Institute for Energy Economics and Financial Analysis

Enhancing Energy Efficiency in Captive Power Generation

An Opportunity to Curb Short-term LNG Demand Growth

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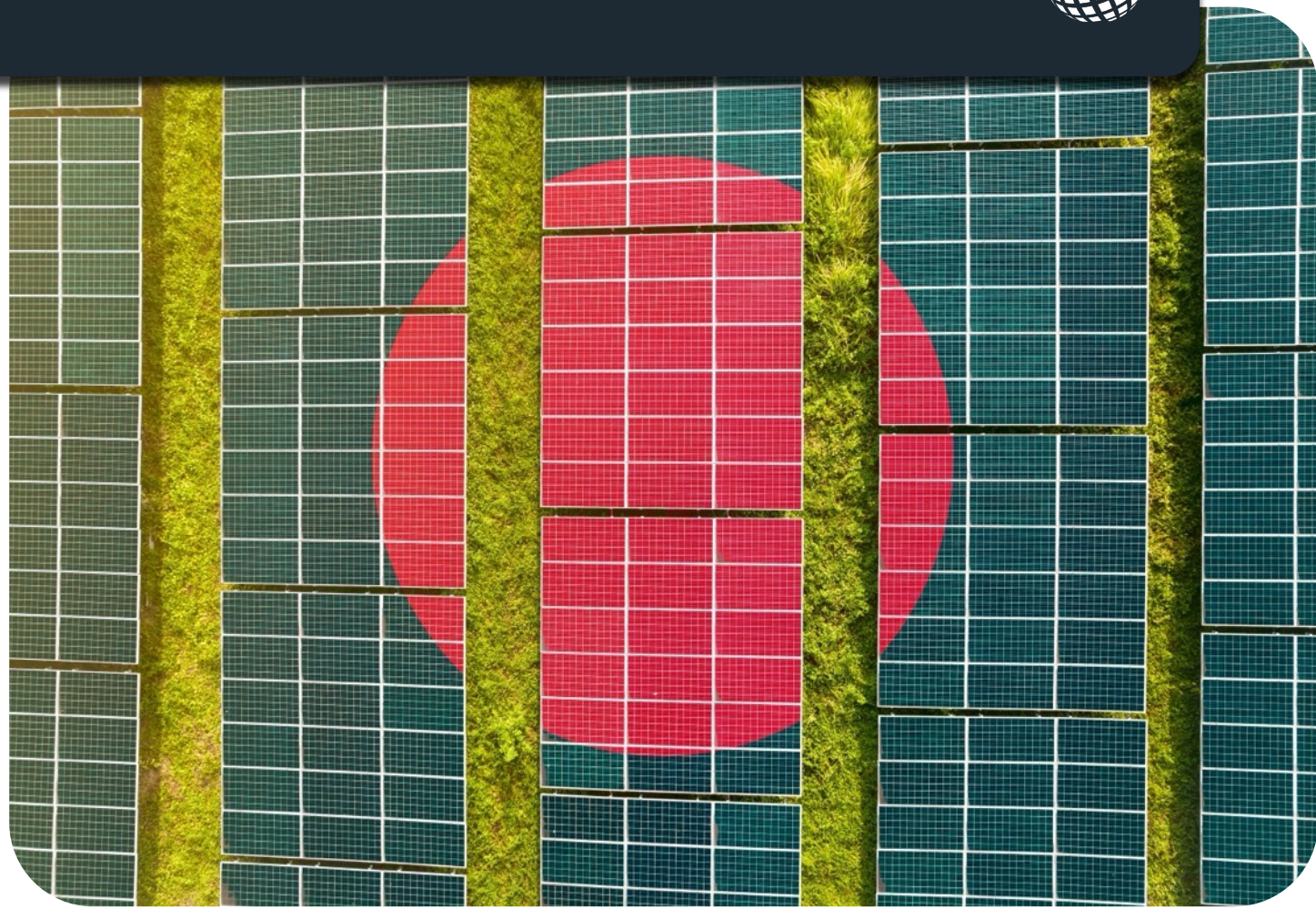
Agenda



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02. Background of the Study
03. Bangladesh’s Dependence on Natural Gas
04. Bangladesh’s Exposure to LNG Imports
05. Efficiency in Gas-fired Captive Power
06. Impacts of Enhancing Efficiency in Captive Generation on Energy Savings (LNG imports)
07. Concluding Remarks

Snapshot of IEEFA

The Institute for Energy Economics and Financial Analysis (IEEFA) is a non-profit global impact think tank that produces a significant volume of original independent public interest research and analyses on issues related to sustainable energy markets, trends, regulations, and policies.

Intellectual leadership

We produce cutting-edge, solutions-focused analyses. We don't just highlight the problems – we offer ways to resolve the issues and roadblocks that stand in the way of a zero-emissions future.

Independence

We are an independent non-profit think tank. Our analyses are thoroughly researched, fact-based, and data driven. Our work is free from political influence, corporate and sectoral interests.

Nimble

We act on signals across the energy and finance spectrums in South Asia and worldwide. Our analyses are timely and relevant. We can learn, adapt, and move quickly.

