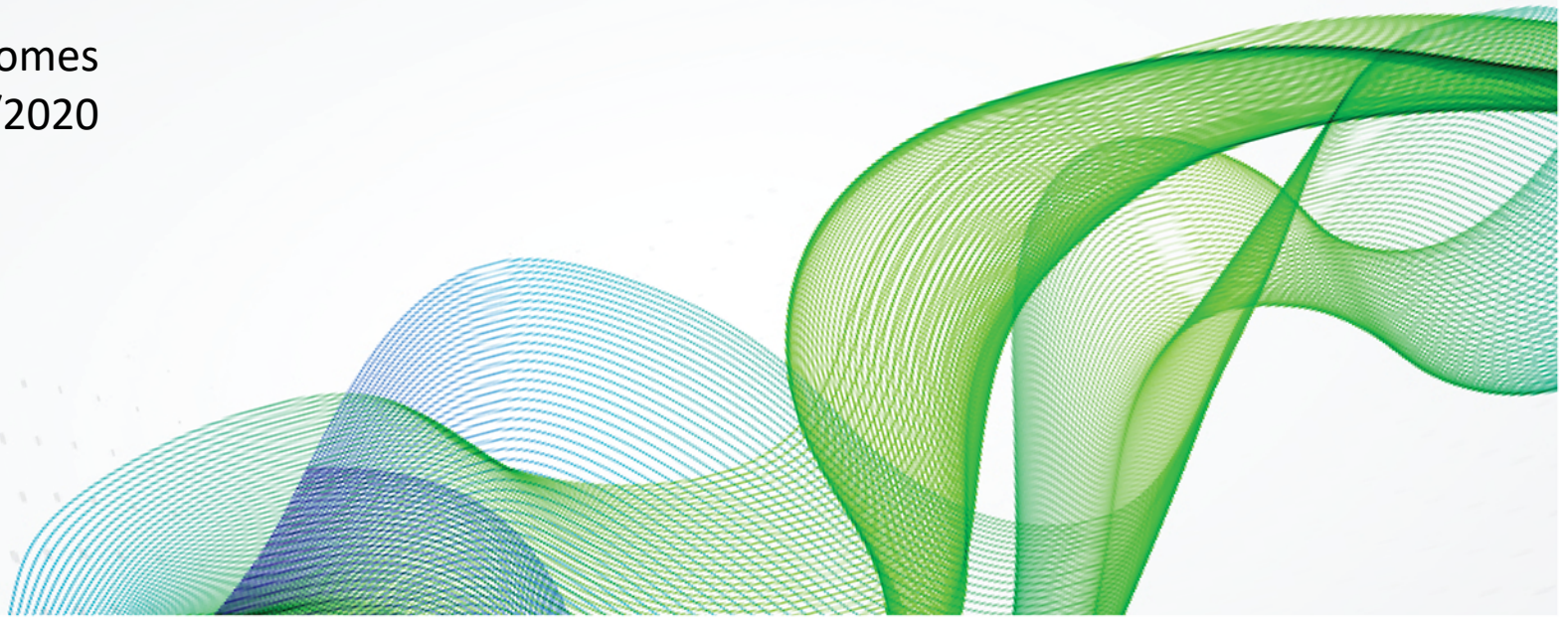


Black swan and energy transition webinars

Natural gas markets and the pandemic

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02/07/2020





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Please remember that antitrust/competition law continues to apply

Information not discussed under normal circumstances during such sessions should not be discussed now either - even with the current uncertainty in markets as a result of Covid-19

With the evolving Covid-19 situation and broader implications for industry supply chains, there is the potential for questions to arise concerning current or future production levels, impact on product pricing or supply strategies - these are matters that should not be discussed with, or broadcast to, competitors.

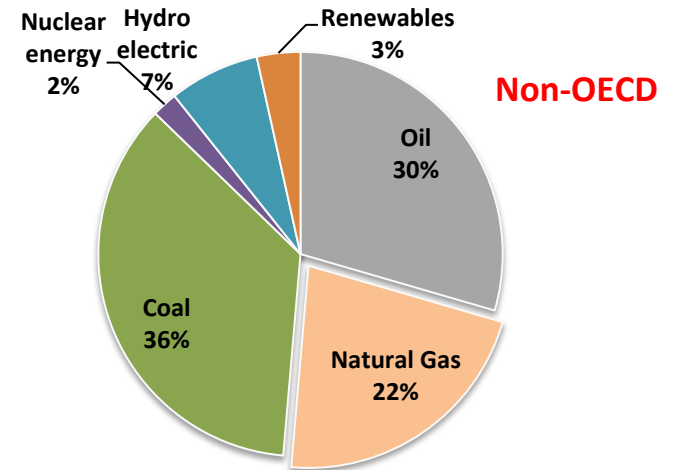
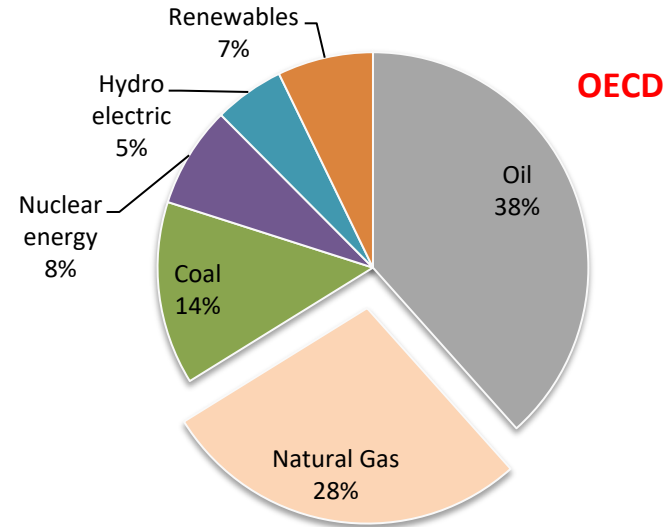
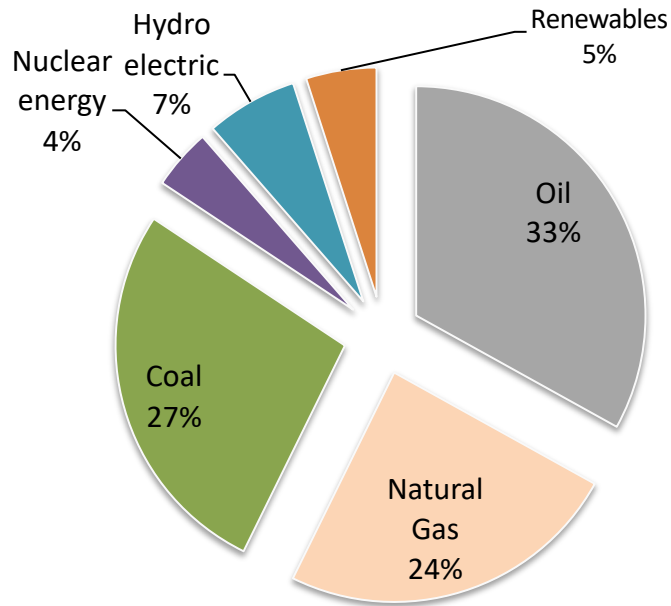


Agenda

- Natural gas evolution and outlook: the world before 2020
- Challenges facing the natural gas industry
- Impacts of COVID19
- The Brazilian gas market



