ENERGIA

FGV ENERGIA

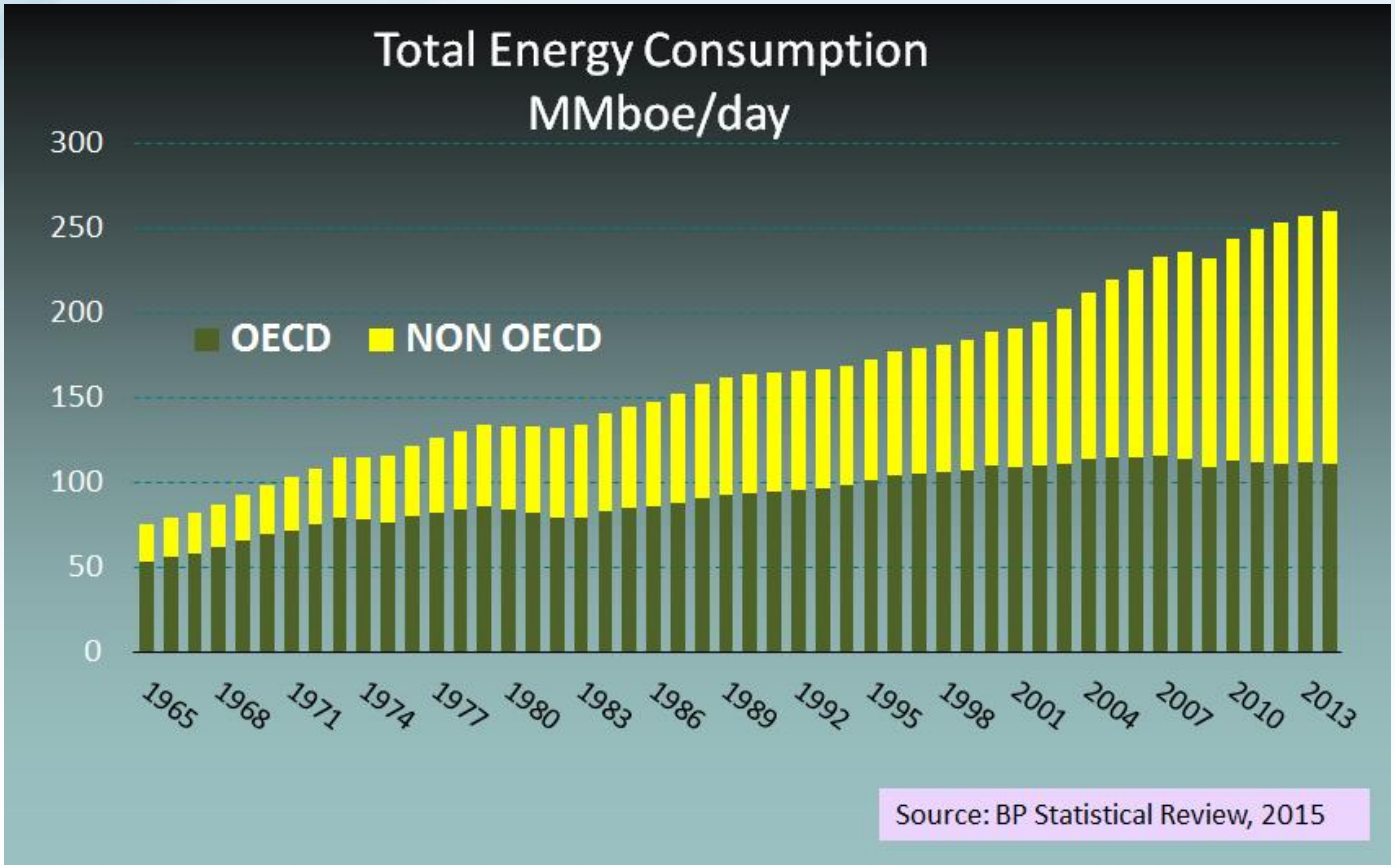
Energia em Foco – Estratégias e Dasafios para o Futuro

Desafios e Oportunidades para o setor de Petróleo & Gás

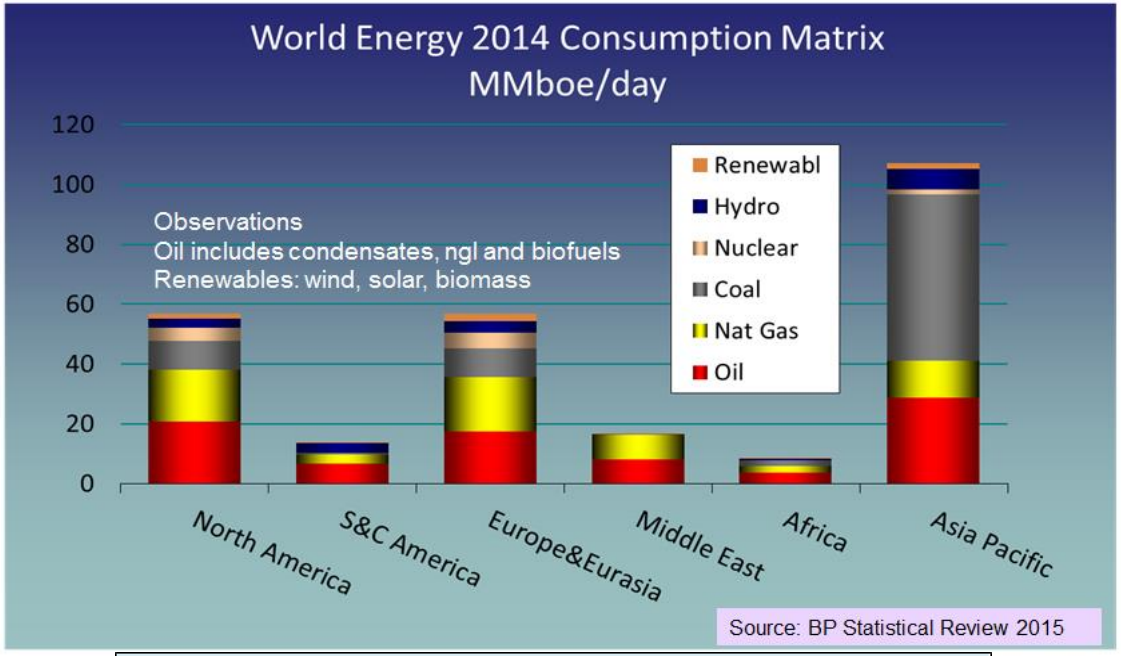
João Carlos de Luca
Diretor Presidente

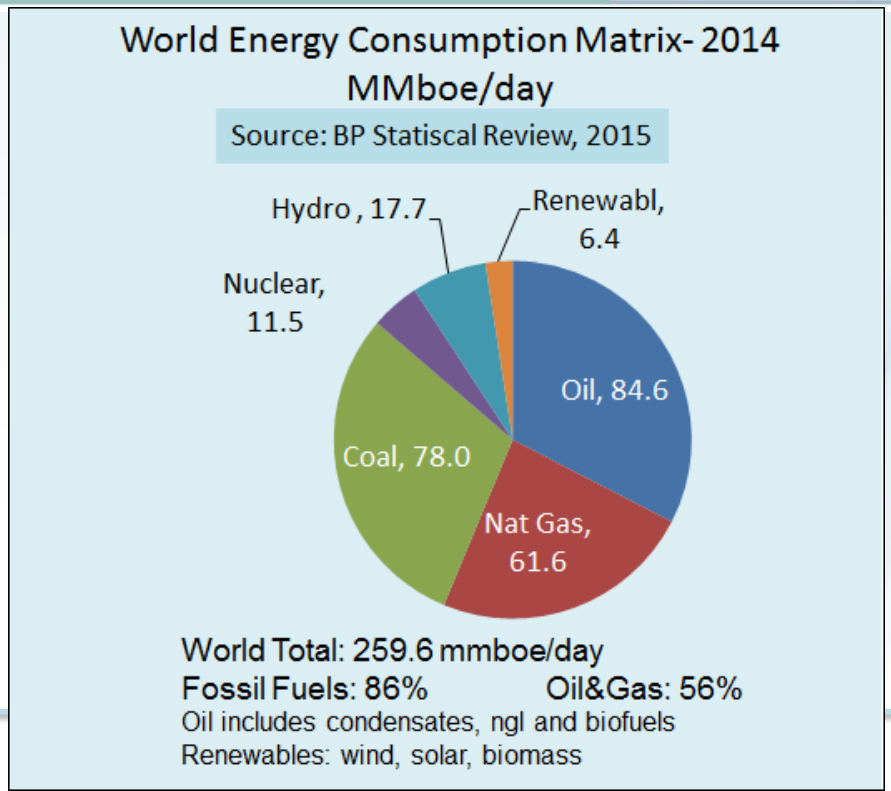
30.07.2015

ENERGY, OIL AND NATURAL GAS
Past Trends in Supply and Demand



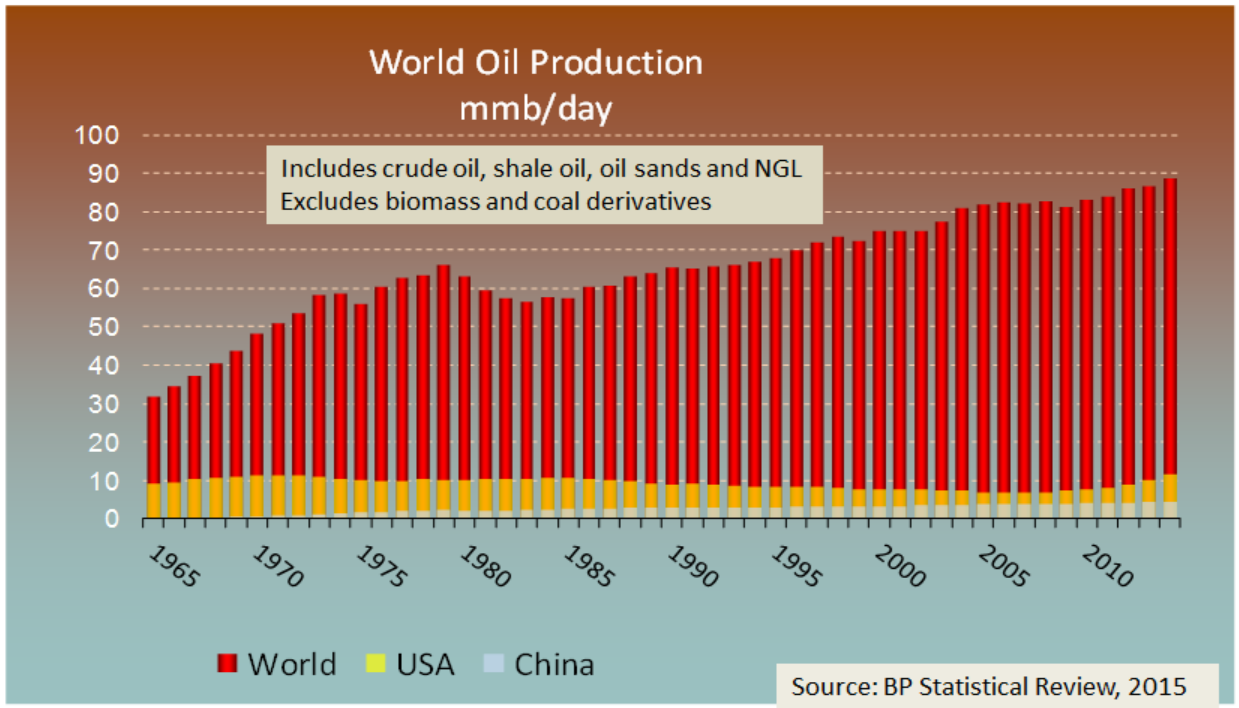
The world's energy matrix has been predominatly based on fossil fuels since the industrial revolution.
Coal remained as the single most important source of energy until the early part of the 20st century. By the 1950's oil had displaced coal as the largest component of the energy matrix and remained so since then. At the same time natural gas substantially increased its participation in the energy mix, particularly in the more industrialized and developed countries.
Today's energy mix still relies mostly on fossil fuels (86%), with oil and natural gas accounting for 56% of the overall energy consumption.
Increasingly, environmental, social and economic factors indicate that, to be sustainable, the future matrix will have to be de-carbonized, more efficient, and rely a lot more on renewable, clean and socially acceptable sources of energy. A transition into this new model will require massive technology, capital, infrastructure development/adaptation and changes in consuming habits.

