

26th World Gas Conference

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SP 12 THE ROLE AND IMPACT OF INNOVATION IN THE GAS INDUSTRY

Development and Innovation in Brazilian Oil & Gas Sector

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- Founded in 1957
- 244 corporate members
- 1500 volunteers
- Rio Oil & Gas, OTC Brasil

Main challenges for natural gas industry in the World



Main challenges for natural gas industry in the World

How to minimise the carbon intensity of the entire gas supply chain?

UPSTREAM

Exploration & Production



- Avoid flaring
- Eliminate methane fugitive emissions
- CO2 separation and permanent sequestration
- Unconventional sources (methane hydrates, shale, CSG)

MIDSTREAM

Transportation & Processing



- Eliminate methane fugitive emissions
- Development of energy efficiency technologies and integrated systems

DOWNSTREAM

Distribution & Retail Sale

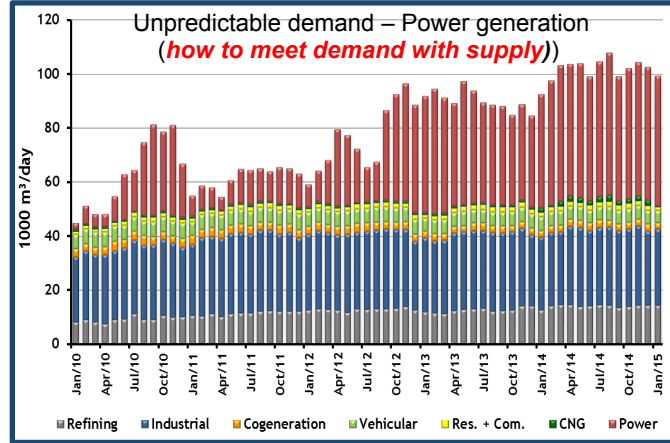
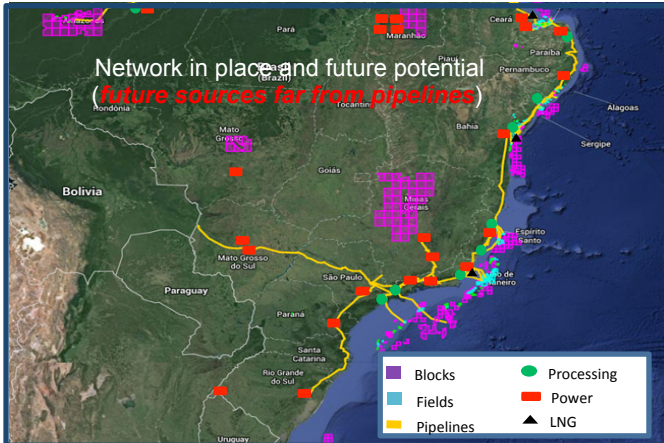
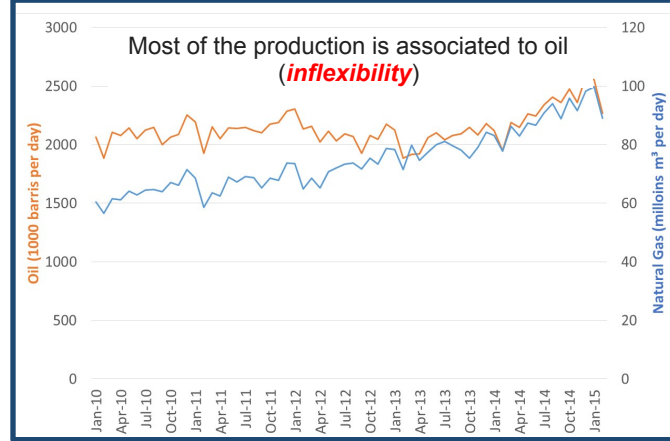
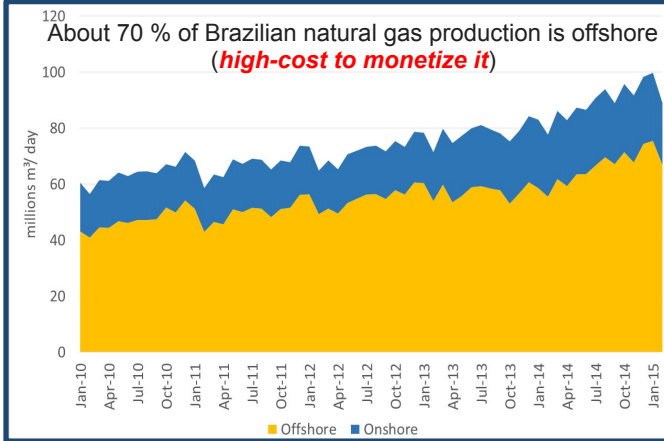


- Disruptive technology for use of gas (fuel cell, gas-fuelled transport)
- Eliminate methane fugitive emissions
- Energy efficiency technologies
- Enhancement of waste heat recovery
- CO2 separation and storage
- Low-carbon Power
- Linking natural gas and renewables

Main challenges for natural gas industry in Brazil

The background image shows an offshore oil and gas platform on the right, with a large LNG tanker ship on the left. The scene is set at sunset or sunrise, with a bright sun low on the horizon, casting a golden glow over the sea and sky. The platform has a crane and various structures. The tanker is a large, dark vessel with a complex superstructure. The water is dark with shimmering reflections from the sun. The sky is filled with soft, orange and yellow clouds. The overall mood is industrial and serene.

Natural gas in Brazil



Main challenges for natural gas industry in Brazil

How to meet the supply-demand balance?

