



## India's First Small-Scale LNG Unit in Madhya Pradesh

**For Prelims:** First Small-scale Liquefied Natural Gas Unit in India, Composition of Natural Gas, LNG And CNG, [BioCNG](#), Major Applications of LNG.

**For Mains:** Challenges Related to LNG, Need for Small-Scale LNG.

[Source: IE](#)

### Why in News?

The **Union Minister for Petroleum and Natural Gas** recently inaugurated India's first **small-scale liquefied natural gas (SSLNG)** unit at GAIL (India) Ltd's Vijaipur complex in Madhya Pradesh.

- This development is part of the government's broader initiative to promote the **use of natural gas** in various sectors and increase its share in the country's primary energy mix to **15% by 2030**.

### What is LNG and SSLNG?

- **About:** Liquefied natural gas (LNG) is natural gas that has been cooled to a liquid state, about **-260°F (-162°C)**, to make it easier and safer to store and transport.
  - Natural gas is a cleaner and more economical alternative to conventional hydrocarbons like **coal and oil**, making it crucial in India's transition towards greener energy sources.
    - The primary component of natural gas is **methane**, comprising 70-90% of its composition.
  - According to the IEA, Natural gas accounts for about a quarter of global electricity generation.
    - Presently in India the share of natural gas in the energy basket is **6.7%**.
  - The top natural gas producing countries are the **United States, Russia and Iran**.
- **Small-Scale LNG:** SSLNG involves **liquefying and transporting natural gas on a smaller scale**, catering to areas without pipeline connections using specialised trucks and vessels.
  - Starting from large-scale LNG import terminals, **SSLNG can supply LNG directly to consumers via cryogenic road tankers** or small vessels, either as a liquid or regasified for traditional uses.
  - It will lead to reduced dependency on **costly gas imports**, especially if it replaces a significant portion of **diesel consumption**, leading to substantial foreign exchange savings.
    - It also promotes cleaner energy and supports India's transition towards sustainable fuel sources.
- **Major Applications:**
  - **Transportation:**
    - **Marine Fuel:** LNG is increasingly used as a fuel for ships and vessels, especially in **emission-controlled areas**, due to its lower emissions of sulphur oxides (SOx) and particulate matter compared to traditional marine fuels.
    - **Road Transport:** LNG is used as a fuel for **trucks, buses, and other heavy-**

**duty vehicles**, offering reduced emissions of nitrogen oxides (NOx), particulate matter, and greenhouse gases compared to diesel.

- **Industrial Applications:**
  - **Power Generation:** LNG is used in [gas-fired power plants](#) to generate electricity, providing a cleaner alternative to coal or oil-fired power plants with lower emissions of pollutants.
  - **Heating and Cooling:** LNG can be used in industrial processes for **heating and cooling applications**, such as in manufacturing, food processing, and refrigeration.
- **Energy Storage and Backup:**
  - **Renewable Energy Integration:** LNG can complement [renewable energy sources](#) like wind and solar by providing backup power when renewable generation is intermittent or unavailable.
- **Related Challenges:**
  - **High Costs:** Building LNG liquefaction and regasification facilities is expensive. Additionally, the transportation process itself requires specialised cryogenic (super cold) carriers, further adding to the cost.
    - Countries like China have successfully integrated LNG in commercial vehicles, but India faces challenges such as **limited availability of LNG vehicles**, higher initial costs, and a **lack of financing and retail networks for LNG**.
  - **Environmental Impacts:** While cleaner than coal, LNG production and transportation still have some environmental impact, such as **methane emissions**.
    - Methane is the **second-most abundant GHG after CO<sub>2</sub>**. Although methane dissipates faster than CO<sub>2</sub> in the atmosphere, it has a much stronger planetary warming effect.
  - **Safety Concerns:** LNG is highly flammable and can pose significant safety risks if not handled properly. Improper storage, handling, or use can lead to leaks, fires, or explosions.

## What is Compressed Natural Gas?

- **About: CNG** is natural gas that has been compressed under **high pressure**, allowing it to occupy a smaller volume in fuel tanks.
  - It is usually compressed at pressures ranging from **200 to 250 kg/cm<sup>2</sup>**, reducing its volume to less than **1% of its size at atmospheric pressure**.
    - Unlike LPG, which is a mixture of compressed propane and butane, **CNG primarily consists of 80 to 90% methane in a gaseous state**.
  - The **distinction between CNG and LNG lies in their physical states:** CNG exists as a gas, whereas LNG exists as a liquid which is then regasified for usage.
- **Advantages of CNG:**
  - **Lighter than air**, disperses quickly in case of leaks.
  - Clean burning with minimal residue, reducing engine maintenance.
  - Lower greenhouse gas emissions compared to petrol or diesel.
  - High safety due to its **high auto-ignition temperature**.
  - Cost-effective compared to petrol and diesel, with a higher calorific value.
- **Disadvantages of CNG:**
  - Requires large fuel tanks.
  - Limited range per fill-up.
  - Fewer filling stations available.
  - Retrofitting older vehicles for CNG is challenging.
- **BioCNG:** [BioCNG](#), also known as **biomethane**, is a renewable, clean-burning transportation fuel made from organic waste. It's produced by upgrading biogas to natural gas quality.

## Way Forward

- **LNG Infrastructure Development:** Investing in expanding LNG import terminals and **regasification facilities** to increase LNG availability.

- Also, building a robust SSLNG infrastructure, including specialised trucks, vessels, and storage facilities, to reach areas without pipeline connections.
- **Market Development:** Creating awareness and promoting the benefits of LNG and SSLNG among industries, commercial users, and the transportation sector.
  - Encouraging **investment in LNG-powered vehicles and equipment**, offering incentives and financing options for adoption.
- **Regulatory Support:** Developing clear regulatory frameworks and standards for LNG and SSLNG operations, ensuring safety, environmental compliance, and quality control.
- **Investing for Innovation:** Invest in R&D of advanced LNG technologies, such as **cryogenic storage and transport solutions**, to improve efficiency and reduce costs.
- **Push for International Collaboration:** At [COP28](#), the [United Nations Framework Convention on Climate Change](#) mentioned “**transitional fuels**” for energy security in its outcome of the First Global Stocktake, alluding to natural gas.
  - Participating in regional and global initiatives for LNG trade, infrastructure development, and policy harmonisation can strengthen India's position in the global LNG market.

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

### Mains

**Q.** The question of India's Energy Security constitutes the most important part of India's economic progress. Analyse India's energy policy cooperation with West Asian countries. **(2017)**

**Q.** “Access to affordable, reliable, sustainable and modern energy is the sine qua non to achieve Sustainable Development Goals (SDGs)”. Comment on the progress made in India in this regard. **(2018)**

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