LNG from USA in Brazil and Americas

U.S. - Americas LNG Forum
Rio de Janeiro/RJ • May 23rd 2018

Giovani Machado
Head of Natural Gas and Biofuels
ABOUT EPE

State-owned company, founded by Law in 2004 and based in Rio de Janeiro.

Technical staff having around 320 people, average age of 38 years, 65% with MBA, MSc or PhD degrees.

EPE has a key role in the generation and transmission auctions & energy market design.

Responsible for planning studies for the energy industry, including: power sector, oil & gas sector, energy efficiency, renewables, nuclear power, etc.

EPE aims at carrying out studies and researches to support the Ministry of Mines and Energy in elaborating the energy planning of Brazil.
Overview of the Brazilian Natural Gas Industry
NATURAL GAS INFRASTRUCTURE

Supply – Demand (Total Brazil, 2017 average) Million m³/d

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<thead>
<tr>
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Source: Based on MME

- 15 Processing Zones (95 MMm³/d)
- 3 Existing LNG terminals (41 MMm³/d)
- 9.409 km Transmission pipelines
- 179 Operating citygates

Supply – Demand

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Source: Based on MME

Energy Research Office
Ministry of Mines and Energy

https://gisepe.epe.gov.br/WebMapEPE/
Natural Gas Demand – Total Brazil

Note: Includes downstream demand in the concession area of LDCs.

Source: Based on ABEGAS, MME
Average Consumption – January to December 2017
BRAZILIAN POWER SYSTEM

- Installed Capacity: 167 GW
- Electricity Consumption: 575 TWh/year (2017 average)
- Peak Demand: 85.7 GW (05/02/2014)
- Consumer Units: 82.5 x 10^6 (December 2017)

Source: ONS, ANEEL
Natural Gas Demand – Total Brazil
Variations in Non-Thermoelectric and Thermoelectric Demands

Source: Based on ABEGAS, MME
GAS TO GROW INITIATIVE: Market Opening Process

A natural gas market with diversification of agents, liquidity, competitiveness, transparency of information and best practices, which contributes to economic growth of the country.

CNPE Committee for Natural Gas Development

- SC1: Third Party Access to Essential Facilities: Gathering pipelines, Gas Processing Plants and LNG Terminals
- SC2: Transmission and Storage
- SC3: Distribution
- SC4: Commercialization
- SC5: Improvement of taxes structure
- SC6: Natural gas as feedstock
- SC7: Natural gas of the Union (mainly Production Sharing Agreements)
- SC8: Integration of Natural Gas and Power Industries

Source: MME
FORECAST OF NATURAL GAS SUPPLY AND BALANCE
GROSS AND NET PRODUCTION OF NATURAL GAS

GROSS AND NET PRODUCTION OF GAS

NET PRODUCTION AND DOMESTIC SUPPLY OF GAS

Fonte: EPE
NATURAL GAS SUPPLY (INTEGRATED NETWORK)

Million cubic meters per day

- Associated Domestic Natural Gas
- Imports by Pipelines
- Total Supply (integrated network)
- Non-Associated Domestic Natural Gas
- Imports by LNG
- Total Supply with new LNG in Açu/RJ

Fonte: EPE
NATURAL GAS BALANCE – INTEGRATED NETWORK

Million cubic meters per day

Positive Balance

- Non-Thermoelectric Demand
- Indicative Combined Cycle Thermoelectric Demand
- Total Demand (Max gas-fired dispatch)
- Total Supply (integrated network)
- Natural Gas Thermoelectric Demand
- Bi-fuel Thermoelectric Demand
- Total Demand (Avg gas-fired dispatch)
- Total Supply with new LNG in Açu/RJ

Fonte: EPE
**NATURAL GAS BALANCE - SENSITIVITY**

(new open cycle gas-fired thermoelectric plants supplied by new LNG Terminals)

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**Stress Case Scenario**
(low probability)

- 6 new terminals of 14 MMm³/d

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- How many indicative open cycle gas-fired thermoelectric plants in the integrated network to deal with peak load, intermittences and dry seasons?
- Open Cycle gas-fired thermoelectric plants will have to compete with other alternatives, such as pump-store hydro, DSM, Biomass
LNG TERMINALS: EXISTING, PLANNED AND ANNOUNCED

- EPE has published a report on Announced Projects for LNG Terminals in Brazil
- Available at www.epe.gov.br
- Will be launched on June 15th

New LNG terminals: How many will really be constructed?

3 Existing LNG terminals (41 MMm³/d)
3 Planned LNG terminals (42 MMm³/d)
5 Announced LNG terminals ("x" MMm³/d)

Which will be the role of LNG in Brazil?

Could it be new interconnections to South Cone? Gas & Power?

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### Reserves and Yet to Find Resources

<table>
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<tr>
<th>Country</th>
<th>Proved Reserves (tcm)</th>
<th>Yet to Find Resources – F50 (tcm)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Conventional</td>
<td>Unconventional</td>
</tr>
<tr>
<td>Argentina</td>
<td>0.29</td>
<td>0.94</td>
</tr>
<tr>
<td>Bolivia</td>
<td>0.30</td>
<td>0.66</td>
</tr>
<tr>
<td>Paraguay</td>
<td>0.00</td>
<td>0.09</td>
</tr>
<tr>
<td>Peru</td>
<td>0.42</td>
<td>0.14</td>
</tr>
<tr>
<td>Uruguay</td>
<td>0.00</td>
<td>0.03</td>
</tr>
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### LNG Capacity in South Cone

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<thead>
<tr>
<th>Country</th>
<th>Existing Terminals (Million m³/d)</th>
<th>Planned Terminals (Million m³/d)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Argentina</td>
<td>31</td>
<td>16*</td>
</tr>
<tr>
<td>Brazil</td>
<td>41</td>
<td>42**</td>
</tr>
<tr>
<td>Chile</td>
<td>20.5</td>
<td>19.5***</td>
</tr>
<tr>
<td>Uruguay</td>
<td>0</td>
<td>10****</td>
</tr>
</tbody>
</table>

Sources: BnAmericas (2017); EPE (2017).

Notes: * Bahia Blanca 16 Millions m³/d (expansion up to 30 Millions m³/d); ** Sergipe/SE 14 Millions m³/d + Porto Açu/RJ 14 Millions m³/d; Río Grande/RS 14 Millions m³/d *** Penco 15 Millions m³/d (under construction) + Mejillones 4.5 Millions m³/d (expansion up to 10 Millions m³/d); **** GNL Del Prata 10 MM m³/d (under construction).
FINAL REMARKS
KEY UNCERTAINTIES IN SUPPLY AND DEMAND

- Path of economic recovery
- Time for the Gas to Grow
- Supply
  - Bolivia
  - Natural gas pre-salt availability
    - CO₂ content, distance from shore, price competitiveness
  - Natural gas onshore resources
    - Potential versus gas discovers
- Gas-fired power plants (base/peak loads, renewable dispatchability, etc.)
  - Some improvements implemented and others under discussion
- LNG regasification capacity expansion and competitiveness
  - Brings additional supply, flexibility and market contestability
  - New terminals on their way