Trust

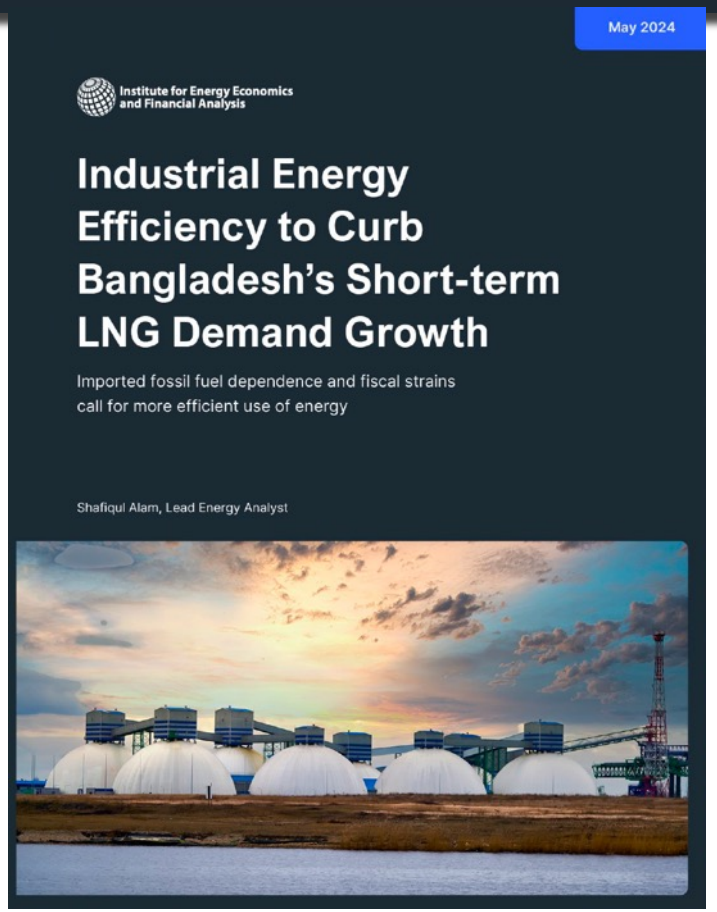
IEEFA is a trusted voice on issues related to sustainable energy markets, trends, regulations, and policies.

Impact

Our work makes a positive impact in the world. We aim to accelerate the energy transition to help achieve a cleaner future for humankind and the planet.

Background

- Cheap and subsidised natural gas has been the centrepiece of Bangladesh's energy system since the early 70's;
- Used extensively in power generation, industrial processes and other applications, gas has **powered** the country's **economic progress**;
- The demand for uninterrupted electricity compelled the policymakers to supply gas to industries for captive power generation amid **unreliable grid power**;
- The **insatiable demand** for gas outpaced local production, directly affecting the country's energy supply system;



Background

- With limited success in renewable energy, spiralling gas demand in different sectors and concerns about long-term energy security, the government frontloaded efforts to import liquefied natural gas (LNG) to supplement local gas;

- As things stand, there is a need for policy-level intervention to assess the benefits of improving energy efficiency to contain increasing LNG demand in the short- to medium-term instead of only enhancing regasification capacity and imports;

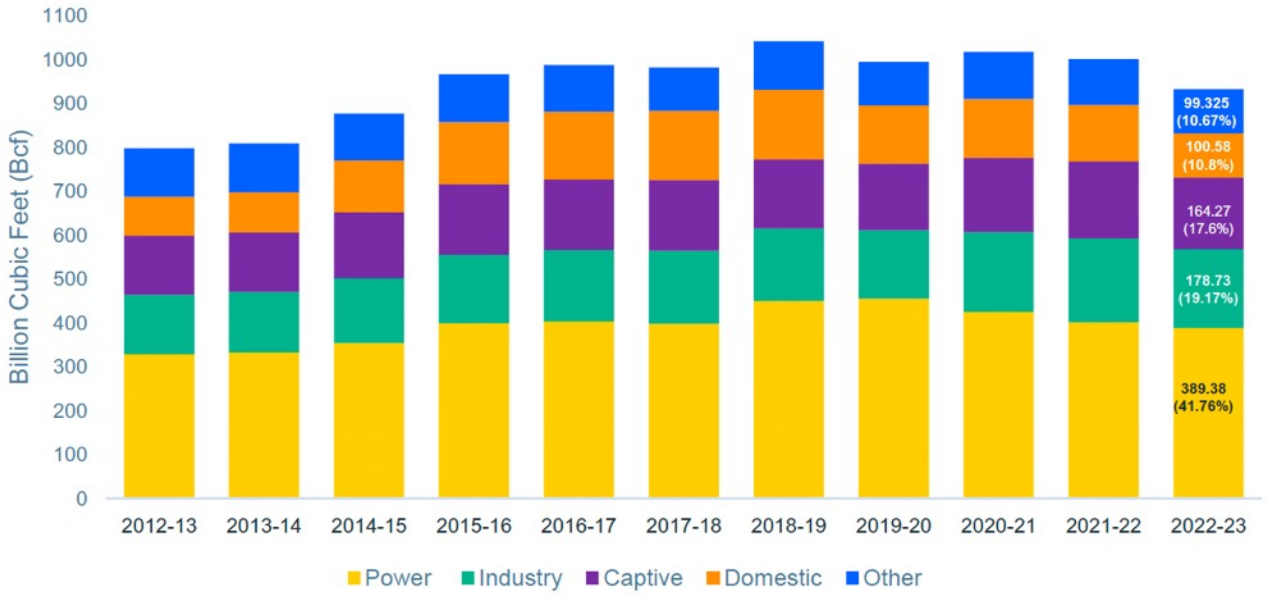
- There is also concern about the inefficient use of gas in captive power generation;

- In light of these, the study analysed:

  - Bangladesh's **brief** but **turbulent** relation with LNG;
  - The **efficiency** of the operational gas-fired captive generators ;
  - The status of utilising **waste heat** (released by captive generators) in industries;
  - Possibility of enhancing **energy efficiency** in captive generation and likely impact on LNG imports.

