India’s Nuclear Power Capacity

For Prelims: Nuclear Power Corporation of India Limited (NPCIL), National Thermal Power Corporation Limited (NTPC), Indian Oil Corporation Limited (IOCL), Kamini, Non-Proliferation Treaty (NPT).

For Mains: Recent Developments Related to India’s Nuclear Energy, Ways to Enhance India’s Nuclear Power Capacity.

Why in News?

India’s nuclear power capacity experienced a significant increase. By **2021-22,** it had risen to **47,112 Million Units.**

- In 2017, the government gave **simultaneous approval for 11 indigenous pressurised** heavy water reactors with a **total capacity of 7,000 MegaWatts.**

What is the Status of India’s Nuclear Energy?

- **About:**
  - Nuclear energy is the **fifth-largest** source of electricity **for India** which contributes about 3% of the total electricity generation in the country.
  - India has over **22 nuclear reactors in 7 power plants** across the country which produces **6780 MW of nuclear power.** In addition, one reactor, **Kakrapar Atomic Power Project (KAPP-3)** has also been connected to the grid in January- 2021.
    - **18 reactors** are **Pressurised Heavy Water Reactors (PHWRs)** and 4 are **Light Water Reactors (LWRs).**
    - **KAPP-3** is the India’s first 700 MWe unit, and the biggest indigenously developed variant of the PHWR.
- **Recent Developments:**
  - **Joint Ventures with Public Sector Undertakings (PSUs):**
    - Government has also allowed Joint Ventures with PSUs to **enhance India's nuclear program.**
    - As a result, the **Nuclear Power Corporation of India Limited (NPCIL)** is now in two joint ventures with the **National Thermal Power Corporation Limited (NTPC)** and the **Indian Oil Corporation Limited (IOCL).**
  - **Expansion of Nuclear Installations:**
    - In the past, **India's nuclear installations were mostly located in South India** or in Maharashtra and Gujarat in the west.
      - However, the government is now **promoting its expansion to other parts of the country**. As an example, the upcoming **nuclear power plant in Gorakhpur town of Haryana**, which will become operational in the near future.
  - **India’s Indigenous Move:**
    - The world's first thorium-based nuclear plant, **"Bhavni,"** using **Uranium-233**, is being set up at **Kalpakkam in Tamil Nadu.**

        - This plant will be **entirely indigenous and will be the first of its kind**. The experimental thorium plant "Kamini" **already exists in Kalpakkam.**
- **Challenges:**
    - **Limited Domestic Resources:** India has **limited domestic resources of uranium**, which is the fuel for nuclear reactors.
        - This has **forced the country to import a significant portion of its uranium requirements**, making the country's nuclear energy program vulnerable to global market conditions and **political tensions**.
    - **Public Opposition:** The construction of nuclear power plants often faces opposition from local communities due to **concerns over the safety of the reactors** and the potential **impact on the environment.**
    - **Technical Challenges:** The development of nuclear power plants involves **complex technical challenges,** including the design and construction of reactors, the **management of nuclear waste, and the maintenance of nuclear safety standards.**
    - **International Sanctions:** India is not a member of the Nuclear **Non-Proliferation Treaty (NPT)** and has faced international sanctions in the past for its nuclear weapons program.
        - This has **limited its access to advanced nuclear technology** and fuel supplies from other countries.
    - **Regulatory Barriers:** The **regulatory framework for the development of nuclear power in India** is complex and has been criticised for **being slow and bureaucratic,** leading to delays in the implementation of projects.

How India Can Enhance its Nuclear Power Capacity?

- **Overcoming Public Opposition:** Addressing public concerns and increasing public awareness about the **safety of nuclear power** is critical to **overcoming opposition to the construction of new reactors.**
    - This can be achieved through **transparent communication and consultation with local communities**, as well as the implementation of rigorous safety standards.
- **Technical Innovation:** To overcome the technical challenges faced by the nuclear energy sector, **India needs to focus on innovation in reactor design, waste management**, and safety systems.
    - This could involve **investment in research and development** and the deployment of advanced technologies.
- **Financial Sustainability**: To overcome the financial challenges faced by the nuclear energy sector, **India needs to find ways to make nuclear energy more cost-competitive** with other forms of energy.
    - This could involve **reducing construction and operation costs**, as well as developing innovative financing models.
- **Improving International Collaboration:** India needs to strengthen its international partnerships to **overcome the limitations posed by international sanctions and access to advanced nuclear technology** and fuel supplies.
    - This could involve the **development of joint ventures with other countries,** the participation in international research initiatives, and the **negotiation of** nuclear trade agreements.

UPSC Civil Services Examination, Previous Year Questions (PYQs)

Prelims

Q. The function of heavy water in a nuclear reactor is to (2011)

(a) Slow down the speed of neutrons
(b) Increase the speed of neutrons
(c) Cool down the reactor
(d) Stop the nuclear reaction

Ans: (a)

Mains

Q. With growing energy needs should India keep on expanding its nuclear energy programme? Discuss the facts and fears associated with nuclear energy. **(2018)**

Source: PIB