multi level scrutiny involving the designers of the systems through Non-Conformance requests (NCRs) or Design Concession Requests (DCRs).
- Regular Quality audit of the supplier QA systems by expert team of NPCIL engineers comprising of QA, Design & Procurement Engineers
- Independent assessment & verification of the products supplied by independent regulatory body under GOI, Atomic Energy Regulatory Board (AERB), before the items are cleared for erection and also before the items are cleared for commissioning.
- AERB also conducts Regulatory Inspection (RI) of the systems & procedures being followed in all the functional groups like Design, Procurement, QA etc. in HQ and also in all the functional groups of Projects Sites; report Non-conformances and suggest improvements.
- We also have the system of Feed back from Industries / Sites/ Stations for continual improvement of the systems/specifications/Products.



# For the Nuclear Energy to be sustainable in the current century.....

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- Nuclear Energy shall be cost competitive
  - Cost effective Nuclear Power is possible only if:
    - Technology become more affordable
    - Projects are completed in time
    - Project cost is coming down
    - Capacity factor is going up
    - Plant life is moving up (50+years)
  - Supply chain plays a pivotal role in achieving the above objectives.



# For the Nuclear Energy to be sustainable in the current century.....

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□ So.....Let's ponder on...

- Can we have a common vendor base for Nuclear Supply chain??
- Can we have common specifications to be given to these Industries, so that they need not re-orient their manufacturing facilities country specific??
- Can we ensure quality certification of the products by the respective member country??
- Can we share the quality assurance plans (QAPs) being followed for standard components / systems, so that we can prepare our Industries to be ready for supplying to other member countries also??





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**Let's jointly make the Nuclear Energy  
sustainable in the 21<sup>st</sup> Century...**

**For a better tomorrow....**

**Thank you.**



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