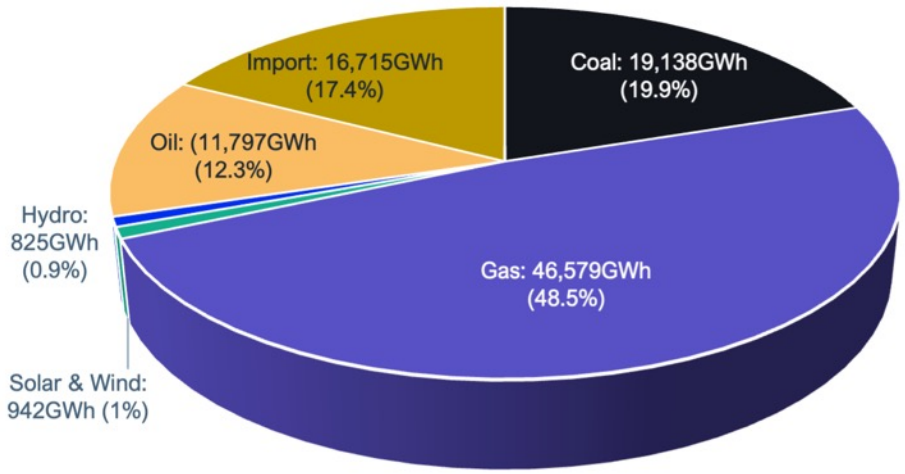
Bangladesh's High Dependence on Natural Gas

Figure: Sectoral Gas Consumption Pattern



Source: Hydrocarbon Unit Annual Report 2022-23

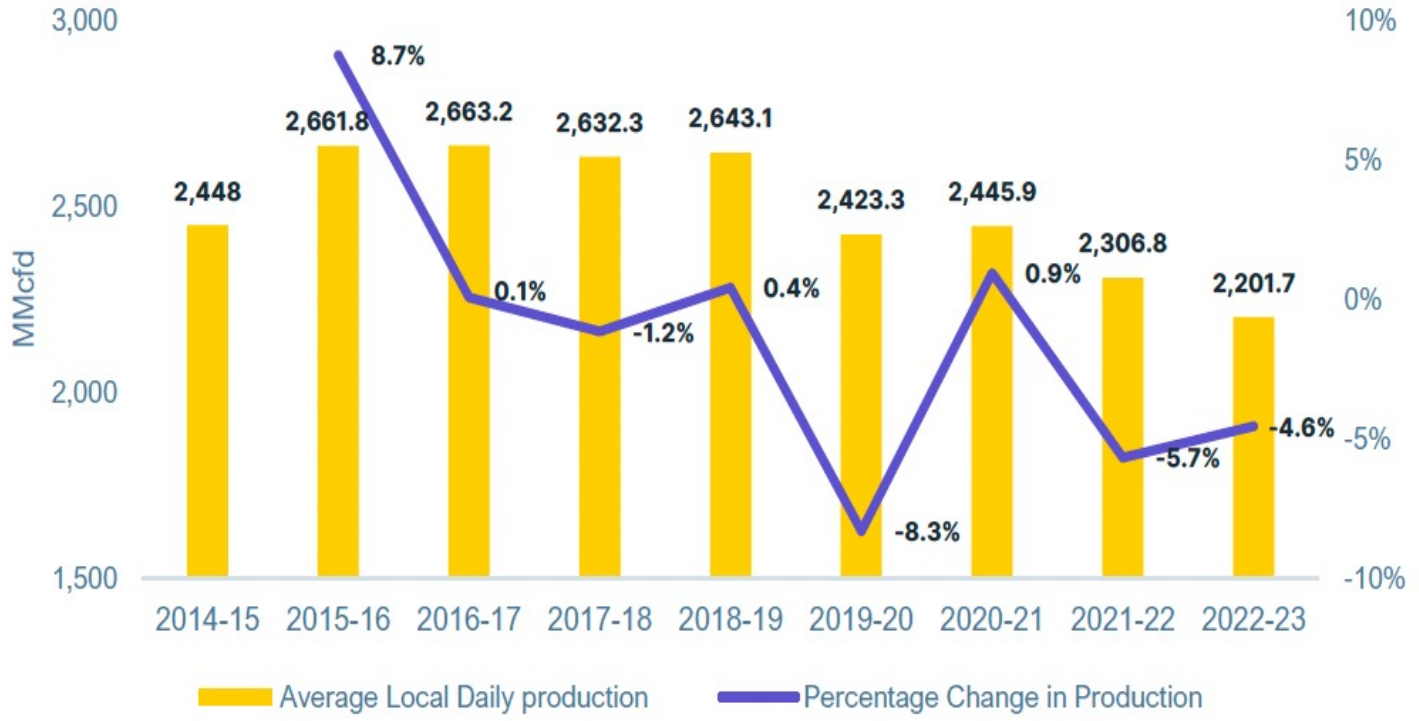
Figure: Energy Mix in Grid Power, 2023-24



Source: BPDB Annual Report, 2023-24

Bangladesh's Natural Gas Sector – Diminishing Local Production

Figure: Decreasing Trajectory of Local Gas Production



Sources: Hydrocarbon Unit Annual Reports 2014-15 to 2022-23; IEEFA Analysis

Bangladesh's Exposure to LNG

Drivers	
Economic	High and sustained economic growth in the pre-COVID era increased energy demand, tempting policymakers to shift to LNG as an alternative fuel.
Energy Use Pattern	Natural gas has shaped the country's energy and power sectors for decades, contributing considerably to the nation's development.
Energy Security Concern	With the shrinking local gas supply, investment and efforts to ramp up local production were inadequate. Fears of a drastic fall in local gas supply, compromising economic growth, prompted policymakers to import LNG. Uncertainty over renewable energy deployment at scale and the high cost of battery storage systems also influenced the decision to import LNG.
Systemic	The reliability of grid power remains a concern, and cheap gas-fired captive generators have become popular.

Source: IEEFA's study "Industrial Energy Efficiency to Curb Bangladesh's Short-term LNG demand Growth", 2024