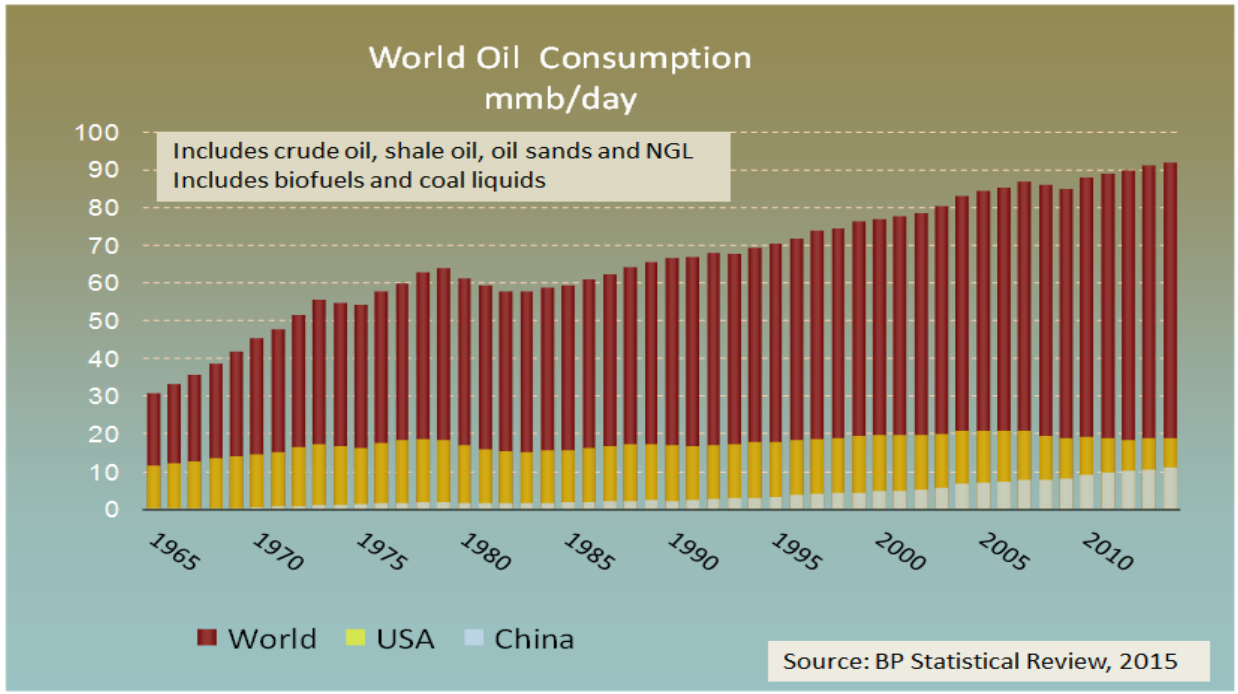




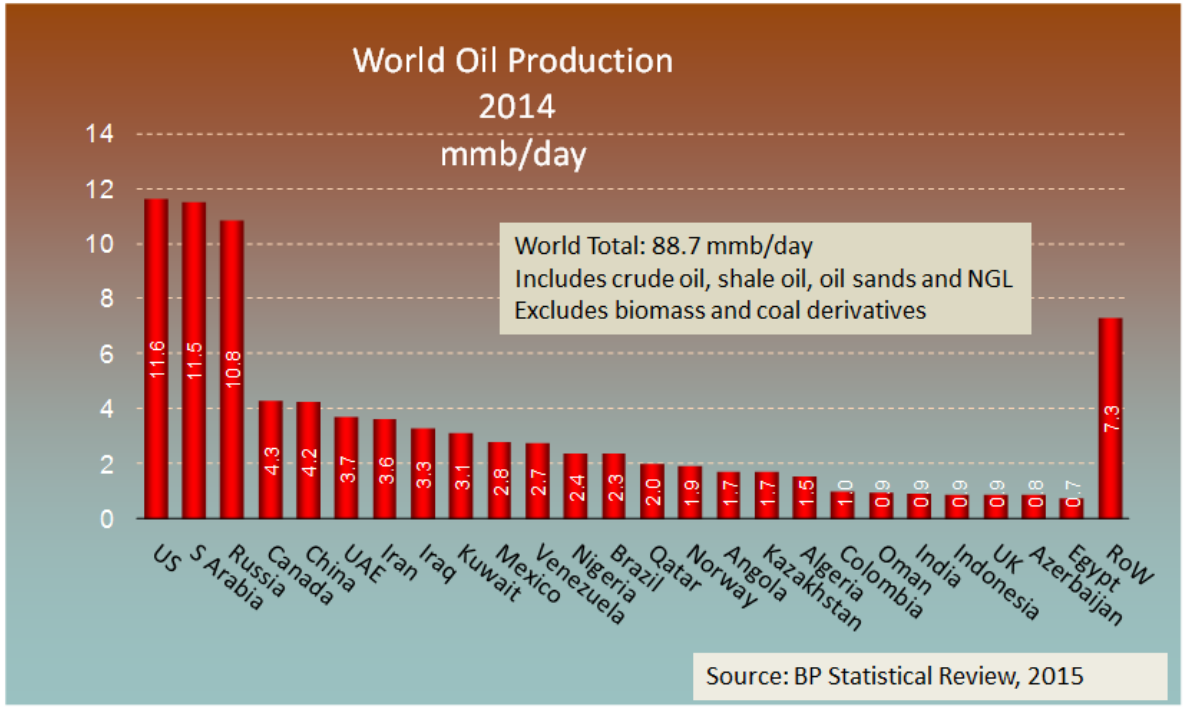
Global oil demand, and supply, has steadily increased during the last 50 years except for brief periods following the 1970s and 1980s oil price shocks and the severe global recession of 2008.

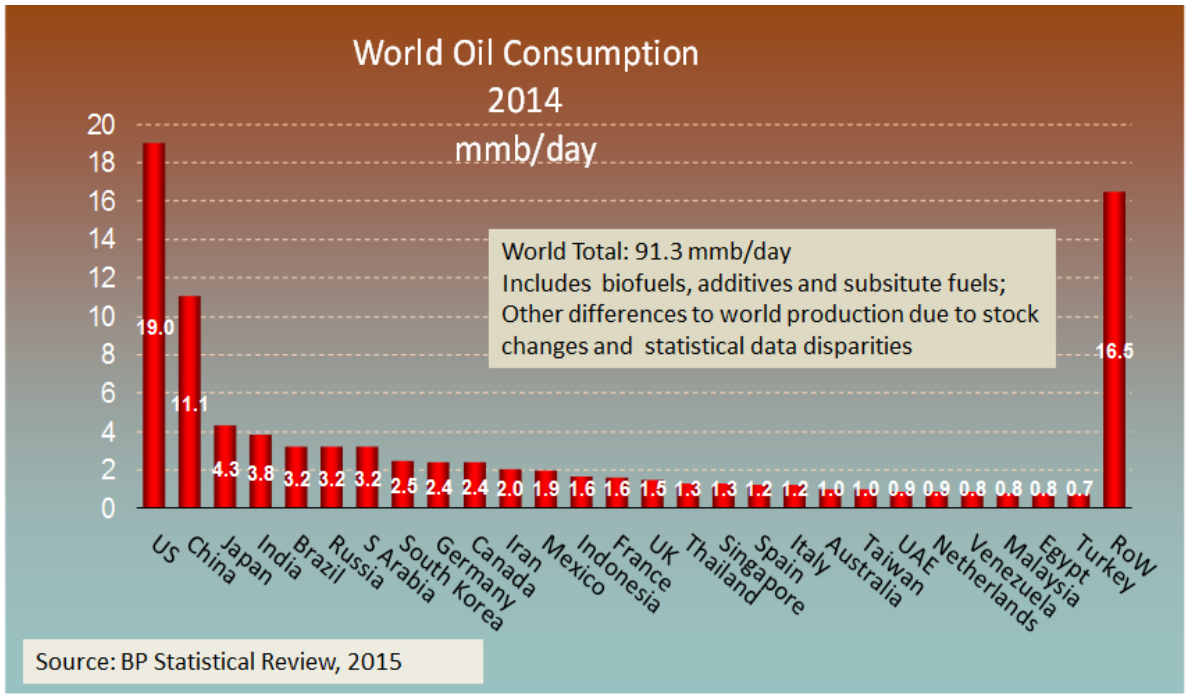
It is interesting to note that the USA and China, currently the largest consumers, followed different production vs consumption trends in the last 10yrs. The USA production has been steadily growing at the rate of 6% y/y while the consumption has slightly declined. On the other hand, China's production has moderately increased (1.7% y/y) while its consumption continued growing at a faster pace (5.5% Y/Y).





