

Natural Gas Reforms in Brazil: Market Outlook & Challenges

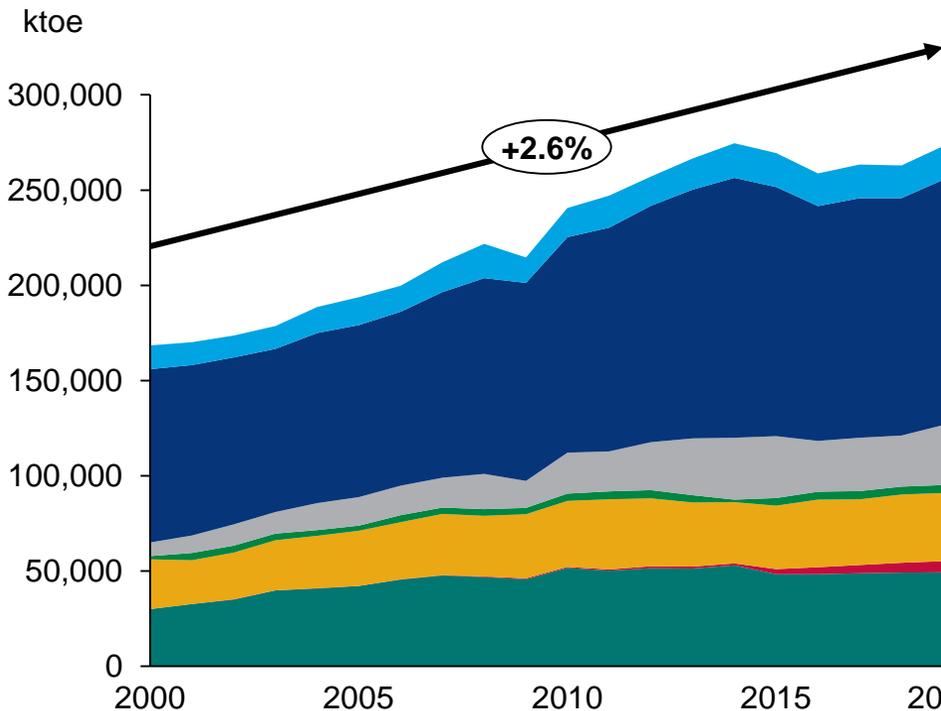
Brazilian-American Chamber of Commerce

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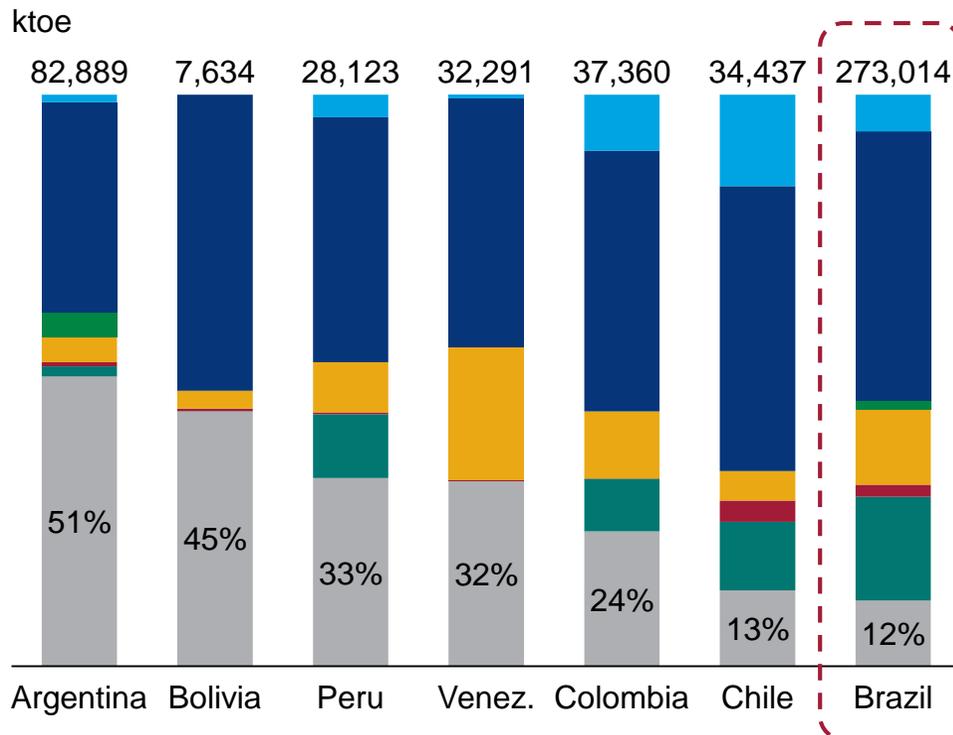


