Challenges in developing Nuclear Power Infrastructure

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India – The Country, Electricity & Nuclear Power

The Country

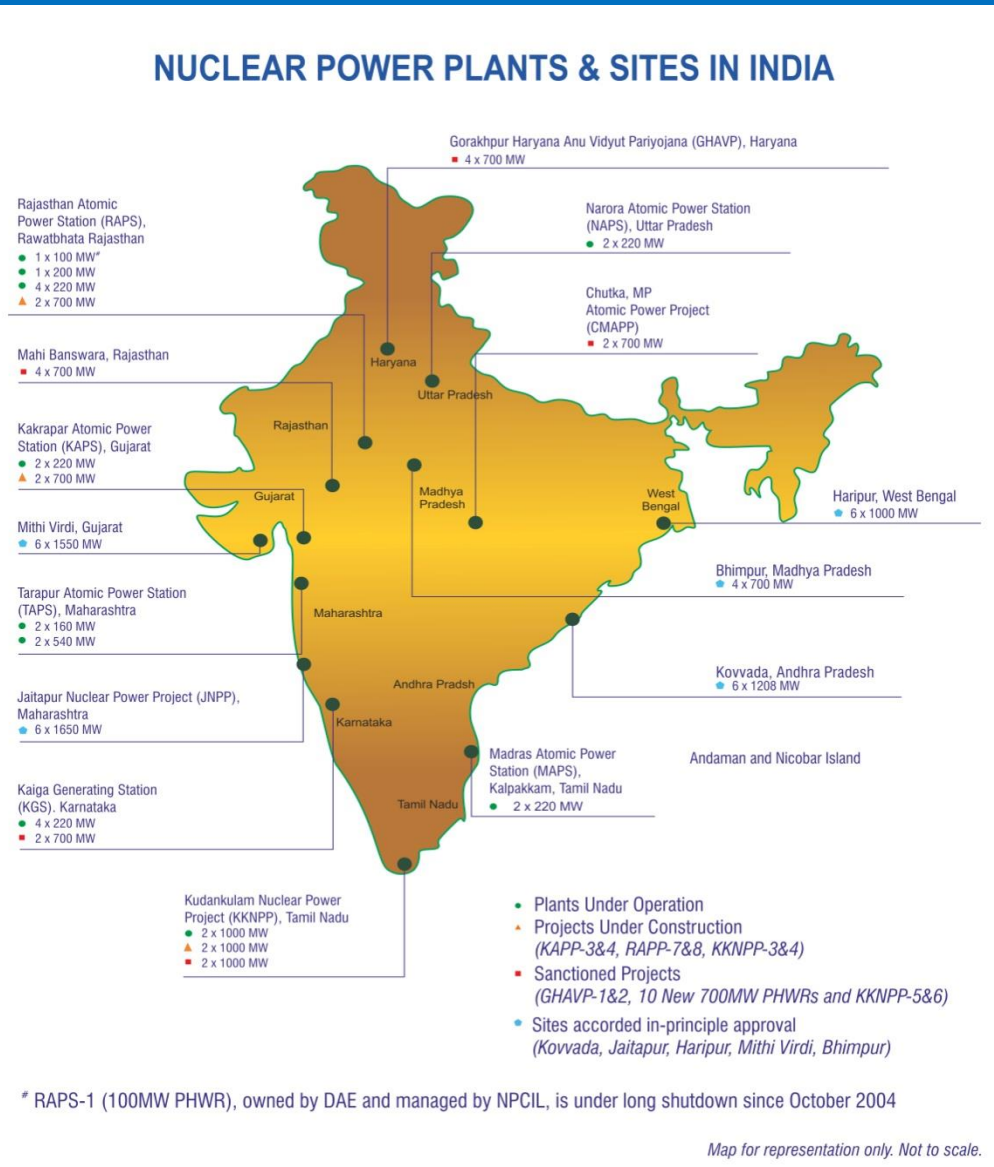
- **Old Civilisation, rich cultural heritage.**
- **Largest democracy, multi cultural**
- **Federal polity 29 states and 7 Union Territories**
- **Population of about 1.3 billion**
- **Thousands of languages, 22 major**
- **GDP of about USD 2.5 trillion**
- **Growing economy**