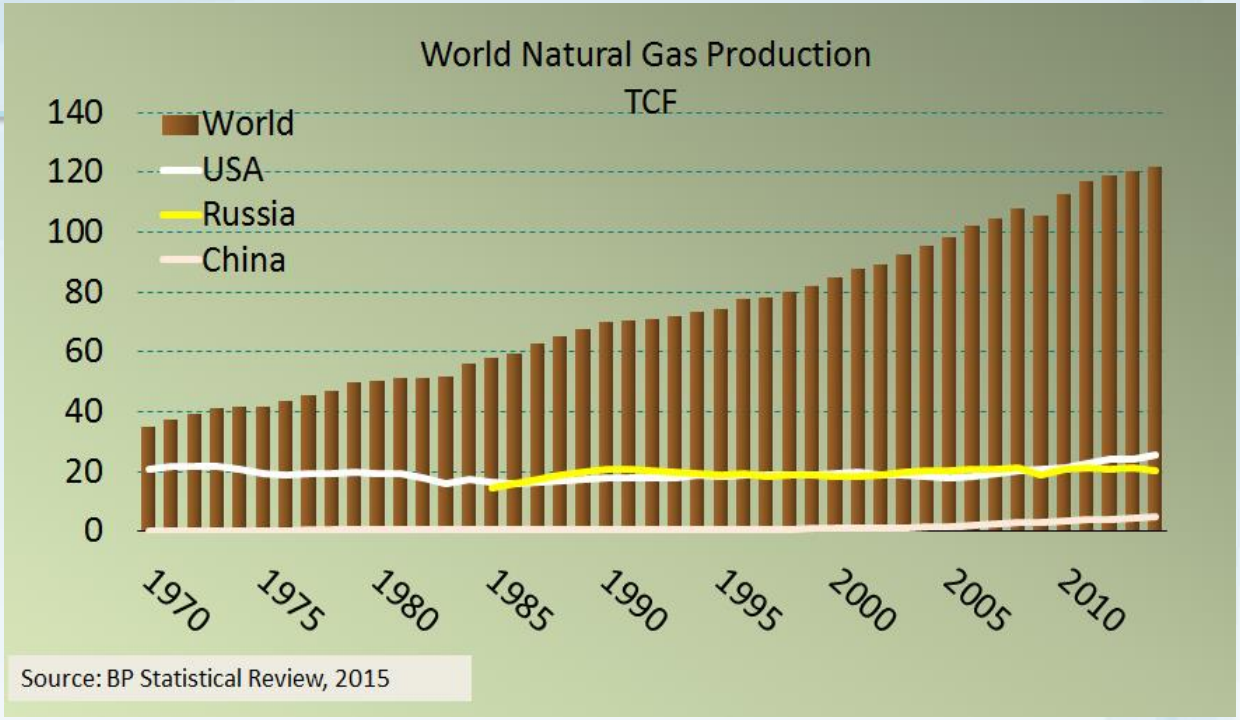
Main Oil Producing and Consuming Countries, 2014.



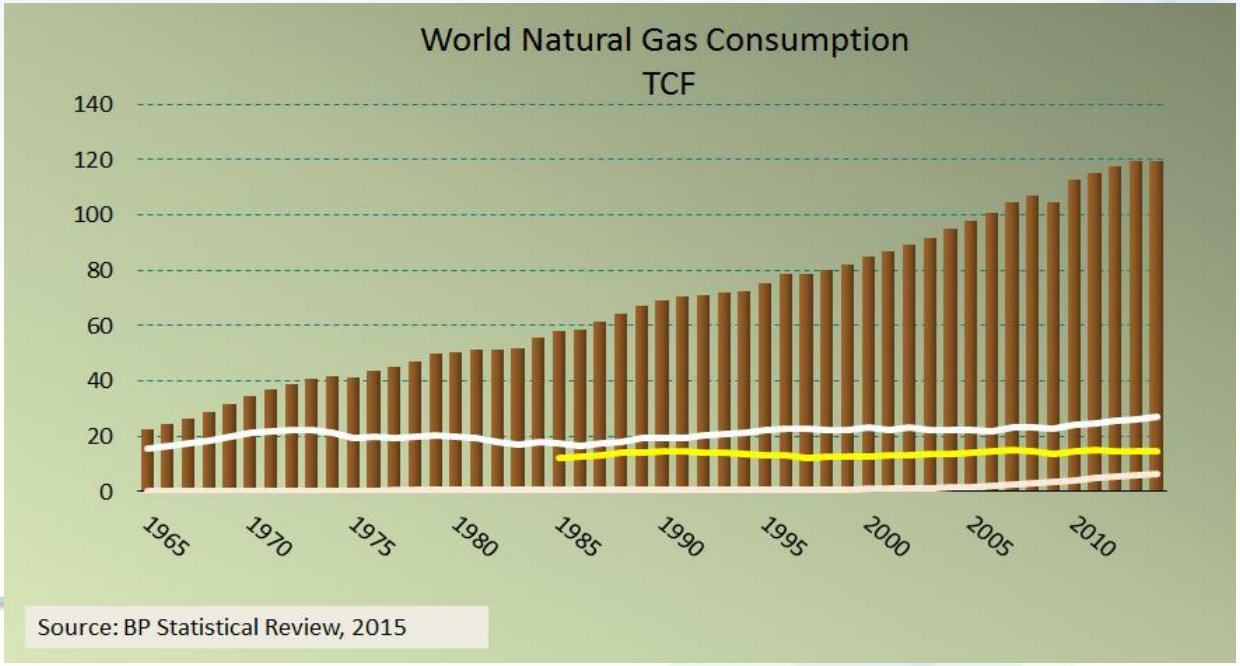


Global natural gas demand and supply also grew at a steady (and faster) pace during the last 50 years. Demand growth was in general more resilient than in the oil case, with only one year on year decrease following the 2008 recession.

In the last 10 years both demand and production grew in the USA (about 2.2% and 4% y/y, respectively) and China (about 16% and 11% y/y, respectively). Russia, for several years the largest producer, and consistently the second largest consumer after the USA, had both production and consumption approximately constant during this period.

