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ocean

TIDAL ENERGY



Why in the news?

Parliamentary Standing Committee on Energy submitted a report on 'Tidal Power Development in India.'



- There are three main types of ocean energy Wave, Tidal and Thermal Energy-
- The committee stated that the estimated potential of Tidal Energy is 12 GW and Wave Energy is 41 GW,
 - Potential of Ocean-Thermal energy has not been estimated till date





Ocean energy

Oceans' water movement creates a vast store of kinetic energy (energy in motion) in the various forms of renewable energy viz

wave energy,
tidal energy,
ocean current energy,
salinity gradient energy and
ocean thermal gradient energy
which can be harnessed to generate electricity.





Tidal Energy?

- Tidal energy is a form of power produced by the natural rise and fall of tides
 - Tidal energy is a renewable source of energy.
 - Tidal currents with sufficient energy for harvesting occur when water passes through a constriction, causing the water to move faster.



• There are currently three different ways to get tidal energy:

- Tidal Streams,
- Barrages, and
- Tidal Lagoons.

Tidal Streams

- turbines are placed in tidal streams.
- tidal generators produce a steady, reliable stream of electricity.



The environmental impact of turbines could be severe, depending on the size of the turbine and the site of the tidal stream.





Barrage

- uses a large dam called a barrage.
- Turbines inside the barrage harness the power of tides
- The barrage gates are open as the tide rises.
- The water is then released through the barrage's turbines, creating energy at a rate that can be controlled by engineers.



Environmental Impact of A Barrage

- The environmental impact of a barrage system can be quite significant.
- The change in water level in the tidal lagoon might harm plant and animal life.
- The salinity inside the tidal lagoon lowers, which changes the organisms that are able to live there.
- Turbines move quickly in barrages, and marine animals can be caught in the turbine blades.



Tidal Lagoon

- A tidal lagoon is a body of ocean water that is partly enclosed by a natural or manmade barrier.
- A tidal energy generator using tidal lagoons would function much like a barrage.
- Unlike barrages, however, tidal lagoons can be constructed along the natural coastline.
- The lagoon turbines work as the lagoon is filling and emptying and generate continuous power.
- The environmental impact of tidal lagoons is minimal.

The lagoons can be constructed with natural materials like rock.



Tidal energy in India



Gulf of Cambay/Khambat

- Maximum Tidal Range: 11m
 Average Tidal Rang: 6.77
- Average final Kalig: 0.1
- Potential: 7000MW

<u>Gulf of Kutch</u> • Maximum Tidal Range: 8m • Average Tidal Rang: 5.23 • Potential: 1200MW

• Maximum Tidal Range: 5m • Average Tidal Rang: 2.97

Average Tidal Rang: 2.97Potential: 100MW

o The potential areas with low/medium tidal wave strength are:

Gulf of Khambat, Gulf of Kutch & southern regions in Gujarat.

✓ Palk Bay- Mannar Channel in Tamil Nadu.

✓ Hoogly river, South Haldia & Sunderbans in West Bengal.

India is expected to have 9 GW of tidal energy potential.



Other Types of Ocean Energy

- Waves Energy
- Ocean currents.
- Ocean Thermal Energy Conversion
- Salinity gradient

Wave Energy

This is generated by the movement of a device either floating on the surface of the ocean or moored to the ocean floor.







Osmotic Energy

This technique produces energy from the movement of water across a membrane between a saltwater reservoir and fresh water reservoir.

It is also called Salinity Gradient Energy.

Ocean Thermal Energy Conversion (OTEC)-

The temperature difference between warm surface waters and the cold deeper layers can be used to generate steam and then power.

•OTEC has a theoretical potential of 180 GW in India subject to suitable technological evolution.



Salient Features of ocean energy

Predictable and Reliable: Unlike wind, ocean energy sources are more predictable. The endless flows create a reliable supply source for future availability.

Global presence: Tidal streams and ocean currents are available almost everywhere across the globe.

Energy-rich: Moving water is more than 800 times denser than moving air, which multiplies the kinetic energy by the same factor and opens up the scope of huge amounts of energy.

Unlimited usage area: Land is a scarce resource for many regions so on-shore solutions have to compete and can extend to a limit but ocean energies are provided by the vast and deep oceans ending the competition.

Limitations of Ocean Energy

Deployment is currently limited in India and already deployed technologies are under utilized.

Either there is not much research done on the technologies or most are currently at the initial stage of R&D, demonstration and commercialization.

>Uncertainty of the marine environment and commercial scale risks like- corrosion of materials due to the salinity of seawater,

>offshore maintenance difficulties

Way Forward

- Reassessment of various forms of ocean energy: To explore the practically exploitable potential.
- o Site-specific tidal power development cost also needs to be reassessed to consider economic viability and long-term benefits.
- Set up demonstration/ pilot projects: To showcase proof-of-concept and commercial viability of tidal power.
- Non-solar Renewable Purchase Obligations (RPOs): Ministry should follow-up on inclusion of ocean energy under non-solar RPOs to ensure development of commercial tidal projects.
- Environmental Impact Assessment: Pragmatic assessment of environmental impact and ecological sustainability of ocean energy projects.

