



NUCLEAR POWER EXPANSION IN INDIA

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INDIA



NUCLEAR POWER CORPORATION OF INDIA LTD. (NPCIL)

**A PUBLIC SECTOR ENTERPRISE
UNDER THE ADMINISTRATIVE CONTROL
OF
DEPARTMENT OF ATOMIC ENERGY**

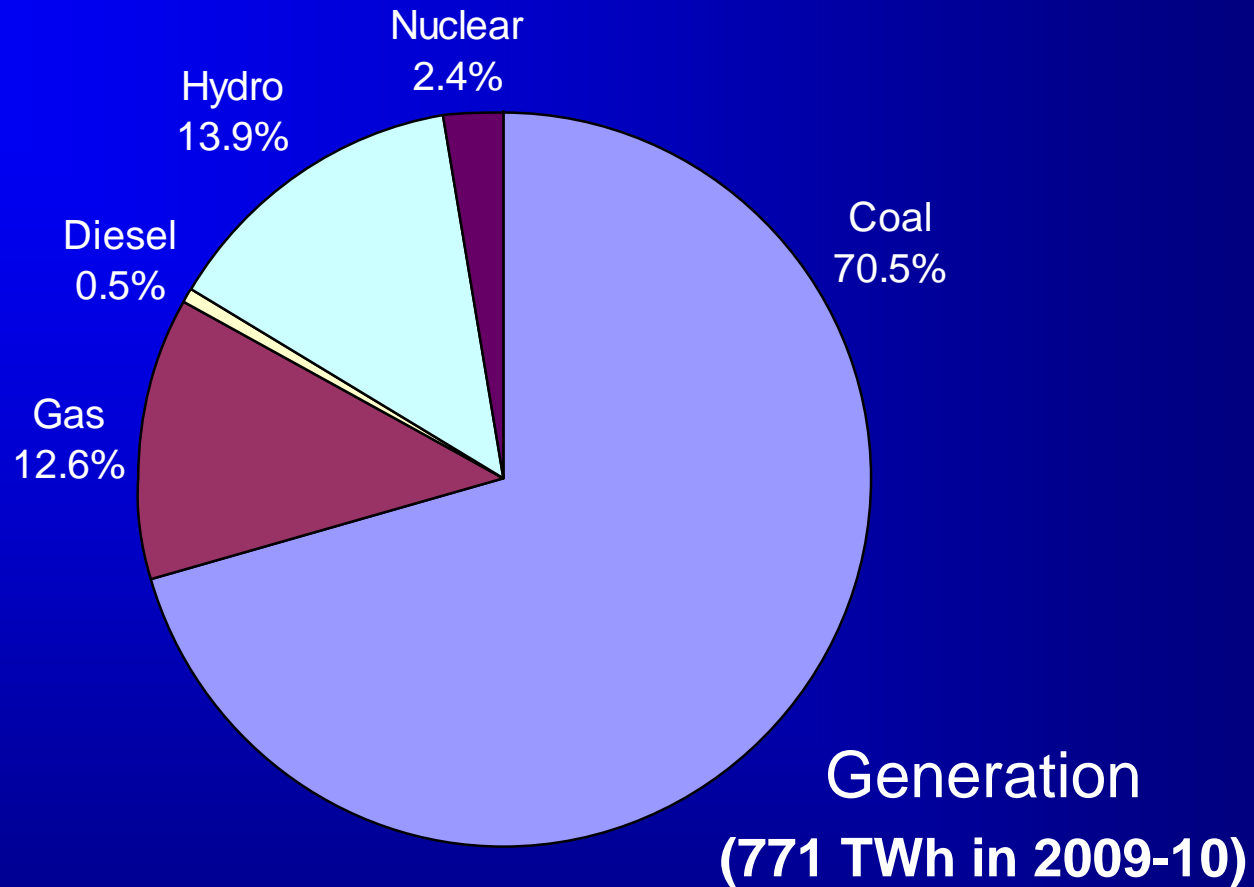
NPCIL - MANY COMPANIES IN ONE

- Siting
- Design
- Construction
- Commissioning
- Operation & Maintenance
- R&M & Upgrades
- Life Extension
- Waste Management



