

Safety challenges Rapid growth in diverse & new technologies

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Key Elements of the Topic

Safety challenges due to rapid growth scenario in diverse NPP technologies in India.

- ✓ **Safety**
- ✓ **Growth – rapid**
- ✓ **Diverse technologies**
- ✓ **Challenges**

Fundamental Safety Objective

The fundamental safety objective is to protect people and the environment from harmful effects of ionizing radiation.

- This fundamental safety objective has to be achieved **without unduly limiting**
 - ✓ the operation of facilities or
 - ✓ the conduct of activities that give rise to radiation risks
- To ensure that facilities are operated at highest standards of safety, measures have to be taken:
 - ✓ to control the radiation exposure of people and the release of radioactive material to the environment;
 - ✓ to restrict the likelihood of events occurring in a Nuclear Power Plant
 - ✓ to mitigate the consequences of such events if they were to occur.

Fundamental Safety Objective

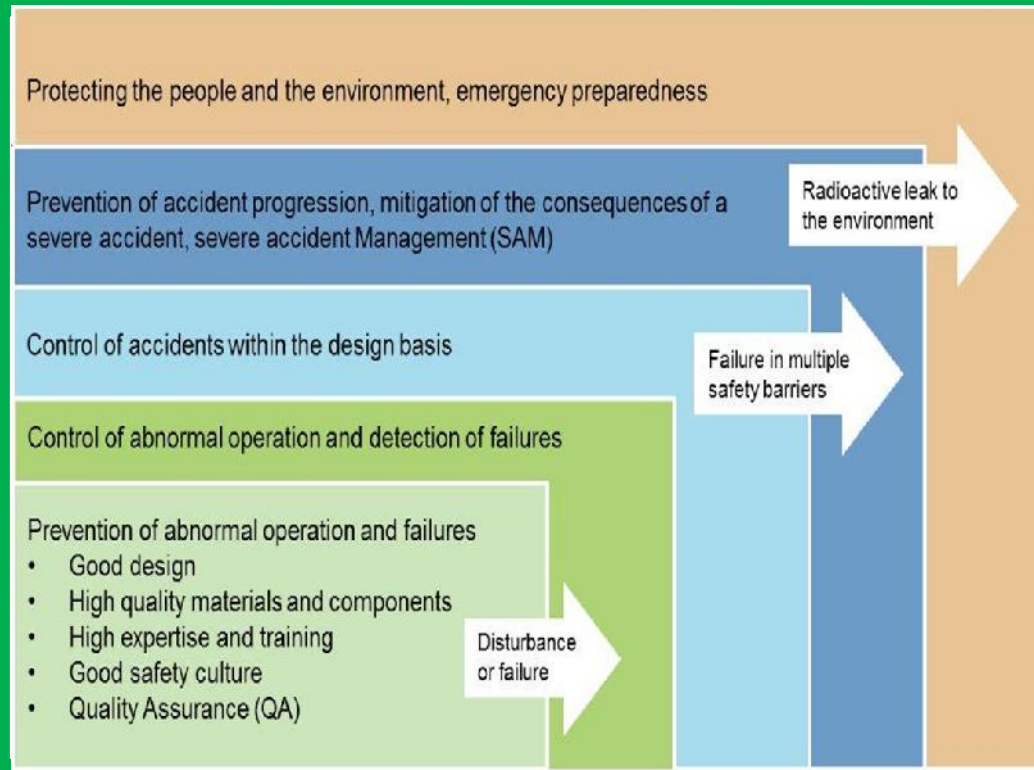
(Contd.)

- **The fundamental safety objective applies to all stages over the lifetime of an NPP,**
 - **planning, siting,**
 - **design, manufacturing, construction,**
 - **commissioning and operation,**
 - **decommissioning**
- **To achieve fundamental safety objective in all stages of Nuclear facilities, Ten safety principles have been formulated.**
- **On the basis of these safety principles safety requirements are developed and safety measures are to be implemented in order to achieve the fundamental safety objective.**

Ten Safety Principles

1. **Responsibility for safety**
2. **Role of government**
3. **Leadership and management for safety**
4. **Justification of facilities and activities**
5. **Optimization of protection**
6. **Limitation of risks to individuals**
7. **Protection of present and future generations**
8. **Prevention of accidents – With provisions of Defence-in-Depth**
9. **Emergency preparedness and response**
10. **Protective actions to reduce existing or unregulated radiation risks**