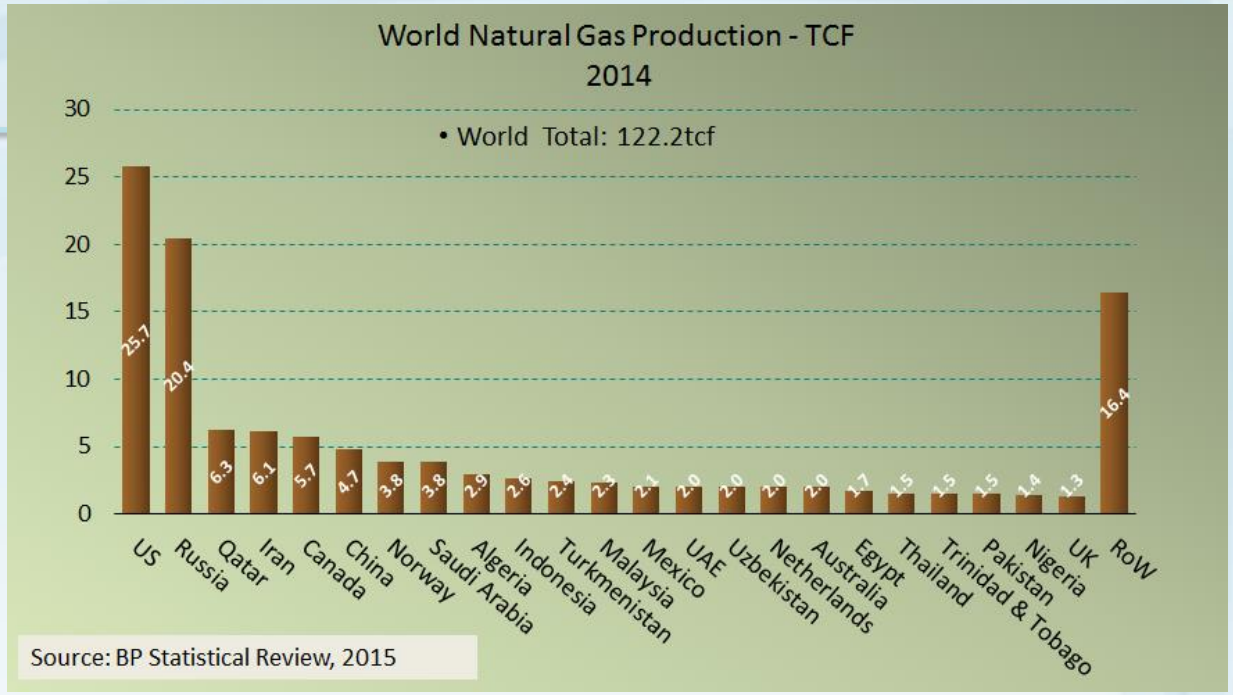


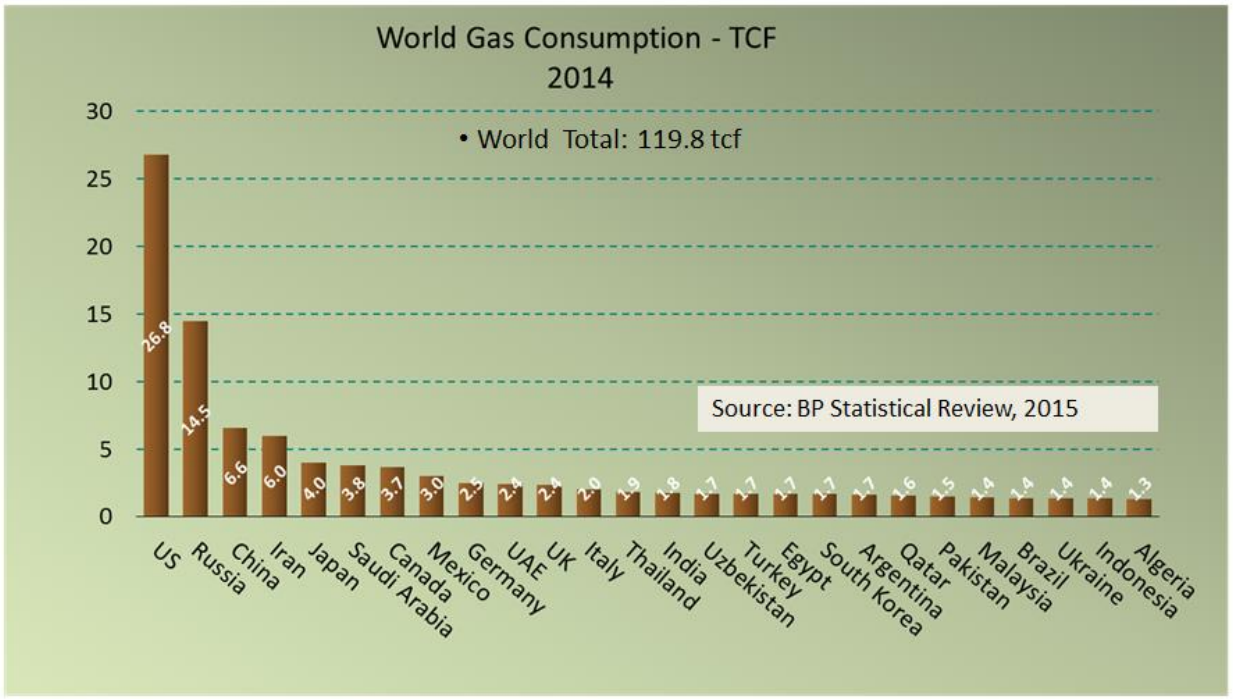
Source: BP Statistical Review, 2015



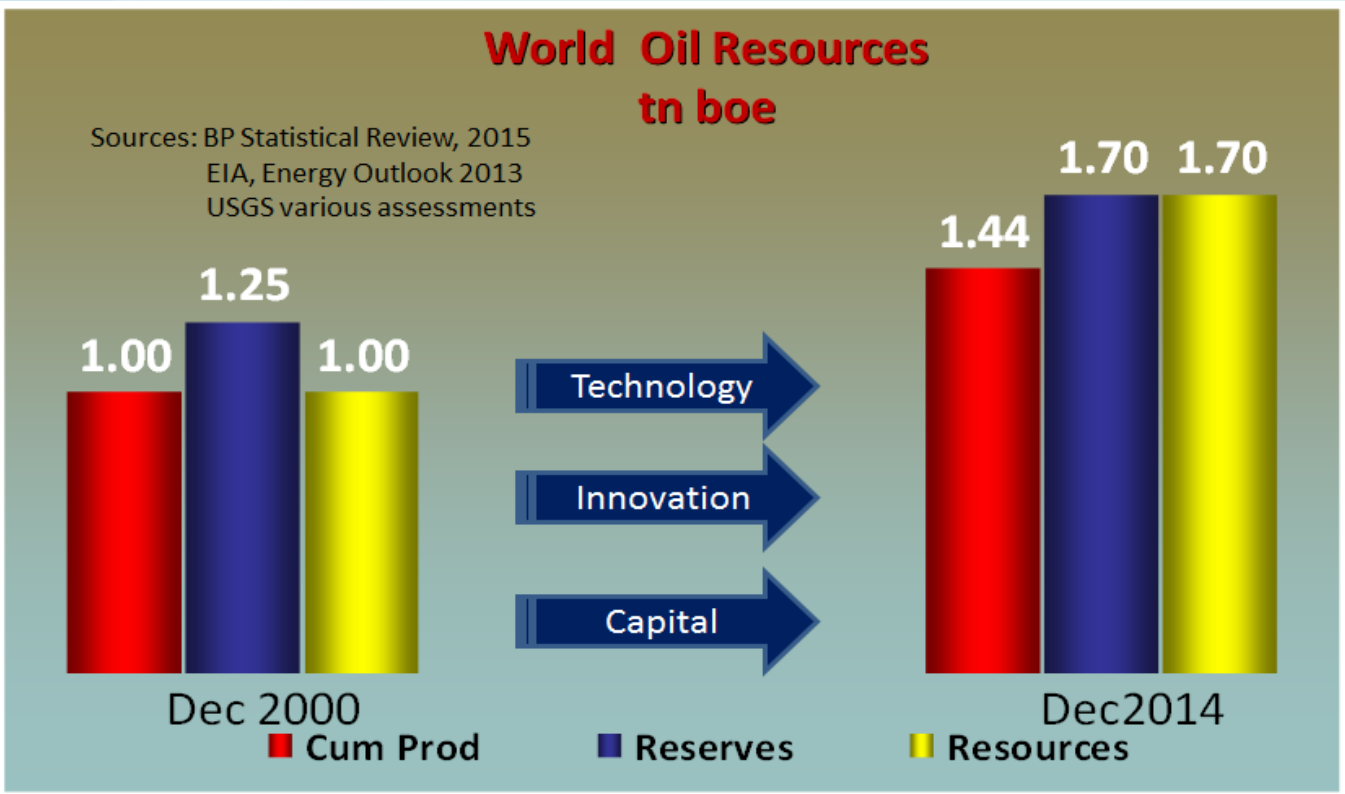
Source: BP Statistical Review, 2015

Main Natural Gas Producing and Consuming Countries, 2014.



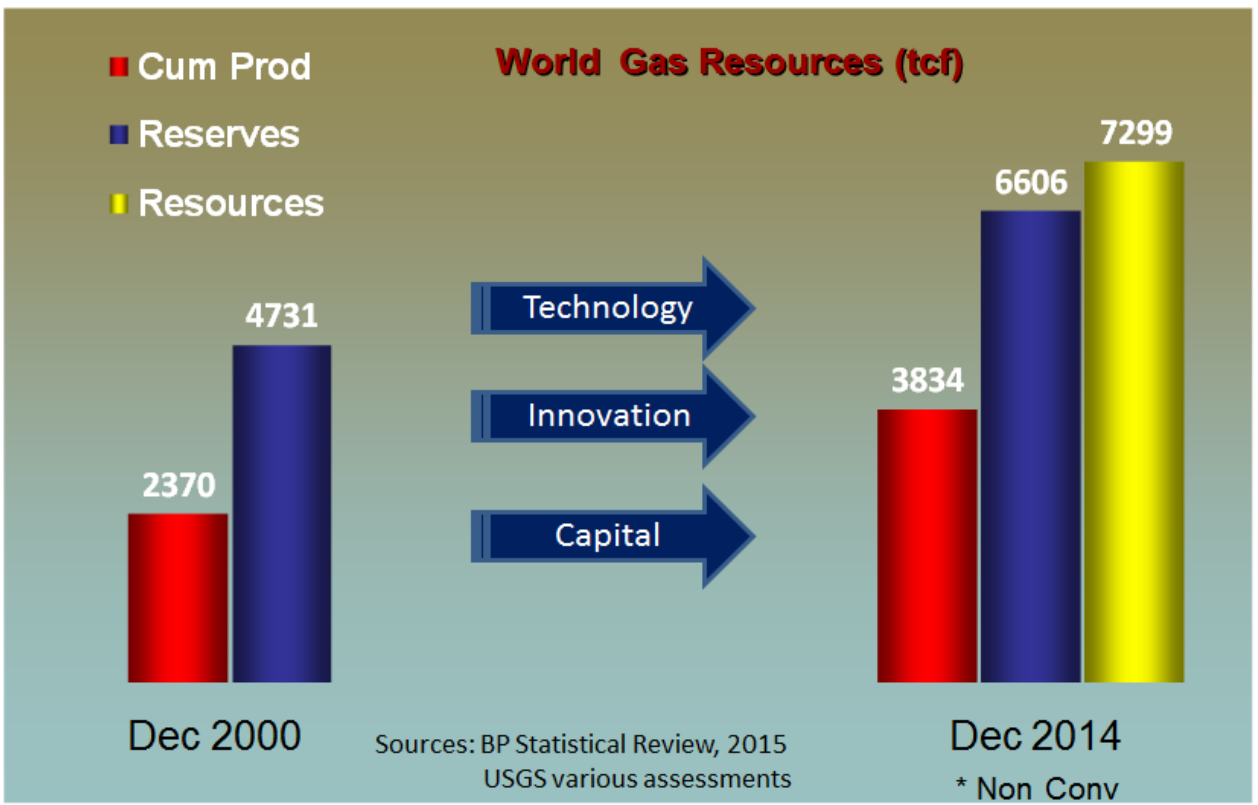


OIL AND NATURAL GAS RESERVES AND RESOURCES
Past Evolution and Current Situation



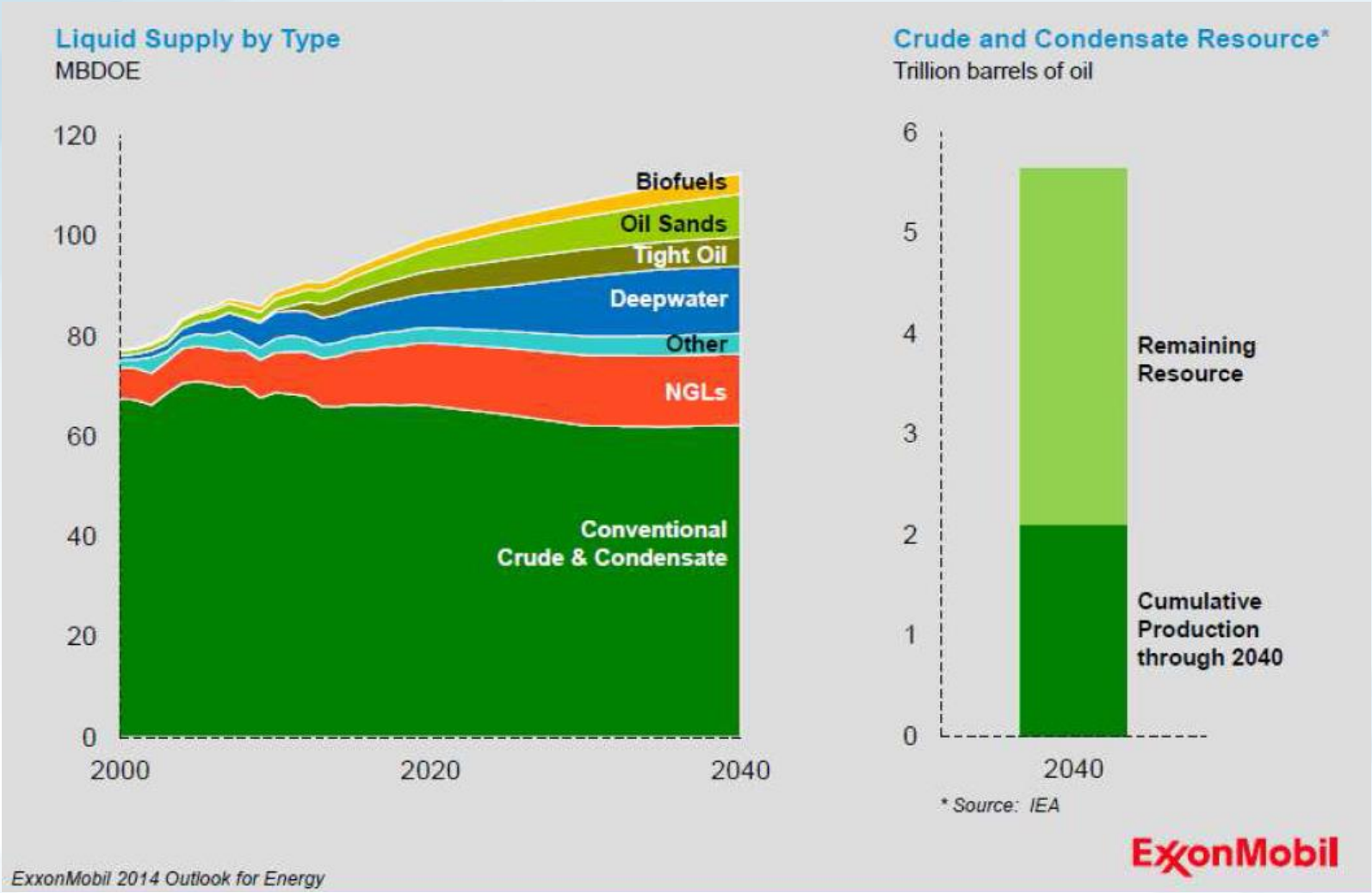
Since the middle of the 19th century the industry has managed to meet the world's oil demand, except for brief disruptions caused by war or natural disasters, while at the same time continuously increasing the available resource base.

By the year 2000, the world had consumed its first trillion barrels of oil. Only 14 years later, another 440 billion bo were consumed. Meanwhile the reserve base was not only fully replenished but increased by 450 bbo, to 1,700 bbo. Which implies that for every barrel of oil consumed about 2 new barrels were added to the reserve base. Furthermore, basin analyses performed by various industry and academic entities identified potential global oil resources that could duplicate the current proved reserves.