INDIAN ENERGY SCENARIO

Fuel Shares in Electricity Generation



Shortage in 2009-10

Energy

10.1%

Peak Power

13.3%

Demand Projections

(based on 8% GDP Growth)

Year	Energy Requirement (BUs)	Peak demand (GW)	Required Installed Capacity (GW)
2012	1097	158	220
2017	1524	226	306
2022	2118	323	425
2027	2866	437	575
2032	3880	532	778

Source: Integrated Energy Policy, Planning Commission, Gol

India's Energy Resource Base

	Amount	Electricity Potential [¤] GWe-yr
Coal	38-BT	7614
Hydrocarbon	12 –BT [#]	5,833
Uranium-Metal	61,000 -T	
- In PHWR		328
- In Fast Breeders		42,231
Thorium-Metal (In Breeders)	2,25,000 –T	155,502
Hydro	150 -GWe	69 GWe-yr / yr
Non-conv. Ren.	100 -GWe	33 GWe-yr / yr

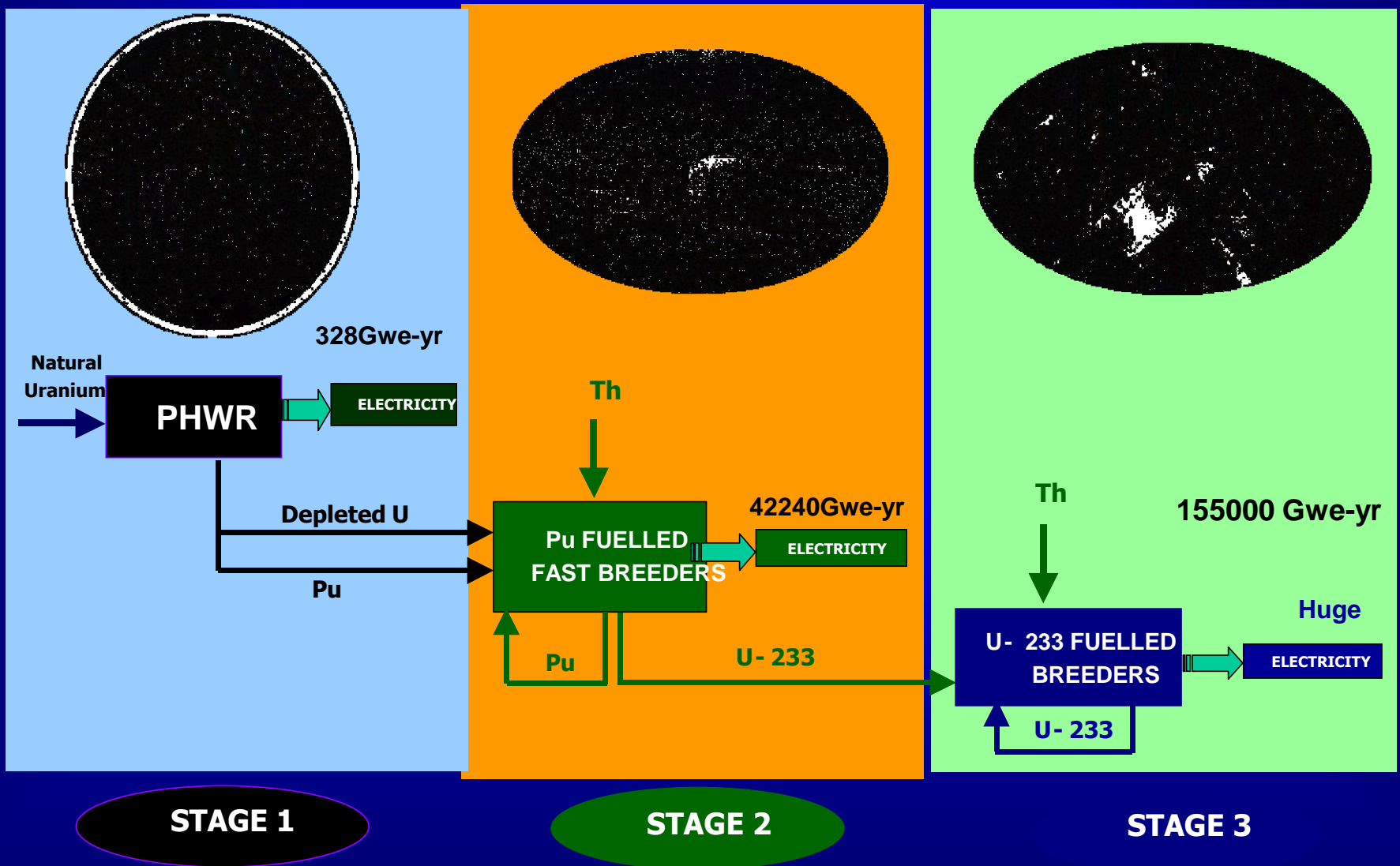
¤ Assuming entire resource is used for generating electricity.