World Primary Energy Consumption by Fuel

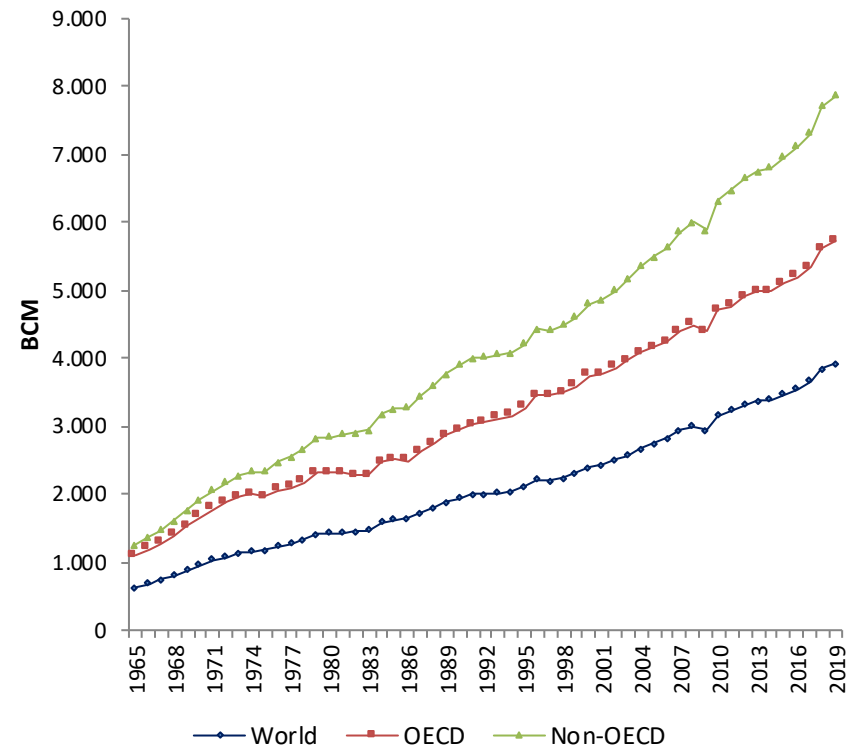


- Coal : the predominant source of primary energy in non-OECD countries
- Natural gas share stable at 24%



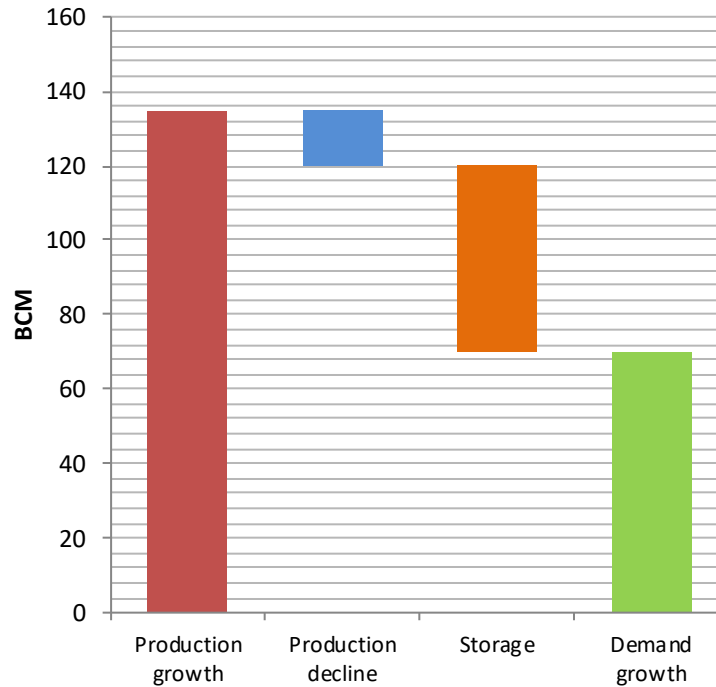
Natural gas: fundamentals already weakening in 2019

- Historic 2008-2018 rate: 2.5%
- 2018/2017: 5.3%
- 2019/18 consumption growth: 2%
 - Slower growth in China (slower coal to gas switch/lower GDP growth/infrastructure bottlenecks)
 - Warmer weather in Russia
 - Weak demand in Latin America
- Coal switch to gas accounted for 75% of additional demand
- Japan and S. Korea: nuclear coming back





Surplus gas without a home (2019)

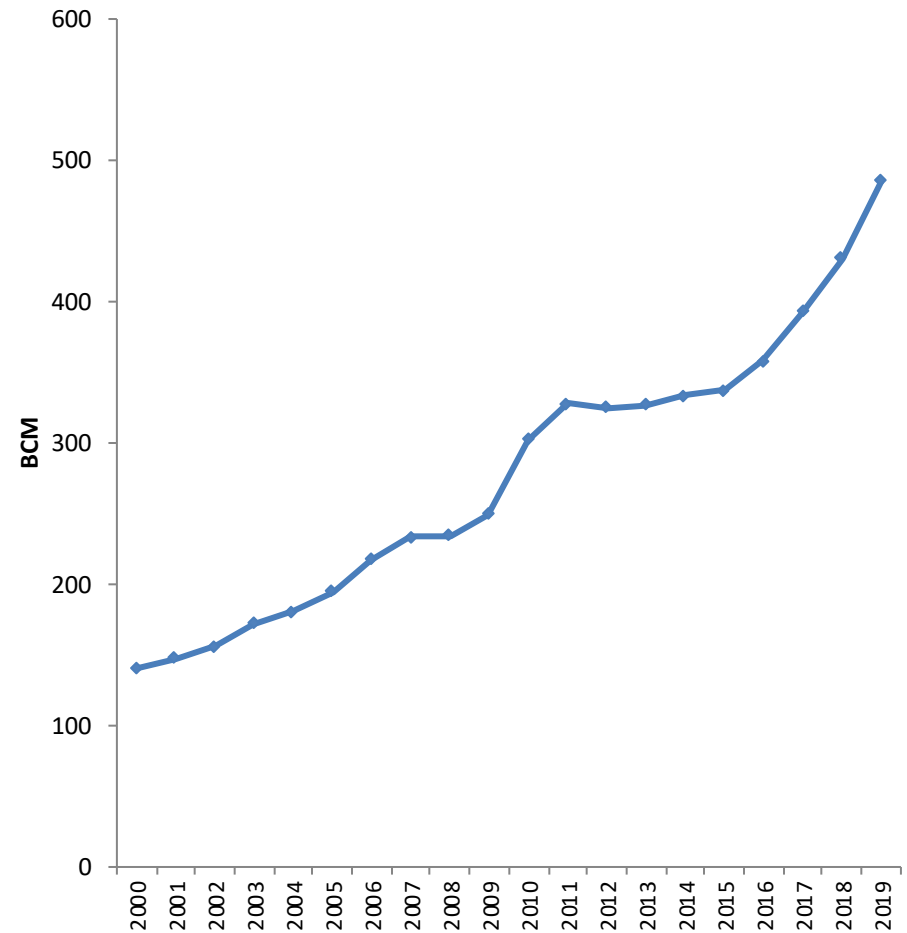


- Production outpaced demand by circa 60 BCM (2019)
- Led by US shale (70 % of growth)
- Strong build up of storage in US and Europe in 2019/2020