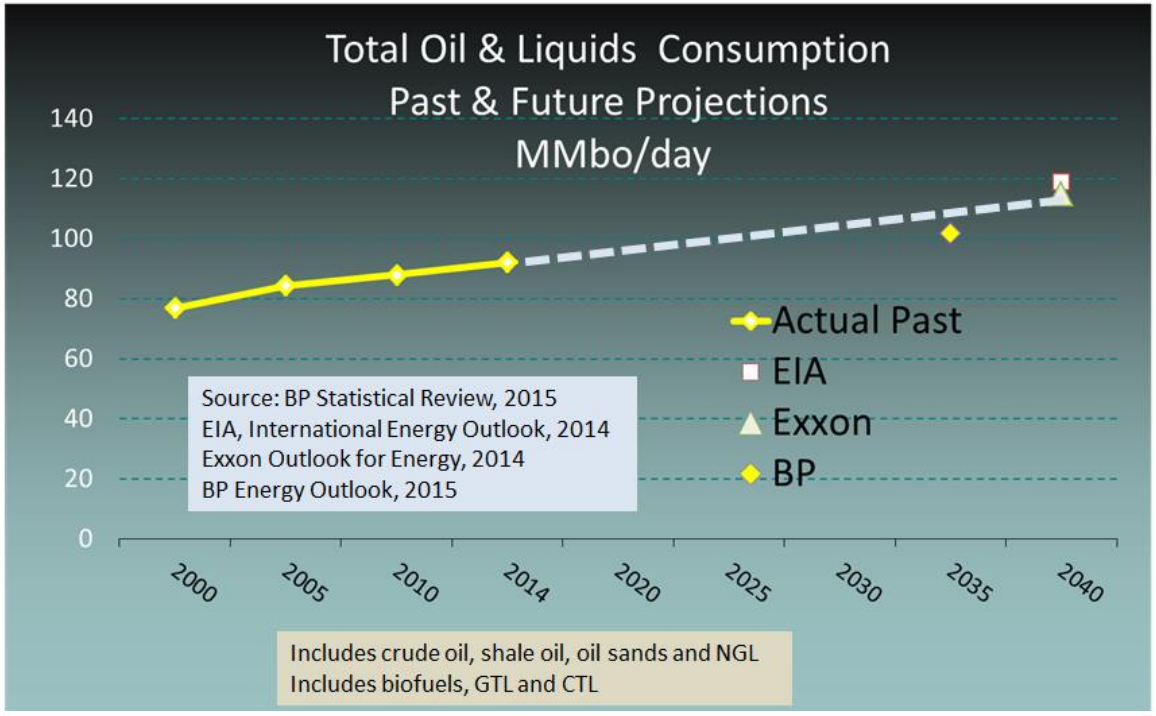


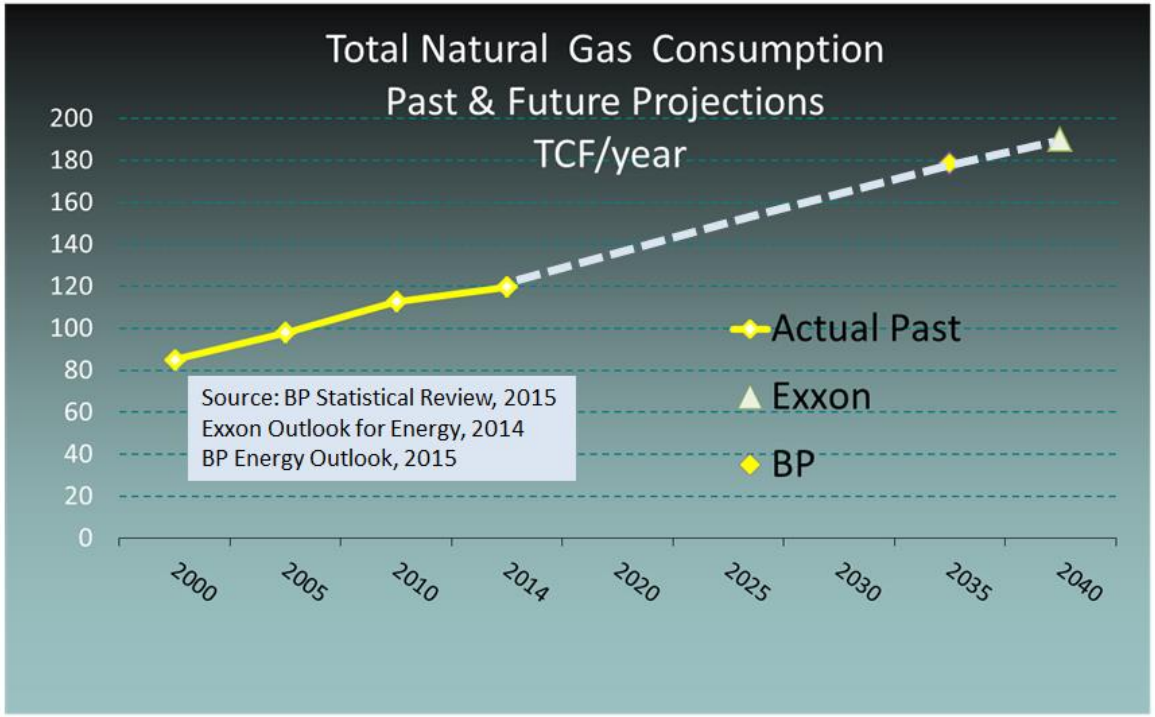
An analogous situation occurs with respect to natural gas since the early part of the 20st century. While demand, and supply, steadily grew to current levels, the available resource base has also grown in the same pace.
By the year 2000, the world had consumed over 2,300 tcf of natural gas and, only 14 years later, almost 1,500 tcf were additionally used. Meanwhile the reserve base was not only fully replenished but increased by almost 1,900 tcf, to 6,606 tcf, which implies a replenishment rate of approximately 2.25cf per cf consumed.
Also similarly to the oil situation, huge potential resources, particularly of non conventional shale and tight sand gas, were identified that can more than double the current proved reserves.

FUTURE CONSUMPTION PROJECTIONS
Capital Requirement to Meet Demand

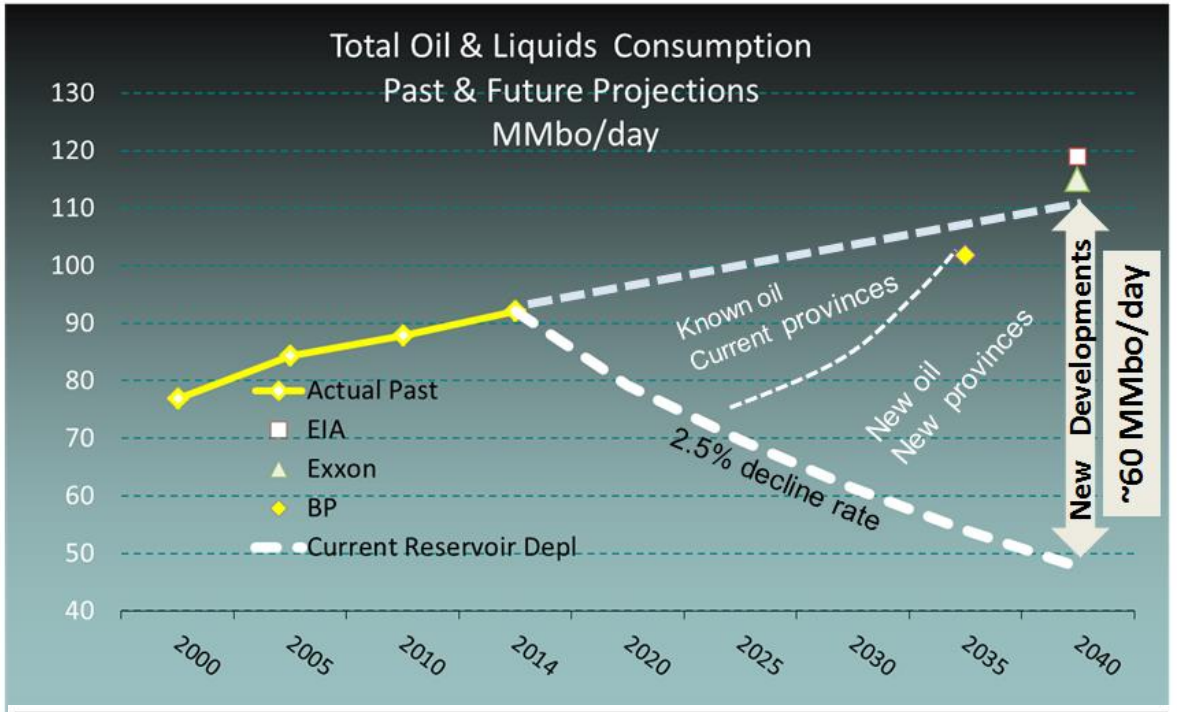


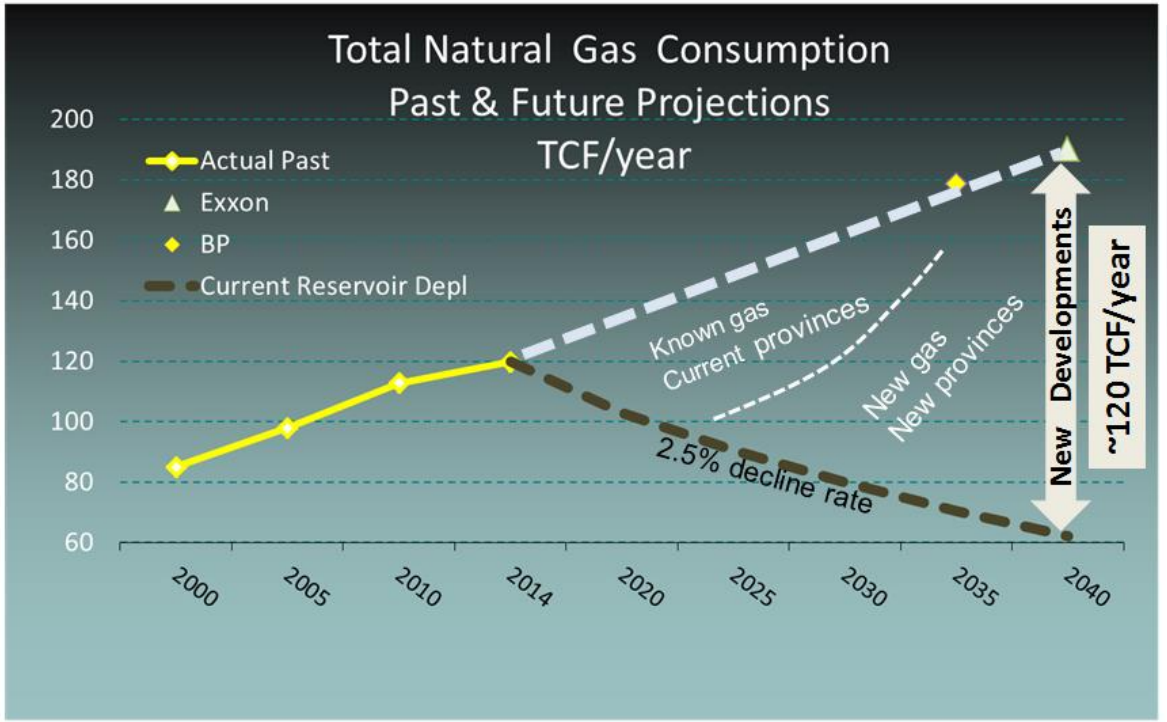
Projections of future demand of oil and liquid fuels by BP, Exxon and the EIA, are fairly different with respect to the growth rate, ranging from 0.4% to 0.9% per year. Nevertheless all point out to a steady growht in demand albeit at a low pace.
Conversely, projections by Exxon and BP are almost coincident with respect to future demand of natural gas, expected to continue growing at a rate of approximately 1.85% per year.





