Science & Technology · GS - III

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

EXAM YEAR	PAPER	SUBJECT
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MARKS	WORD LIMIT
15	~250 words

Answer Hint

Rising electricity demand; low-carbon baseload power; energy security; uranium and thorium; nuclear safety; radioactive waste; capital costs; public acceptance

Model Answer

Introduction

India needs reliable electricity to sustain economic growth while reducing emissions. Nuclear power offers low-carbon electricity, but its expansion requires careful assessment of safety, costs and waste management.

Reasons to Expand Nuclear Energy

1. **Low-carbon generation:** Nuclear plants produce electricity with very low operational greenhouse-gas emissions.
2. **Reliable baseload power:** They can generate electricity continuously, complementing variable solar and wind power.
3. **Energy security:** Nuclear power diversifies the energy mix and can reduce dependence on fossil fuels.
4. **Technological capability:** Indigenous reactor development and the long-term thorium programme offer strategic opportunities.
5. **Land-use considerations:** Nuclear plants can generate substantial electricity from comparatively compact sites.

Facts and Fears

1. **Accident risk:** Events such as Fukushima and Chernobyl demonstrate the potentially severe consequences of nuclear accidents, although accident probability depends on design, operation and regulation.
2. **Radioactive waste:** Spent fuel and other radioactive materials require secure handling, storage and long-term management.
3. **High costs:** Large upfront investment, long construction periods and financing risks can make nuclear projects expensive.
4. **Water requirements:** Many reactors need substantial cooling water, creating challenges in water-stressed locations.
5. **Proliferation and security:** Nuclear materials and facilities require stringent safeguards against theft, sabotage and misuse.
6. **Public acceptance:** Communities may oppose projects because of safety concerns, land acquisition and emergency preparedness.

Way Forward

Expand nuclear capacity through transparent regulation, independent safety oversight, robust emergency plans and secure waste management. Compare projects with alternatives on lifecycle costs, environmental impact and grid requirements. Continue investment in renewables, storage and grid modernisation.

Conclusion

India should expand nuclear energy selectively where it is safe, economically justified and environmentally sustainable. A diversified energy mix is more resilient than dependence on any single source.

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