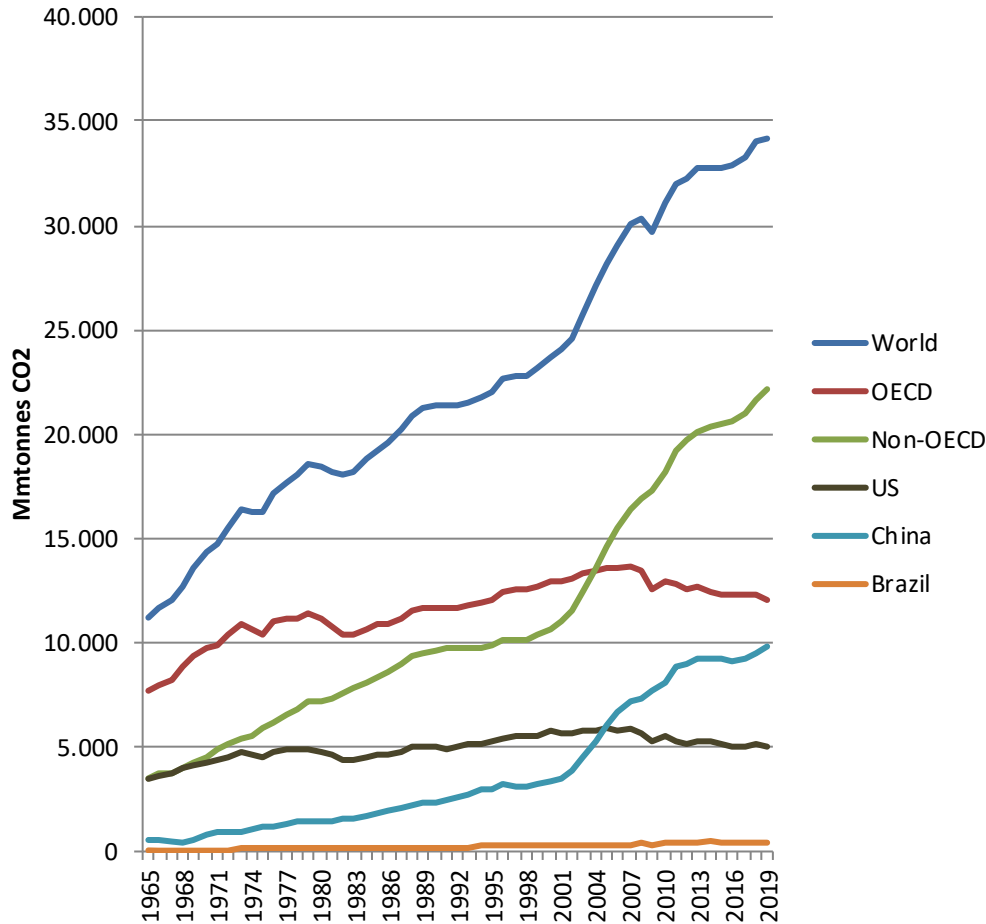
LNG: record consumption in an oversupplied market

- LNG trade 2019: 355 mtpa
- Record increase in LNG trade: 13% (2019/2018): +40 mtpa
- Pushed by lower prices and energy policy
- +42.5 mtpa of liquefaction capacity
- 826 mtpa regas capacity
- LNG accounts for 49% of the world gas trade





Global CO2 emissions continue to rise, at slower rate



- Emissions 2019/2019: 0.5%
- Non-OECD accounts for 2/3 of global emissions
- Share of CO₂ emissions 2019
 - OECD = 35.2%
 - Non-OECD=64.8%
 - **China=28.8%**
 - US=14.5%
 - **Brazil=1.3%**



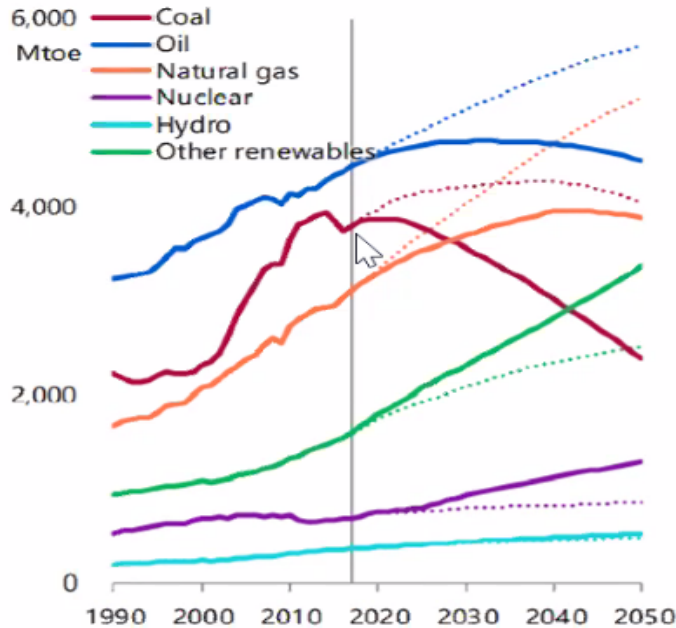
Key challenges facing natural gas

- Energy transition: what is the role of gas?
- Impact of pandemic on demand
- Weaker global prices: impact on new investment
- Emerging markets: lack of infrastructure and price policies

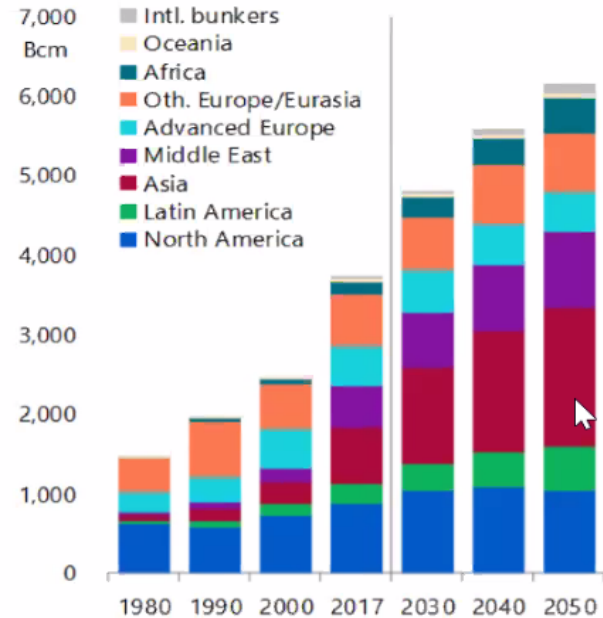


Energy transition

By energy source



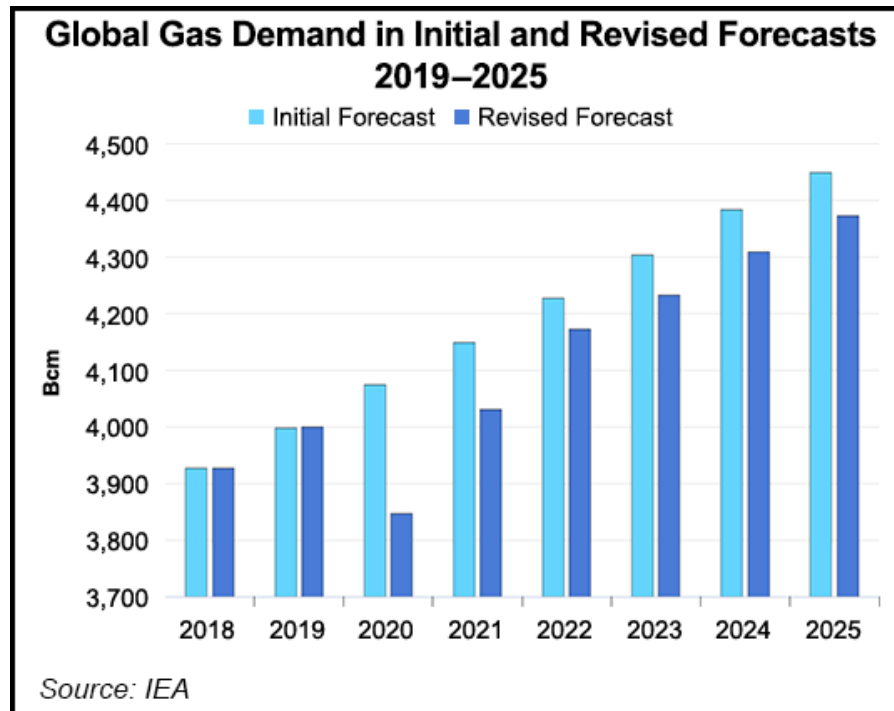
Natural gas consumption By region



- Global energy demand expected to grow +40% by 2040
- Natural gas consumption grows until 2040 then start moderate decrease
- Asia is the driver for gas growth
- Upstream and LNG investment 20-30 years project lifetime
- Decision is needed now for a contraction in demand in 2040-2050