Currently known resources (including coal bed methane) are 3 BT.

Meeting the Demand

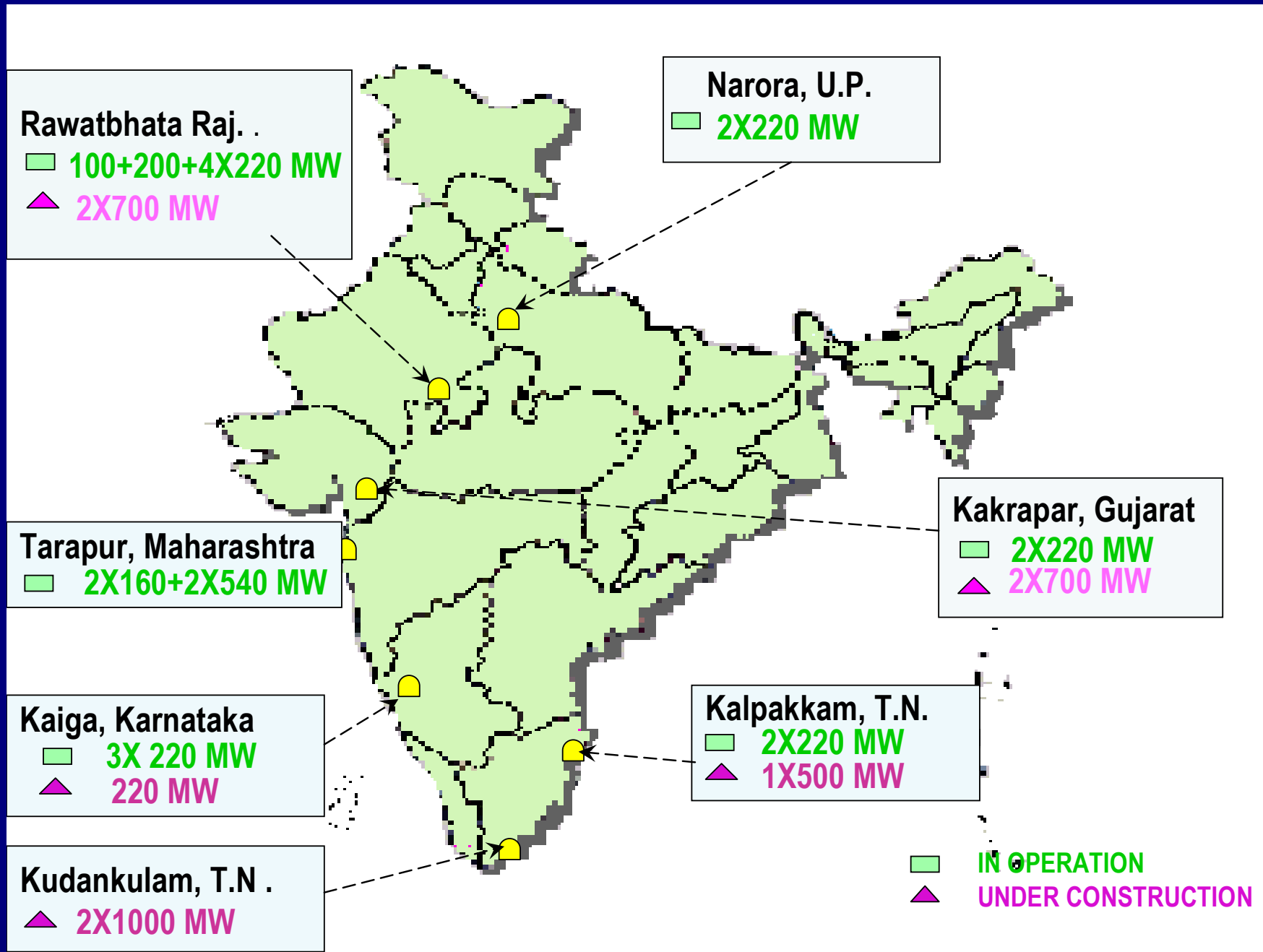
- **Optimal Deployment of all sources**
- **Emphasis on Nuclear Power for long term energy security & sustainability**
- **Setting up Nuclear Power Reactors based on**
 - **Indigenous Nuclear Power Programme**
 - **International cooperation**