Bangladesh's Exposure to LNG

Figure: LNG Import Trend

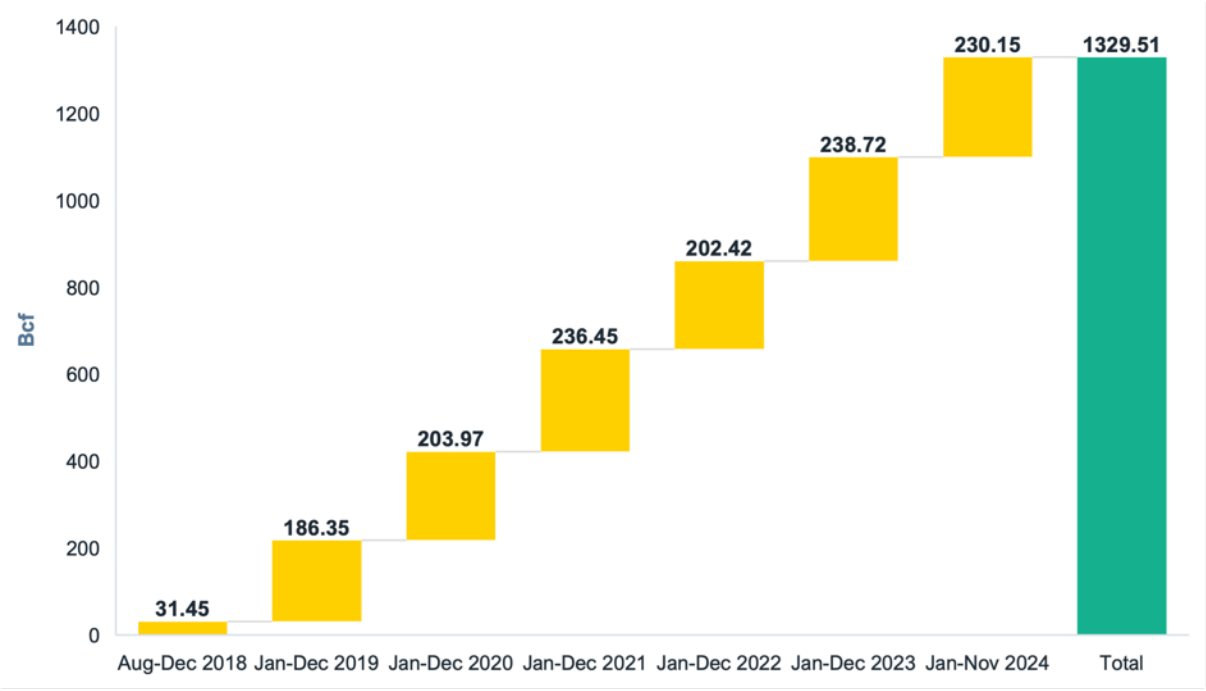
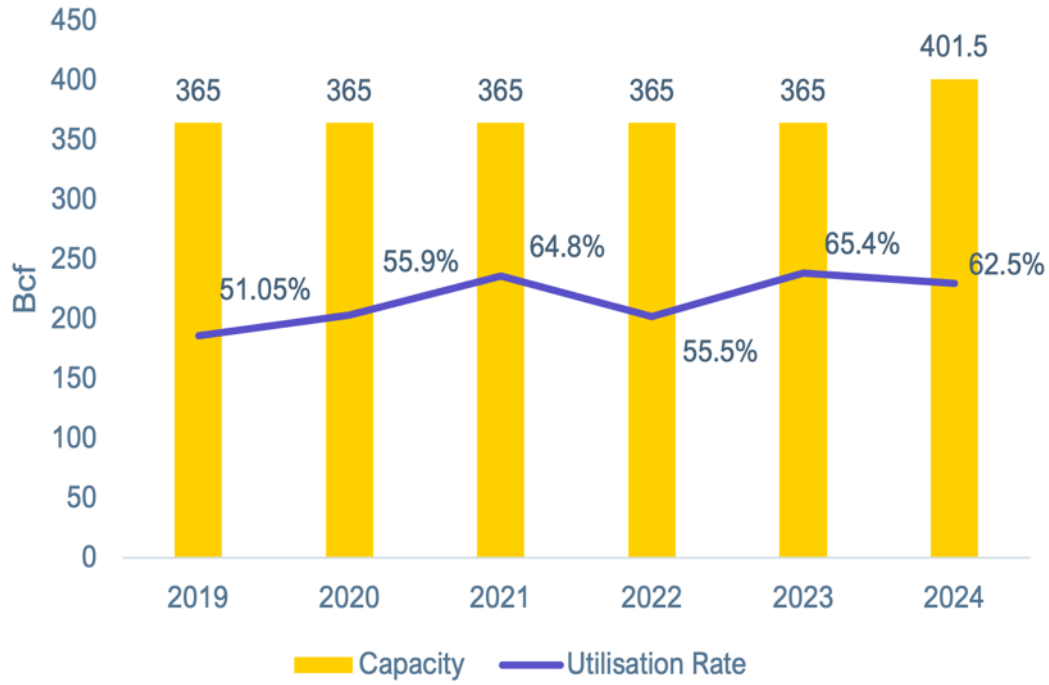


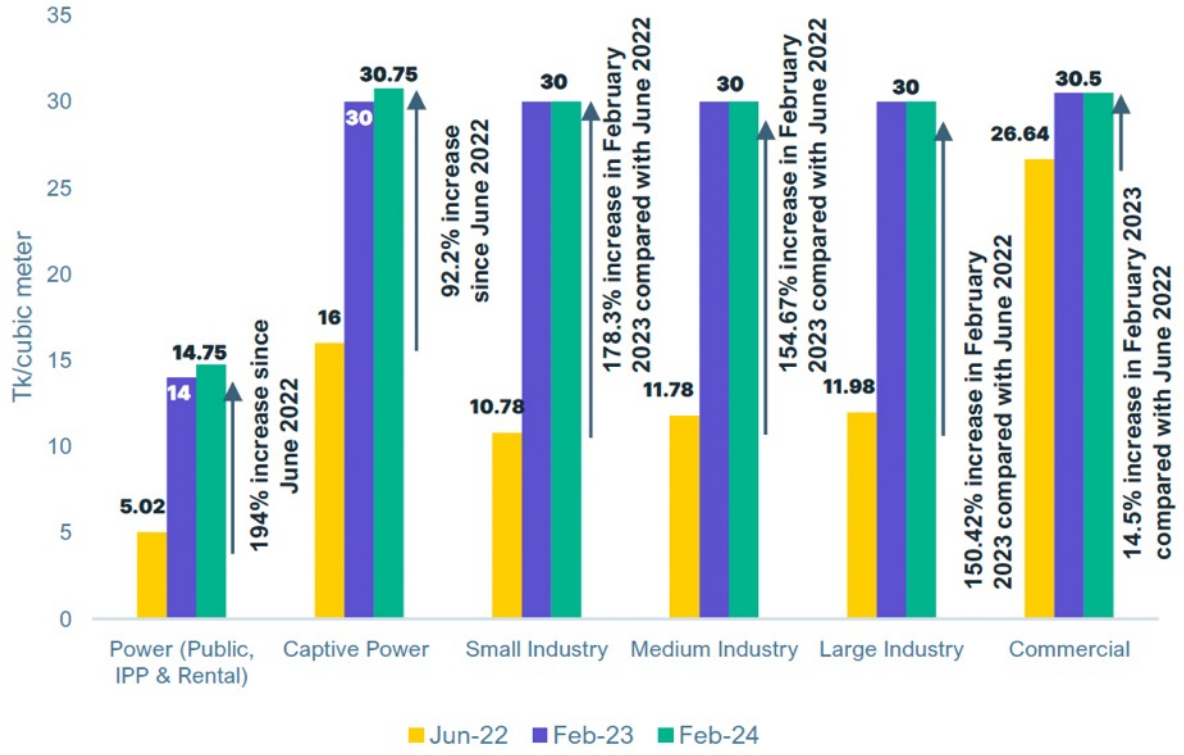
Figure: Utilisation Rate of Regasification Capacity



