Science & Technology · GS - III

The fusion energy programme in India has steadily evolved over the past few decades. Mention India's contributions to the international fusion energy project - International Thermonuclear Experimental Reactor (ITER). What will be the implications of the success of this project for the future of global energy?

EXAM YEAR	PAPER	SUBJECT
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MARKS	WORD LIMIT
10	~150 words

Answer Hint

ITER, nuclear fusion, tokamak, cryostat, in-wall shielding, cryogenics, Aditya-U, clean energy, energy security, decarbonisation

Model Answer

Introduction

ITER is an international experiment designed to demonstrate the scientific and technological feasibility of fusion energy. India joined the ITER project in 2005 and contributes through technology, components and skilled manpower.

1. India's contributions

India's major contributions include the cryostat, in-wall shielding for the vacuum vessel, cooling-water and cryogenic systems, diagnostic systems and the diagnostic neutral beam. Indian companies such as L&T and Inox India have supplied major systems. India's domestic Aditya tokamak programme has also supported fusion

expertise.

2. Global implications of successful fusion

Successful fusion could provide:

1. A low-carbon source of large-scale energy.
2. Reduced dependence on fossil fuels.
3. Greater long-term energy security.
4. Lower greenhouse-gas emissions.
5. Diversification of the global energy mix.
6. Technological advances in superconductors, cryogenics and plasma science.

However, commercial fusion would still require further advances in cost, materials, reactor durability and fuel-cycle management.

Conclusion

ITER's success would not immediately replace conventional energy, but it could establish the technological foundation for a future low-carbon energy system and significantly reshape global energy security.

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