Three Stage Nuclear Power Programme



Nuclear Power Plants in India

10



Operating Nuclear Power Plants in India

TARAPUR 1&2



RAJASTHAN



MADRAS



TARAPUR 3&4



4560 MW

NARORA



KAKRAPAR



KAIGA



Experience in Construction of NPPs

Construction of Nuclear Power Plants in India remained alive over the last 40 years.

Simultaneous construction of 8 Reactors.

Vendors specializing in manufacture and supply of exacting standards equipment and supplies are developed .

Reactors Under Construction



RAPP 7&8 (2x700 MWe) - Just Launched

Future Plans

Plan up to 2012

Start of Work (Pre-Project Activities) on

- 4 more indigenous PHWRs of 700 MW each
- 10 LWRs of 1000 MW or larger size based on international cooperation
- Fast Breeder Reactors(500MW)

Projection beyond 2012

- To reach 63000 MW by 2032 based on indigenous reactors & LWRs with international cooperation

LWR Projections

Setting up of 40 GW LWR capacity by 2032

- Capacity expansion through a mix of Russian, US & French designs
- Russian VVERs – 2 under construction at Kudankulam
- 4 more VVERs at Kudankulam
- More VVERs at Haripur site.

Considerations for Setting up LWRs

- **Viable Tariff**
- **Progressive Indigenization to optimize Cost**
- **Cooperation between Indian Industries & Foreign Technology Partners**
- **Life time fuel supply guarantees**

Our Experience in setting up LWRs

Two VVERs at Kudankulam (KK 1&2 – 2 X 1000 MW) at an advanced stage of completion