Source: Hydrocarbon Unit; IEEFA's Analysis

Bangladesh's Exposure to LNG

Figure: Rising Gas Tariffs in Different Sectors



Sources: MPEMR & BERC; IEEFA Analysis

Note: The government is mulling a massive hike in gas prices; BERC will evaluate the proposal.

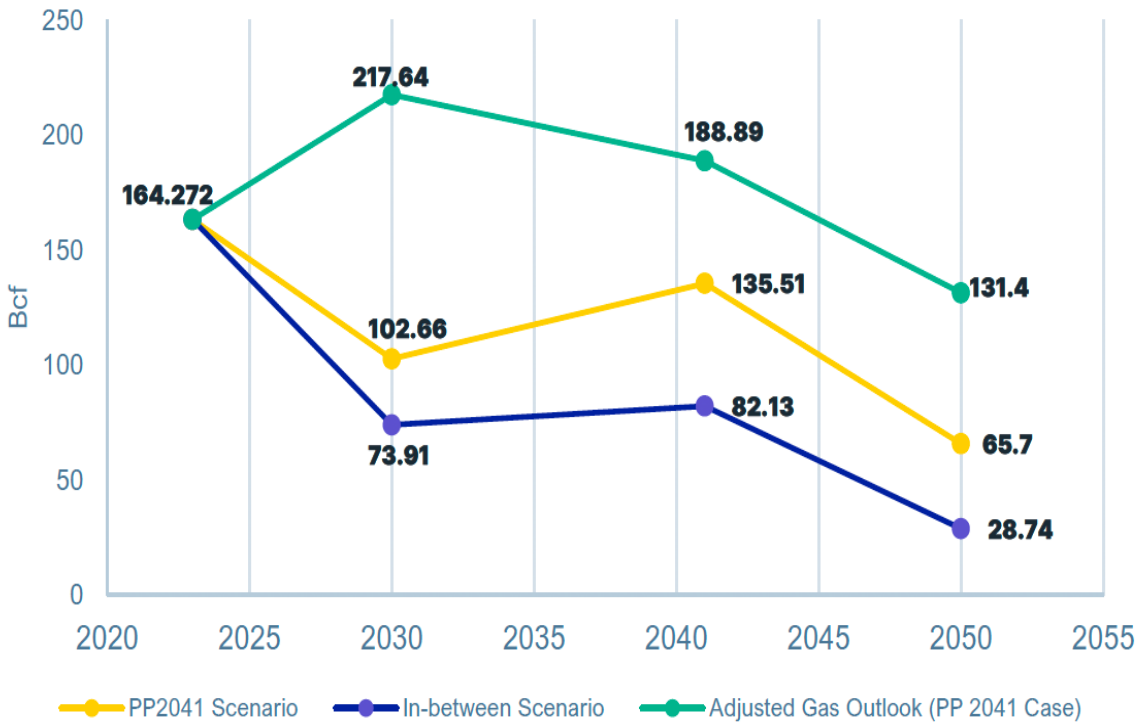
Can Enhancing Efficiency in Captive Power Generation Reduce Short-term LNG Demand Growth?

- **Growing Captive Power Generating Units**: Despite the challenges of ensuring uninterrupted gas supply, the number of gas-fired captive generators is increasing. In September 2022, the combined capacity of gas-fired captive generators was **2,943MW**, which has exceeded **3,000MW** by now (IEEFA, 2024).

- **Concern over Inefficiency**: Investment-grade energy audits carried out from December 2012 to November 2013 in 120 industries concluded that gas-fired captive power plants were operating at **30%** efficiency. Few industries were using waste heat recovery boilers/plants and no industries undertook measures to use jacket cooling water.

- **Future Role of Captive Power**: Gas-fired captive generation is likely to play an important role in 2050 (see Figure on Future Gas Outlook for Captive Power Generation).

Figure: Future Gas Outlook for Captive Power Generation



Source: IEPMP, 2023; IEEFA's Analysis

Assessing the Efficiency of Operational Gas-fired Captive Generators

- **Data Collection Method**: Survey from January to April 2024;
- **Statistical Significance**: The minimum sample size of generators required was **68** at **90%** Confidence Interval;

