



West Asia Tensions Renew Strategic Focus on Compressed Biogas for India's Long-Term Energy Security Transition

Published On: 16-07-2026

Recent Developments:

- Continued geopolitical tensions in **West Asia** have highlighted India's energy vulnerability due to its heavy dependence on imported hydrocarbons.
- Renewed concerns over disruptions in the **Strait of Hormuz**, through which nearly **90%** of India's **LPG** imports transit, have strengthened policy focus on **Compressed Biogas (CBG)** as a domestic, renewable alternative fuel.
- Despite sustained policy support through initiatives such as **SATAT**, **GOBARDhan**, and the **CBG Blending Obligation**, the pace of implementation remains considerably below targets, prompting calls for stronger financial incentives, infrastructure expansion, and waste-based feedstock utilisation.

India's Energy Vulnerability:

Dependence on Imported Hydrocarbons:

- India imports nearly **85%** of its crude oil requirement, making the economy highly vulnerable to global supply disruptions and price volatility.
- A substantial share of India's hydrocarbon imports originates from **West Asia**, exposing the country to geopolitical conflicts in the region.
- Although India has diversified crude oil suppliers over the years, around **90%** of **LPG** imports continue to pass through the **Strait of Hormuz**, making uninterrupted maritime trade essential for national energy security.

Implications for Energy Security:

- Disruptions in international supply chains can adversely affect fuel availability, inflation, fiscal stability, transportation, industrial production, and household energy consumption.
- Strengthening domestic renewable fuels has therefore become an important component of India's long-term **Energy Security Strategy**.

Biogas and Compressed Biogas (CBG):

What is Biogas?

- **Biogas** is a renewable gaseous fuel produced through the **Anaerobic Digestion** of organic materials such as cattle dung, agricultural residues, municipal organic waste, food waste, and sewage.
- It primarily consists of **Methane (CH₄)**, **Carbon Dioxide (CO₂)**, and trace gases.

What is Compressed Biogas (CBG)?

- After purification and compression, biogas is converted into **Compressed Biogas (CBG)**.
- **CBG** is chemically equivalent to **Compressed Natural Gas (CNG)** and can directly replace fossil-based natural gas in transport, industries, and domestic applications.
- Since it is produced from renewable biomass, **CBG** is considered a **Carbon-Neutral Fuel**.

Advantages of Biogas:

Energy Security:

- Domestic production of **CBG** reduces dependence on imported crude oil and natural gas.
- It diversifies India's energy basket and improves resilience against international supply disruptions.

Environmental Benefits:

- Biogas converts agricultural residues and organic waste into clean energy, reducing methane emissions from uncontrolled decomposition.
- It supports India's commitments under the **Paris Agreement** and contributes towards achieving **Net Zero** emission goals.

Waste Management:

- Biogas promotes scientific utilisation of cattle dung, crop residues, municipal organic waste, food waste, and sewage.
- It reduces open dumping, stubble burning, and associated environmental pollution.

Rural Economy:

- Biogas plants generate additional income for farmers through biomass supply.
- Production of **Bio-slurry** provides nutrient-rich organic manure that improves soil health while reducing dependence on chemical fertilisers.

Multiple End Uses:

- **CBG** can be utilised for:
- Electricity generation.
- Industrial heating.
- Household cooking.
- Transportation fuel.
- Injection into the **City Gas Distribution (CGD)** network.

Government Initiatives:

SATAT Initiative:

- The **Sustainable Alternative Towards Affordable Transportation (SATAT)** initiative was launched in **2018** to establish **5,000** commercial **CBG** plants across the country.
- As of **3 June 2026**, only **132** plants had become operational, highlighting a significant implementation gap.

GOBARDhan Scheme:

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Plot A P.127, AF block, 6 th street, 11th Main Rd, Shanthi Colony, Anna Nagar, Chennai, Tamil Nadu 600040

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- The **Galvanising Organic Bio-Agro Resources Dhan (GOBARdhan)** Scheme promotes conversion of organic waste into wealth through biogas and bio-fertiliser production.
- Financial support includes:
- Grants up to **₹50 lakh** per district for community biogas plants.
- **₹564 crore** for biomass collection machinery.
- **₹994 crore** for pipeline infrastructure connecting **CBG** plants with the gas grid.

Mandatory CBG Blending:

- In **2023**, the **National Biofuels Coordination Committee (NBCC)** approved mandatory blending of **CBG** in the **CGD** sector.
- The blending obligation begins at **1%** during **FY26** and will gradually increase to **5%** by **FY29**.

Budget Announcement:

- The **Union Budget 2024-25** announced phased mandatory blending of **CBG** in **CNG** used for transportation and **Piped Natural Gas (PNG)** supplied for domestic cooking.

