Monaco ITER International Future Energy Days

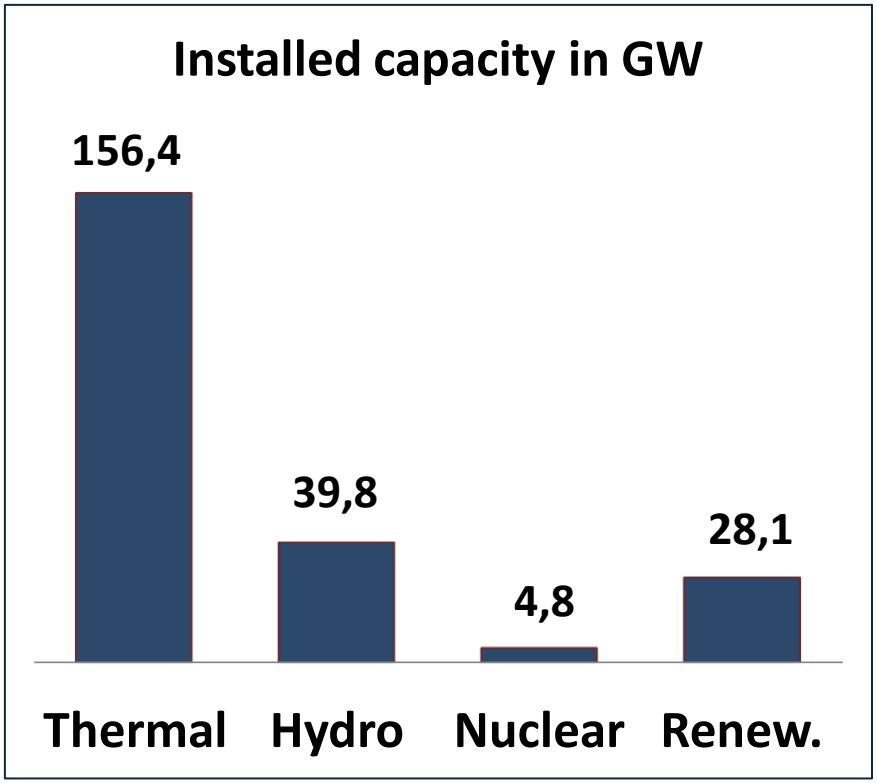
Indian Nuclear Industry

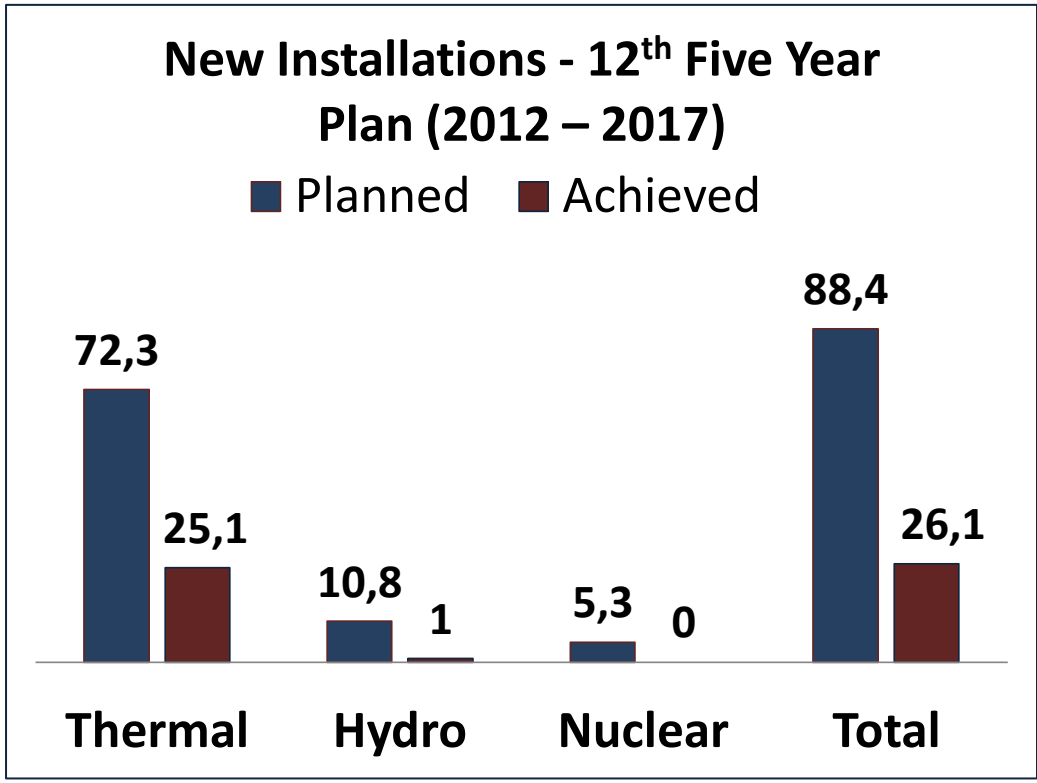
L&T's contribution

Mr. M V Kotwal

3 Dec 2013

Power Scenario in India

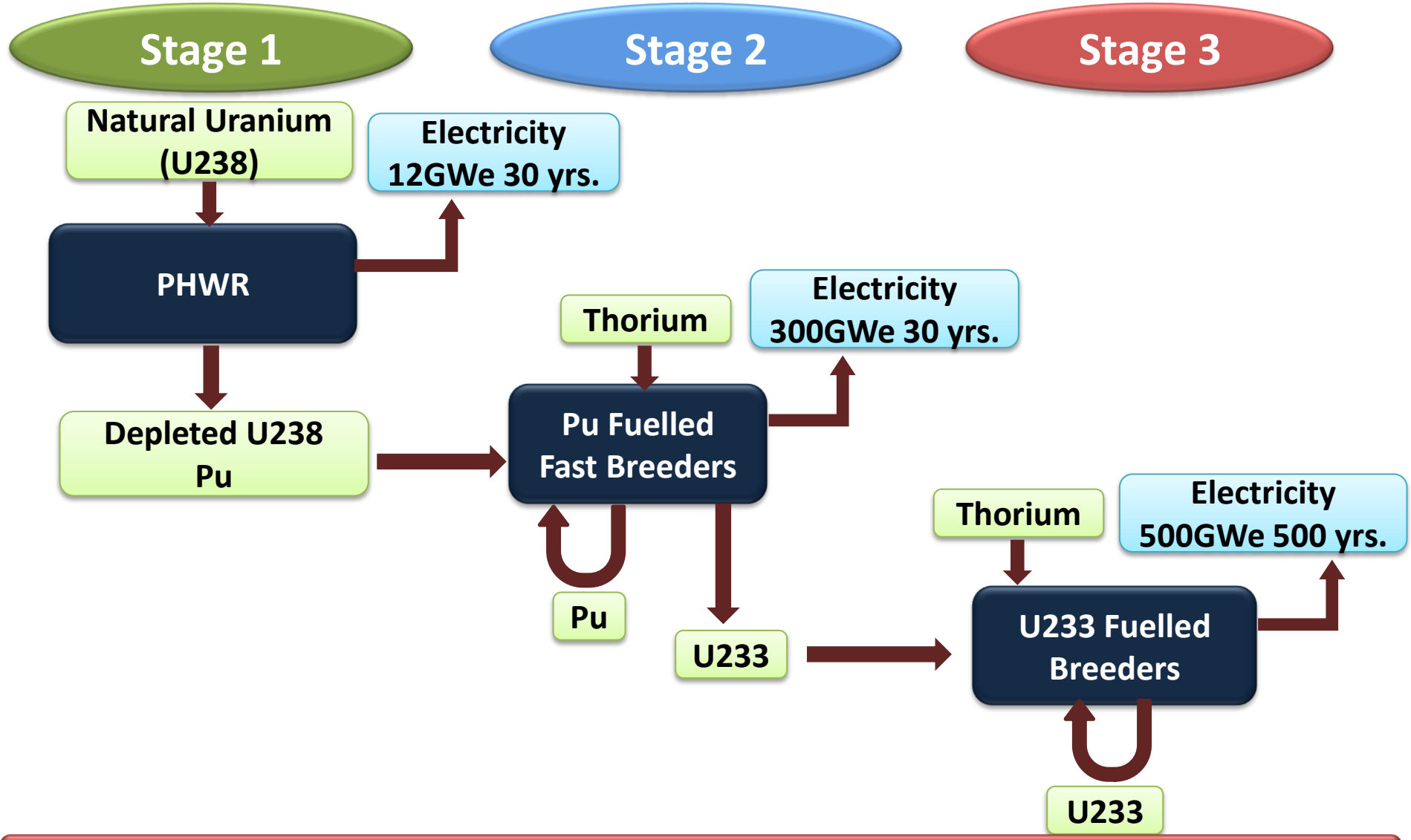




➢ ***Total Installed Capacity – 229 GW***

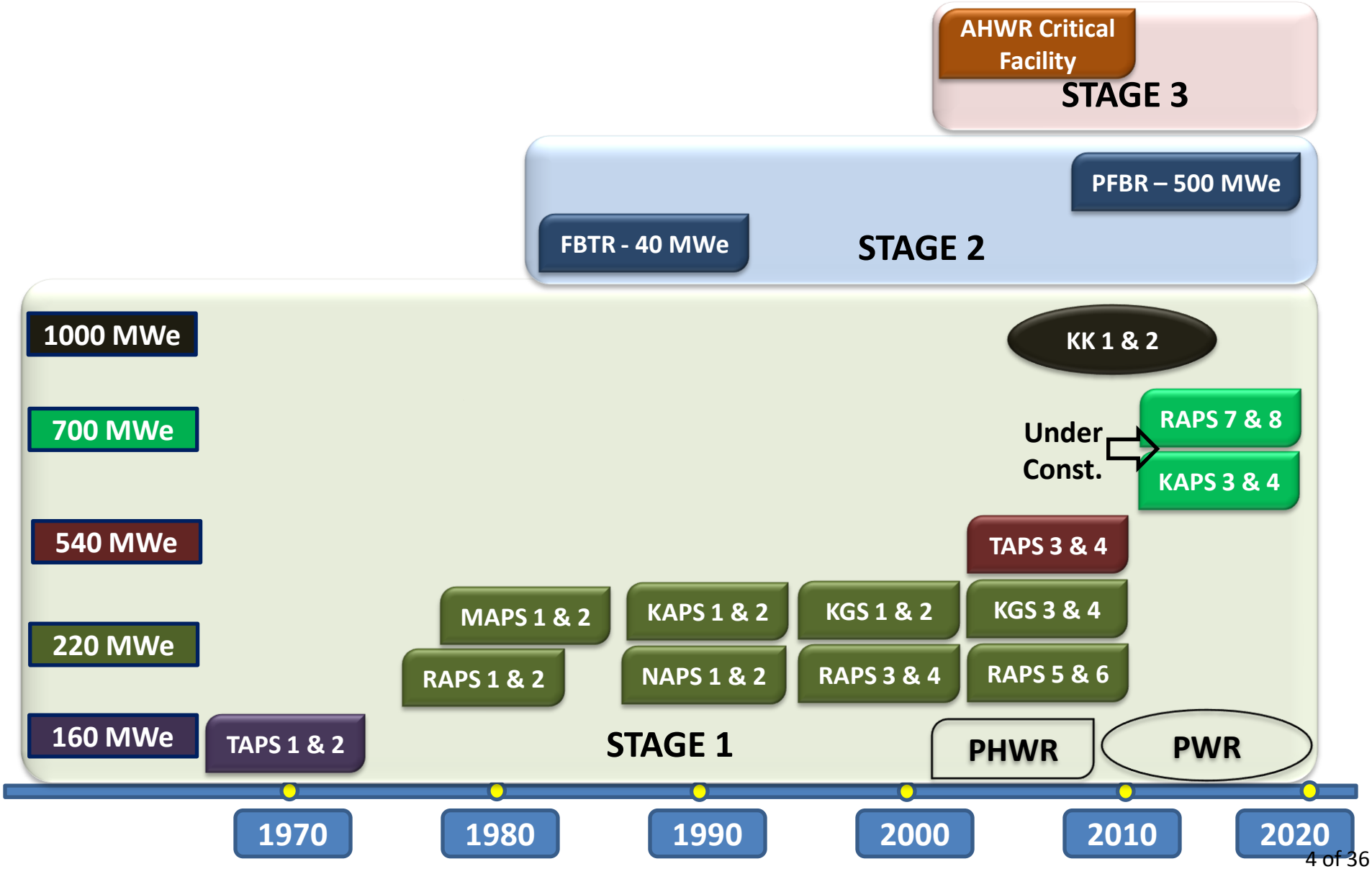
Source – CEA Report, Oct'13

The Indian Nuclear Power Road Map