Natural gas demand: impact of and pandemic



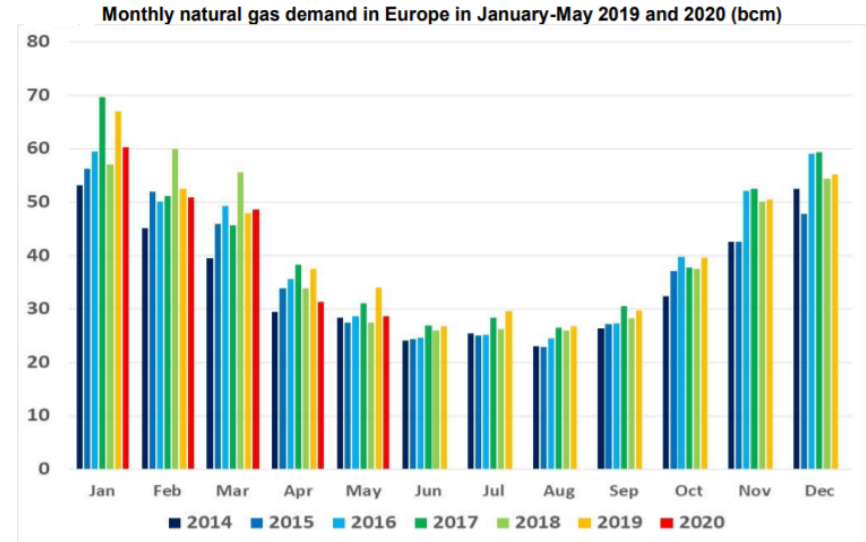
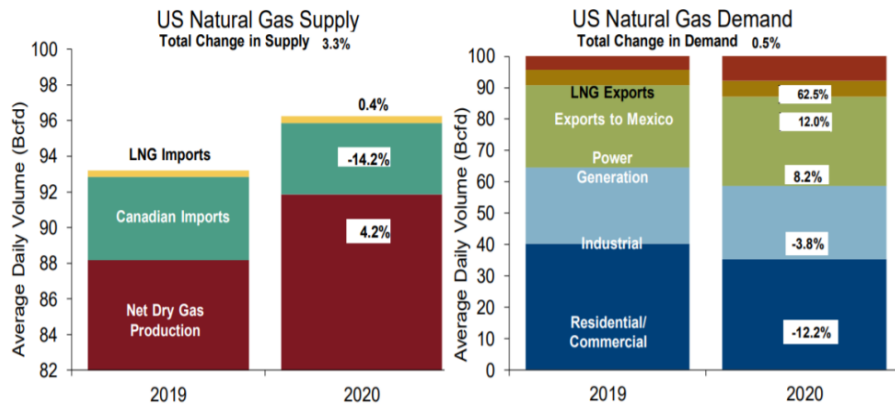
- World GDP expected to contract by -5% to -7% in 2020
- IEA predicts a drop in consumption of 4% in 2020
- Expected loss of 75 BCM in demand by 2025



Impact of pandemic on natural gas consumption: US and Europe

U.S. NG Supply and Demand Apr-19 YTD vs. Apr-20 YTD

Federal Energy Regulatory Commission Market Assessments

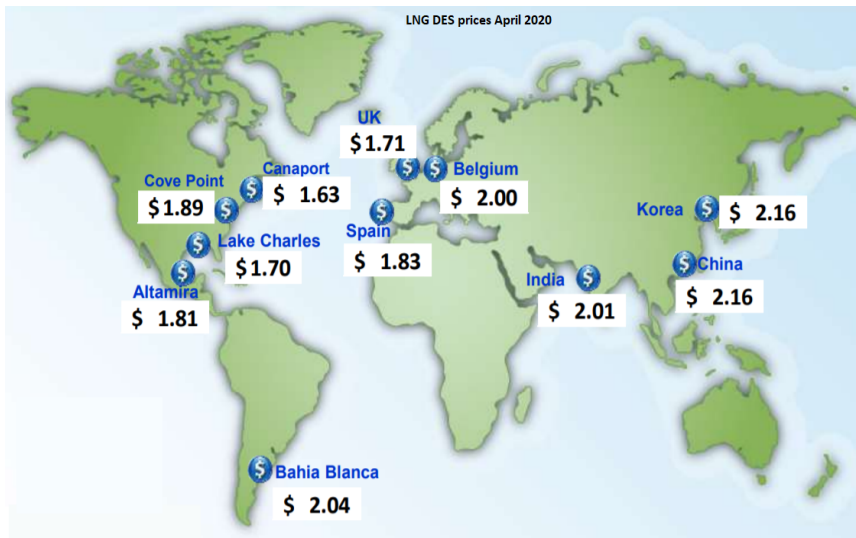
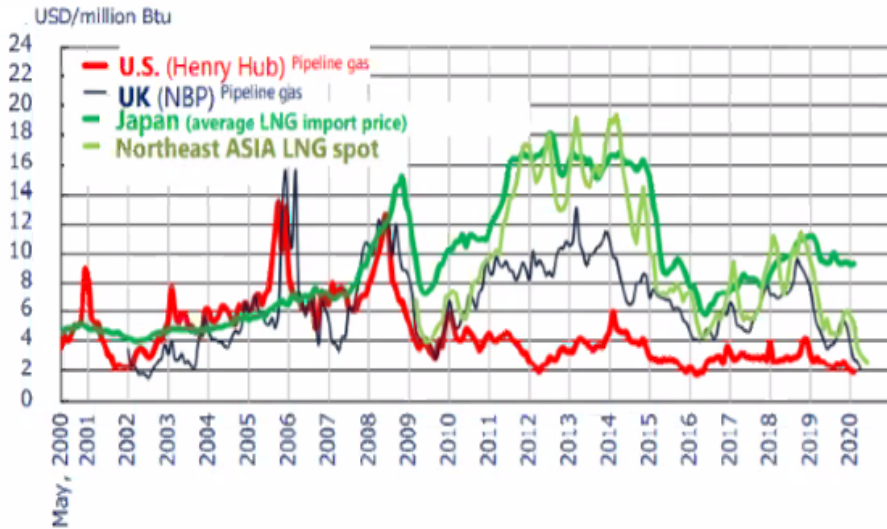


Sources: IEA, Eurostat, EntsoG, GRTgaz, Terega, NCG, Gaspool, SNAM, Enagas, NationalGrid and author's calculations

- US: sharp contraction in residential and industrial demand YTD April 2020
- But production still growing YTD April
- Europe demand down 16% in April and May year on year