Electricity Scene

- **Third largest producer** of electricity
- **Low per capita** consumption
- Large & Growing Demand
- Predominantly Thermal (Coal)
- Nuclear Share about 3%

Nuclear Power Programme

- **Unique three-stage indigenous programme**
- Reactors based on foreign cooperation
- Comprehensive capabilities in all aspects of Nuclear Power and Associated Fuel Cycles
- Poised for large expansion
- **22 reactors in operation, 21 under construction & sanctioned**



Indian Nuclear Power Programme - Evolution

Dr. Homi J Bhabha

"Any substantial rise in the standard of living in this region – that can be sustained in the long term – will only be possible on the basis of very large imports of fuel or on the basis of atomic energy"

1950s Onwards – Vision Articulation and Institution Building

Government Institutions

R&D : BARC (1957), IGCAR (1971), IPR (1982), RRCAT (1984)

Fuel Cycle : UCIL (1951) , IREL (1950), NFC (1968)

Industries : Heavy Water Plant (1962), ECIL (1967)

Human Resources : Training School (1957)

Regulation: AE Act- 1948, 1962 , AERB (1983)

Private Industries for manufacturing & execution

Initial Hand holding by Government

1954 –Establishment of DAE

1948 – Atomic Energy Act & AEC Constitution

1947 – Independence

1944 -Initiative on setting up atomic research in the country

Building Institutions contd…

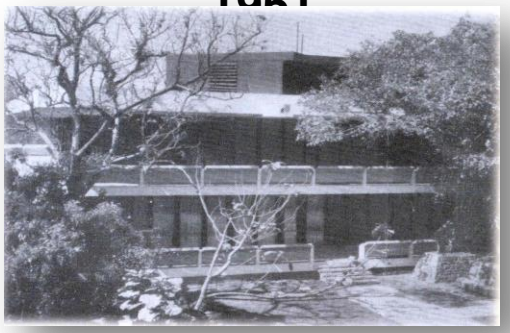
AMD 1949

IREL 1950

Jaduguda (UCIL) 1951

APSARA 1956

BARC 1957



Training School 1957

CIRUS 1960

Heavy Water Plant 1962

ECIL 1967

Building Institutions

NFC 1968

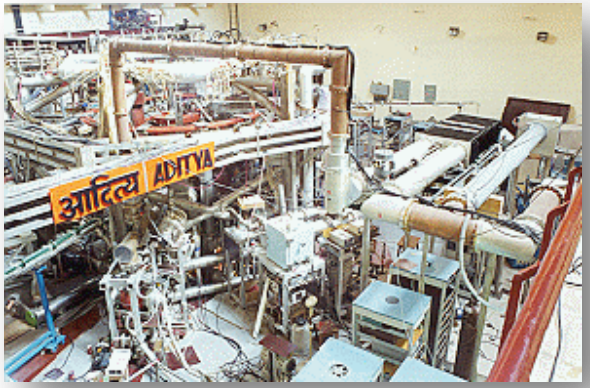
एनपीसीआईएल
NPCIL

NPCIL 1987

Isotopes & Radiation : Health & Prosperity

BRIT 1989

IGCAR 1971



IPR 1982

AERB

AERB 1983

RRCAT 1984

Total number of employees in DAE units and installations : ≈ 1,00,000

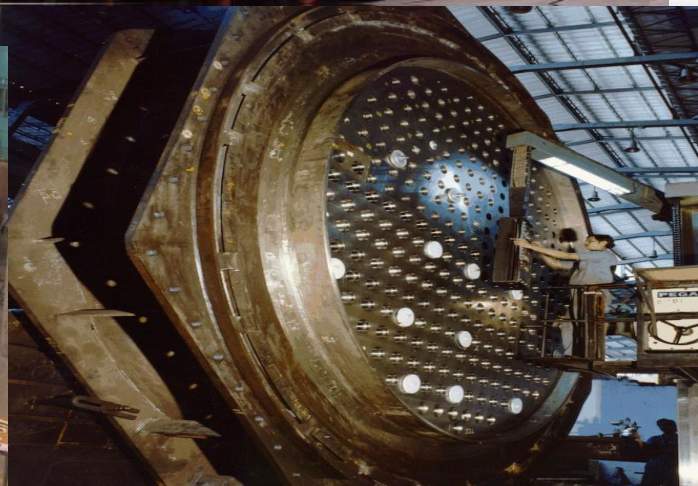
Indian Industry Capability **in** manufacturing and supplying NPP equipment and components