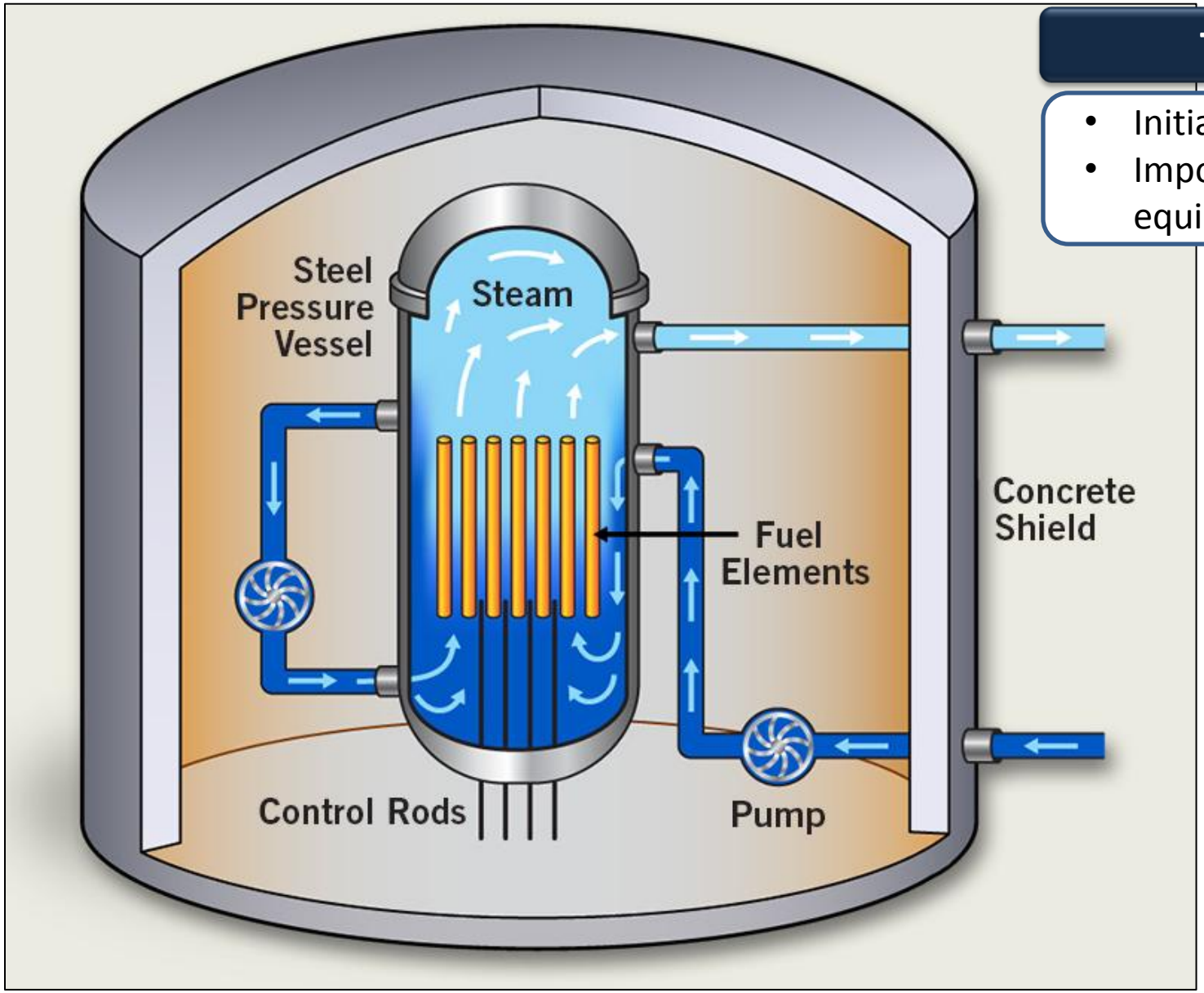


Dr. Homi Bhabha's Vision - Three Stage Closed Cycle Nuclear Program

The Indian Nuclear Power Road Map



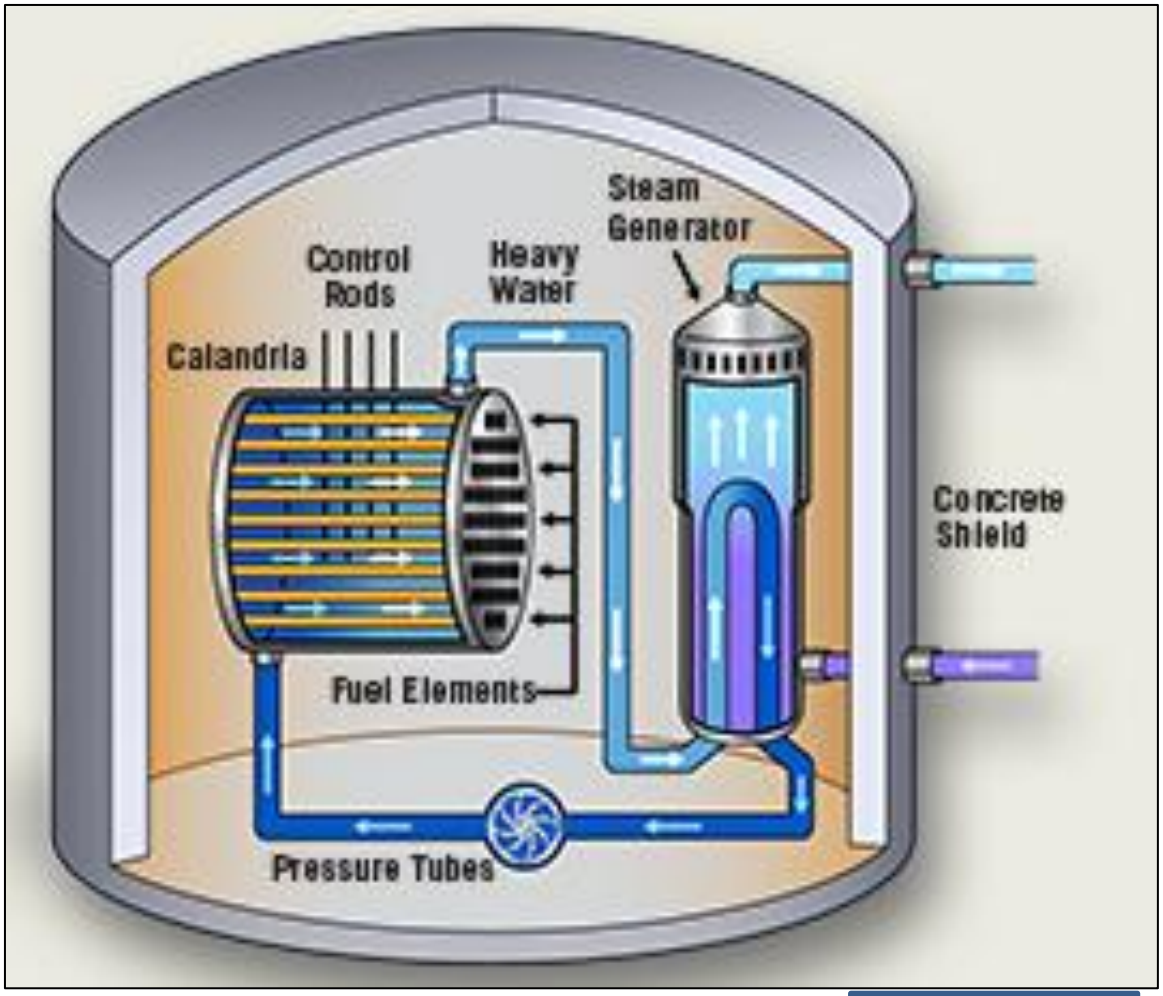
BWR



TAPS 1 & 2

- Initial 2 reactors (1969)
- Imported technology & equipment

Stage 1 : PHWR – Indigenous Capability Dev.



Equipment

- Calandria
- End Shield
- Steam Generator
- Heat Exchangers

Construction

EPC

