The Prospect of Nuclear Energy

This editorial is based on **"Shutdown This Misguided Energy Policy"** which was published in The Hindu on 12/03/2022. It talks about the key challenges associated with the adoption of Nuclear Energy in India.

For Prelims: Nuclear Energy, Uranium, Thorium, Pressurised Heavy Water Reactors (PHWRs), Jaitapur nuclear power reactors, India-U.S. civil nuclear deal, Kudankulam NPP.

For Mains: Nuclear Energy - opportunities and challenges.

Energy is the most fundamental requirement of every society or nation as it progresses through the ladder of development.

In recent times, the world has been dealing with a power and energy crisis. While the factors that caused this emergency differ country to country, the **upshot has been a clamour to reduce dependence on fossil fuels** and look for viable alternatives.

In this context, **Nuclear Energy** has a lot to offer. On one side, it may be the **cheapest, greenest and safest source of energy** currently known to man. On the other, it has also been **responsible for some of the worst disasters** in the history of mankind

What are India's Initiatives Regarding Nuclear Energy?

- India has consciously proceeded to explore the possibility of tapping nuclear energy for the purpose of power generation.
    - In this direction a **three-stage nuclear power programme** was formulated by **Homi Bhabha** in the 1950s.
- The **Atomic Energy Act, 1962** was framed and implemented with the set objectives of using two naturally occurring elements **Uranium** and **Thorium** as nuclear fuel in Indian Nuclear Power Reactors.
- In December, 2021, the Government of India informed Parliament about building ten **indigenous** Pressurised Heavy Water Reactors (PHWRs) to be set up in fleet mode and had **granted "in principle approval" for 28 additional reactors,** including 24 to be **imported from France, the U.S. and Russia.**
- Recently, the Centre has given in-principle (first step) approval for setting up of **six nuclear power reactors at Jaitapur in Maharashtra.**
    - Jaitapur would be the **world's most powerful nuclear power plant**. There would be six state-of-the-art **Evolutionary Power Reactors (EPRs)** with an installed capacity of 9.6 GWe that will produce low carbon electricity.
    - The six nuclear power reactors, which will have a capacity of 1,650 MW each, will be set up

with **technical cooperation from France.**

Why Nuclear Energy?

- **Availability of Thorium:** India is the **leader of the new resource of nuclear fuel called Thorium,** which is considered to be the **nuclear fuel of the future.**
  - With the availability of Thorium, India has the **potential to be the first nation** to realise the **dream of a fossil fuel-free nation.**
- **Cuts Import Bills:** Nuclear energy will also **relieve the nation of about $100 billion annually** which we spend on importing petroleum and coal.
- **Stable and Reliable Source:** The greenest sources of power are definitely solar and wind. But solar and wind power, despite all their advantages, are not stable and are dependent excessively on weather and sunshine conditions.
  - Nuclear power, on the other hand, **provides a relatively clean, high-density source of reliable energy** with an international presence.
- **Cheaper to Run:** Nuclear power plants are **cheaper to run than their coal or gas rivals.** It has been estimated that even factoring in costs such as managing radioactive fuel and disposal nuclear plants cost between **33 to 50% of a coal plant and 20 to 25% of a gas combined-cycle plant.**

What are the Challenges to Adoption of Nuclear Energy?

- **Capital Intensive:** Nuclear power plants are capital intensive and recent nuclear builds have suffered **major cost overruns**. An illustrative example is the V.C. Summer nuclear project in South Carolina (U.S.) where **costs rose so sharply that the project was abandoned — after an expenditure of over $9 billion.**
- **Insufficient Nuclear Installed Capacity**: In 2008, the **Atomic Energy Commission** projected that India would have 650GW of installed capacity by 2050; **the current installed capacity is only 6.78 GW.**
  - Such targets were based on the expectation that India would import many light-water reactors after the **India-U.S. civil nuclear deal.** But, the **deal has not led to the establishment of a single new nuclear plant,** over 13 years after it was concluded.
- **Lack of Public Funding:** Nuclear power has **never received the quantum of generous subsidy the fossil fuel received** in the past and renewable is receiving currently.
  - In absence of public funding, nuclear power will find it tough to compete against natural gas and renewables in the future.
- **Acquisition of Land:** Land acquisition and selection of location for Nuclear Power Plant (NPP) is also a **major problem in the country.**
  - NPP's like **Kudankulam in Tamil Nadu** and Kovvada in Andhra Pradesh have **met with several delays** due to the land acquisition related challenges.
- **Impact of Climate Change:** Climate change will **increase the risk of nuclear reactor accidents.** During the world's **increasingly hot summers,** several nuclear power plants have already had to be **temporarily shut down** or taken off the grid.
  - Further, nuclear power plants **depend on nearby water sources to cool their reactors,** and with many rivers drying up, those **sources of water are no longer guaranteed.**
  - The frequency of such extreme weather events is likely to increase in the future.
- **Deployment at Insufficient Scale:** It might not be the appropriate choice for mitigating **India's carbon emissions** since it **cannot be deployed at the necessary scale.**
- **Nuclear Waste:** Another side effect of nuclear power is the **amount of nuclear waste it produces.** Nuclear waste can have drastically **bad effects on life, causing cancerous growths,** for instance, or causing **genetic problems** for many generations of animals and plants.
  - In a densely populated country such as India, land is at a premium and **emergency health care is far from uniformly available.**

What Steps Can Be Taken?

