



## OTEC Plant in Lakshadweep

**For Prelims:** National Institute of Ocean Technology, Ocean Thermal Energy Conversion Plant, Deep Sea Mining, Deep Ocean Mission, DNA Bank

**For Mains:** Significance of harnessing Ocean Thermal Energy in tackling climate change

### Why in News?

Recently, the **National Institute of Ocean Technology**, an autonomous institute under the Union **Ministry of Earth Sciences (MoES)** is establishing an **Ocean Thermal Energy Conversion Plant** with a capacity of 65 kilowatts (kW) in Kavaratti, **Lakshadweep**.

- The plant will power the one lakh liter per day low temperature thermal desalination plant, which converts seawater into potable water.
- The plant is the first of its kind in the world as it will **generate drinking water from sea water using indigenous technology, green energy** and environmentally friendly processes.

### What is Ocean Thermal Energy Conversion?

- **About:**
  - Ocean Thermal Energy Conversion (OTEC) is a **process for producing energy by harnessing the temperature differences (thermal gradients) between ocean surface waters and deep ocean waters.**
    - Oceans are **huge heat reservoirs** as they **cover almost 70% of Earth's surface.**
  - Researchers focus on **two types of OTEC technologies-**
    - **Closed cycle method** - where 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.
    - **Open cycle method** - where 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.
- **Historical perspective:**
  - India initially had planned to set up an OTEC plant way back in 1980, off the Tamil Nadu coast. However, with the foreign vendor closing down its operation, it had to be abandoned.
- **India's OTEC Potential:**
  - As India is **geographically well-placed to generate ocean thermal energy, with around 2000 kms of coast length along the South Indian coast**, where a temperature difference of above 20°C is available throughout the year.
  - The total OTEC potential around India is estimated as **180,000 MW**, considering 40% of gross power for parasitic losses.

## How does an OTEC Plant Work?

### ▪ About:

- As the energy from the sun heats the surface water of the ocean. In **tropical regions, surface water can be much warmer than deep water.**
- This temperature difference can be **used to produce electricity and desalinate ocean water.**
  - Ocean Thermal Energy Conversion (OTEC) systems **use a temperature difference (of at least 77°F) to power a turbine to produce electricity.**
  - Warm surface water is pumped through an evaporator containing a working fluid. The vaporized fluid drives a turbine/generator.
  - Then the vaporized fluid is turned back to a liquid in a condenser cooled with cold ocean water pumped from deeper into the ocean.
  - OTEC systems **use seawater as the working fluid** and can use **condensed water to produce desalinated water.**

### ▪ Significance:

- Two of the biggest advantages of OTEC are that it produces **clean environmentally friendly renewable energy** and, unlike solar plants which can't work at night and wind turbines which only work when it's windy, **OTEC can produce energy at all times.**

## What are the Related Recent Initiatives of the Government?

### ▪ Deep Sea Mining:

- The MoES is developing technologies for [mining deep sea](#) resources like polymetallic nodules from the [Central Indian Ocean](#) at a water depth of 5,500 meters.

### ▪ Weather Forecasting:

- The ministry is also working on introducing **ocean climate change advisory services** for climate risk assessment due to [sea level rise](#); [cyclone intensity and frequency](#); **storm surges and wind waves**; biogeochemistry, and changing [harmful algal blooms](#) in the coastal waters of India.

### ▪ Deep Ocean Mission:

- MoES is trying to design and develop a **prototype crewed submersible rated for 6,000 meters of water depth** under the [Deep Ocean Mission](#).
- It will include technologies for underwater vehicles and underwater robotics.

### ▪ DNA Bank:

- There efforts are being made to improve the detection, sampling and **DNA storage** of benthic fauna of the northern Indian Ocean through systematic sampling using a remotely operated vehicle.

## National Institute of Ocean Technology (NIOT)

- It was 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.**

## UPSC Civil Services Examination Previous Year Question (PYQ)

### Prelims

**Q. Where was the first desalination plant in India to produce one lakh litres freshwater per day based on low temperature thermal desalination principle commissioned? (2008)**

- (a) Kavaratti
- (b) Port Blair
- (c) Mangalore
- (d) Valsad

**Ans: (a)**

**Exp:**

- The National Institute of Ocean Technology (NIOT), Chennai has **developed the world's first Low Temperature Thermal Desalination (LTTD) plant in Kavaratti, the capital of Lakshadweep** to cater to the requirements of the local population of Karavatti, Minicoy and Agatti.
- The reverse osmosis, a membrane process which is globally accepted technology suitable for desalination of saline water, is quite different from LTTD technology.
- The LTTD is a process under which the warm surface sea water is flash evaporated at low pressure and the vapour is condensed with cold deep sea water.
- The LTTD technology does not require any chemical pre and post-treatment of seawater and thus the pollution problems are minimal and the process is suitable for island territories. Since no effluent treatment is required, it gives less operational maintenance problems compared to other desalination processes. **Therefore, option (a) is the correct answer.**

**Source: DTE**

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