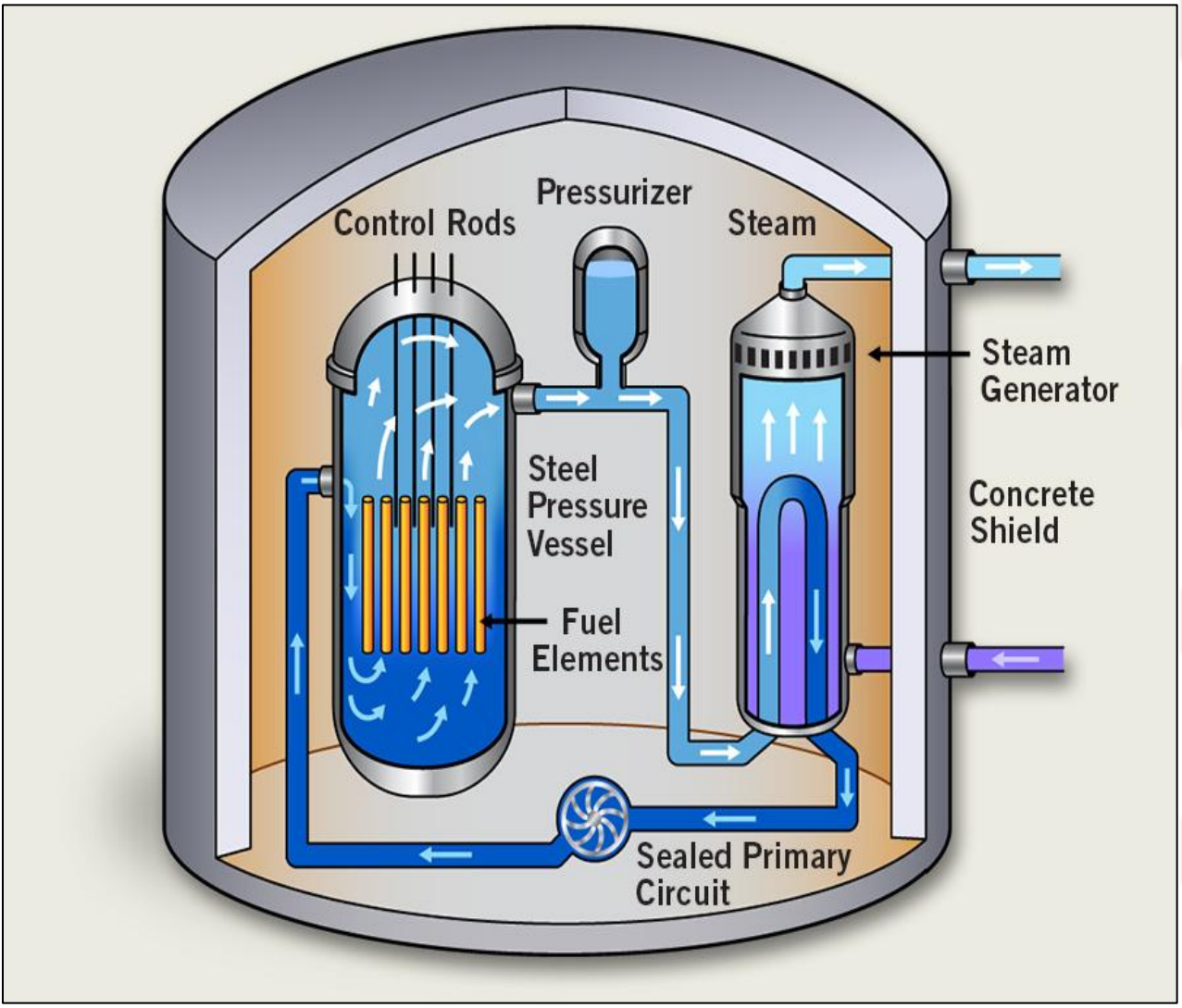
Control & Automation

Valves

RAPS 1 to 6	MAPS 1 & 2	NAPS 1 & 2	RAPS 7 & 8
KAPS 1 & 2	KGS 1 & 4	TAPS 3 & 4	KAPS 3 & 4

→ **Under Const.**

Foreign PWRs - Faster Capacity Augmentation



VVER (Rosatom)

2 Final stages of construction
4 planned – Tamil Nadu
4 planned – West Bengal

EPR (AREVA)

6 planned – Maharashtra

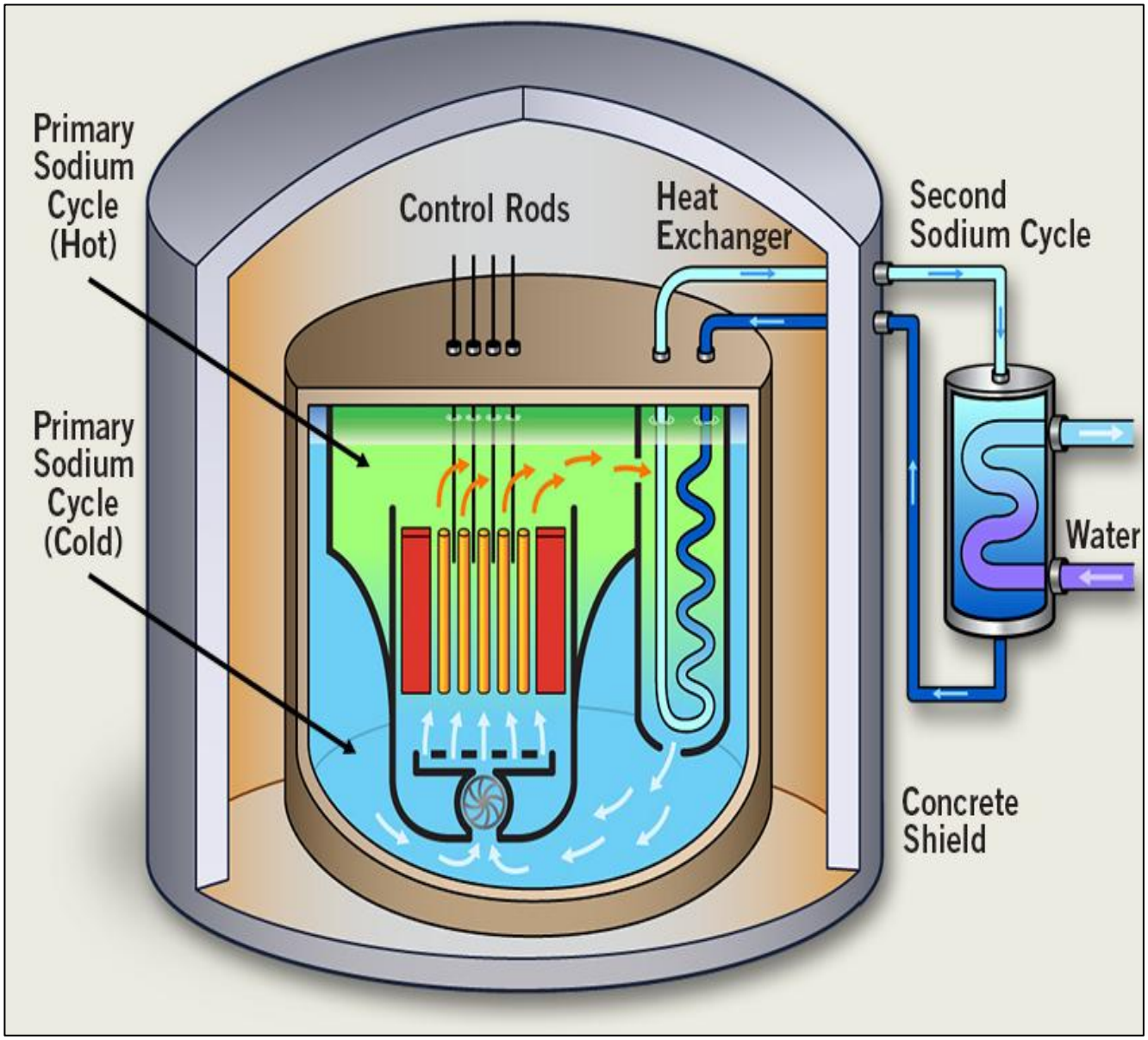
AP1000 (WEC)