Natural gas and pandemic: impact on prices



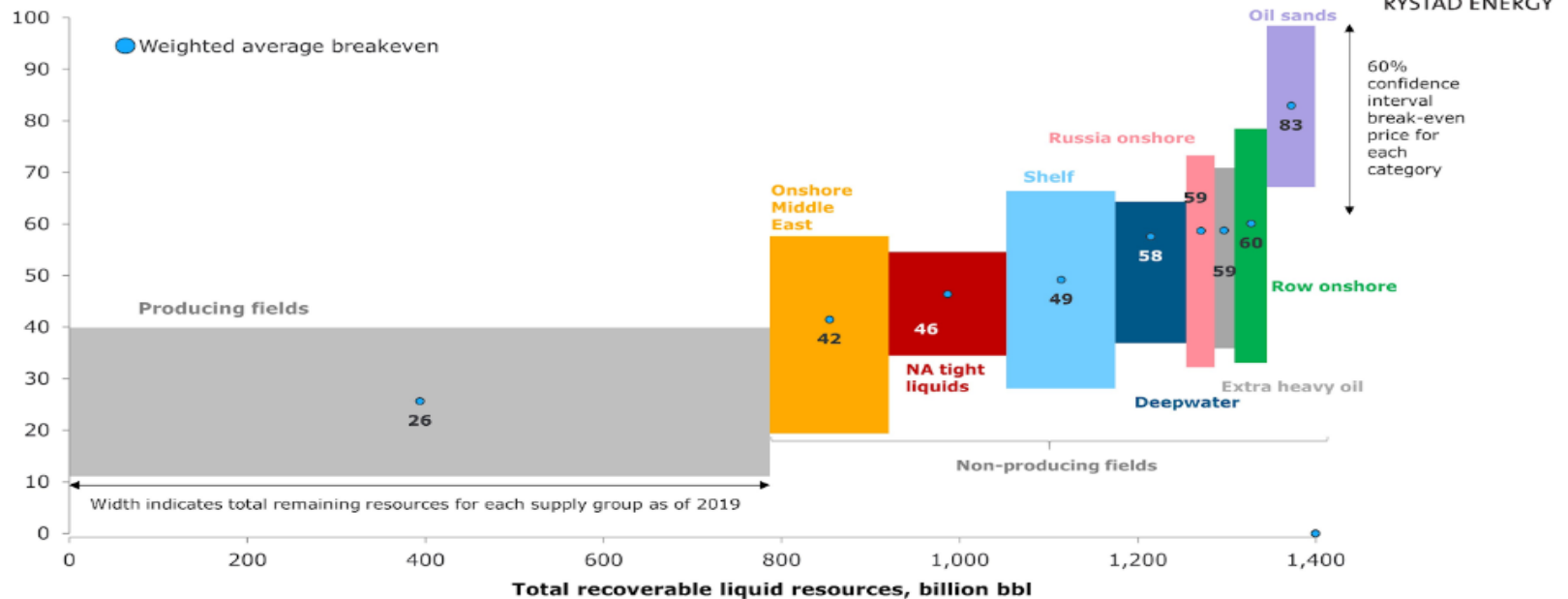
- Before pandemic: convergence of Japanese and European spot prices (over supply)
- Oil prices drop below \$20/barrel
 - OPEC lack of agreement in early 2020
 - Demand curtailed by pandemic
- Pandemic impact: spot prices converging to HH (<USD 2.0/MMBtu)
- USD 2/MMBtu = USD 11.6/barrel
- Industry response: CAPEX cuts, LNG cargoes cancellation (>120 June-August)
- Potential deferral of >80 mtpa LNG by 2030



How to develop new oil & gas in a world below \$40/barrel

Global liquid supply curve

Real Brent Break-even price, USD/bbl



Source: Rystad Energy UCube

- Future oil supply growth depends on oil prices > \$42/barrel (USD 7.2/MMBtu for dry non associated gas)

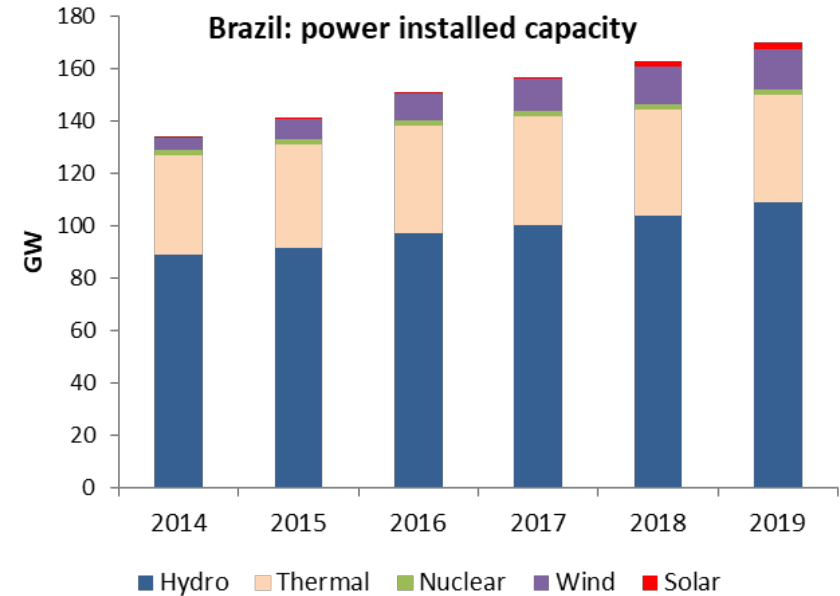
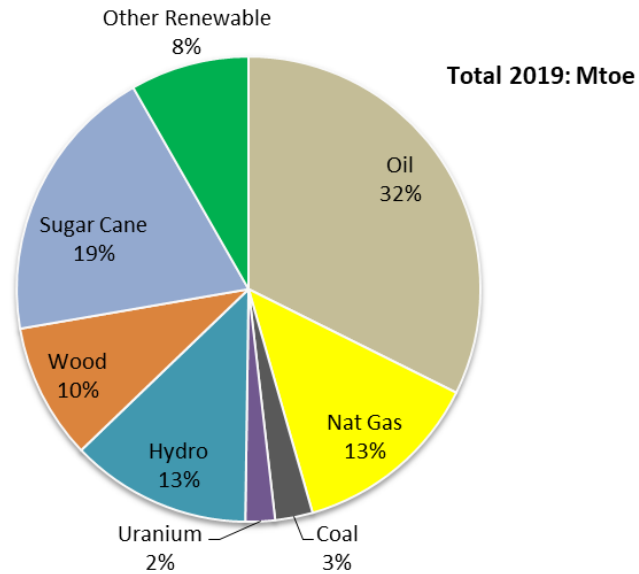


The case of BRAZIL





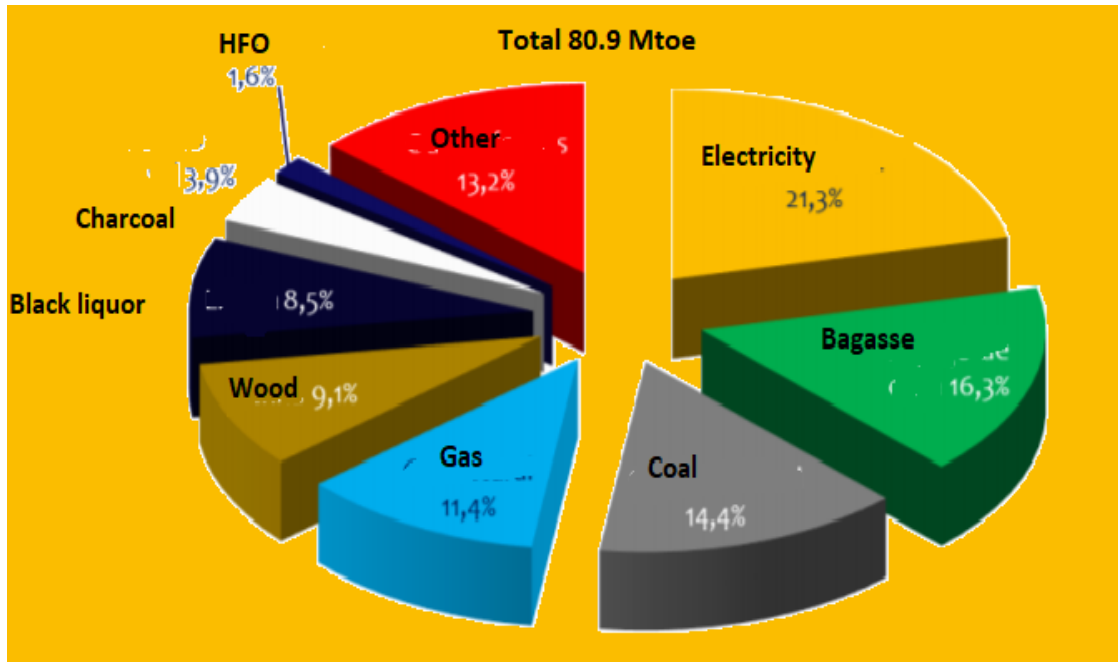
Brazil: a large energy player



- 10th largest world primary energy consumer
- 11th largest oil producer: 2.8 mm barrels/d, 2019 (62% from pre-salt)
- Renewable energy
 - 38% of primary energy offer
 - 75% of electricity capacity (wind + solar = 10%)
 - 78% of electricity generation



