



## EDITORIAL ANALYSIS

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### India Needs to Go Nuclear

**Syllabus: GS3/Energy, Space, Defence**

**In Context**

- India's emerging economy demands rapid deployment of new nuclear-energy capacity.

**India's emerging economy & rising energy consumption**

- India's economy is **growing rapidly**. It is **expected to surpass Germany and Japan** and move up from number five to number three position before the end of this decade.
- **Demand for energy:**
  - Economic growth triggers demand for energy.
  - One would thus **expect significant growth in our primary energy consumption** which is already the third-highest globally. Most of this is based on fossil energy.
- **Issues with conventional energy sources:**
  - Fossil fuel consumption is a major contributor to global warming, which has now become an existential crisis for humanity. Deep and immediate emission cuts, leading to net zero, have become unavoidable.
- **The challenge of net zero target:**
  - Transition to net zero involves massive transformation of energy systems, involving new technologies, restructuring of energy systems at supply-and-demand ends and large costs.
  - For a large and developing country like India, the challenge of reaching net zero is much bigger.
- **Nuclear energy as the answer:**
  - While we are rightfully making rapid strides in deployment of renewable energy including hydro, this alone would not enable us to become an advanced country.
  - The only way out then is a rapid scale-up of nuclear energy.

**Advantages of Nuclear Power**

- **Efficient power supplier:**
  - Nuclear power has **higher energy density** as it requires a lesser **quantity of fuel** than other sources of power like coal or natural gas based power plants.

- It is especially suitable for space missions which must not have bulky cargo, making it difficult for them to escape the earth's gravity.
- **Co-existence with other power sources:**
  - A lot of countries claim that nuclear power would be **good to have in the mix** because it is firm, dispatchable power, while wind and solar are intermittent or variable.
    - **Firm power** is the power that can be sent to the electric grid to be supplied whenever needed.
- **Efficiency of newer machines:**
  - Older designs required active cooling pumps, but the world now has systems which, even if the power fails, will gradually and gracefully control temperature, waste-heat, etc.
  - The worst sort of accident in history, Chernobyl, was a design that will never get repeated again.
- **Advantage over coal-based thermal power plants:**
  - **Lower emissions:**
    - India's nuclear power sector is saving 41 million tonnes of carbon dioxide emissions annually, compared to emissions that would have been generated by equivalent electricity generation from coal-based thermal power plants.
  - **Ash Waste - significant polluter:**
    - Looking at many of the power plants in India, they have huge ash ponds. In some cases, the size of the ash pond is bigger than the size of the plant.
    - Ash also contains many heavy metals, which are detrimental to the water source.

## Challenges

- **Construction costs & delay:**
  - Building a nuclear power plant can be discouraging for stakeholders. Conventional reactor designs are considered multi-billion dollar infrastructure projects.
  - High capital costs, licensing and regulation approvals, coupled with long lead times and construction delays, have also deterred public interest.
- **Impact on the environment:**
  - The most significant impact on the environment stems from the destructive process of uranium mining.
  - Batteries required for the reactors are very expensive and have an environmental impact.
- **Generation of radioactive waste**
  - While no emissions are produced in nuclear energy generation, a bi-product of radioactive waste is developed.
  - The waste must be stored in secure facilities to avoid polluting the environment.
  - Radiation is not harmful in small quantities, but radioactive waste from nuclear plants is hazardous.
- **Safety issue:**

- Resistance to nuclear energy is also driven by fears about safety, nuclear proliferation, or some other concern.
- **Global examples:**
  - Germany has switched off its three remaining nuclear power plants as part of a long-planned transition toward renewable energy.

### **Suggestions**

- **Need of a national strategy:**
  - It would be worthwhile to pursue a national strategy for a rapid scale up of nuclear energy.
- **Building indigenous reactors:**
  - Building indigenous Small Modular Reactors (SMRs) at a large number of sites that would be vacated by retiring coal plants in the coming decades.
  - Industrial partners could be involved in the process.
- **High temperature reactor for hydrogen production:**
  - Developing a high temperature reactor for direct hydrogen production without resorting to electrolysis.
  - This would enable cheaper green hydrogen production and reduce pressure on excessive electrification of the energy system in the country, which otherwise appears inevitable.
  - Bhabha Atomic Research Centre has the requisite capability.
- **Speeding up existing nuclear-power programs:**
  - Speeding up second and third stage nuclear-power programme development to unleash thorium energy potential in accordance with the pre-existing plans for long-term sustainable energy supply.
- **Initiating global efforts to address climate change challenge:**
  - Emerging-economy countries, where one expects maximum net growth in energy consumption, should see rapid deployment of new nuclear-energy capacity to credibly address the climate-change challenge at the global level.
  - India should seize this opportunity through piloting a major international co-operation for global efforts to address climate change challenges.

### **Way ahead**

- Leveraging nuclear energy in a significant way is inevitable.
- A large and growing economy like India can certainly implement this, provided it is driven as a national programme guided by a bold policy support that provides a level playing field for nuclear energy on par with renewable energy.

### **What is Nuclear Energy?**

- Nuclear energy is the **energy source found in an atom's nucleus, or core**. Once extracted, this energy can be **used to produce electricity** by creating nuclear fission in a reactor through two kinds of atomic reaction:
  - **Nuclear fusion and nuclear fission**: During the latter, uranium used as fuel causes atoms to split into two or more nuclei.
- The energy released from fission generates heat that brings a **cooling agent**, usually **water**, to boil.
- The **steam deriving from boiling** or **pressurised water** is then channelled to spin turbines to generate electricity.
  - To produce nuclear fission, reactors make use of **uranium as fuel**.

### **Daily Mains Questions**

**[Q]** India's emerging economy demands rapid deployment of new nuclear-energy capacity. Examine. Suggest a framework for a national strategy to rapidly scale up nuclear energy.