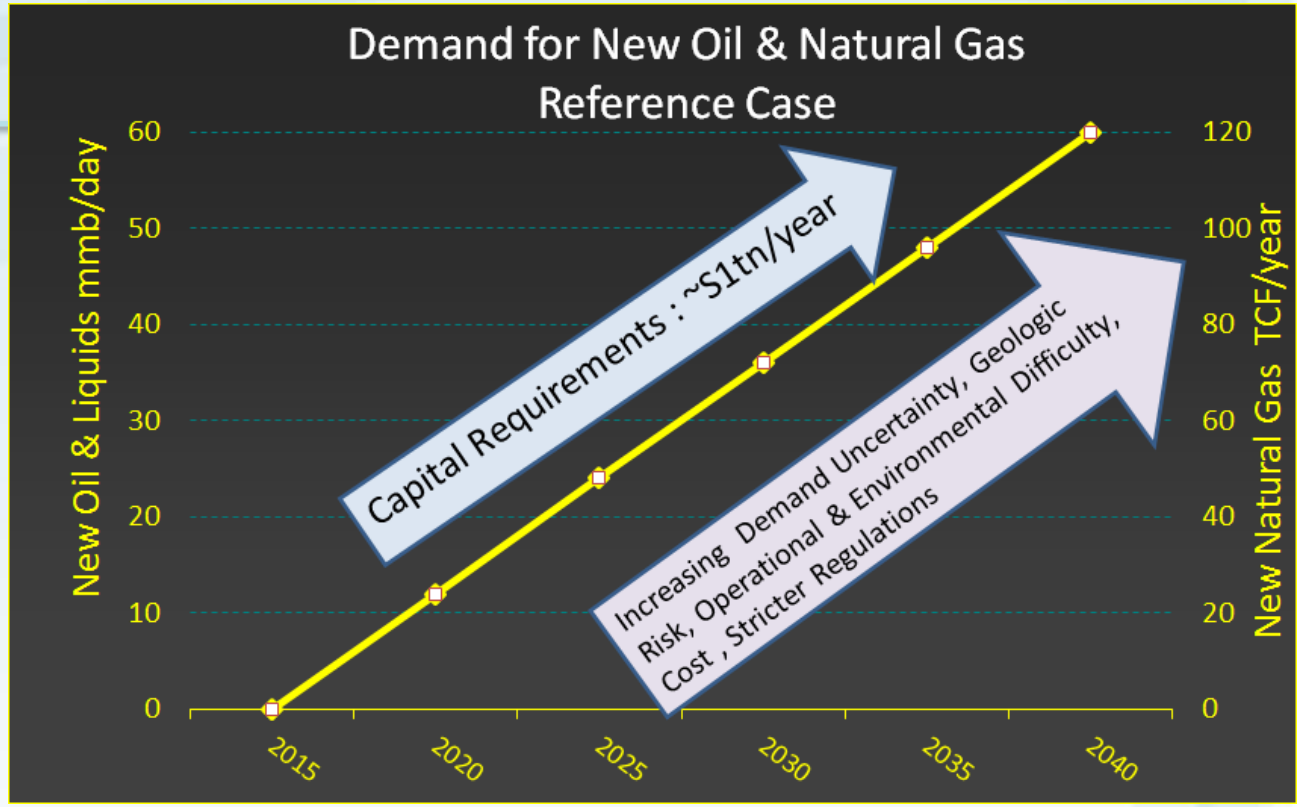
Given the natural depletion of the currently producing oil and gas reservoirs it is clear that, even if a modest 2.5% depletion rate is assumed, very significant new production will have to be brough onstream to meet demand. In the scenarios outlined in the graphs about 60 mmbo/day and 120TCFG/year of new production will be necessary by 2040. This new oil and natural gas will initially be sourced in the existing fields (enhanced recovery, infill drilling) and producing provinces, but progressively will require the discovery and development of resources in new provinces, which will be increasingly more geologically risky, expensive and challenging from the operational and environmental perspectives.
Massive amounts of capital will be required to continue meeting the demand, estimated at around $1trillion per year by the IEA.

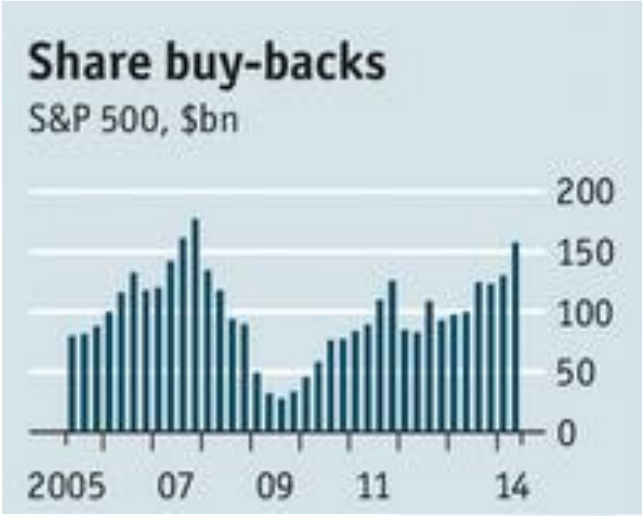




According to IEA's estimates more than $40tn will need to be invested in energy supply until 2035, approximately $2tn per year over the next 20 years (Maria van de Hoeven, World Energy Outlook 2014) to meet the global energy demand. At least half of this will have to be allocated to the oil and gas sector if the above demand projections are to be met.

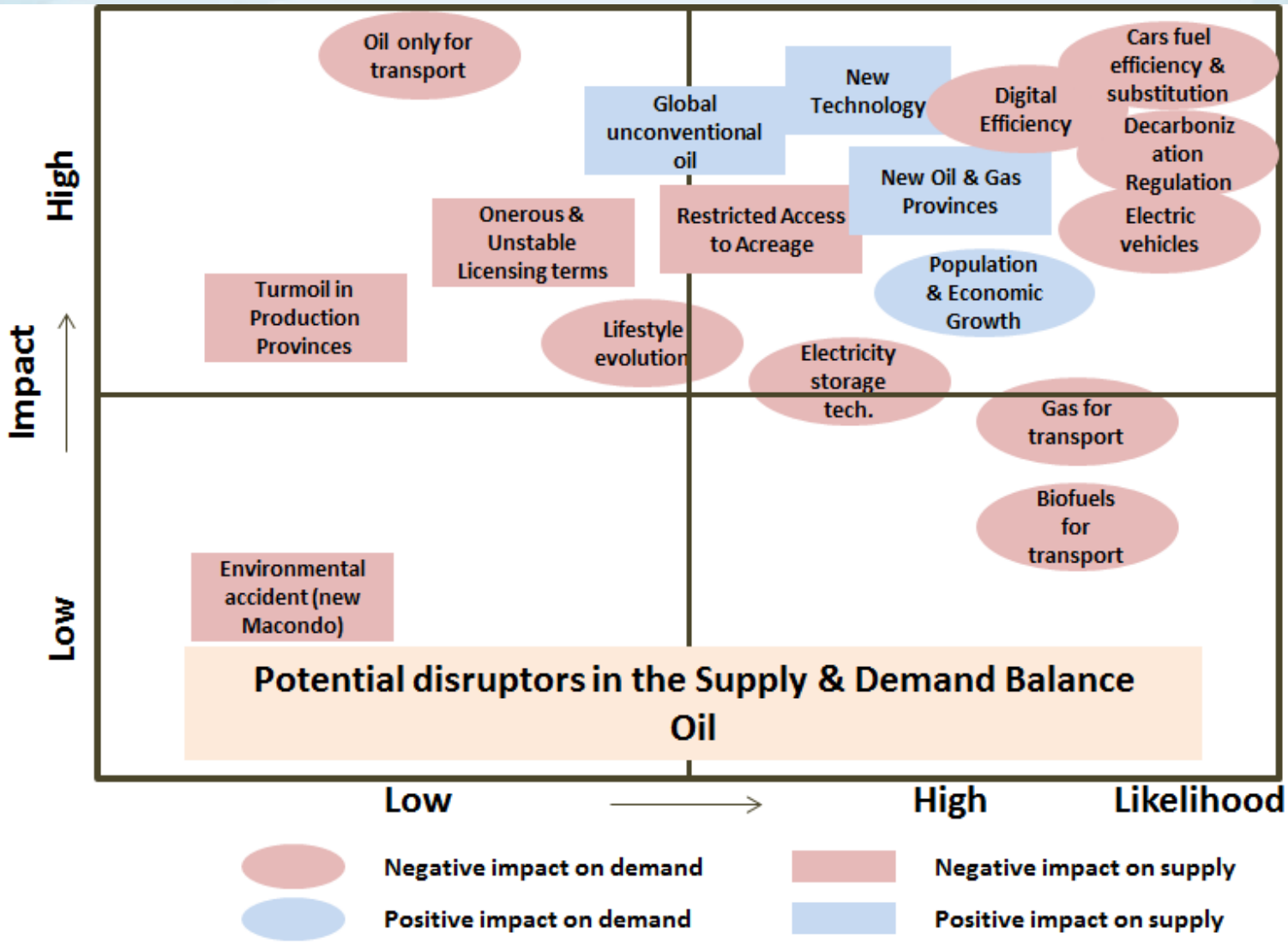
There is plenty of capital in the world seeking investment opportunities with sufficiently attractive rates of return. To illustrate the point, The Economist points out in their Sep13th, 2014 issue (Figure 6) the record amounts of share buy-backs (over $ 150bn so far this year by S&P 500 companies), the main reason being that these companies are not finding enough investment opportunities with return meeting shareholder's expectations.