6 planned – Gujarat

ESBWR (GEH)

6 planned – Andhra Pradesh

Stage 2 – FBR 500 MW



- Reactor Safety Vessel
- Reactor Main Vessel
- Reactor Roof Slab
- Steam Generator
- Decay Heat Exch.
- Sodium Air Heat Exch.
- Dummy Fuel Assembly
- Thermal Insul. Panels

Indian Industry Capability Spectrum

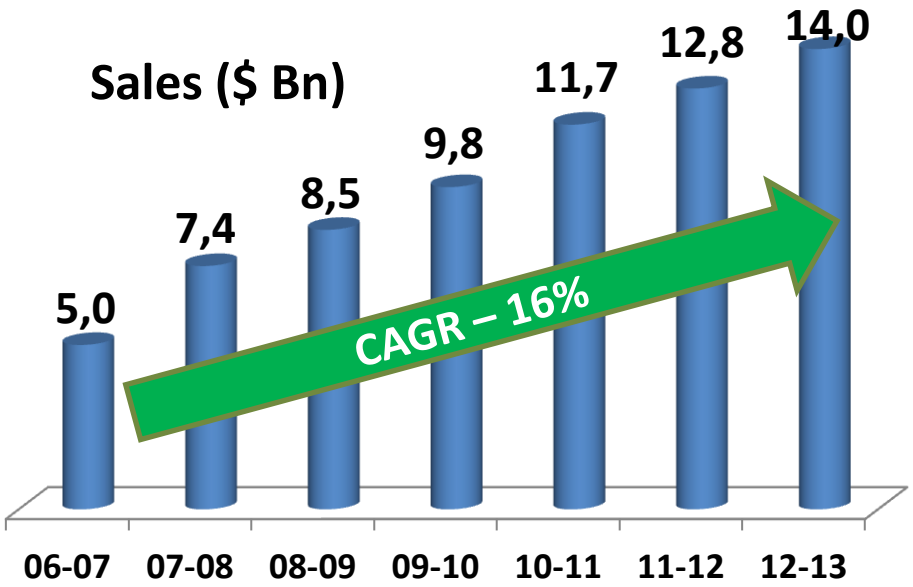
Capabilities ⇨ / Industries ⇩	Design & Engg.	Raw Material	Equip. Mfg.	Civil Const.	Valves	C & A	EPC
Avasarala			✓				
BHEL	✓		✓		✓	✓	
ECIL						✓	
Godrej & Boyce			✓				
Gammon				✓			
HCC				✓			
L&T	✓	✓	✓	✓	✓	✓	✓
NFC		✓					
Walchandnagar			✓				

Larsen & Toubro

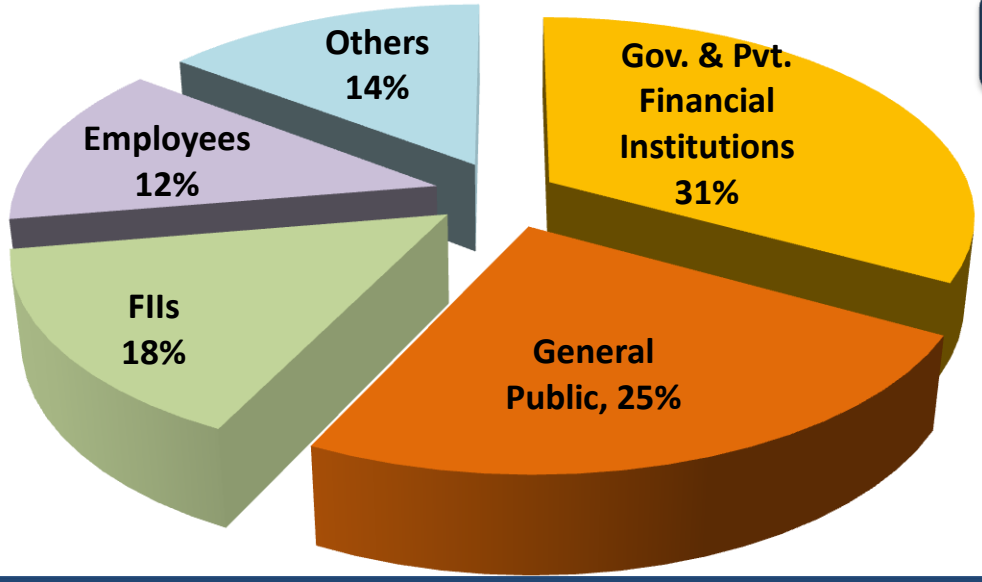
Founded
1938

Number of Emp.
54,000+

Market Cap
USD 13.8 Bn



Share holders



Major Shareholders

- LIC of India (16%)
- Employee Welfare Foundation (12%)
- Unit Trust of India (8%)

AAA Rating with Stable outlook from CRISIL & AAA from ICRA

Business Segments

Infrastructure

Buildings & Factories

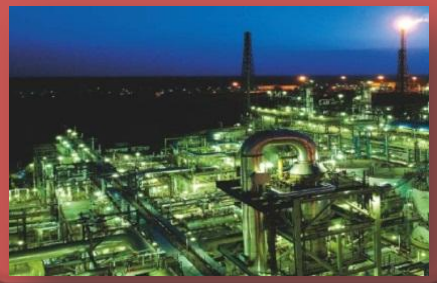
Heavy Civil Infra

Power T&D

Transportation

Water & Ren. Energy

Hydrocarbon



Heavy Engineering

Power

Metal & Material Handling

Machinery & Industrial Products

Electrical & Automation

Others

- IT & Engg Services
- Shipbuilding
- Realty

India's Largest Constn. Engineering & Manufacturing conglomerate

World Class Safety Standards

Sword of Honour

This is to certify that

LARSEN & TOUBRO LTD HED
MUMBAI, INDIA

has satisfied the requirements prescribed by the British Safety Council
and been awarded the Sword of Honour for the year

2009

In winning this award they have shown an awareness and commitment to safety management that puts them among the safest organisations in the world.

Nina Wrightson OBE
Chairman of the Board of Trustees

Julie Nerney
Interim Chief Executive

BRITISH SAFETY COUNCIL

★ ★ ★ ★ ★

BRITISH SAFETY COUNCIL

Five Star & Sword of Honor by BSC

Safety Innovation Award

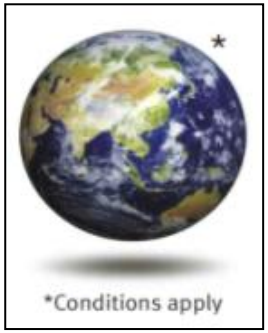
DU PONT

Engagement of Du Pont for Safety consulting

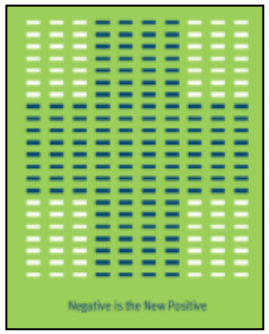
Sustainability

Project "Prithvi"

Sustainability Report 2008

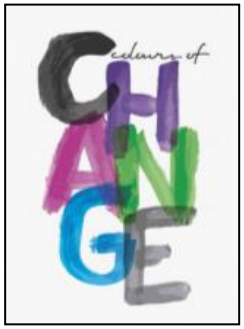


Sustainability Report 2009

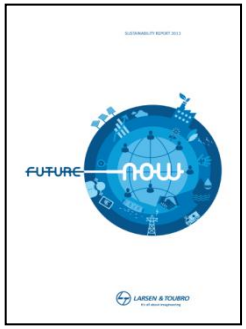


Sustainability Report 2010

Sustainability Report 2011



Sustainability Report 2012



Sustainability Report 2013

GRI Checked A+ Rating

1st Indian company in Engg. & Const. space to report

1st Indian E&C Co. to do Org. wide Carbon Footprint Mapping

Nuclear Accreditations

Construction of NPP Safety Related Components in accordance with:

- **ASME NQA-1**
- **10 CFR Part 50 Appendix B**

RCC-MR experience

Steam Generator

Emergency Passive Cooling Systems

Primary Pipe

Roof Slab

Sodium and Argon Tanks

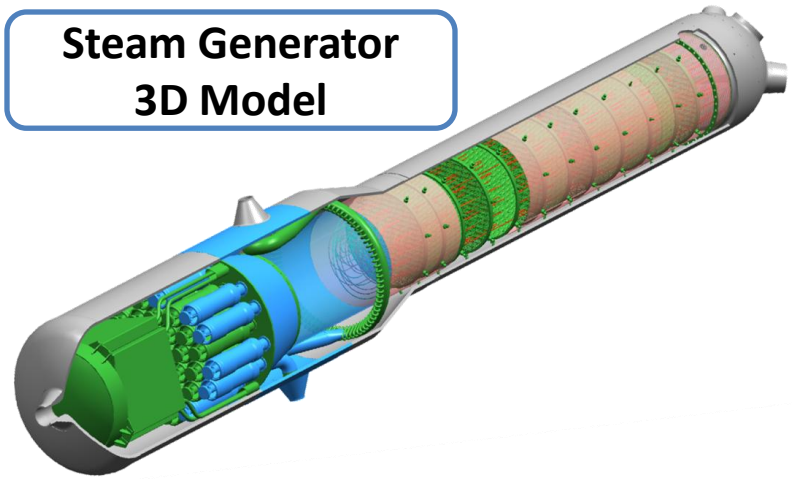
L&T is the manufacturer for major components in Fast breeder Reactor Program. Specifications of these are based on RCC-MR.

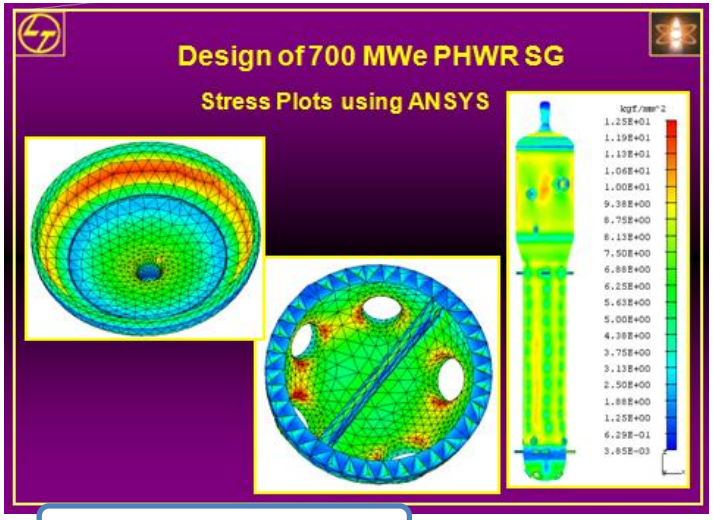
Reactor Safety Vessel and Main Vessel

Capabilities

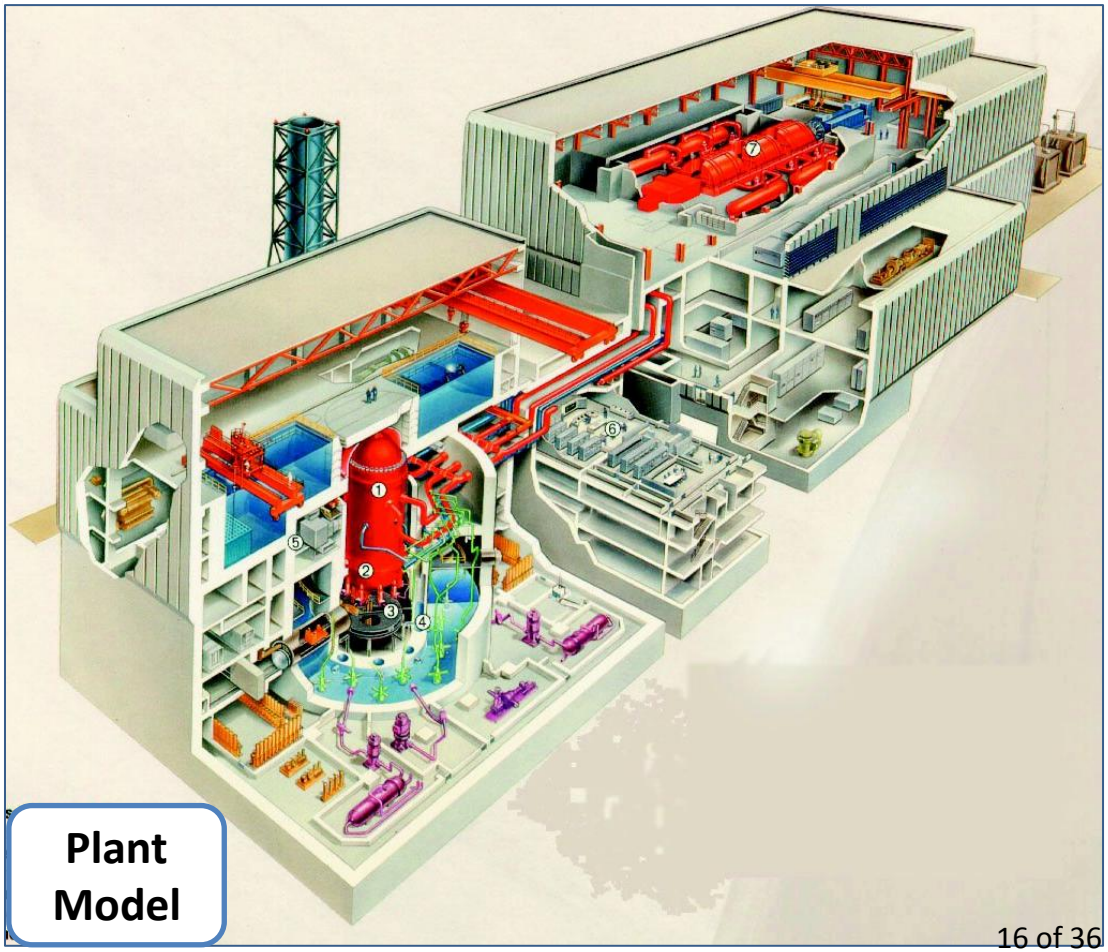
Design & Engg. | Raw Material | Equipment Mfg. | Construction | Valves | Control & Automation | EPC

Steam Generator 3D Model





Stress Analysis



Plant Model

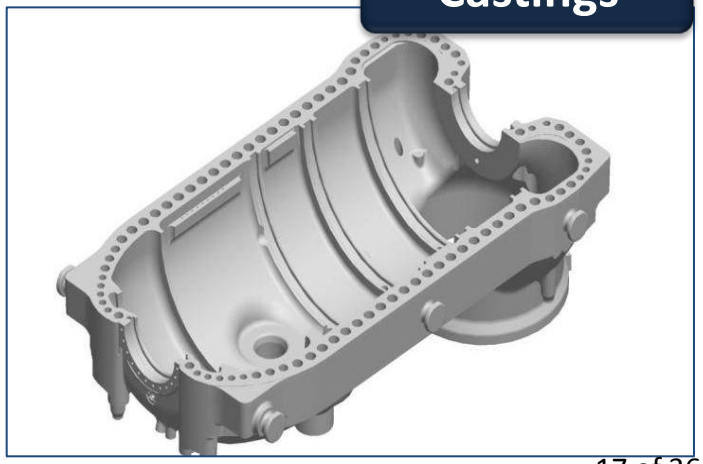
Capabilities

Design & Engg. | **Raw Material** | Equipment Mfg. | Construction | Valves | Control & Automation | EPC

Forgings

Piping

Castings



Capabilities

Design & Engg. | Raw Material | **Equipment Mfg.** | Construction | Valves | Control & Automation | EPC

Critical Eqpt. Supply since late 60s

Capabilities

Design & Engg. | Raw Material | Equipment Mfg. | Construction | Valves | Control & Automation | EPC