Safety Culture



Safety Culture

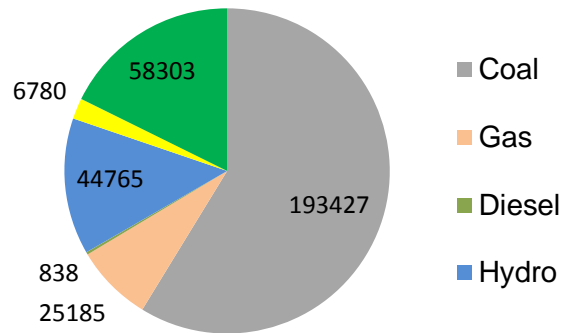
Present Nuclear Power Scenario in India

- **22 Reactors operating by NPCIL – at an installed capacity of 6780 MW**

 - **8 Reactors are under construction**
 - **2X700 MW at KAPP 3&4 Gujarat**
 - **2X700 MW at RAPP 7&8 Rajasthan**
 - **2X700 MW at GHAVP 1&2 at Haryana**
 - **2X 1000 MW at KK NPP 3&4 Tamilnadu**
- 6700 MW**

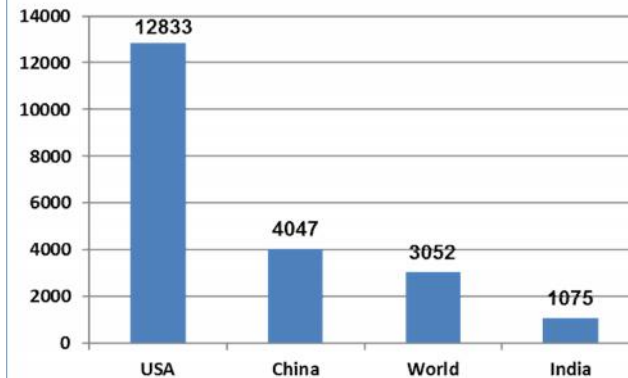
Present Indian Electricity Scene

**Installed Capacity (Sept 2017)
329298 MW**



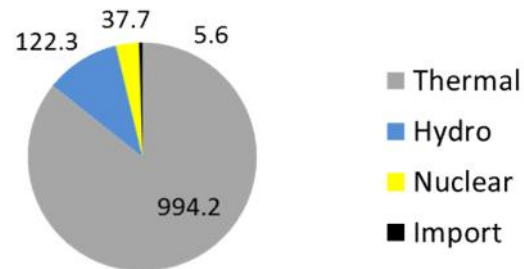
Source: CEA

Electricity Consumption per Capita (kWh) 2015



Sources: Key World Energy Statistics IEA,2017 and CEA, India

**Generation in 2016-17
(1242 BU)**



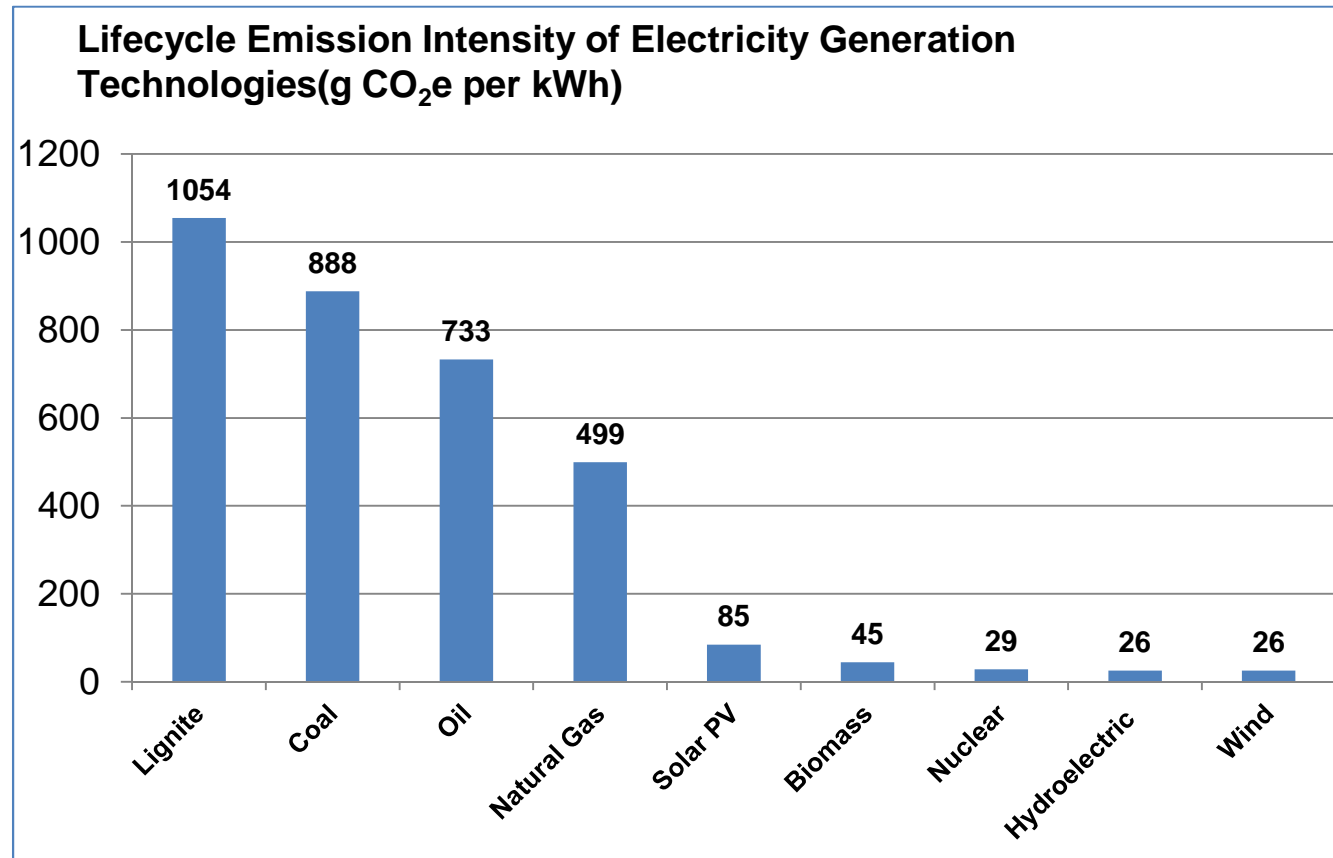
- Third largest producer in the world
- About 30% of households do not have access to electricity
- Shortages and Load Shedding
- Growing Electricity Demand