Ground Reality and Implementation Status:

Slow Progress:

- Despite ambitious policy targets, actual commissioning of commercial **CBG** plants remains limited.
- According to Government data released during **August 2025**, only **36** medium-sized biogas plants had been established under the **MNRE Biogas Programme** during the preceding three years.

Implementation Gap:

- The gap between policy announcements and project execution indicates persistent structural constraints requiring targeted policy intervention.

Major Challenges:

Infrastructure Deficit:

- Inadequate biomass collection systems, transportation facilities, pipeline connectivity, and storage infrastructure increase project costs.

Financial Constraints:

- High initial capital requirements discourage private investment.
- Small developers face difficulties in accessing institutional finance and affordable credit.

Technology Costs:

- Advanced purification, compression, and quality control technologies require substantial investment and specialised technical expertise.

Limited Private Sector Participation:

- Uncertain commercial returns and regulatory delays reduce investor confidence in the sector.

Lessons from International Experience:

Germany's Experience:

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- Germany significantly expanded biogas production through the **Renewable Energy Sources Act, 2000**, which guaranteed long-term producer income.
- However, generous incentives encouraged extensive cultivation of maize exclusively for biogas production.
- Excessive dependence on maize reduced crop diversity and created concerns regarding food security.
- The Government subsequently imposed limits on maize utilisation as feedstock for biogas plants.

Denmark's Model:

- Denmark aims to replace conventional natural gas with biomethane by **2030**.
- The country discourages cultivation of dedicated energy crops for biogas production.
- Livestock manure, agricultural residues, and organic waste constitute the principal feedstock, thereby avoiding competition with food production.

Emerging Challenges for India:

Changing Cropping Pattern:

- The **Economic Survey 2025-26** observed rapid expansion in maize cultivation.
- Maize productivity increased from approximately **2.56 tonnes/hectare** in **FY16** to **3.78 tonnes/hectare** in **FY25**.

Food Security Concerns:

- Attractive administered pricing for maize-based ethanol has encouraged farmers to shift away from pulses, oilseeds, millets, soybean, and cotton.
- Such crop substitution could increase India's dependence on imports of edible oils and pulses while reducing agricultural diversification.

Feedstock Competition:

- Excessive dependence on food crops for biofuel production may create long-term conflicts between **Energy Security** and **Food Security**.

Way Forward:

Prioritise Waste-Based Feedstock:

- Agricultural residues, cattle dung, municipal organic waste, and sewage should remain the primary feedstock for biogas production.
- Food crops should be avoided wherever possible to safeguard national food security.

Strengthen Financial Incentives:

- Government support may include:
- Accelerated depreciation.
- Tax holidays.
- Interest subvention.
- Viability Gap Funding.
- Long-term purchase guarantees.

Expand Infrastructure:

- Accelerate development of biomass aggregation systems, storage facilities, pipeline connectivity, and **City Gas Distribution** infrastructure.

Improve Access to Finance:

- Simplify institutional lending procedures for small developers and provide dedicated financing mechanisms for renewable gas projects.

Replicate Ethanol Blending Success:

- India increased ethanol blending in petrol from **1.5%** in **2014** to **20%** by **December 2025**, achieving the target five years ahead of schedule.
- Similar policy consistency, assured procurement, and infrastructure support could accelerate **CBG** adoption.

Strengthen Circular Economy:

- Promote integrated waste management systems combining renewable energy production, organic fertiliser generation, methane mitigation, and sustainable agriculture.

Conclusion:

- **Compressed Biogas** offers India a strategic opportunity to simultaneously strengthen **Energy Security**, reduce fossil fuel imports, improve waste management, enhance rural incomes, and support climate commitments.
- Achieving these objectives will require sustained policy support, faster infrastructure development, stronger private investment, and prioritisation of waste-based feedstock over food crops to balance both **Energy Security** and **Food Security**.

Value Addition for UPSC:

Important Terms:

- **Biogas.**
- **Compressed Biogas (CBG).**
- **Compressed Natural Gas (CNG).**
- **Piped Natural Gas (PNG).**
- **Anaerobic Digestion.**
- **Bio-slurry.**
- **Carbon-Neutral Fuel.**
- **City Gas Distribution (CGD).**
- **Circular Economy.**
- **Energy Security.**

Important Schemes and Institutions:

- **Sustainable Alternative Towards Affordable Transportation (SATAT).**
- **Galvanising Organic Bio-Agro Resources Dhan (GOBARdhan).**
- **National Biofuels Coordination Committee (NBCC).**
- **Ministry of New and Renewable Energy (MNRE).**
- **National Policy on Biofuels, 2018.**
- **Pradhan Mantri JI-VAN Yojana.**
- **Global Biofuels Alliance**