Steam Generators for PFBR

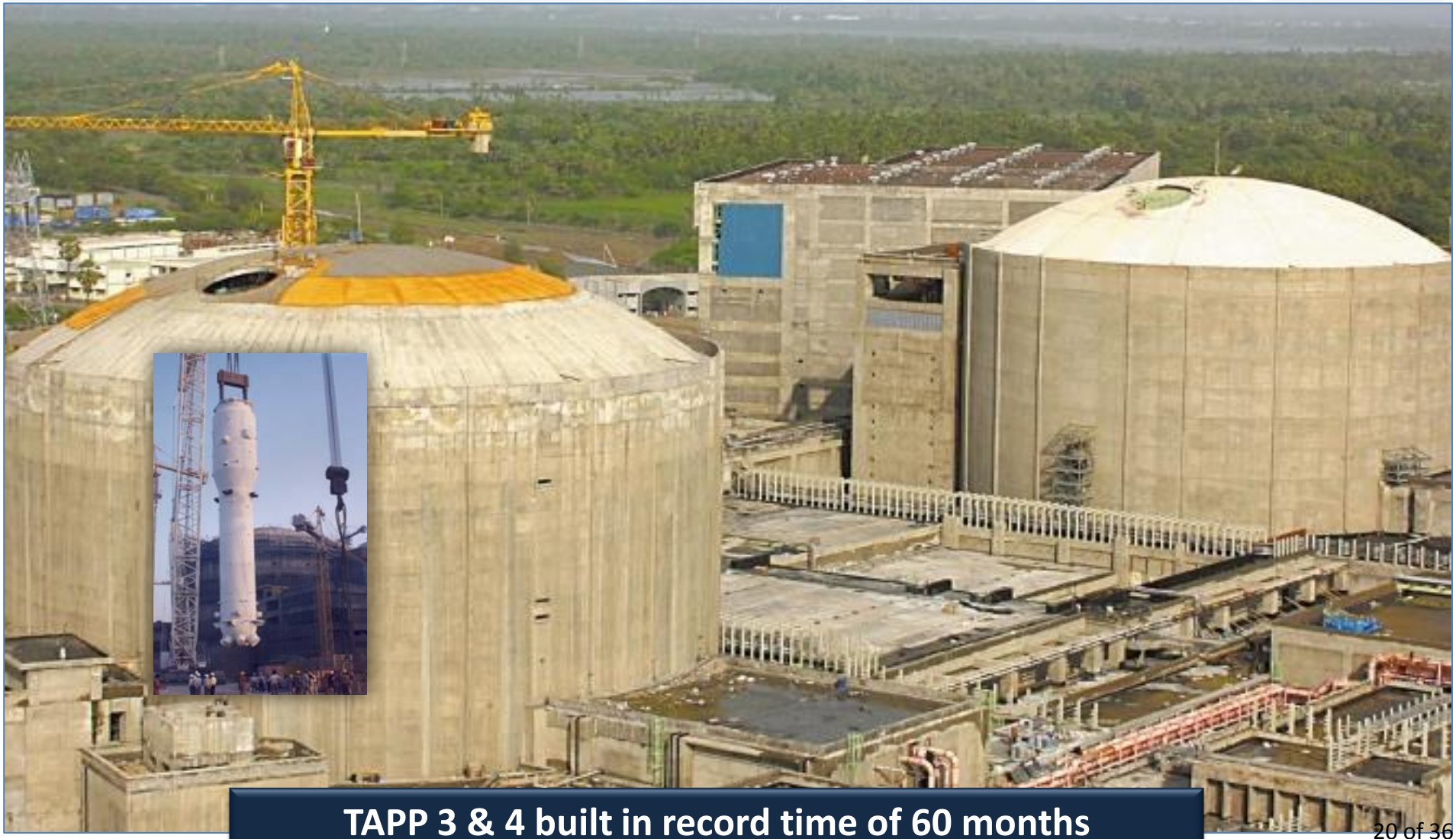
Steam Generators for PHWR

Special Steels & Heavy Forgings

Control Rod Drive mechanism

Capabilities

Design & Engg. | Raw Material | Equipment Mfg. | **Construction** | Valves | Control & Automation | EPC



TAPP 3 & 4 built in record time of 60 months

Capabilities

Design & Engg. | Raw Material | Equipment Mfg. | Construction | Valves | Control & Automation | EPC

Industrial Valves – For Nuclear Application & BOP

Capabilities

Design & Engg. | Raw Material | Equipment Mfg. | Construction | Valves | Control & Automation | EPC

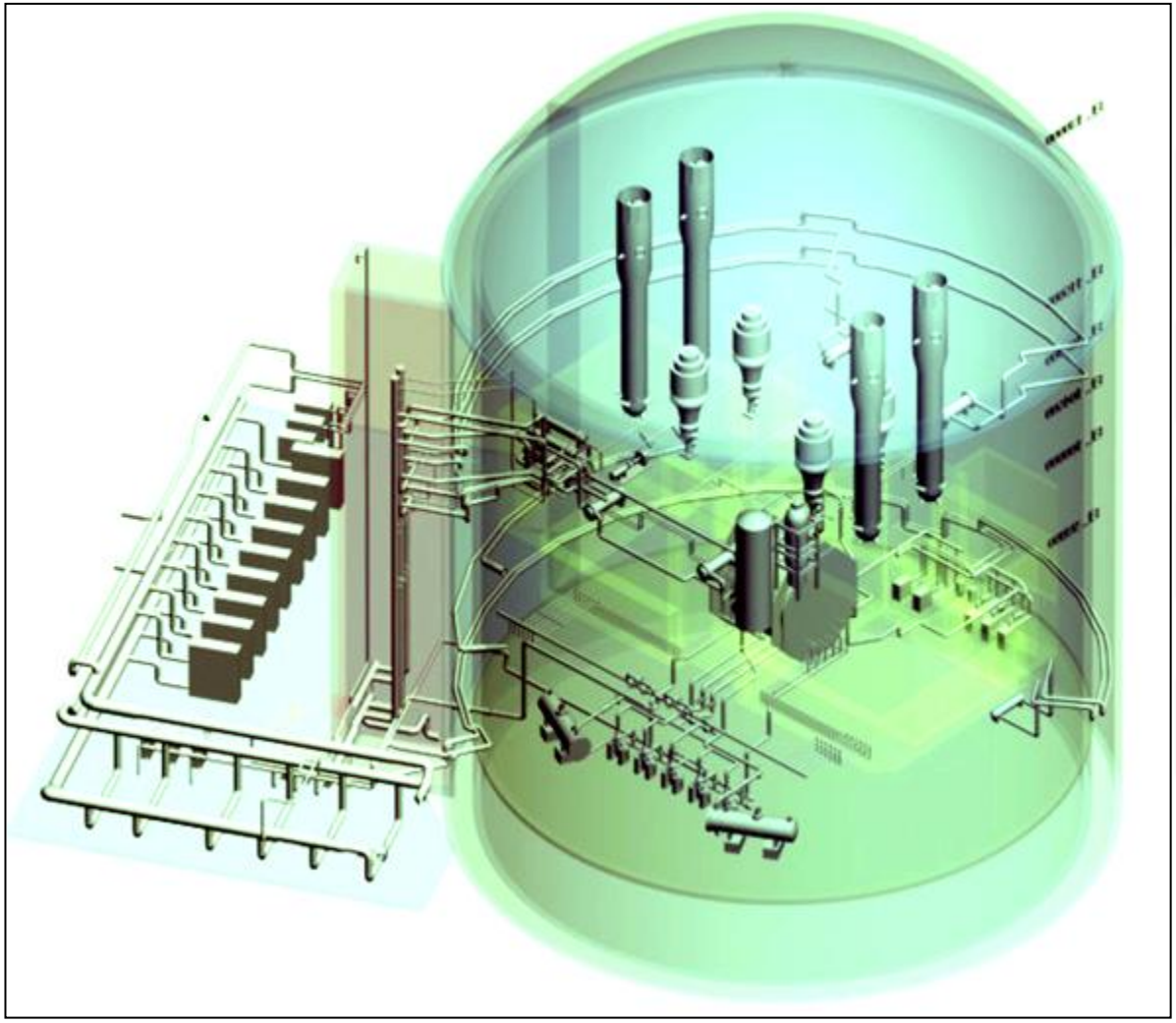
LV switchgear

sophistication and range to meet global benchmarks

Teaming with Rolls-Royce

Capabilities

Design & Engg. | Raw Material | Equipment Mfg. | Construction | Valves | Control & Automation | EPC

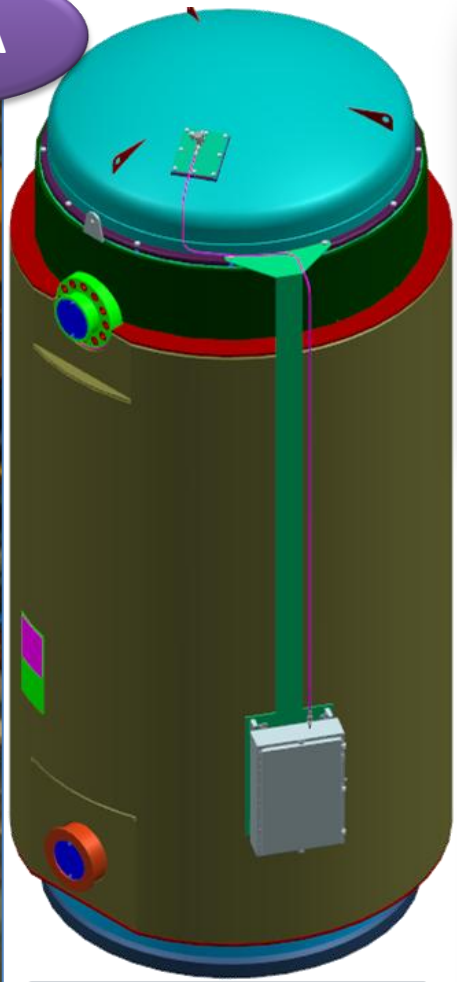


- Engineering
- Procurement
- Quality Systems
- Project Management

Global Participation – a New Frontier

To USA

Canisters



Casks for TN Inc.

