



## Geothermal Power in Ladakh

**For Prelims:** Geothermal Energy, Geography of Ladakh

**For Mains:** Geothermal Energy, It's Uses & Benefits, Significance of Geothermal Energy for India

### Why in News?

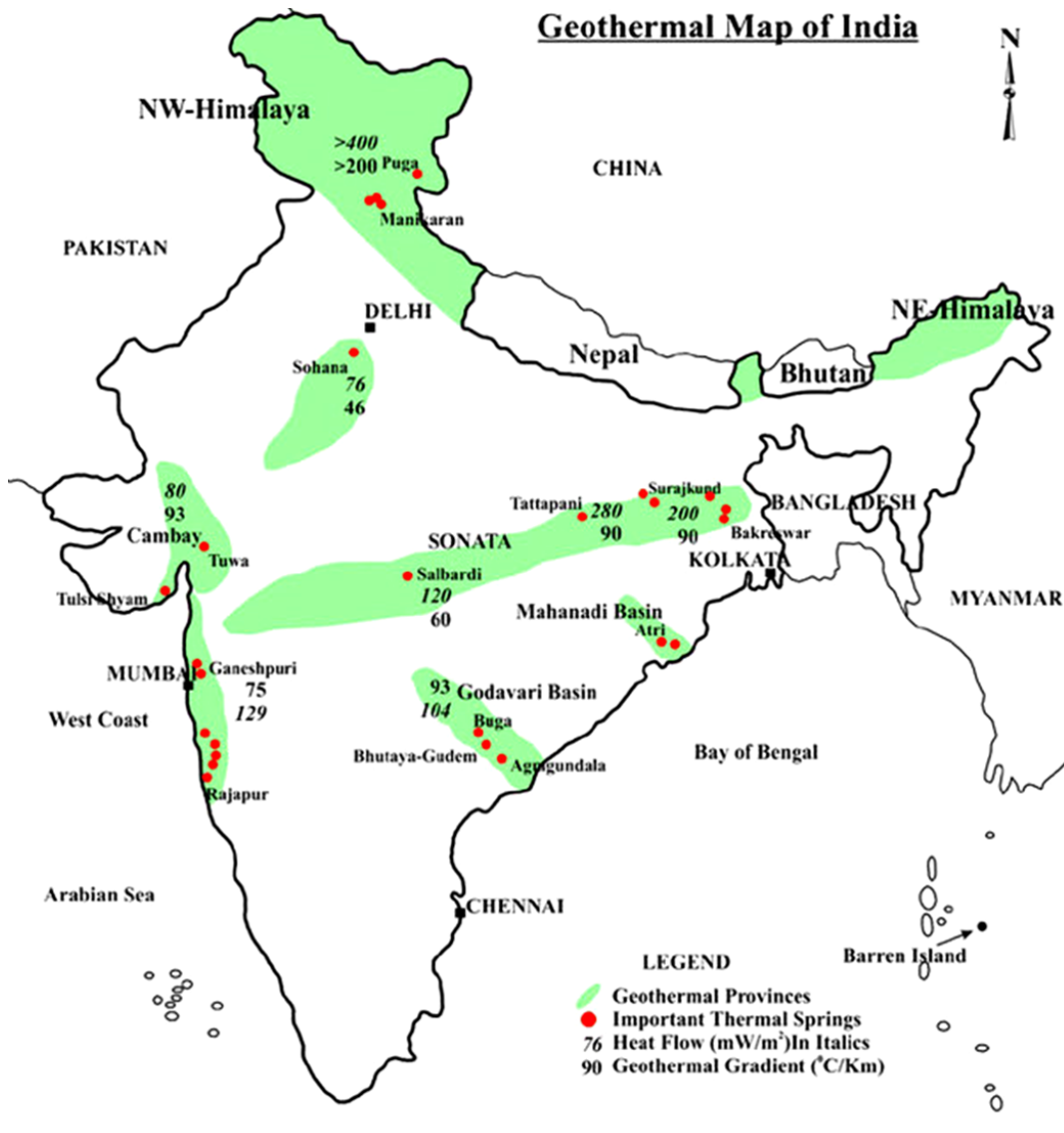
**State-run explorer [Oil and Natural Gas Corporation \(ONGC\)](#)** will be participating to generate electricity through **[Geothermal Energy](#)** at Puga, a remote valley located in Ladakh, off the road to Chumar on the de-facto border with China.

### What do we need to know about the Puga Project?

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## Geothermal Map of India



### ▪ About Puga Valley:

- Puga Valley is situated in the **Changthang Valley** in the south-eastern part of Ladakh, about 22 km away from the **Salt Lake Valley**.
- It is a region of great significance known for its **natural beauty and geothermal activities**.
- Puga is also visited for its **hot sulphur spring**.