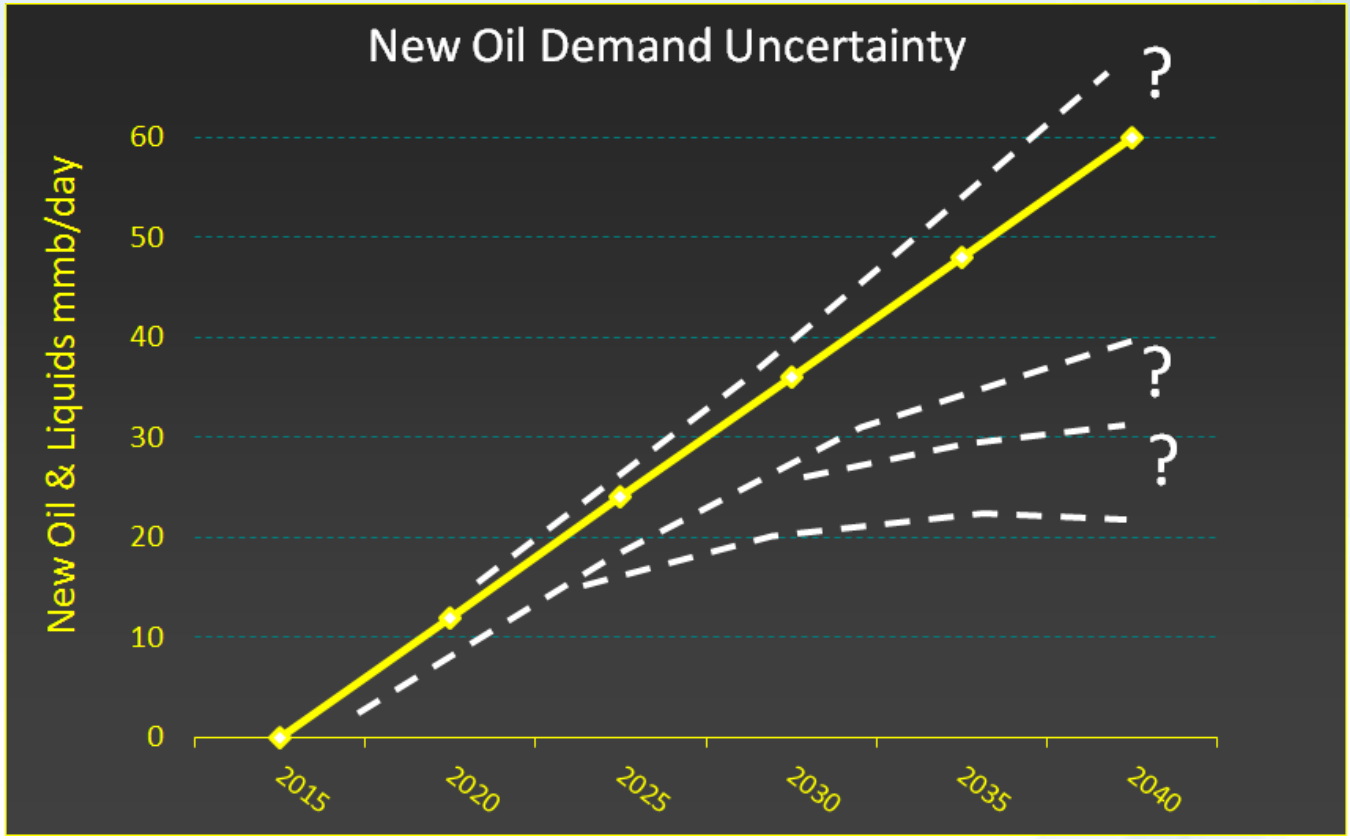


FUTURE SUPPLY & DEMAND BALANCE
Potential Disruptions and Uncertainties

Potential disruptions in the supply&demand balance of oil are mostly driven population growth and economic development, new technological developments on both production and consumption, and regulatory restrictions to carbon emissions.

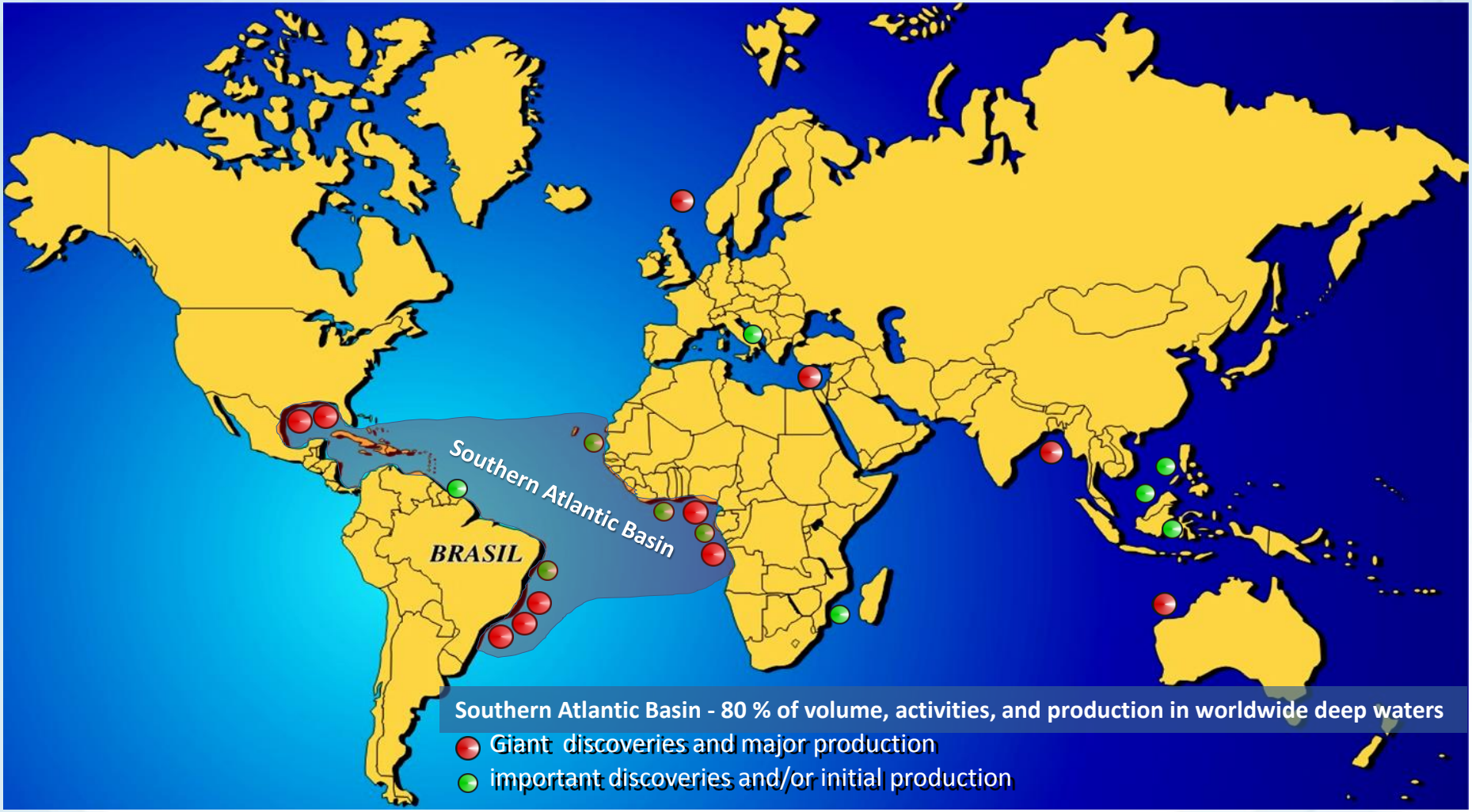


On balance the potential disruptions to oil supply and demand seem to be skewed towards slower consumption growth (driven by technology, fuel efficiency and environmental restrictions). On the supply side it is expected that productivity will increase from both existing and new oil provinces, as long as restrictions to E&P investment are removed/mitigated.

