



Tapping into Helium Reserves

For Prelims: Helium, Carbon footprint, Radioactive elements, Nuclear magnetic resonance (NMR)

For Mains: Significance of Helium Gas, Uses of Helium, Shortage of Helium.

Why in News?

Researchers propose a **new model to tap into [helium](#) reserves to address shortage issues** and a recent new study suggests that reservoirs of this gas, with **no [carbon footprint](#)**, likely exist in geological formations beneath the Earth.

- The helium production process comes with a high carbon footprint as **its production is related to drilled natural gas or oil**.

What is the Proposed Model to Tap Helium Reserve?

- The **gas can be produced and stored in crystalline basement rocks**, dense rocks that extend from the mantle to the near-surface or surface.
 - These rocks naturally contain **uranium and thorium**, both of which decay to form helium naturally.
- These rocks are **30-40 kilometre thick**. They have also existed for millions or billions of years, allowing large amounts of helium to be produced and stored.
- Also, these rocks could also be a source of hydrogen. The model showed that **energy generated from the radioactive decay of uranium and thorium** could split water to form hydrogen.

What is the Significance of Helium Gas?

- **About:**
 - Helium is a **noble gas and has a closed-shell electronic configuration**, making it stable and unreactive.
 - It has the **lowest boiling and melting points of any element** and exists only as a gas, except under extreme conditions.
- **Discovery of Helium:**
 - Helium was **first discovered in 1868 by French astronomer Jules Janssen and English astronomer Joseph Norman Lockyer**, who observed a yellow spectral line in the light emitted by the sun during a solar eclipse.
 - Helium gets its name from the **Greek word "helios," which means [sun](#)**.
- **Sources and Extraction of Helium:**
 - Helium is the **second most abundant element in the universe**, after hydrogen. However, **it is relatively rare on Earth, with most of it being produced by the decay of [radioactive elements](#)** in the Earth's crust.
 - Natural gas is the primary source of helium on Earth.
 - Helium is extracted from natural gas using a process called **[cryogenic distillation](#)**.
- **Reserves and Production:**

- As of 2022, the reserves of helium in the **United States has the largest reserves of helium** globally followed by Algeria and Russia.
- **India's Rajmahal volcanic basin in Jharkhand** is the **storehouse of helium** trapped for billions of years.
- **Uses of Helium:**
 - **Balloons and airships** (because it is lighter than air and does not react chemically with other elements).
 - **Industrial applications**, including **welding, cooling, and as a protective gas** in the production of semiconductors and fiber optic cables.
 - In **medical applications**, such as **magnetic resonance imaging (MRI)**, as a cooling agent for superconducting magnets.
 - It is also used in [nuclear magnetic resonance \(NMR\)](#) spectroscopy and as a carrier gas in gas chromatography.
- **Shortage of Helium:**
 - There is currently a shortage of helium in the world, with **demand outstripping supply**.
 - The shortage is due to a variety of factors, including the **shutdown of some helium plants, the increasing demand for helium in emerging economies**, and the lack of new helium sources.
 - The shortage of helium has led to concerns about its use in balloons and airships, as well as its use in medical and industrial applications.

Conclusion

The proposed model for tapping into **carbon-free helium reserves** could provide a **sustainable and cost-effective solution** to the current helium shortage, with the added benefit of hydrogen production.

[Source: DTE](#)

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