Figure: Summary of Industries Surveyed

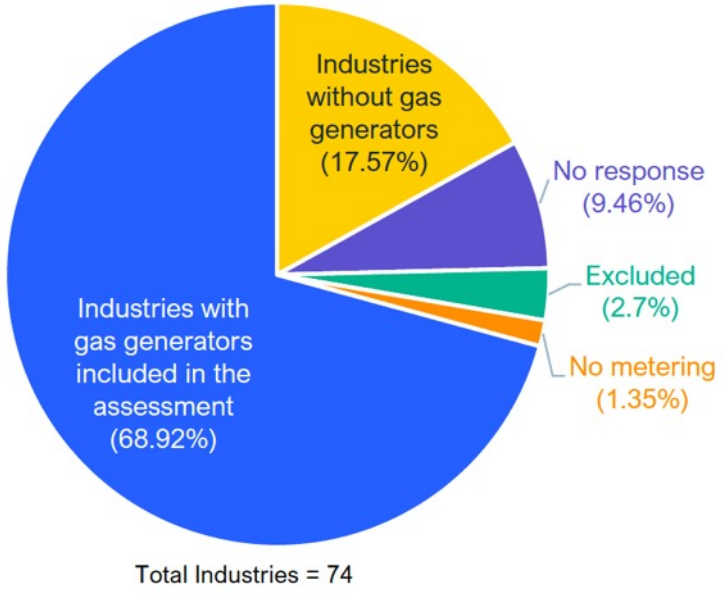


Figure: Snapshot of Industries with Gas Generators

Industry Samples with Gas generators	**51**
Type of Industries	Garment, textile, steel, chemical, fertiliser, pharmaceutical etc.
Total Operational Gas Generators in Surveyed Industries	124
Total Gas Generators Considered as Samples (some industries have common gas meters for multiple generators and, as such, multiple generators with a common meter are considered one sample)	73
Combined Gas-fired Captive Generation Capacity of the Sample Industries	~250MW[40,41]

Source: IEEFA's study "Industrial Energy Efficiency to Curb Bangladesh's Short-term LNG demand Growth", 2024

Assessing the Efficiency of Operational Gas-fired Captive Generators

- **Average Efficiency Identified**: Despite the speculation about the very low efficiency of gas-fired captive plants, this assessment finds that the average efficiency of the sample generators is 35.38%. However, their efficiency ranged from a low of 27.08% to as high as **45.2%**.

- **Does the Average Efficiency Represent Sample generators**: Yes (see Figures below)

Figure: Distribution of Efficiency of Sample Gas generators

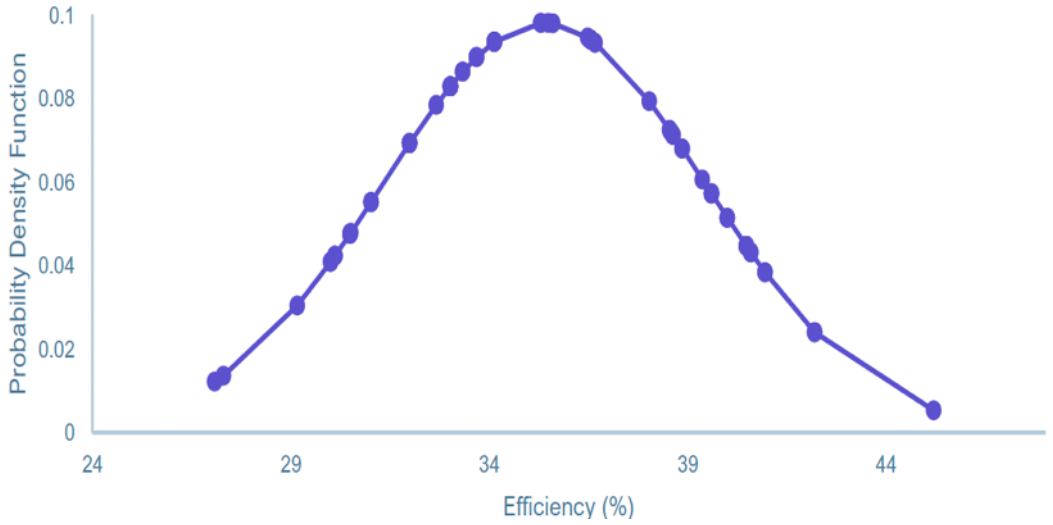
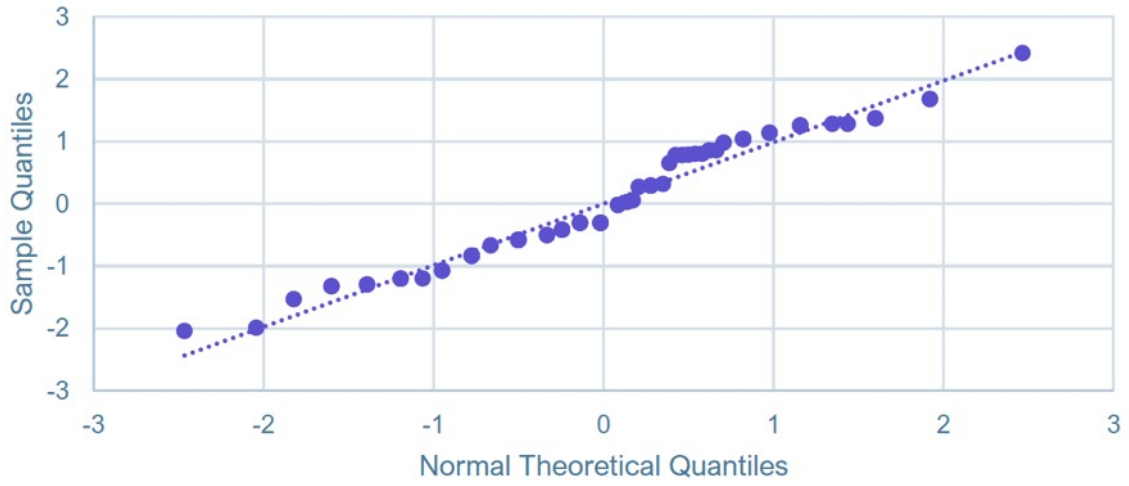


Figure: Quantile-Quantile Plot



Source: IEEFA's study "Industrial Energy Efficiency to Curb Bangladesh's Short-term LNG demand Growth", 2024