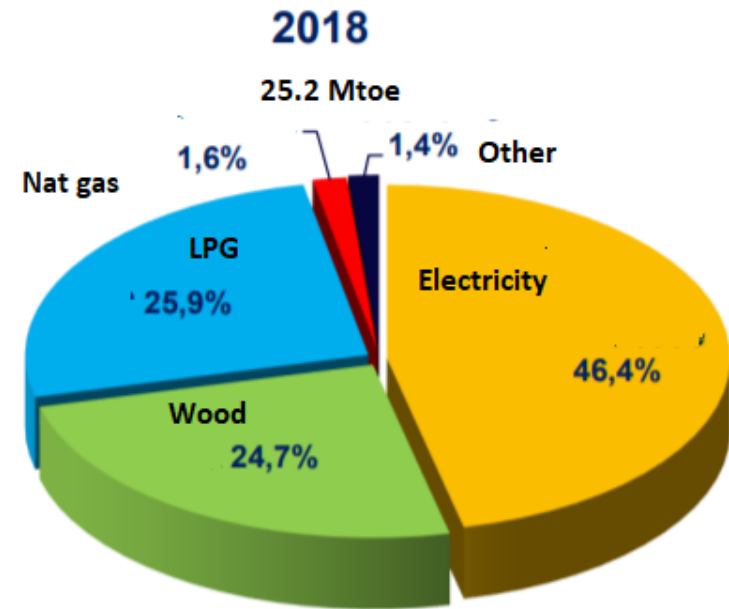
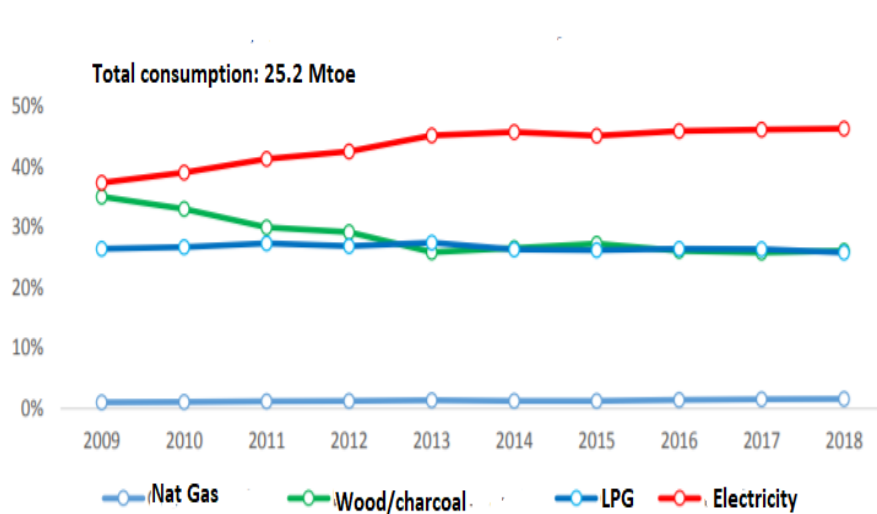
Energy demand: industrial sector(2018)



- Gas consumption share: 11.4%
- Industrial energy demand dropped 8.2% before COVID(2019/2017)
- Potential to replace wood, LPG,HFO: 8.8 Bcm/y, at the right price
- April 2020: 18.8% drop in industrial output



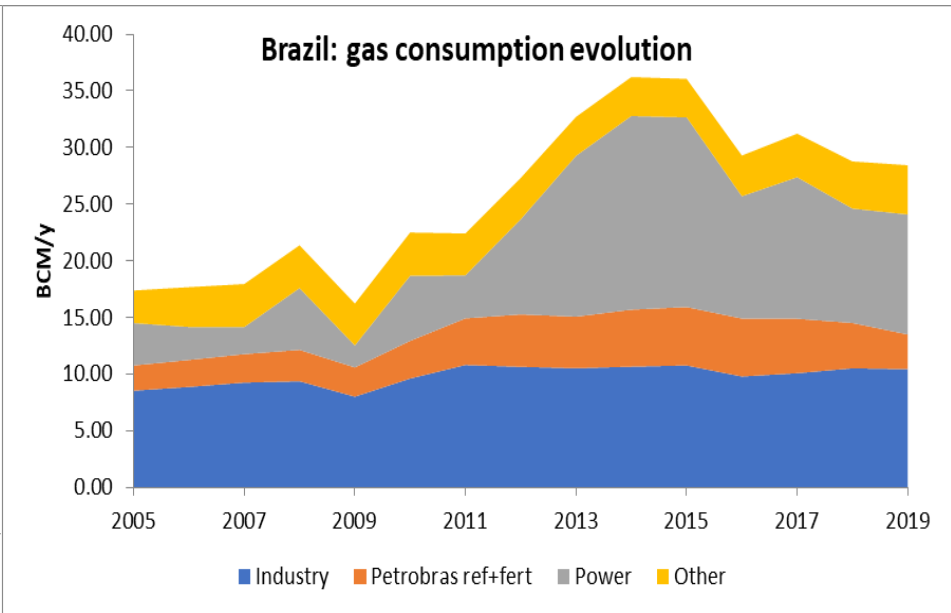
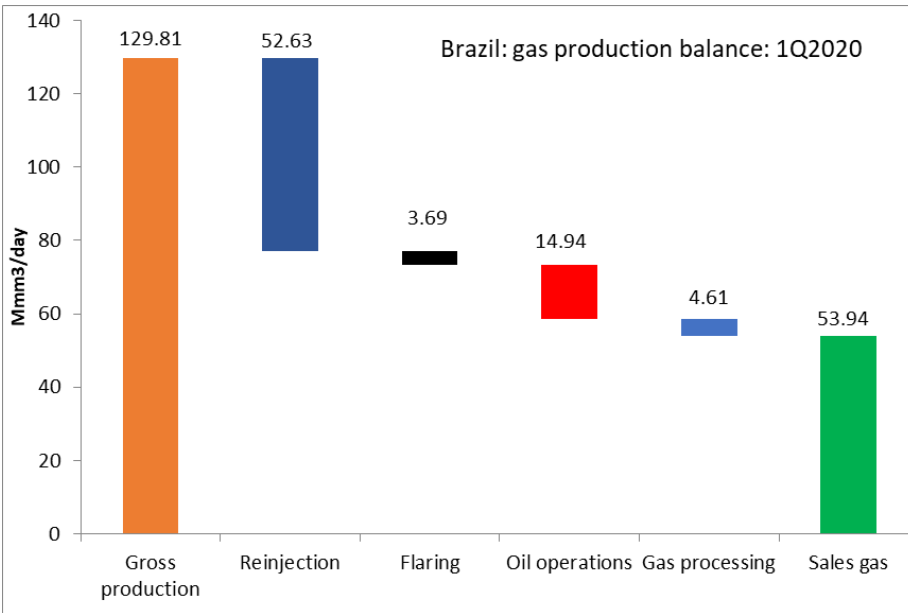
Residential energy demand: gas plays a small role



- Natural gas: 1.6% of residential consumption
- Wood is extensively used in rural areas, no gas grids
- 6.8% YoY growth due to network expansion
- Potential market: 2.3 Bcm/y, if replacing 30% GLP