Public Acceptance Challenge

- **Causes**: Disproportionate fears about nuclear power (due to events like Fukushima), Misinformation by ideologically opposed groups
- **Key Concerns:**
  - Safety of Nuclear Power Plants,
  - Effects on health due to radiation from plants – cancer, infertility & congenital abnormalities,
  - Loss of Traditional Livelihoods like fishing, agriculture etc.
  - Environmental Concerns – Bio diversity loss
- **Addressing the Challenge- Gaining of Social Trust**
- **Public Outreach programmes Restructured, Institutionalized & Enhanced manifold**
  - **Spreading awareness about nuclear power & related issues and addressing concerns in a simple, understandable and credible manner**
  - **Inclusion of neighborhoods / surrounding population**

Strategies Adopted

- Public Outreach recognised as cross functional area, **Organisational Framework** Instituted:
  - Apex Committee- Guidelines & Procedures with clear Roles and Responsibilities
  - Senior management participation
- **Action Plans** for near , medium and long term , based **on t**hrust Areas identified
- **Monitoring,** Feedback & Improvement mechanism instituted

- **Resources Allocation**(~ USD 50 million over five years)

- **Multipronged Approach to PA- Innovation** in communication, **Partnerships** with Professional organizations

- **Permanent Capacity Creation** & Sustainable Programmes

- **Environment Stewardship Programme** in and around Indian NPPs

Public Awareness

- **Multipronged Approach**
- **Capacity Creation and sustenance**
- Development of in-house Resources- Training for senior officials for media interaction by expert faculty
  - *Permanent Exhibition Centres (Halls of Nuclear Power)*
  - ***Visits of different target groups to Indian NPPs*** Villagers, students, policy & opinion makers and public
  - *Publications in simple , vernacular languages –use of visuals,Single sheet publications,**Comic Books***
  - *Digital Media – Short films,TV,Cinema & Cable TV,*

    Radio jingles,Animation Films
  - *Web based Awareness- use of social media*
  - *Press Meets, Doctors Meets*
  - *Briefing Opinion and policy makers, planners and other influential groups*
  - *Lectures to students and teachers in School & Colleges*
  - *Exhibition on Wheels*
  - *Letters & Rejoinders*

Neighborhood Inclusion

Healthcare

Sanitation – Toilets
Swatch Bharat Abhiyaan

Education

Infrastructure

Rs 500 crore (~ USD 80 million) neighbourhood development package at Kudankulam comprising 10000 houses & infrastructure

Skill Development

Introducing Imported Reactors

- ***India has well established infrastructure with pool of trained human resource and developed Industry base to absorb and support multiple nuclear technologies.***
- ***For introducing imported reactor technologies necessary framework and required linkages have been addressed;***

  - Harmonising laws and policies, Regulations & regulatory requirements, Codes, Standards and Practices etc. to arrive at mutually acceptable agreements.
  - Cooperation between Indian Industries & Foreign Technology Partners
  - Dedicated groups of experienced/ trained personnel for working on each of these aspect
  - Exploring different business models to arrive at an optimum cost and viable tariff.
  - Exploring vendor country credit, financing from multilateral agencies etc. to optimise financing costs
  - Building guarantees for lifetime supply of fuel, spares, design support etc. in commercial contracts.
  - Initiatives on Progressive Indigenization to optimize Cost