To Switzerland

Overpack Casks

Casks for Energy Solutions

Facilities

Integrated Manufacturing Complex at Hazira

- ✓ Heavy Engineering
- ✓ Heavy Steel Forgings
- ✓ Ship Building
- ✓ E&C - Hydrocarbon
- ✓ Turbine JV
- ✓ Boiler JV
- ✓ HP Piping
- ✓ Casting
- ✓ ESP Howden

Facilities

L&T Special Steels & Heavy Forgings

India's largest integrated facility for heavy forgings – 300 MT ingot, 120 MT forgings

L&T Special Steels & Heavy Forgings

Steel Melting

- 100 MT Electric Arc Furnace
- Vacuum Degassing
- Atm., Vacuum & Hollow Casting

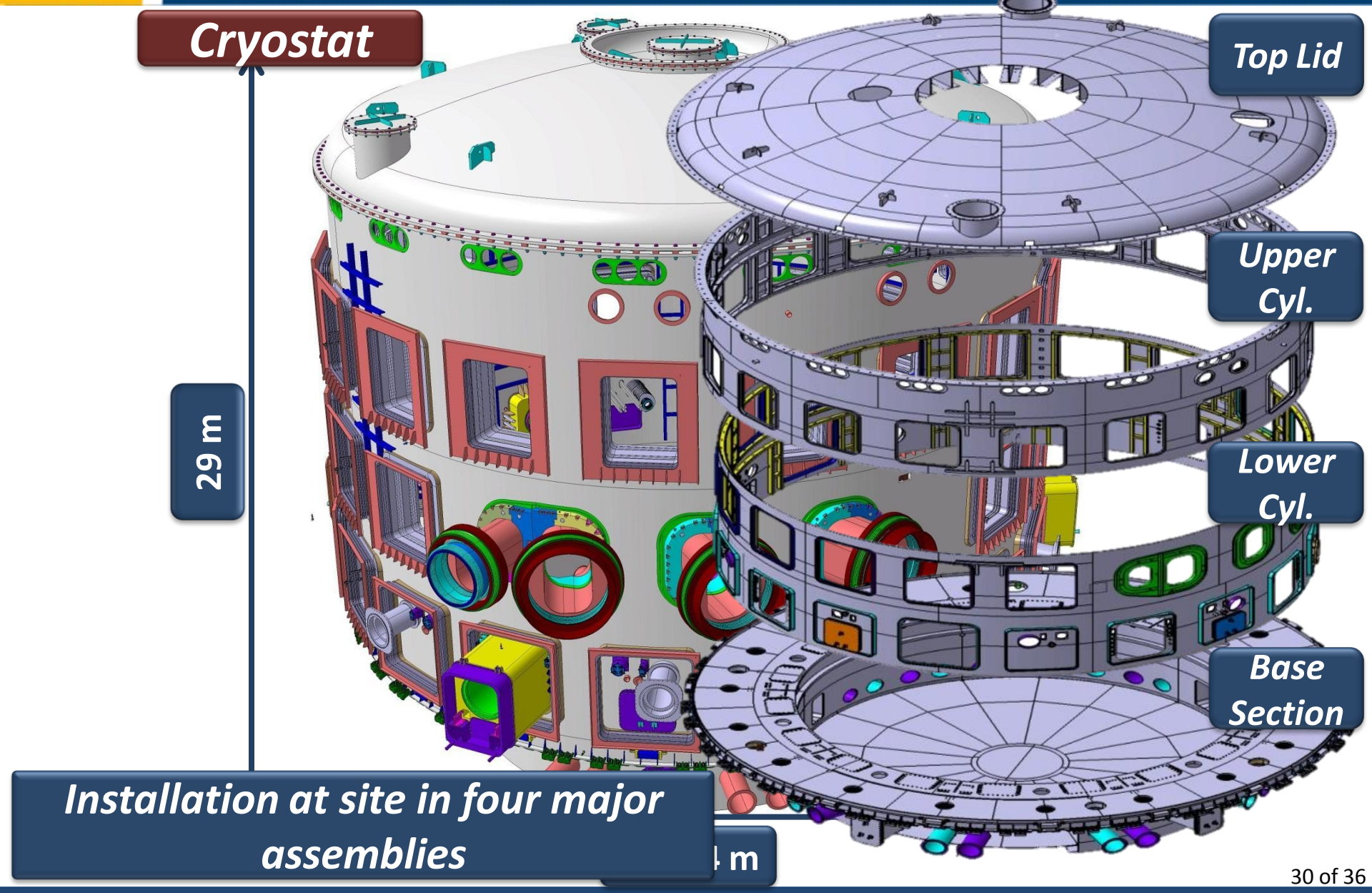
L&T Special Steels & Heavy Forgings

India's Biggest Open Die Hydraulic Press (9000 MT) and 150MT Manipulator

L&T Special Steels & Heavy Forgings

Heavy Ingots

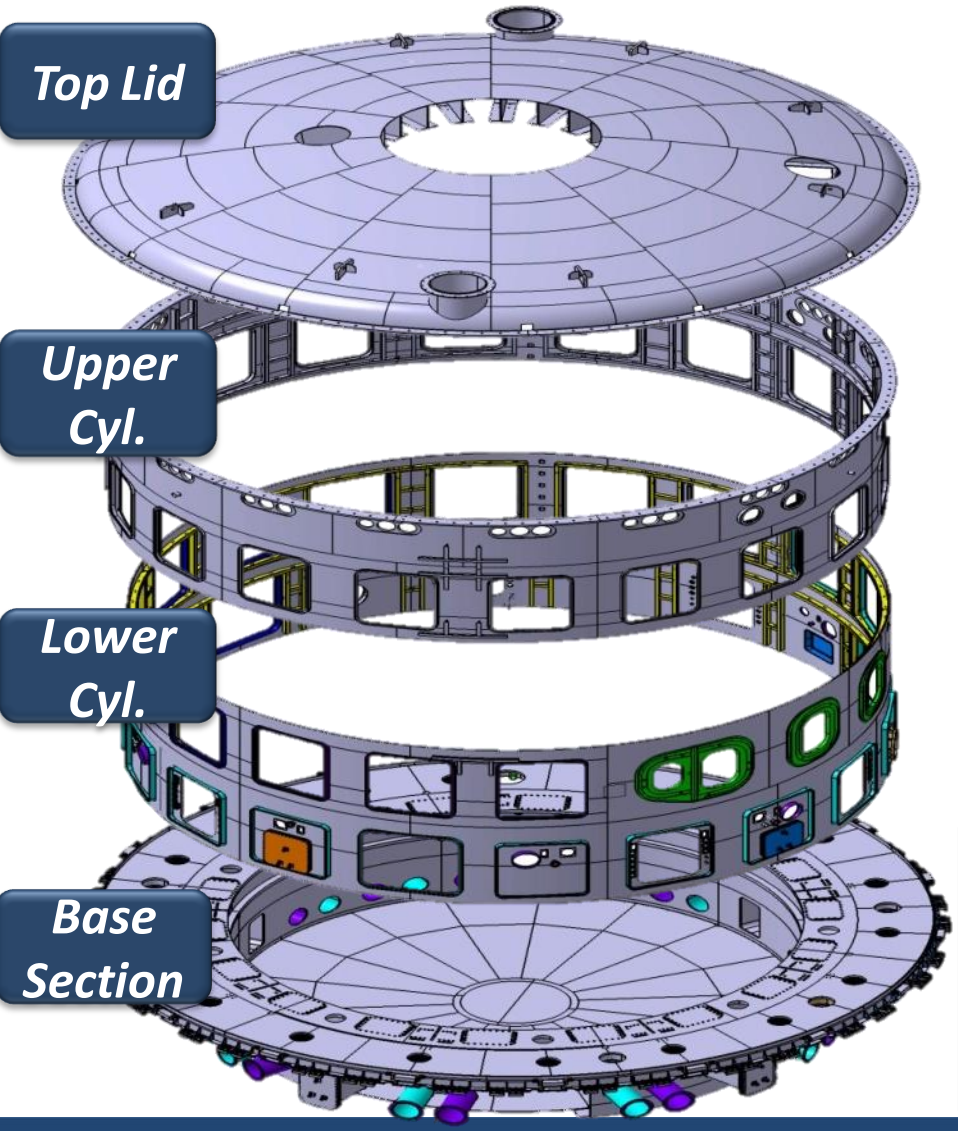
Participation in ITER



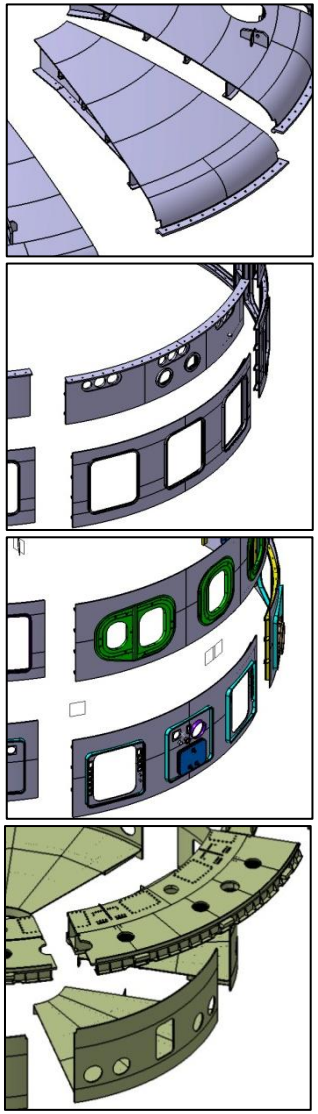
Installation at site in four major assemblies