### ▪ About Geothermal Project:

- It will be India's **first geothermal energy project** and also the **world's highest at 14,000ft**.
- ONGC has started drilling its first well for the project and encountered **high-pressure steam at 100 degrees Celsius** with a discharge rate of 100 tonne geothermal energy per hour, **considered as a good sign for the project**.

### ▪ Phases:

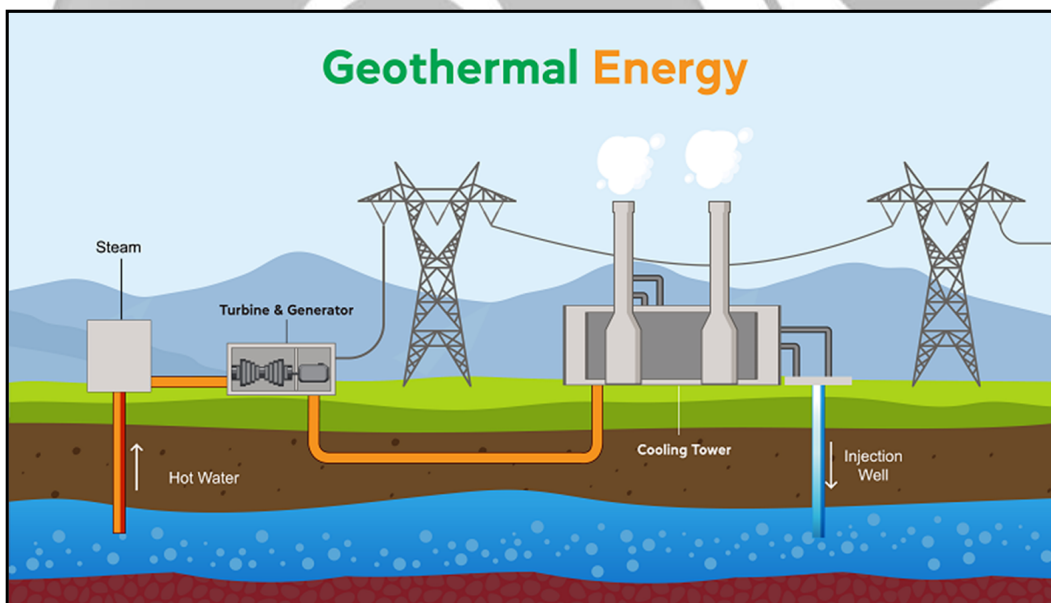
- In the first phase, the company will drill 1,000-metre-deep wells to run a **one-megawatt power plant as a pilot**.
- The second phase envisages a **deeper exploration of the geothermal reservoir** and a higher capacity demonstration plant.
- The third phase would involve commercial development of the geothermal plant.

### ▪ Benefits:

- It will **boost Ladakh's potential to emerge as one of the country's clean energy bowl** by expanding the area's horizon beyond **solar** or **wind power**.
- The pilot plant provides **power and heating needs** of the nearby settlements of Tibetan pastoralist refugee settlements at Sumdo and nearby areas.

- A bigger plant will provide **24X7 supply for the far-flung settlements and the large defence establishment in the eastern sector**, reducing their dependence on **diesel for running generators**.
- The plant can also play a vital role as a **stabiliser for the 15-gigawatt solar/wind project** being planned in the nearby Morey plains in the southwest.
- **Status of Geothermal Energy:**
  - **National:**
    - Geological Survey of India has identified about 340 geothermal hot springs in the country. Most of them are in the low surface temperature range from 370C to 900C, which is suitable for direct heat applications.
      - The potential for power generation at these sites is about 10,000 MW.
    - The hot springs in the country are grouped into seven geothermal provinces:
      - Himalayan, Sahara Valley, Cambay Basin, San-Narmada -Topi lineament belt, West Coast, Godavari Basin and Mahanadi Basin.
    - **Some of the prominent places where a power plant can be established based on geothermal energy are:**
      - Manikaran in Himachal Pradesh
      - Jalgaon in Maharashtra
      - Tapovan in Uttarakhand
      - Bakreshwar in West Bengal
      - Tuwa in Gujarat
  - **Global:**
    - Gigawatt-Size Geothermal Capacities:
      - The US:
        - The US leads the world in the amount of geothermal electricity generation.
      - Indonesia:
        - Indonesia was the second-largest geothermal electricity producer.
      - Philippines
      - Turkey
      - New Zealand
    - Mexico and Italy have 900 megawatt-plus capacity, while Kenya has over 800 mw, followed by Iceland, Japan and others.