Clean Energy Objective

India's Intended Nationally Determined Contribution (INDC):

- To reduce emission intensity of its GDP by 33 to 35 % by 2030 from 2005 level
- To achieve about 40% cumulative electric power installed capacity from non fossil fuel based energy sources by 2030

Clean Energy Technologies



Source: Comparison of Lifecycle Greenhouse Gas Emissions of Various Electricity Generation Sources, WNA, July 2011
N.B: Although the absolute emission intensity fluctuates in various studies, relative magnitude of GHG emissions between different electricity generation methods is consistent throughout the various studies.

Clean Energy Objective

Nuclear is one of the key technologies for achieving the INDC objectives.

- ✓ **Huge Potential to ensure long term energy security**
- ✓ **Greenhouse Gas Emissions comparable to renewable technologies**
- ✓ **Base load source available 24/7**
- ✓ **High energy intensity**
- ✓ **Among the lowest land requirement per MW**

Rapid growth- Expectation of GOI-People...

- **Government of India has sanctioned**
 - **Ten PHWRs (700 MW each) to be built in fleet mode - pressing speed button.**
 - **Two additional (1000 MW each) LWRs.**
- **Government of India has also laid down expectations in the form of 24 large size LWRs through import route → 29000 MW (approx.)**

Diverse Technologies



➤ 220, 540 & 700 MW PHWRs

➤ 1000 MW VVERs

➤ 1200 MW VVERs

➤ 1650 MW EPRs

➤ 1208 MW PWRs

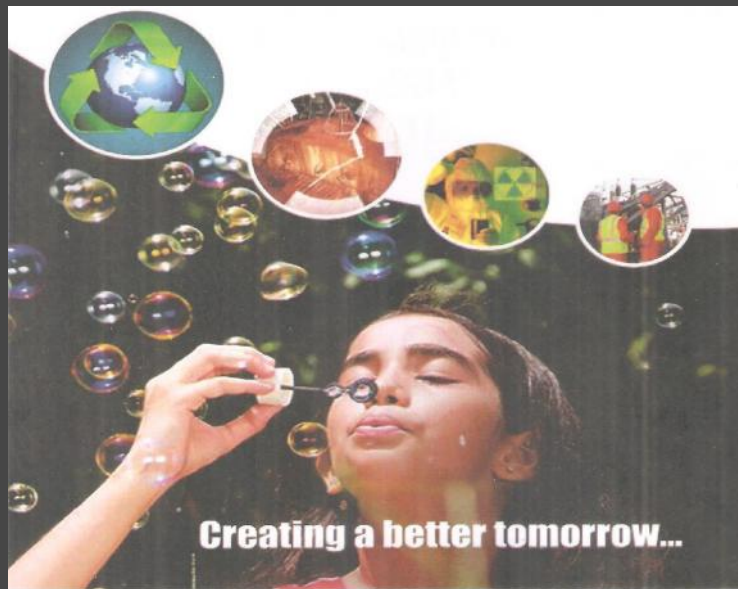
✓ AHWRs

✓ 900 IPWRs

Challenges (?)

- ❑ Basics remain the same
- ❑ Human resource and Knowledge Management
 - ✓ Technology specific verticals
 - ✓ Training
 - ✓ Licencing & qualification
- ❑ Quality – Design, manufacturing, construction, O&M
- ❑ Nurturing safety culture
- ❑ Respect the technology: all big accidents were result of complacency & Technical arrogance.

We have done it earlier - twice!



Thank you