



## Ocean Energy

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### Why in News?

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- Recently, the **Ministry of New and Renewable Energy** has declared **Ocean Energy** as **renewable** energy.
- Includes all forms of ocean energy such as **tidal, wave, current, ocean thermal etc** and makes them eligible for meeting the **non-solar Renewable Purchase Obligations (RPO)**.

### What is Ocean Energy?

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**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**.

### Types of Ocean Energy

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- **Tidal Energy**- Like conventional hydroelectric dams, power plants are built on river estuaries and hold back huge amounts of tidal water twice a day which generates electricity when released. India is expected to have 9,000 MW of tidal energy potential.
- **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.
- **Current Energy**- It is very similar to the wind above the oceans. Underwater turbines, large propellers tethered to the seabed, are moved with the marine currents to generate electricity. According to the **Intergovernmental Panel on Climate Change (IPCC)**, given the scale of open ocean currents, there is a promise of significant project scale growth when technologies harness lower-velocity currents.

### The Intergovernmental Panel on Climate Change (IPCC)

- It was created in **1988** by the **World Meteorological Organization (WMO)** and **the United Nations Environment Programme (UNEP)**.
- Currently has **195** members.
- Headquartered in **Geneva, Switzerland**.
- It has the objective to provide governments at all levels with **scientific information** that they can use to **develop climate policies**.
- It provides regular assessments of the scientific basis of climate change, its impact and future risks, and options for adaptation and mitigation.
- It gives the report on **Renewable Energy Sources and Climate Change Mitigation** among other various reports.

**Ocean Thermal Energy-** Oceans are huge heat reservoirs as they cover almost 70% of Earth's surface. The temperature difference between warm surface waters and the cold deeper layers can be used to generate steam and then power.

### **Ocean Thermal Energy Conversion (OTEC)**

- The technology which uses ocean temperature differences from the surface to depths lower than 1,000 meters, to extract energy.
- Research focuses on **two types of OTEC technologies-**
  - In **Closed cycle method**, a working fluid (ammonia) is pumped through a heat exchanger for evaporation and the steam runs a turbine. The vapour is turned back to fluid (condensation) by the cold water found at the depths of the ocean where it returns to the heat exchanger.
  - In **Open cycle method**, the warm surface water is pressurized in a vacuum chamber and converted to steam which runs the turbine. The steam is then condensed using cold ocean water from lower depths.
- It has high (94%) capacity factor which makes it the best power source and although it has a high initial cost, low maintenance and regular power supply makes it an attractive alternative.
- OTEC is supplied by an infinite supply of solar energy and the stored energy in it after sundown makes it a 24 hour power supplier.
- There are no emissions from the OTEC power plants so air quality will not be degraded.

**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**.

### **Salient Features**

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- **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.

## Objectives

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- To **accelerate and enhance support** for the resource assessment and deployment of ocean energy in the country.
- To harness the ocean energies for power generation and to overcome the barrier of energy deficiency.
- This sector has been **opened to the public and private sectors** so that more projects can be carried out in India.
- **Industry led research and development proposals are invited** from stakeholders, for solving problems in Indian conditions.

## Limitations

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- **Deployment is currently limited** in our country and already deployed technologies are under utilised.
- 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, the environmental impact on landscapes and the marine ecosystem and competition from other marine activities such as fishing.

## Potential

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- Total identified potential of **Tidal Energy** is about **12455 MW**, with potential locations identified at **Khambhat & Kutch regions**, and large backwaters, where barrage technology could be used.
- The total theoretical potential of **wave energy** is estimated to be about **40,000 MW**. This energy is however less intensive than what is available in more northern and southern latitudes.
- **OTEC** has a theoretical potential of **180,000 MW** in India subject to suitable technological evolution.

- Ocean energy has the potential to grow fully, **fuelling economic growth, reducing carbon footprint** and **creating jobs** not only along the coasts but also inland along its supply chains.

## Suggestions

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- India has a **long coastline** with the estuaries and gulfs which can be fully used to harness this energy.
- Tidal streams and ocean currents are huge and almost endless resources which can be used with relatively small environmental interactions for large scale electricity generation.
- Basic R&D is being looked after by **National Institute of Ocean Technology, Chennai under the Ministry of Earth Sciences** but more inputs by other prominent institutions will help us understand and develop the technologies faster.

## National Institute of Ocean Technology (NIOT)

- Established in **November 1993** as an **autonomous society** under the **Ministry of Earth Sciences**, Government of India.
- It aims to develop reliable indigenous technologies to solve various engineering problems associated with harvesting of non-living and living resources in the **Indian Exclusive Economic Zone**.

## Conclusion

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- Ocean energy technology can help India stimulate innovation, create economic growth and new jobs as well as to reduce its carbon footprint.
- It will also **help India to support its neighbouring countries who have energy deficits**, for their better economic growth and can guide them on their way to being self sufficient in energy sector.

*For Mind Map*