Gas plays a relatively marginal role in Brazil's energy matrix compared with the rest of LATAM (albeit, conditioned by hydrological factors) – upside exists

Primary Energy Demand by Fuel in Brazil¹



2019 Primary Energy Demand by Country¹



■ Coal
 ■ Oil
 ■ Gas
 ■ Nuclear
 ■ Hydro
 ■ Other Renewables
 ■ Other Solid Fuels

◆ Gas usage within Brazil is significantly lower than some of its regional counterparts, that have a higher reliance on gas for the power sector (however, gas sets the margin often and plays a key role during dry periods), residential / commercial sector (primarily usage is cooking, versus heating in countries like Argentina and Chile) and transport (penetration focused on RJ)

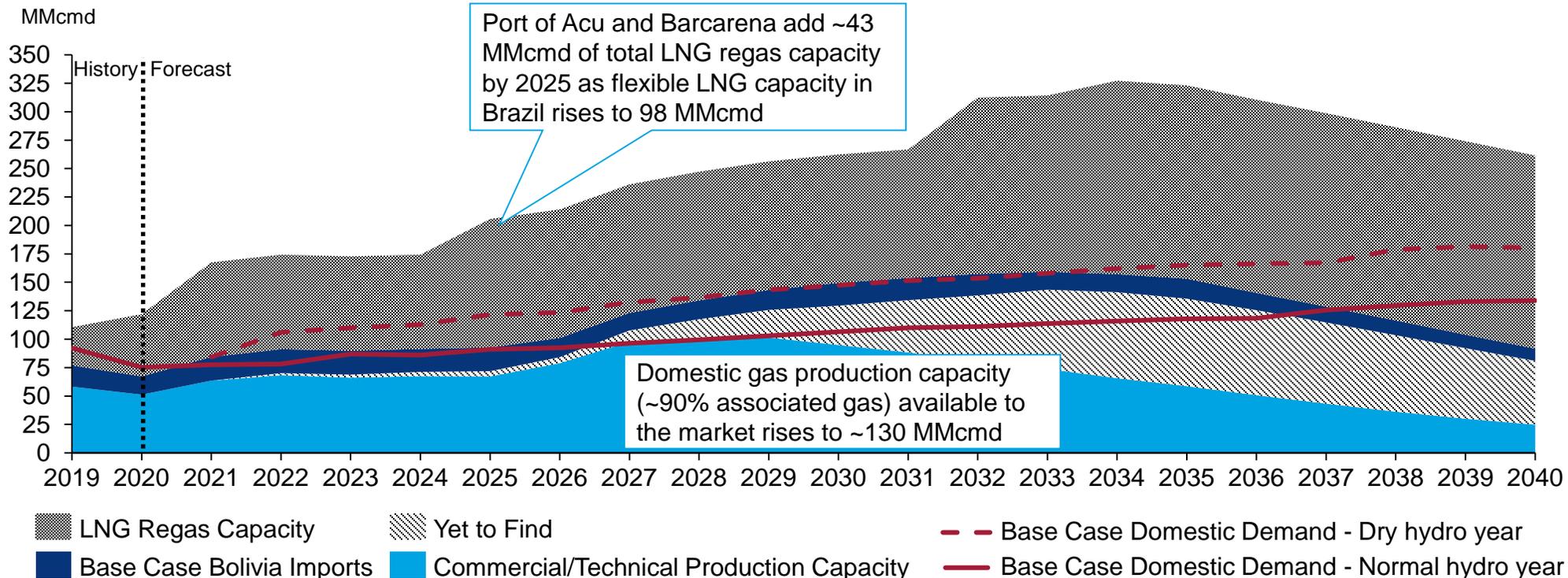
1. Historical values include total demand across the country (including transport, power generation, gains/losses and net imports)