- **Subsidy on Nuclear Electricity:** Electricity from the nuclear reactors would **cost at least ₹ 15**

per unit excluding transmission costs, whereas the recent low bids for solar power stand at ₹2.14 per unit and ₹2.34 for solar-wind hybrid projects.
    - If nuclear electricity is to be sold at a competitive rate, it would have to be **greatly subsidised by the Indian government,** which operates all nuclear plants through the Nuclear Power Corporation of India.
- **Addressing the Pre-Project Issues:** The government must address issues related to the pre-project activities such as **land acquisition at new sites, clearances from various ministries** especially from the environment ministry and **finding timely foreign collaborators.**
    - In addition, continuous efforts must be made to **bring down the capital cost of nuclear power plants.**
- **Addressing Safety Concerns:** Safety which is a major concern should be addressed on priority basis.
    - Complete phasing out of nuclear power generation for the fear of nuclear accident would be a wrong move.
        - If nuclear energy is generated **adhering to the highest standards of safety**, there is **less possibility of catastrophic accidents.**
    - In this regard, setting up a **Nuclear Safety Regulatory Authority** at the earliest would be helpful to the nuclear power programmes in the country.
- **Technological Support:** Reprocessing and enrichment capacity also require boost in India. For this **India needs advanced technology to fully utilise the spent fuel** and for enhancing its enrichment capacity.

Conclusion

India is blessed with the rare, and very important, nuclear fuel of the future – Thorium. It cannot afford to lose the opportunity to emerge as the energy capital of the world, which coupled with the largest youth power, will be India's answer to emerge as the leading economy of the world.

Drishti Mains Question

"India is blessed with the rare, and very important, nuclear fuel of the future. Complete phasing out of nuclear power generation for the fear of nuclear accident would be a wrong move". Discuss.

PYQ

Q. Consider the following countries: (2015)

1. China
2. France
3. India
4. Israel
5. Pakistan

Which among the above are Nuclear Weapons States as recognized by the Treaty on the Non-Proliferation of Nuclear Weapons, commonly known as Nuclear Non-Proliferation Treaty (NPT)?

(a) 1 and 2 only
(b) 1, 3, 4 and 5 only
(c) 2, 4 and 5 only
(d) 1, 2, 3, 4 and 5

Ans: (a)

- France and China along with USA, UK and Russia are the five Nuclear Weapons States as recognized by the Treaty on the Non-Proliferation of Nuclear Weapons or the Nuclear Non-Proliferation Treaty (NPT). **Hence, 1 and 2 are correct.**
- The NPT is a landmark international treaty whose objective is to prevent the spread of nuclear

weapons and weapons technology, to promote cooperation in the peaceful uses of nuclear energy and to further the goal of achieving nuclear disarmament.
- India, Israel, Pakistan and North Korea are the countries that have nuclear weapons, but have not signed the NPT. **Hence, 3, 4, 5 are not correct.**
- **Therefore, option (a) is the correct answer.**

Q. To meet its rapidly growing energy demand, some opine that India should pursue research and development on thorium as the future fuel of nuclear energy. In this context, what advantage does thorium hold over uranium? (2012)

1. Thorium is far more abundant in nature than uranium.
2. On the basis of per unit mass of mined mineral, thorium can generate more energy compared to natural uranium.
3. Thorium produces less harmful waste compared to uranium.

Which of the statements given above is/are correct?

(a) 1 only
(b) 2 and 3 only
(c) 1 and 3 only
(d) 1, 2 and 3

Ans: (d)

- According to the UN nuclear agency IAEA (International Atomic Energy Agency), there are many benefits with Thorium compared to Uranium, which is currently used in nuclear reactors.
- Thorium is four times more abundant in nature than Uranium, and is widely distributed throughout the Earth's crust. **Hence, statement 1 is correct.**
- Thorium fuel generates less harmful waste compared to natural Uranium and most importantly, no new weapon-grade material is present in the waste profile; the waste consists of the radioisotope Uranium-233, or U233, which is virtually impossible to weaponise. **Hence, statement 3 is correct.**
- Thorium fuel generates more energy per unit of mass than Uranium fuel by a factor of approximately 30. **Hence, statement 2 is correct.**
- **Therefore, option (d) is the correct answer.**