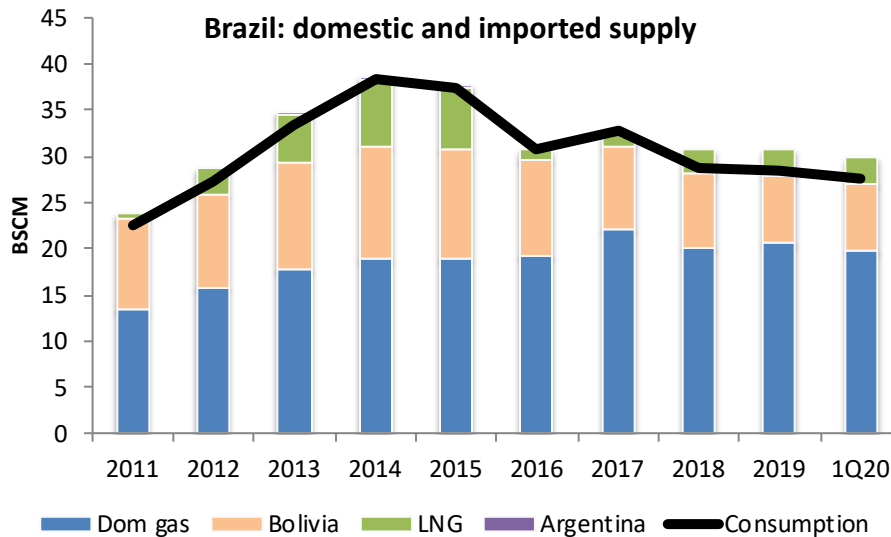
Brazil: lots of gas but slow demand growth



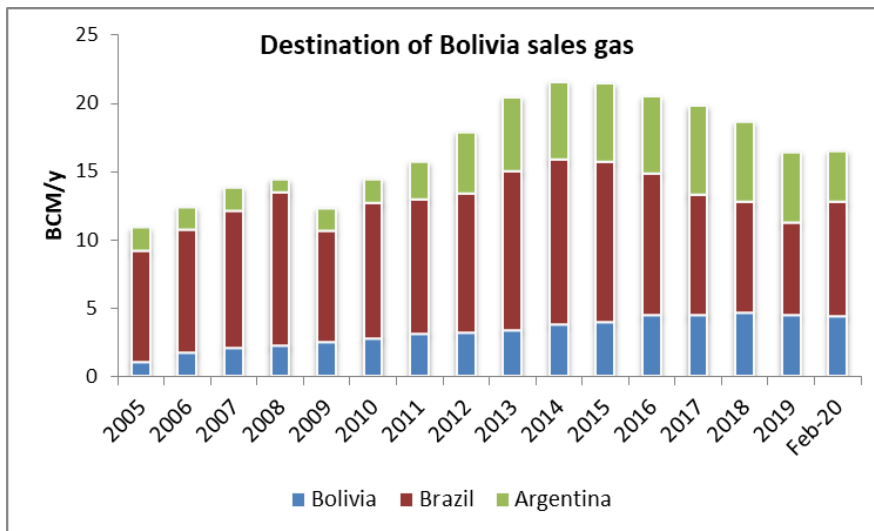
- ✓ Reinjection: 41% of domestic production
- ✓ Power market volatility, stagnant industrial demand and lack of offshore infrastructure inhibits offshore gas monetization
- ✓ Industrial demand: stagnant (high gas prices, Brazilian economy)
- ✓ Flexible model of power auction do not favour domestic associated gas



Brazil: a net gas importer

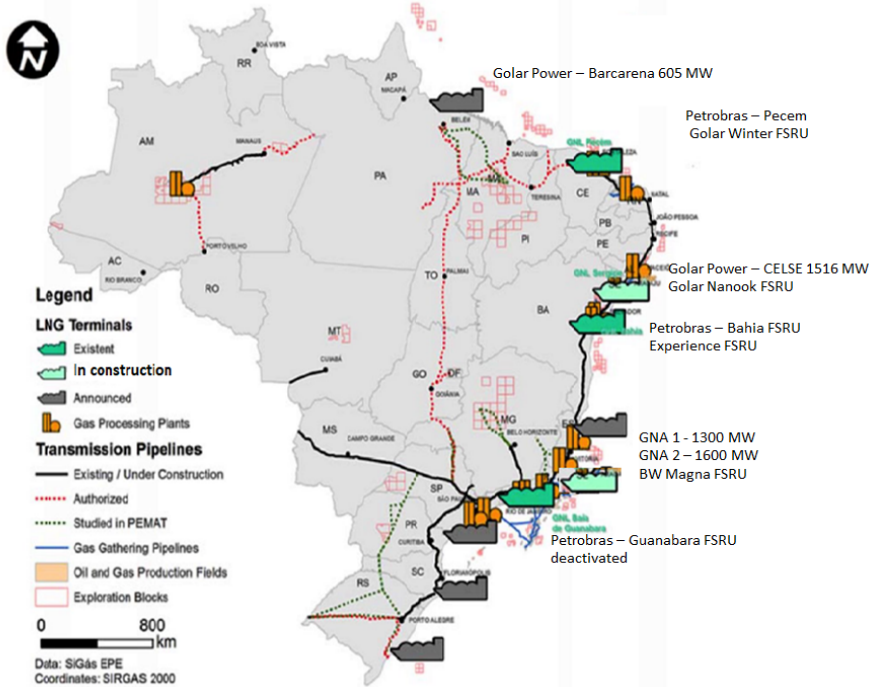


- LNG imports
 - 1Q20: 0.32 mtpa
 - 2019: 2.32 mtpa
 - 2015: 5.75 mtpa
- LNG imports will increase with dedicated private LNG powered plants in 2020/2025
- Bolivia imports: Petrobras uses downturn flexibility (ToP=80%)
- Petrobras/YPFB March 2020 contract renewal:
 - 20 MMm³/day vs former 30 MMm³/day
 - Space for new players