Nuclear Education & HR Development

Stimulus - Basic Education

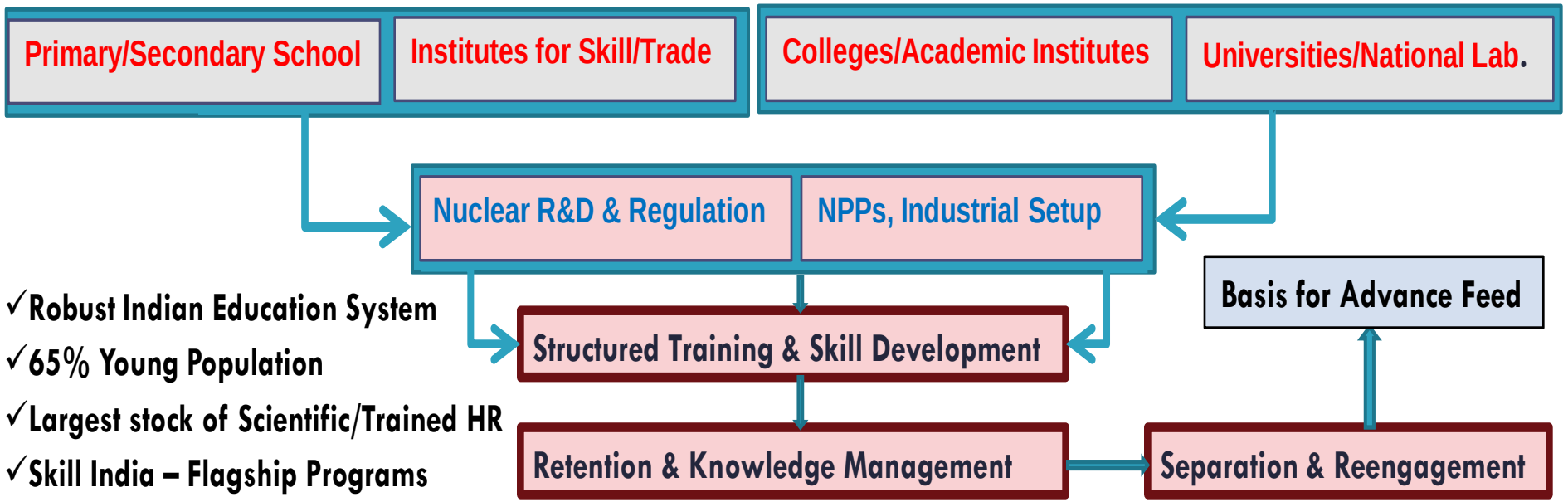
- Curriculum Level Intervention
- Nuclear Awareness/Exhibitions
- Visits to Nuclear Facility
- Apprentice/Scholarships
- Build –School/Education (CSR)

Government /DAE Support

- Special Status for Nuclear Education
- Establishing Specialized Institutes
- Funding for Infrastructure & Project
- Promote Industry-Academia linkage
- Promote Research Programs

Stimulus – Higher Education

- Consortium/Nuclear Courses
- Curriculum Level Intervention
- Internship/Career Counseling
- R&D Projects/Fellowship
- Symposia/Seminar/Conference



- ✓Robust Indian Education System
- ✓65% Young Population
- ✓Largest stock of Scientific/Trained HR
- ✓Skill India – Flagship Programs

Nuclear Workforce Sourcing, Initiatives, Infrastructure, Capacity Building

Nuclear Workforce Sourcing & DAE Initiative

- National Education System, largely funded by Govt.
- Supporting education (infrastructure, aids and scholarships to meritorious students) in the vicinity of nuclear power plant sites
- Spreading Awareness and Spurring interest in nuclear power among students
- Support / Financial Assistance to Universities, Academic Institutions & National laboratories
  - R&D Projects, Symposia/Conferences, Regular Research Project Awards
  - Fellowship for pursuing PhD
  - Consortium & collaborations
- Several schemes to promote higher studied like Fellowship Scheme for M.Tech at IITs/NITs
- Good remuneration and facilities to new entrants

Training Infrastructure & Capacity Building

- BARC Training School and Five Affiliated Schools (400 Engineers yearly).
- Seven Nuclear Training Centre (NTC) at Indian NPPs (400 Engineers, 400 Supervisors and 800 Technicians yearly).
- Specialized Nuclear Institutions – Homi Bhabha National Institute (HBNI)
- Integrated M. Sc Course of National Institute of Science Education and Research (NISER)
- Training & Qualification and Knowledge Management
  - Structured Licensing & Qualification System
  - Embedded Structured Knowledge Elements in Work Processes for ease of Dissemination
  - Knowledge Transfer - Centre of Knowledge' to 'Centre of Growth

Thank You