Status of Using Waste Heat and Jacket Cooling Water

Figure: Status of Waste Heat Application in Boiler or Plant

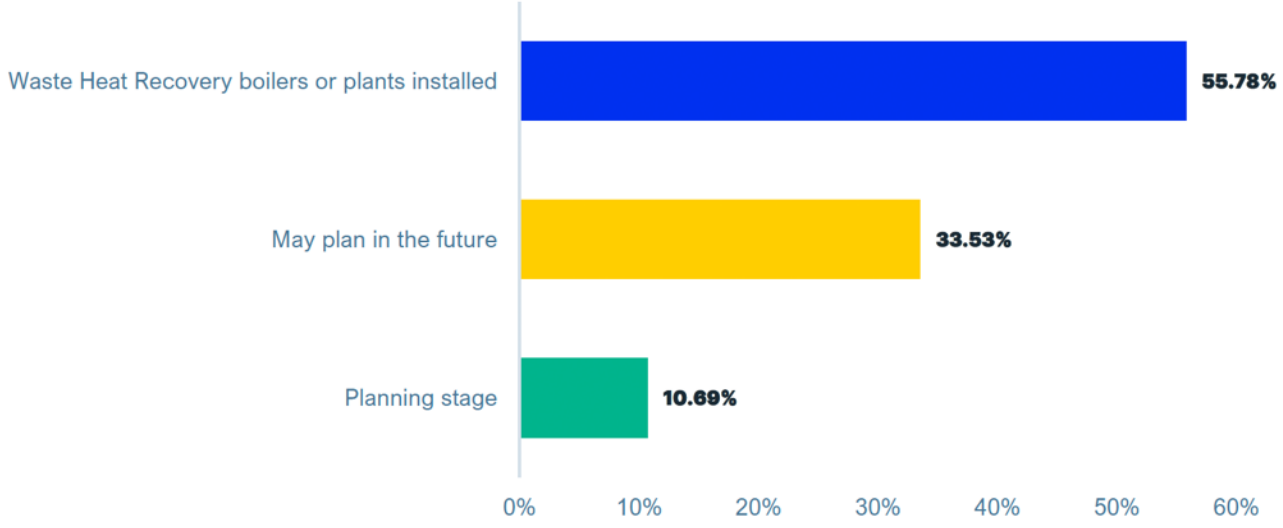
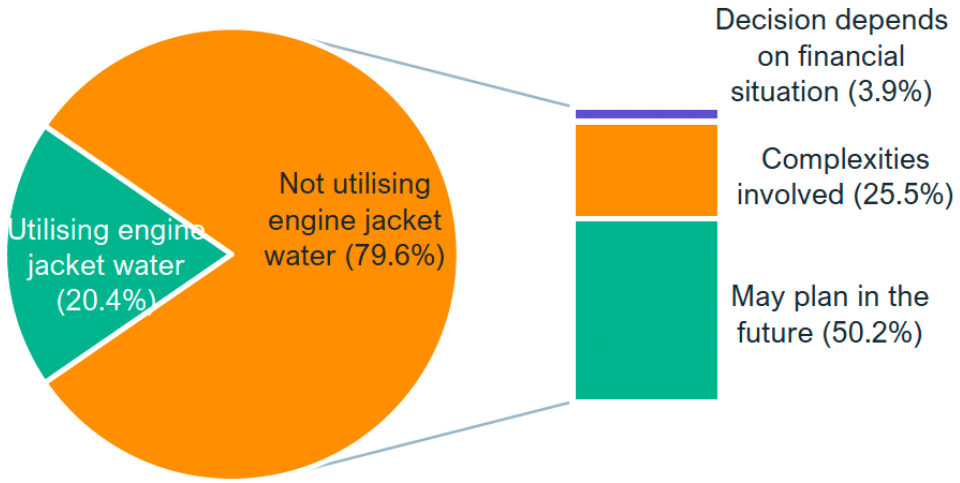


Figure: Status of Using Jacket Cooling Water



Source: IEEFA's study "Industrial Energy Efficiency to Curb Bangladesh's Short-term LNG demand Growth", 2024

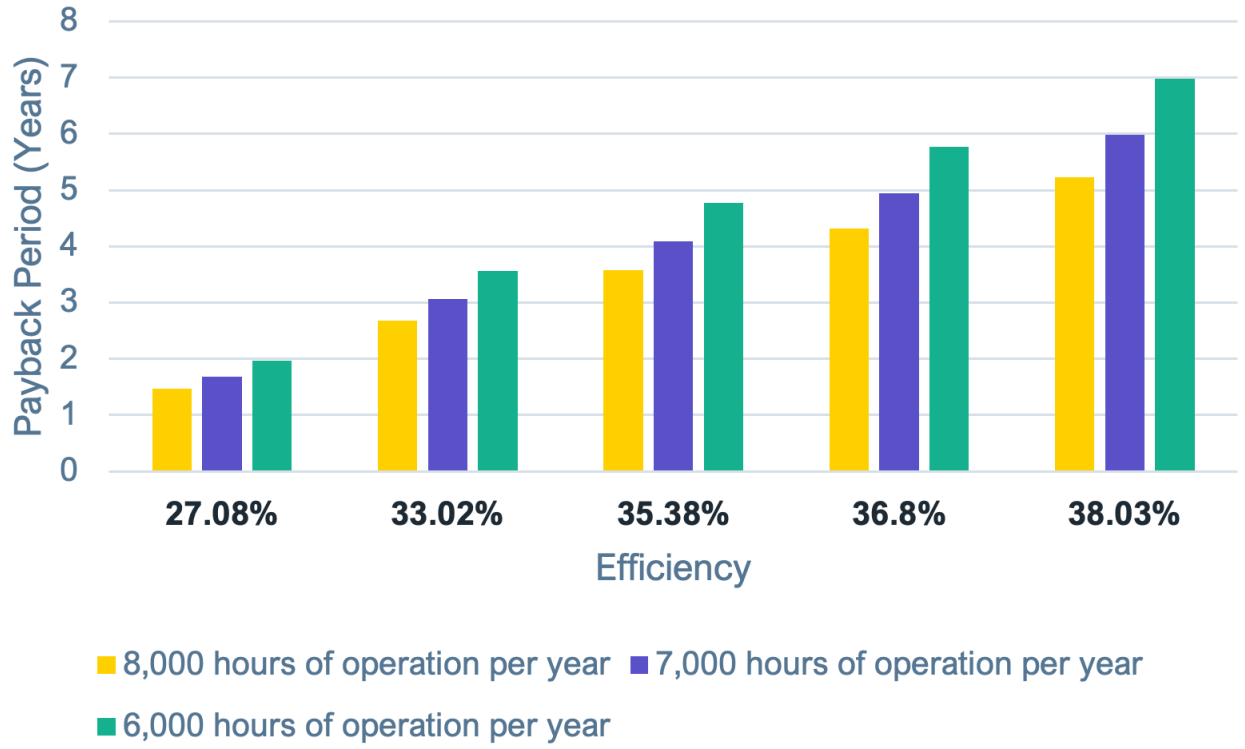
Enhancing Efficiency in Captive Power Generation – LNG Consumption Reduction Potential