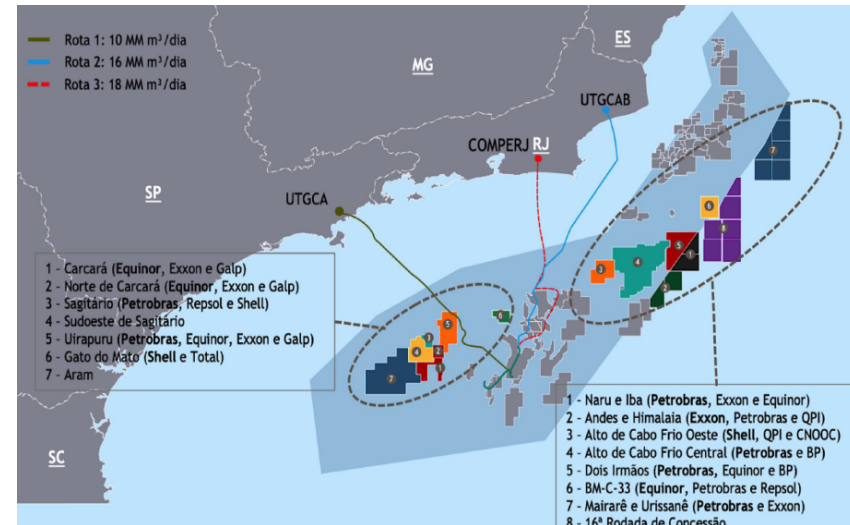




Brazil: limited natural gas infrastructure is a challenge



44 MMm³/day offshore gas pipelines
Campos/Santos Basin cluster

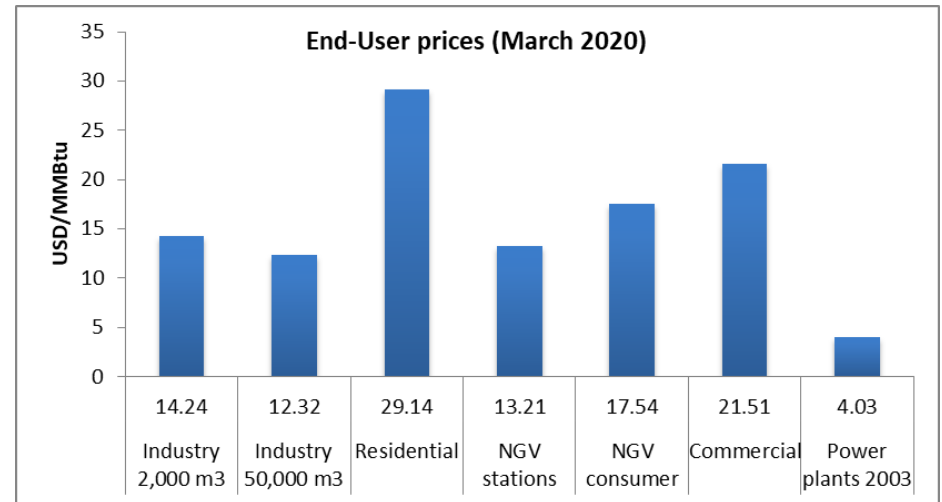
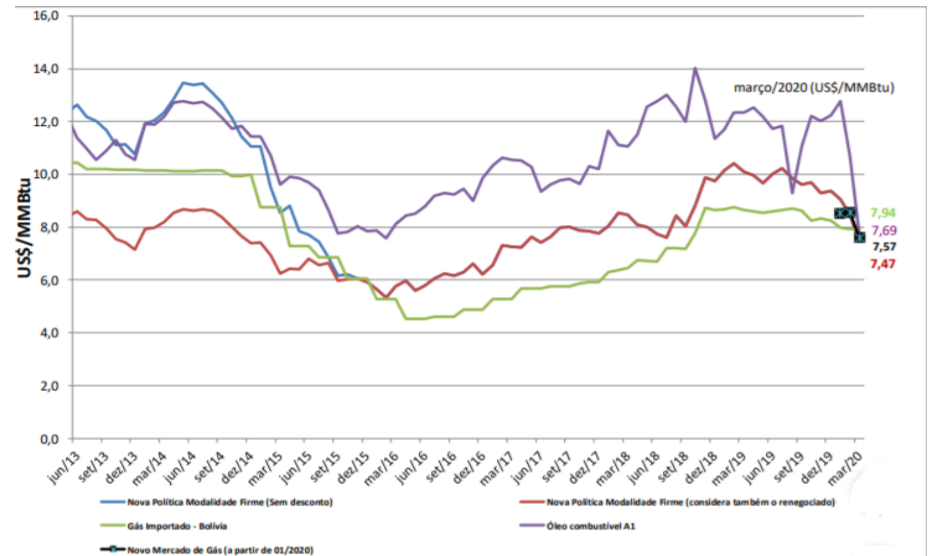


- LNG terminals: 3 in operation, 1 deactivated, 1 in construction, 1 in development
- Pipelines:
 - Transmission: 9409 km, 3 main systems
 - Distribution: 36,429 km, 3.7 million gas consumers
- 14,100 MW gas fired power plants
- Distribution companies investment in grid expansion

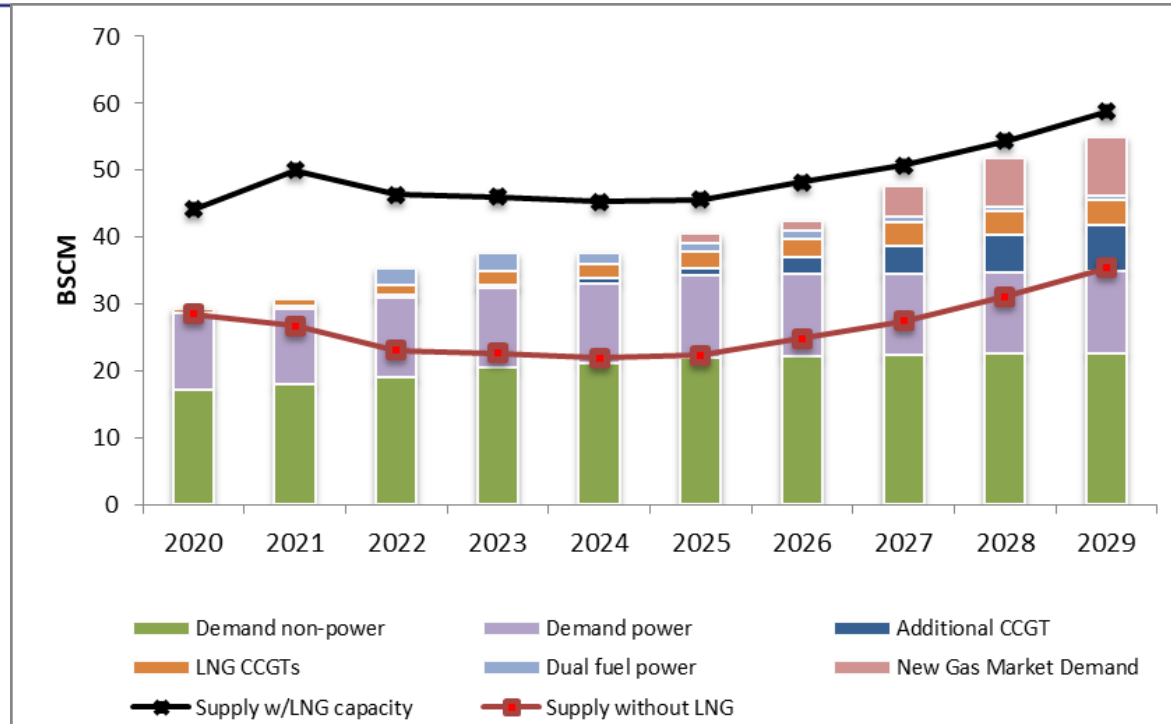


Brazil: LNG and natural gas prices

- Average LNG FOB price:
 - 1Q2020: \$4.04/MMBtu
 - 2019: \$5.35/MMBtu
- City gate prices (March 2020) converging to HFO
 - Bolivia: \$7.94/MMBtu
 - Domestic: \$7.47- 7.57
 - HFO: \$7.69/MMBtu
 - Wood (\$6-7/MMBtu)
- LNG prices for power plants
 - Market/auction prices
 - Price indexation: HH, JKM, Brent



Integrated system: LNG capacity meets demand till 2029



- LNG: doesn't include Guanabara/Barcarena. Pecem at 7 MMm3/d
- Bolivia: 30MMm3/d by 2022; 20 MMm3/day thereafter
- Domestic gas: doesn't include Maranhao, Amazonas
- Power: LNG CCGTs dispatching at 30% and 50%
- New Gas Market creates new demand post 2024 – industries and power




Brazil: natural gas and pandemic

- Suspension of power and E&P auctions in 2020: concerns about demand and investment capacity
 - 2019 power auctions > 2400 MW,
 - 2019 E&P auctions >USD 25 billion in bid bonus
- Consumers unable to pay monthly rates: gas distribution companies seeking Government support
- Substantial drop in demand expected in 2Q2020
- April consumption 2020/2019: -25% (circa -0.4 BCM in one month)
 - -35%-40% industrial
 - -60% commercial market
 - -40% NGV
- Pandemic aggravated situation of a already sluggish market



Conclusions

- Pandemic aggravated the challenges for a globally oversupplied gas market
 - Oil majors CAPEX cuts > USD 40 billion will impact new upstream and LNG investment
 - Gas at USD 2.0/MMBtu (USD 12/barrel) is much below breakeven of USD 40-50/MMBtu: challenge for associated gas
 - No quick recovery until 2025
 - Emerging markets recovery dictated by government policy, infrastructure investment and prices
 - But then, how investment decisions will be impacted by energy transition goals?
- 



Thanks!

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