UPSTREAM

Exploration & Production



- Monetization for associated gas production
- CO₂ and H₂S high-content on natural gas stream from pre-salt
- Monetization for isolated on-shore production (including Amazon source)
- Potential for unconventional gas in Brazil

MIDSTREAM

Transportation & Processing



- Unbundling of gas transportation network, processing plants and LNG terminals
- Gas transportation network expansion
- Gas Storage
- Multi-modal gas supply operation (small scale LNG/CNG + pipeline)

DOWNSTREAM

Distribution & Retail Sale



- Natural gas network and power grid synergetic analyses
- Alignment between federal and regional regulation
- Necessity of regulatory agencies per state mainly in North, Northeast and West of the country

Main challenges for natural gas industry in Brazil

How to meet the supply-demand balance?

- Brazil gas production is driven by oil production
- High volatility in gas-to-power demand causes high idle capacity.
- Integrated planning between gas and power sectors is key to gas business sustainability and to attract investments .

Main challenges for natural gas industry in Brazil

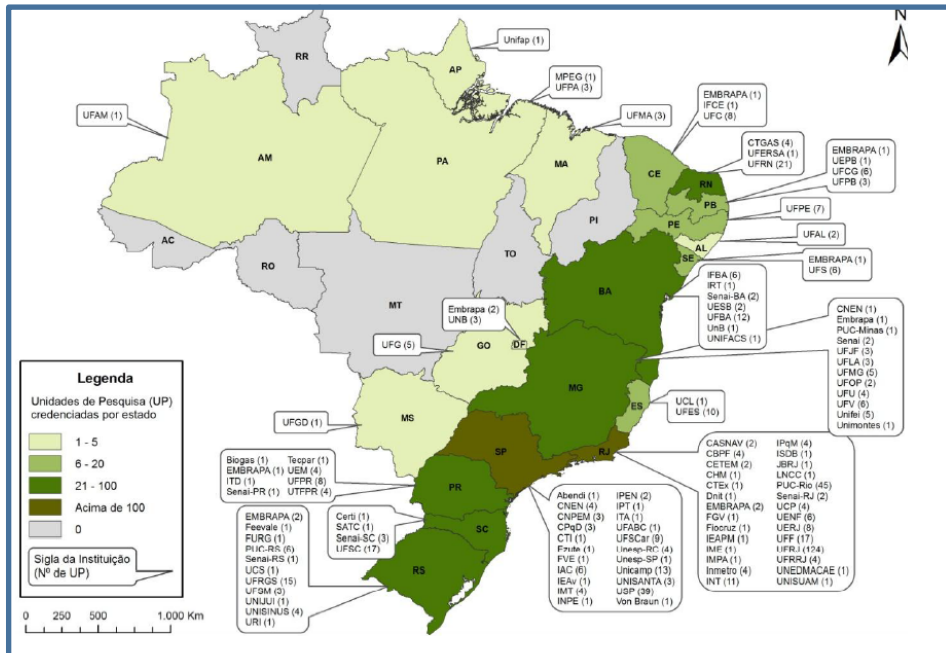
How Brazil is tackling these challenges ?

- Brazilian Gas Act (2009)
 - Regulation still in the early stages
- R&D Clause on E&P Concessions Contracts (1% of gross revenue going to R&D)

Research and Development accreditation

- 585 research units accredited by ANP
- More than US\$ 1.5 billion invested in R&D (2006 to date)

Source: ScoreBoard R&D 2014



Concessionária	Nº de Projetos	Recursos (R\$)	% Recursos
Petrobras	1.197	4.135.503.653	93,13%
BG	40	196.406.961	4,42%
Statoil	19	36.857.048	0,83%
Shell	5	23.510.770	0,53%
Petrogal	5	12.659.663	0,29%
Sinochem	8	11.417.335	0,26%
Repsol	10	10.363.982	0,23%
Chevron	9	6.365.974	0,14%
Frade Japão	1	3.157.523	0,07%
BP	2	2.321.858	0,05%
Queiroz Galvão	1	1.154.289	0,03%
Parnaíba Gás Natural	1	300.167	0,01%
ONGC	1	285.495	0,01%
Brasoil	2	236.250	0,01%
Rio das Contas	1	111.101	0,00%
Total	1	92.198	0,00%
Total	1.303	4.440.744.267	100,00%

Fonte: SPD/ANP.

Some R&D projects for natural gas challenges

Gas Innovation Centre - GIC

Research and development in potential future uses of gas.
Three integrated research programmes: Engineering; Physical Chemistry and Energy Policy & Economics.
BG Brasil and Fapesp.

CO2 Separation

Assessment of Ionic Liquids miscible in water for CO2 capture from gas streams.
Petrobras, PUC-RS

Fellowship Fostering NG Capabilities

Capacitation in science and technology research on future uses of natural gas in emerging low-carbon energy systems.
BG Brasil, USP and Imperial College London.

Biogas optimization

Optimization of biogas generation using computational fluid dynamics tool (CFD).
Petrobras, UCS.

Infrastructure

CO2 and H2S corrosion in metallic materials.
Repsol, UFRJ.

Energy Efficiency Programme

Sustainable Configuration for maritime operation; Unconventional cycles for waste heat recovery. *BG, Unicamp, USP and Unifei*

Natural gas + CO2 combustion

Development of tools for predicting the thermal radiation emission of diffusion flames in a natural gas and CO2 blend.
Petrobras, UFRGS.

Summary

- Brazil is still an immature gas market.
- The main challenge in Brazil is how to meet supply-demand balance (inflexible production, unpredictable demand and immature infrastructure)
- How Brazil faces these challenges?
 - Regulatory: integrated gas and power planning
 - Technological: R&D obligations are fostering innovation



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