2. Hydro is 100% efficient and thus, graphically appears under-represented in these charts

Source: Wood Mackenzie

Brazil's market is undergoing significant changes with domestic gas production capacity and flexible LNG capacity expected to double

Prospective Brazil Supply – Domestic marketable production capacity, Bolivian imports, & LNG capacity^{1,2}



- Brazil's gas matrix has historically relied heavily on Bolivian imports at competitive prices (Brazil imported an average of 26 MMcmd from Bolivia between Jan-15 to April-19: total import capacity is ~30 MMcmd), but this is set to change in the 2020's
- LNG regas capacity reflects the potential available capacity to deal with power-driven demand swings during dry seasons, serve stranded coastal demand or feed into specific projects (e.g. dedicated power plants or industrial complexes)

1. Base Case Bolivia imports defined as Wood Mackenzie's H1 2020 Base Case outlook for Bolivia imports to Brazil

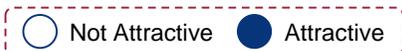
2. LNG Regas Capacity defined as combined LNG regas capacity for all current and projected terminals included in Wood Mackenzie H1 2020 Base Case at max. operating capacity

Source: Wood Mackenzie

Demand creation is critical to unlock the value of Brazil's marketable gas production capacity and flexible LNG...

	Infr. Cost	Mkt. Viab	Eco. Imp.	Soc. Imp.	Cons	Pros
Additional Reinjection* (Offshore Gas)					<ul style="list-style-type: none"> No economic value Could impact oil production optimization 	<ul style="list-style-type: none"> Simplest solution for offshore gas – Investment limited to reinjection well cost, no infrastructure
LNG Exports (Offshore Gas)					<ul style="list-style-type: none"> FLNG export competitiveness? Modular – Won't capture all potential (limited to highest value areas) 	<ul style="list-style-type: none"> Large-scale monetization of resource Isolate value of gas from country-specific dynamics and provide global market exposure
Gas-fired power build-up					<ul style="list-style-type: none"> Limited incremental CCGT capacity need projected for Brazil to 2025 Economic impact modest and limited to coastal areas and could focus off-grid 	<ul style="list-style-type: none"> Can be located proximate to supply Serves as anchor for more penetration
Industrialization via Gas					<ul style="list-style-type: none"> Direct economic impact limited to coastal areas and could focus off-grid Competitiveness tied to global market dynamics, so low cost of gas critical 	<ul style="list-style-type: none"> Highest value in use for gas (vs. other uses), maximizes economic impact Can be located proximate to supply Serves as anchor for more penetration
Gas Massification (Res/Com/NGV + Small-scale LNG projects)					<ul style="list-style-type: none"> Government policies and regulatory changes (federal and state) required More gradual growth vs. alternatives 	<ul style="list-style-type: none"> Highest impact for social and economic development With appropriate incentives and legal framework, value chain investors drive

Complementary



...but, ultimately, continued progress and industry alignment with the ongoing gas reform will be the catalyst to drive investment and markets

Key Industry Signposts		Current Status
 <p>Successful Petrobras gas value chain divestment</p> <ul style="list-style-type: none"> - Pipelines (TAG, NTS, TBG) - LDCs (Gaspetro) 		
 <p>Continued legal and regulatory reform progress & agility</p> <ul style="list-style-type: none"> - Natural Gas Law - ANP/MME resolutions - State regulation / commercialization good practice 		
 <p>Material 3rd party infrastructure capacity contracting</p> <ul style="list-style-type: none"> - Transport - On-system LNG - Gathering and processing 		
 <p>Commercial risk sharing and phased value chain unbundling to drive non-Petrobras GSAs / secondary market development</p> <ul style="list-style-type: none"> - LDCs - Industrials / Power Plants - Producers - Traders / Marketers 		
 <p>Patience as market liquidity builds and today's popular off-grid gas market growth solutions integrate with the system</p>		

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