Implementation Model

Role of Technology Partner

- Design
- Supply of Equipment
- Evaluation of Personnel

Role of NPCIL

Construction
Erection
Commissioning
Training

Training of Personnel

: Carried out in Three Phases

Phase-1 in India

: Induction in Nuclear Technology

Phase-2 in Russia

: Simulator and Technology Specifics

Phase-3 in India

: Commissioning and Systems operation

Evaluation by Technology Partners

Tour To KKNPP

KK 1 – 96%

KK 1&2 – 93%

KK 2 – 90%

Dummy Fuel Bundles loaded in KK-1

Cold commissioning in progress

A few glimpses

KKNPP

THEN

NOW



Technological Partnership Endeavour

Kudankulam Nuclear Power Project 1&2



KK 1&2 Panoramic View



View from the Sea



Intake & Break water Dyke Structure



View from West





**View with
PHRS deflector,
Ventilation Stack and
Trestle Crane**



Loading of Dummy Fuel



Assembly of Hydraulic Stud Tensioner for RPV Head



Central hall at +31.7m

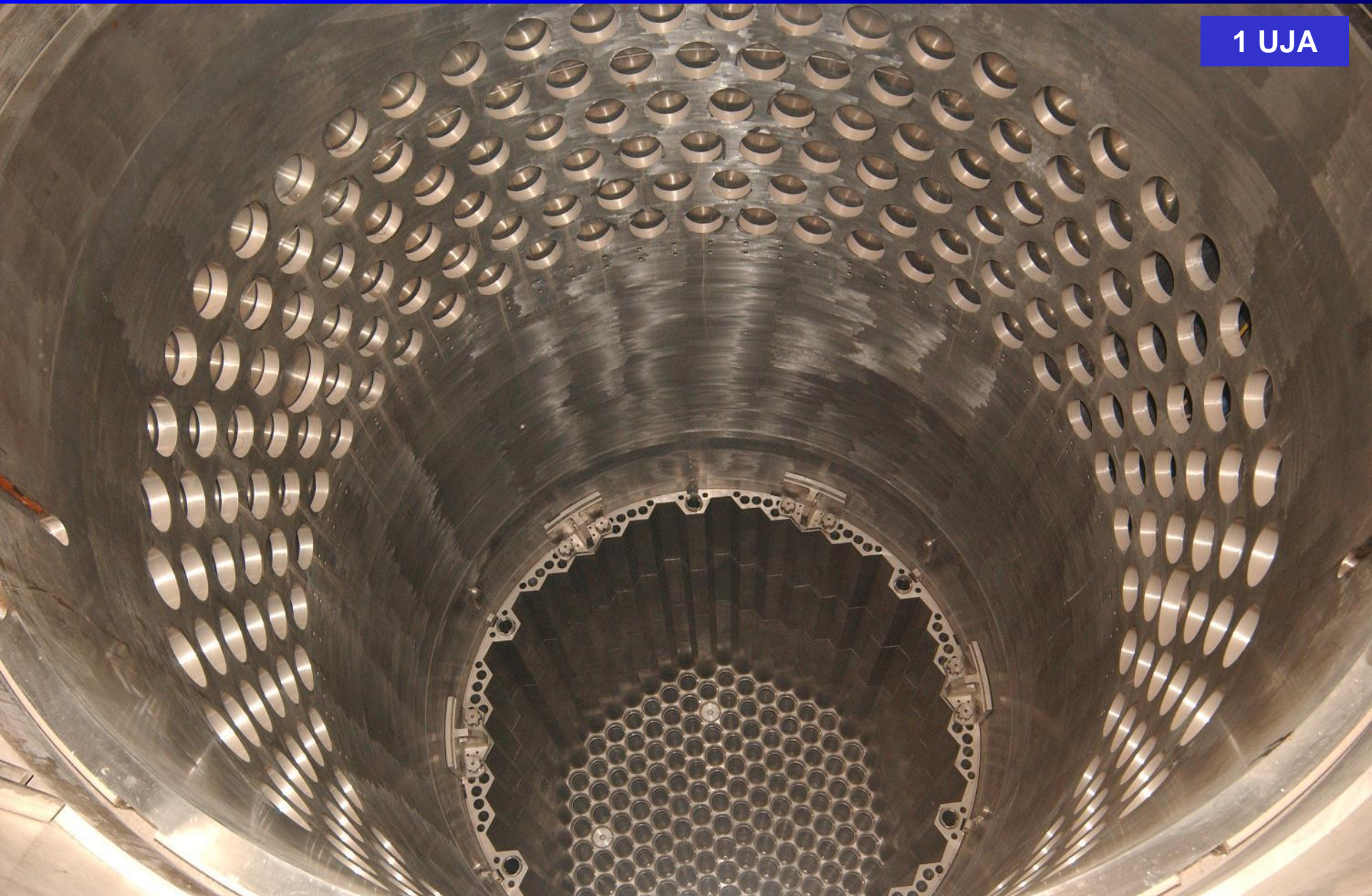


IC Dome & Polar Crane – Inside View



Core barrel and baffle assembled

1 UJA



Re-Fuelling Machine



Switchgear Room

1 3UKD



Control Room



CCW Pump Motors

1 UQA



Desalination Plant





Preparedness for large Capacity Addition

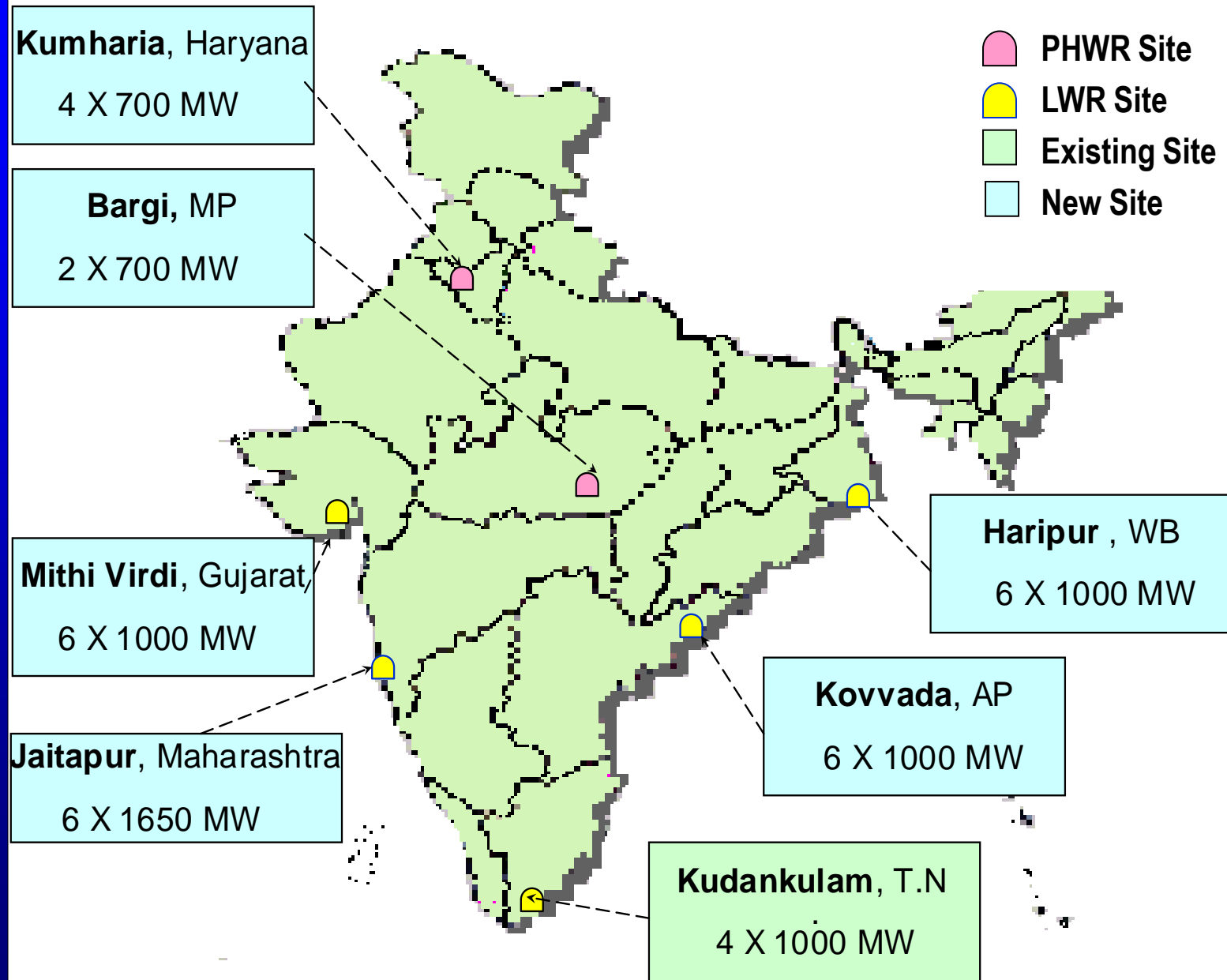
- **Sites made available – Pre project activities in progress**
- **Augmentation of existing capacity & capability of Indian industry initiated**
 - Joint Ventures / Consortia between Indian and foreign companies
 - Companies setting up manufacturing facilities being facilitated
 - Joint Venture Company between NPCIL & L&T for special steels and forgings for reactor vessels
- **Structured development of human resources**

The experience with the Training model adopted for KKNPP has been good. Same model is planned to be followed for each new technology.

Supply Chain

- **Nuclear Island (NI)**
- **Balance of Nuclear Island (BNI)**
- **Conventional Island (CI)**
- **Balance of Conventional Island (BCI)**
- **Balance of Plant (BOP)**

Sites for Expansion



India - Future Nuclear Industry Hub

- **Country having an alive small and Medium reactor technology with excellent safety and performance record**
- **Cost advantage with technology expertise of Indian industry**
- **Availability of Large pool of trained Human Resource**

Conclusion

- **India has a robust Nuclear Power Programme**
- **Stage is set for nuclear power capacity expansion to meet its huge electricity demand through indigenous technologies and with international cooperation**
- **India poised to be the future global nuclear industry hub**

Thank You