ITER Cryostat

Major Assemblies



Sections



Overall Plan

Manufacture of Sections at Hazira Workshop

54 Sections

↓

Pre-assembly at Temp. site workshop in France

4 Sub assemblies

↓

Assembly in Tokamak pit

ITER Cryostat

In India

Phase 1 – Section Mfg. @ Hazira, India

In France

Cadarache W/S

Phase 2 – Preassembly @ Site W/S

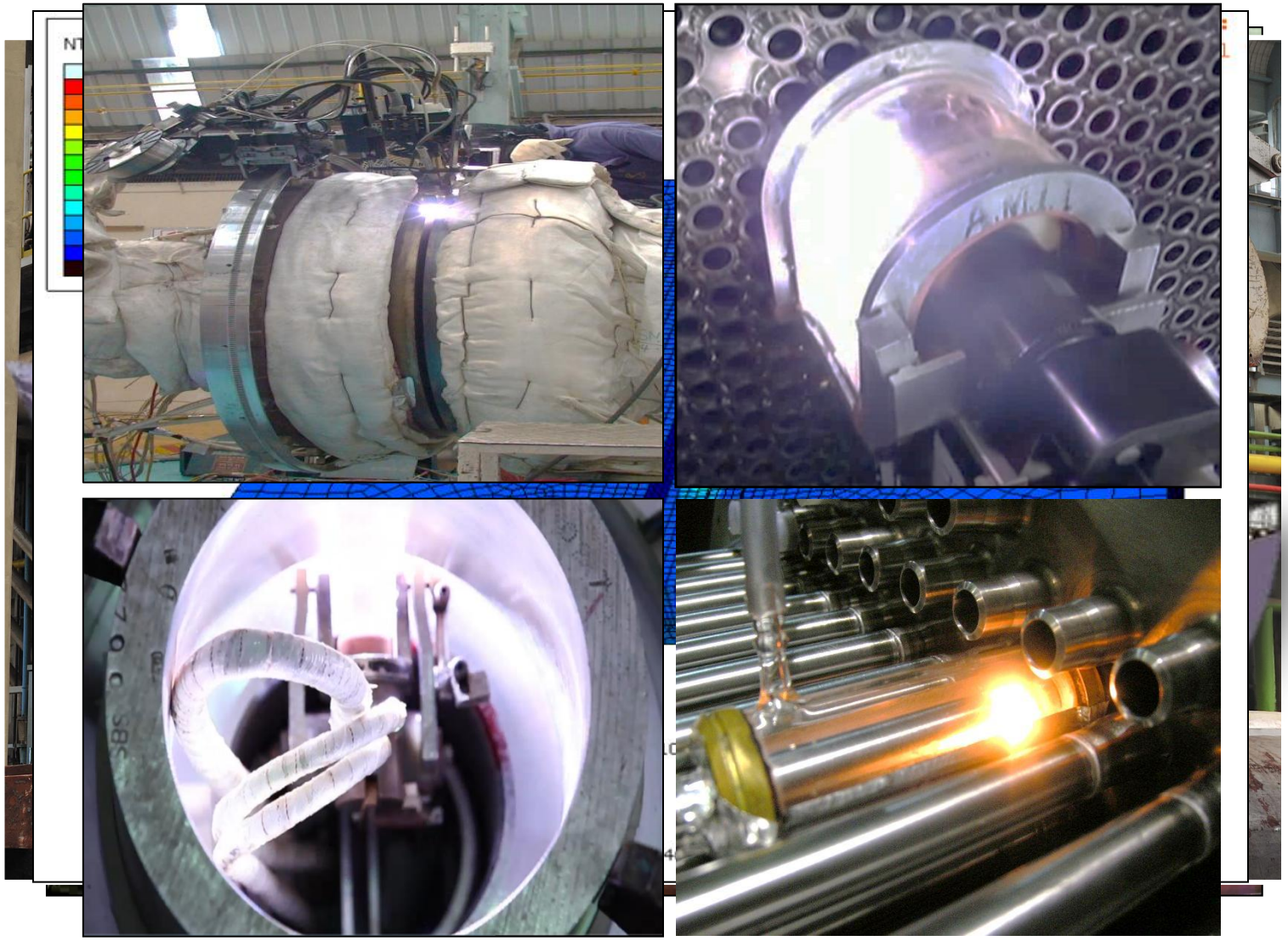
Phase 3 – Final Integration

Total cycle time – 96 months

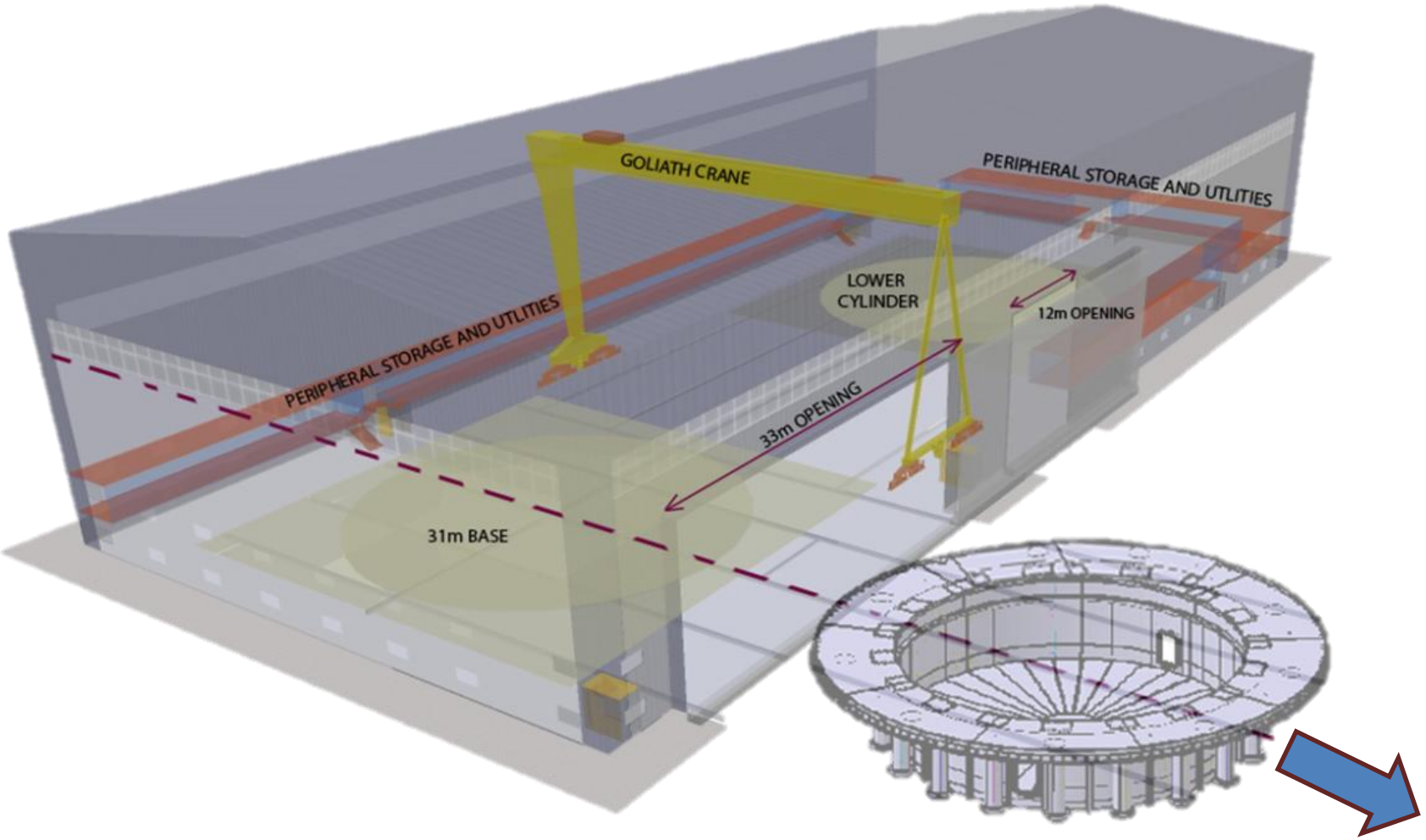
FY13	FY14	FY15	FY16	FY17	FY18	FY19	FY20	FY21

Technology Development

- Visualization
- Raw Material
- Simulation
- Robotics
- Welding Tech.



Site Workshop



TOKAMAK

Site Workshop

40 % work completed; Expected readiness by Aug'14

Summary of required Technologies

- Stainless steel forgings with special properties
- Welding processes to meet specific requirements
- Simulation & prediction of welding deformation
- Measurement methods & simulation of assembly
- Development of special tooling to meet tolerances
- Design for safe handling & transportation

We at L&T look forward to participating in a bigger way in this truly international effort for the betterment of Mankind

Thank you