## What is Geothermal Energy?



- **About:**
  - Geothermal energy is the **heat from the earth**. This heat is used for bathing, to heat buildings, and to generate electricity.
  - The word geothermal comes from the Greek words **geo (earth)** and **therme (heat)**, and

geothermal energy is a [renewable energy source](#) because heat is continuously produced inside the earth.

▪ **Sources:**

- **Hot water or steam reservoirs** deep in the earth are accessed by **drilling**.
- Geothermal **reservoirs located near the earth's surface**, mostly located in the western U.S., Alaska, and Hawaii.
- The **shallow ground near the Earth's surface that maintains a relatively constant temperature** of 50-60°F.

▪ **Uses:**

- Hot water and steam from reservoirs can be used to **drive generators and produce electricity for consumers**.
- Other applications apply the **heat produced from geothermal directly to various uses** in buildings, roads, agriculture, and industrial plants.
- The heat can also be used directly from the ground to provide **heating and cooling in homes and other buildings**.

▪ **Benefits:**

◦ **Renewable Source:**

- Through **proper reservoir management**, the rate of energy extraction can be balanced with a reservoir's natural heat recharge rate.

◦ **Continuous Supply:**

- Geothermal power plants **produce electricity consistently, running 24 hours per day/7 days per week**, regardless of weather conditions.

◦ **Reduced Import Dependency:**

- Geothermal resources **can be harnessed for power production** without importing fuel.

◦ **Small Footprint:**

- Geothermal power plants are **compact and use less land per GWh** (404 m<sup>2</sup>) than coal (3642 m<sup>2</sup>) wind (1335 m<sup>2</sup>) or solar PV with center station (3237 m<sup>2</sup>). \*

◦ **Clean Energy:**

- Modern **closed-loop geothermal power plants** emit **no greenhouse gasses**; life cycle GHG emissions (50 g CO<sub>2</sub> eq/kWhe) are four times less than solar PV, and six to 20 times lower than natural gas.
- Geothermal power plants **consume less water** on average over the lifetime energy output than the most conventional generation technologies.

▪ **Disadvantage:**

- If harnessed incorrectly, it can sometimes produce pollutants.
- Improper drilling into the earth can release hazardous minerals and gases deep inside the earth.

## What is ONGC?

- ONGC is a **public sector petroleum company**.
- **Under the leadership of Pandit Jawaharlal Nehru**, the foundation stone of ONGC was laid in 1955 as the Oil and Gas Division under the [Geological Survey of India](#).
- It may be noted that on 14<sup>th</sup> August 1956, it was renamed as the Oil and Natural Gas Commission and in 1994 the Oil and Natural Gas Commission was converted into a corporation.
- In the year 1997 it was accepted as one of the Navaratnas by the Government of India, while in the year 2010 it was given the status of [Maharatna](#).

## UPSC Civil Services Examination, Previous Year Questions (PYQs)

### Q. Consider the following: (2013)

1. Electromagnetic radiation
2. Geothermal energy

3. Gravitational force
4. Plate movements
5. Rotation of the earth
6. Revolution of the earth

**Which of the above are responsible for bringing dynamic changes on the surface of the earth?**

- (a) 1, 2, 3 and 4 only  
(b) 1, 3, 5 and 6 only  
(c) 2, 4, 5 and 6 only  
(d) 1, 2, 3, 4, 5 and 6

**Ans: (d)**

**Explanation:**

- The Earth's surface is dynamic. The Earth's surface is being continuously subjected to by external forces (exogenic forces) originating above the earth's surface, mainly induced by the energy of the Sun and by internal forces (endogenic forces) from within the earth.
- Endogenic Processes
  - The energy emanating from within the earth is the main force behind endogenic geomorphic processes.
  - This energy is mostly generated by radioactivity, release of electromagnetic energy, rotational and tidal friction and primordial heat from the origin of the Earth.
  - This energy is due to geothermal gradients and heat flow from within the earth.
  - Endogenic process has induced volcanism and associated geothermal phenomena like geysers, hot water springs, etc.; earthquakes; plate movements resulting in the creation of different landforms (mountains, hills, plateaus, etc.) and water bodies (sea, ocean, lake, etc.).
- Exogenic Processes
  - The exogenic processes derive their energy from atmosphere determined by the ultimate energy from the Sun, e.g., weathering and erosion.
  - Temperature and precipitation are the two important climatic elements that control various processes.
- Seasonal and diurnal variation on Earth is due to revolution and rotation of Earth respectively.
- **Therefore, option (d) is the correct answer.**

**Source: TOI**

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