Measures	Natural gas or equivalent LNG saving potential per year (Bcf)
Replacing inefficient gas generators with high-efficiency generators	35.5
Installation of waste heat recovery boilers/plants	9.11
Using jacket cooling water	11.15
Subtotal	55.76
Assuming 10% error	- 5.58
Total	50.18 This saving potential is 21% of the total LNG imported in 2023[51]
LNG saving potential: 48.47 x 10^6 metric million British thermal units (MMBtu) a year	
Total import bill reduction: US$460 million	

Source: IEEFA's study "Industrial Energy Efficiency to Curb Bangladesh's Short-term LNG demand Growth", 2024

Feasibility of Enhancing Energy Efficiency

Figure: Payback Periods of Replacing Operational Generators with Efficient Ones



Source: IEEFA's study "Industrial Energy Efficiency to Curb Bangladesh's Short-term LNG demand Growth", 2024

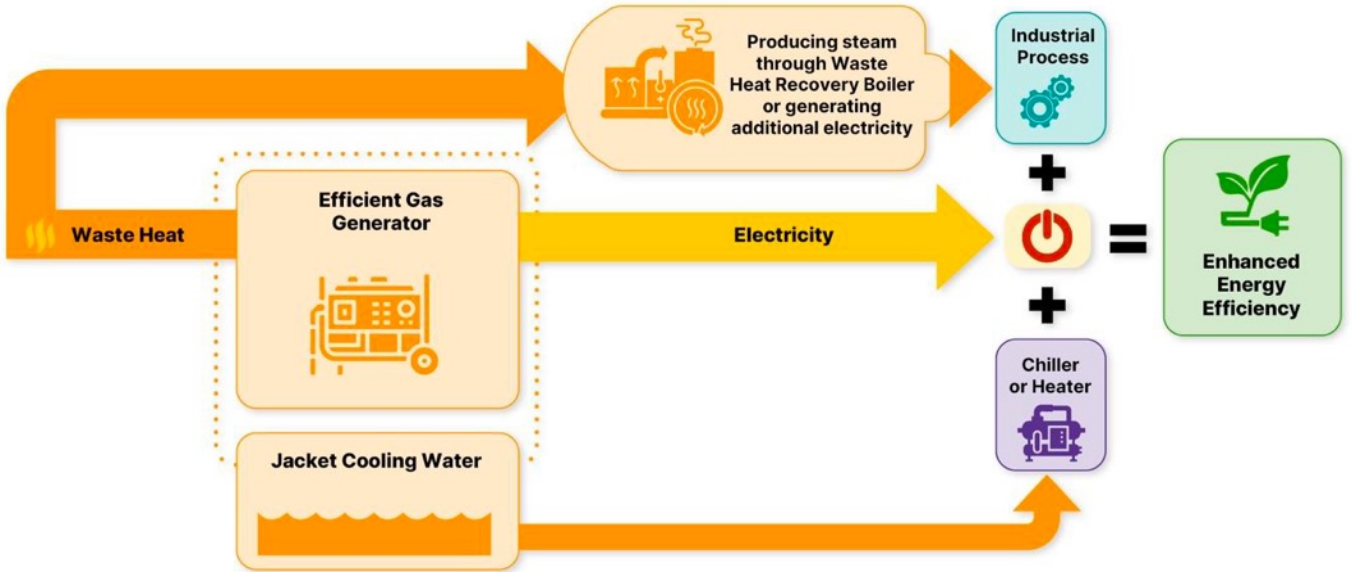
Note: The payback period of installing a waste heat recovery boiler is up to 1.3 years.

Likewise, energy savings from jacket cooling water will help recover the investment in chiller in less than a year.

Final Remarks

- Despite widespread concerns over very low efficiency in captive power generation, IEEFA's study finds that the average efficiency is 35.38%;
- The strong commitment of industries to strive for enhancing energy efficiency has resulted in an improvement from **30%** in 2013 to **35.38%** in 2024;
- Yet, the availability of generators with more than 45% efficiency demonstrates the significant gas (equivalent LNG) saving opportunity; Further, Waste heat released by gas generators and the heat available in the jacket cooling water also offer significant gas saving potential.

Figure: Enhancing Energy Efficiency in Captive Power



Source: IEEFA's study "Industrial Energy Efficiency to Curb Bangladesh's Short-term LNG demand Growth", 2024

Concluding Remarks

- Industries would face the upfront costs of installing efficient generators, waste heat recovery boilers/plants and chillers/heaters, but these investments will deliver long-term savings;
- With international regulations on producing environment-friendly products becoming more stringent, delays in undertaking measures to save energy will likely erode the business competitiveness of export-oriented industries;
- As interest rates for commercial loans have soared from single to double digits with Bangladesh Bank's tightening monetary policy for price and macro stability, the low-cost refinancing schemes are more attractive now;
- Bangladesh can accelerate the momentum, building on policy foundations already in place. For instance, the energy efficiency and conservation rules require mandatory energy auditing in selected designated energy consumers, including industries.
- SREDA, established to help aid clean energy expansion, can design measures to swiftly scale up energy efficiency.
- Full energy independence may be a utopian dream, but the country must find ways to rein in its import dependence.

Thank you

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