



KAMARAJ IAS ACADEMY
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Thorium Molten Salt Reactor (TMSR)

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China successfully achieved the first-ever Thorium to Uranium fuel conversion in a Thorium Molten Salt Reactor (TMSR)

China's TMSR is currently the only operational molten-salt reactor in the world

The achievement of thorium-uranium conversion marks a milestone in TMSR development

About Thorium Molten Salt Reactor (TMSR)

It is **fourth-generation** advanced nuclear energy system that uses **high-temperature molten salt** as a coolant

Key Features: Cool without water, run at atmospheric pressure, deliver a high-temperature output, etc

Key Advantages:

- o **Passive Safety Features:** If an MSR is too hot, a salt plug melts, stopping the reaction

- o **Small High-Level Nuclear Waste Footprint:** Thorium generates fewer long-lived minor actinides (radioactive metallic elements) than plutonium fuels.

- o **Other:** Extract more energy from fuel, etc

Thorium Fuel

Thorium has to be converted to **Uranium-233** in a reactor before it can be used as fuel.

- o Thorium-232 is the only naturally occurring isotope of thorium.

It is three times more abundant in nature than uranium

- o Despite its widespread availability, the metal's utilisation is restricted by its high extraction cost.

The **third stage of India's nuclear power program** envisages large scale power production from thorium

- o **Advanced Heavy Water Reactor**, currently under development with **Bhabha Atomic Research Centre (BARC)**, would serve as a technology demonstrator for thorium fuel cycle.

- o Also, India is developing an **Indian Molten Salt Breeder Reactor (IMSBR)**

Thorium reserves in India

India has the world's largest reserves of thorium

Kerala and Odisha have rich reserves of **monazite**, which contains about 8 – 10% thorium.

It is also found in Andhra Pradesh, Tamil Nadu, West Bengal and Jharkhand.

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