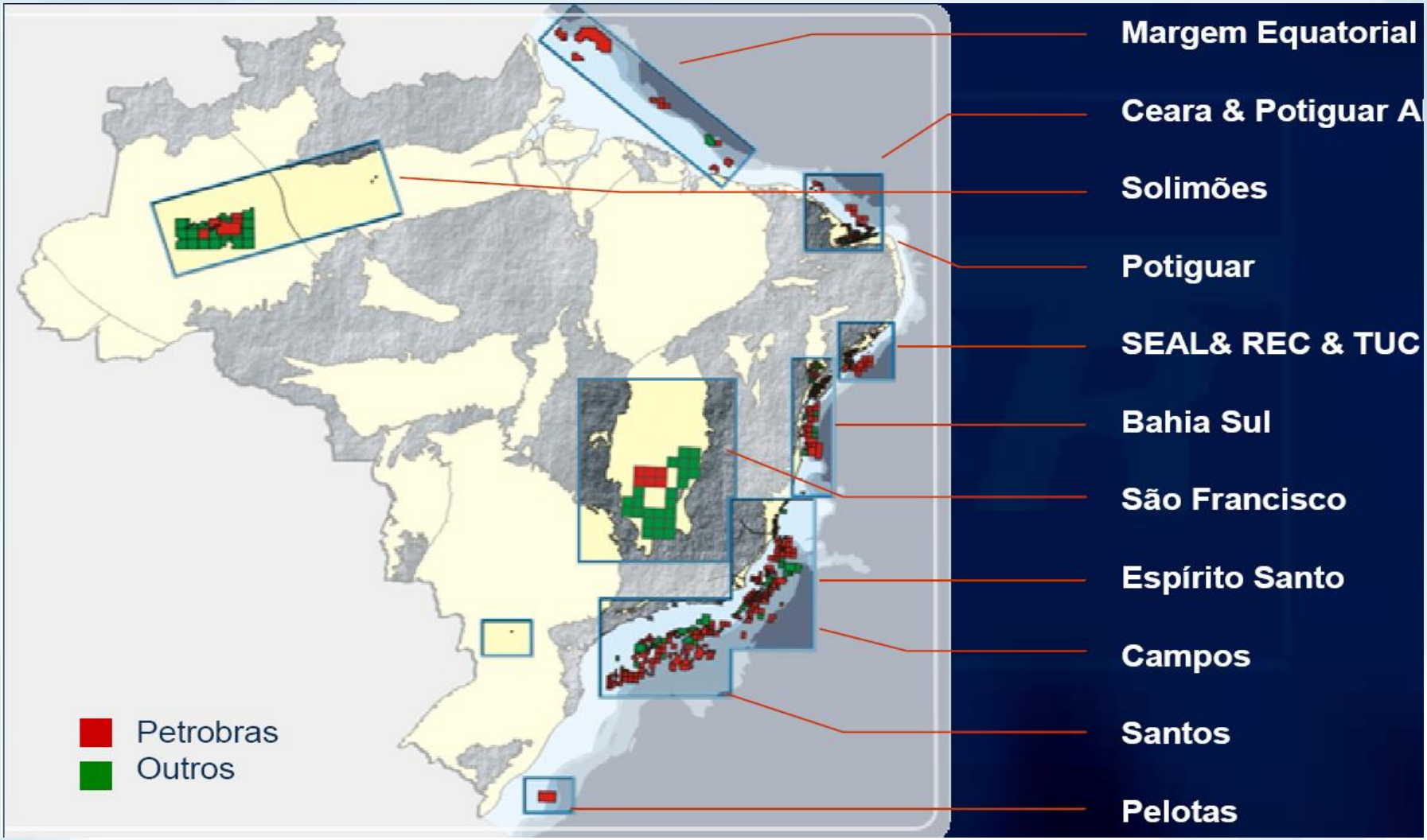


OIL & GAS
PERSPECTIVES IN BRAZIL

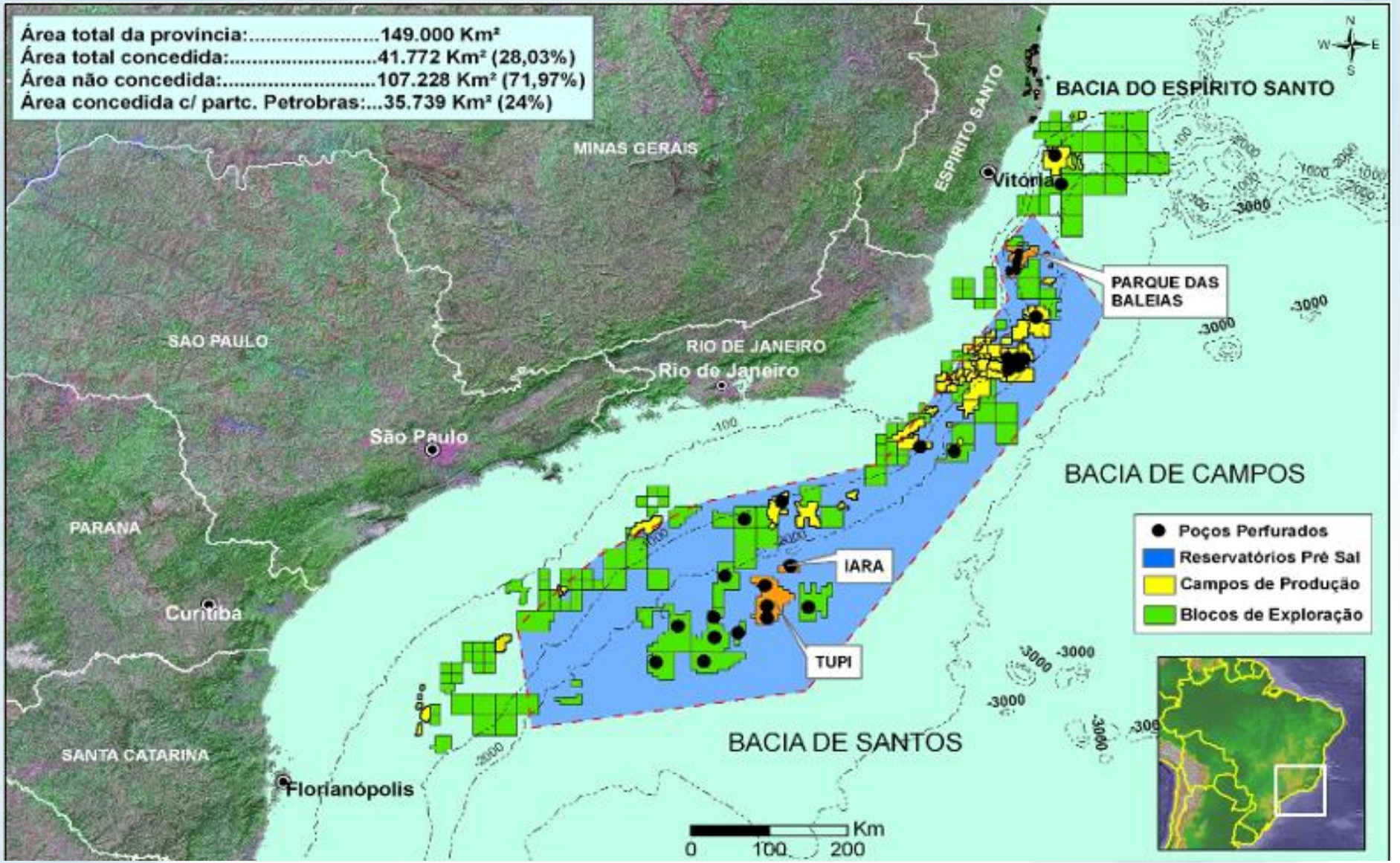
Deep Water Brazil: among the most prospective basins of the world



Source: Company Information, IHS, ANP, WoodMaac, Upstream, Petrobras

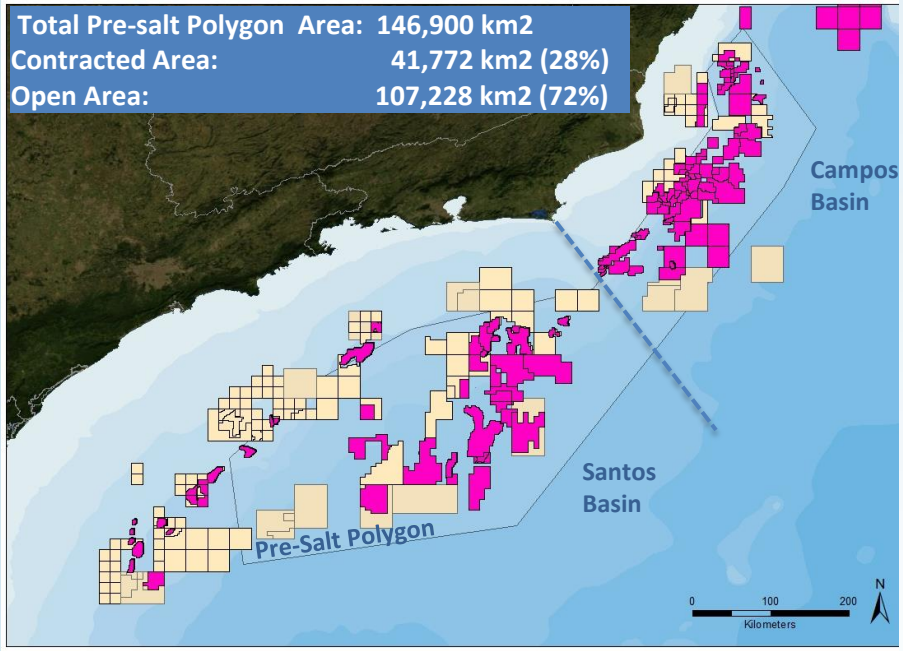


"ONE COUNTRY, Four SYSTEMS..."

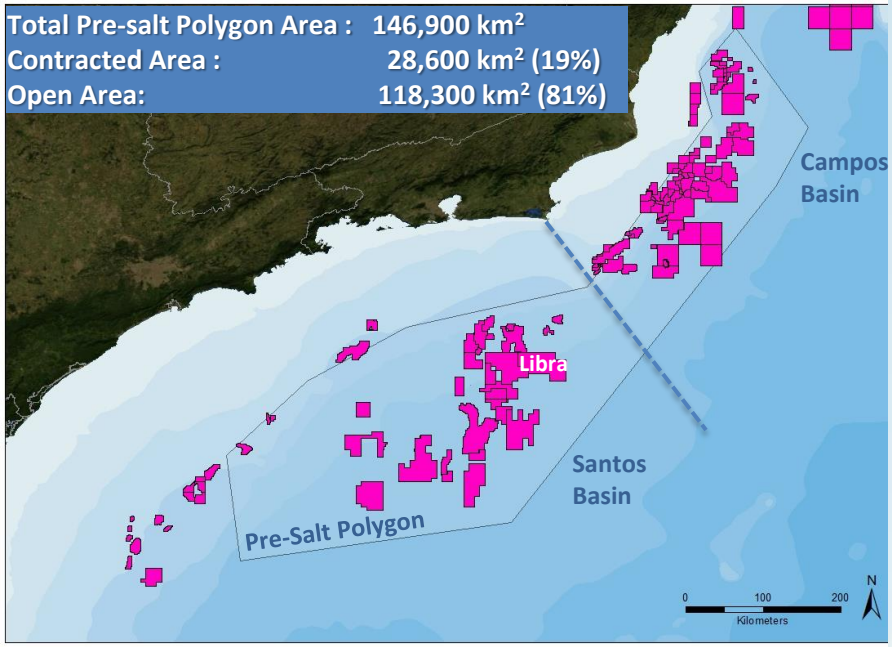


Brazilian Leased Blocks and Pre-Salt Polygon

2006 Situation



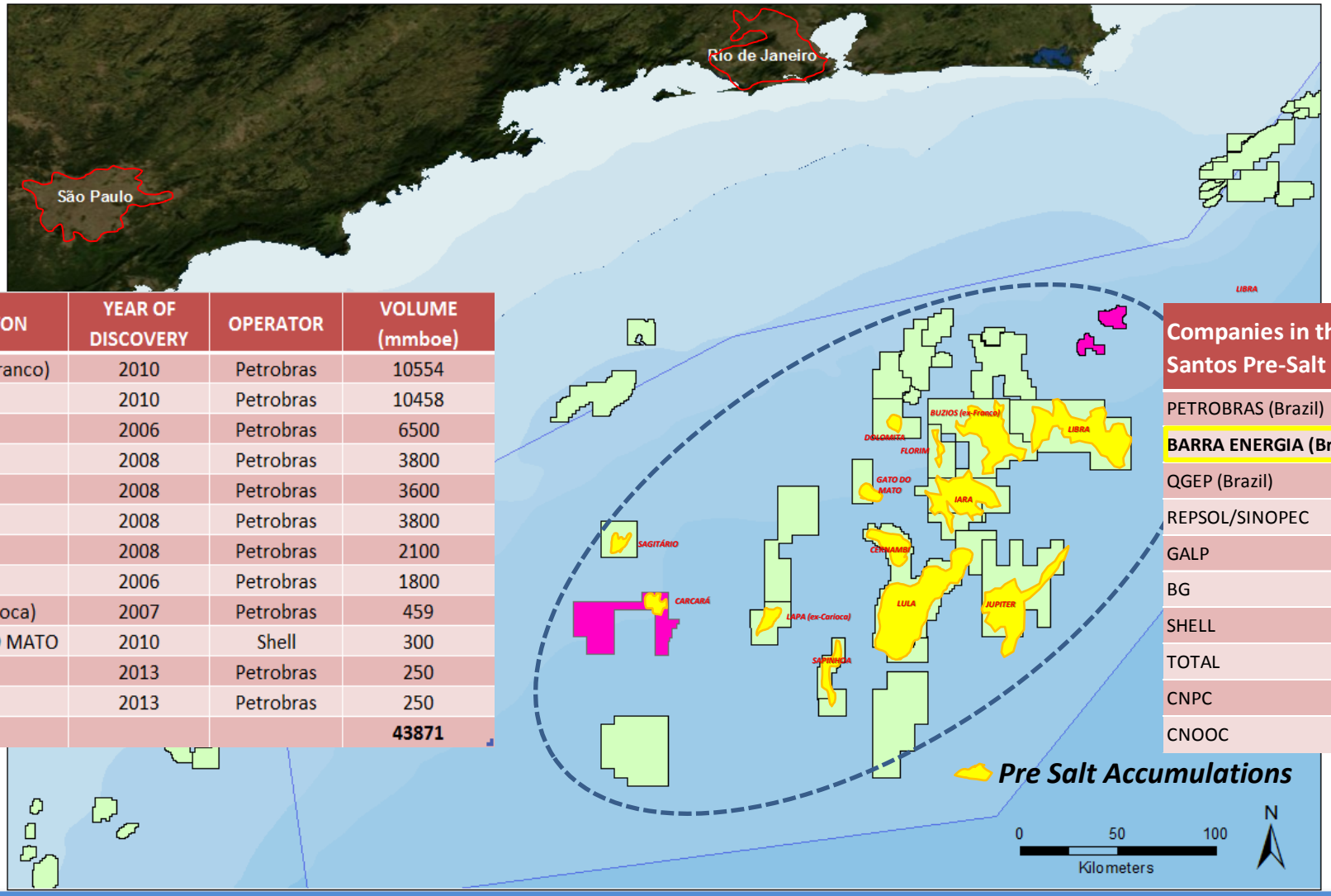
2014 Situation



- From 2006 to 2014 a large number of blocks in yellow was relinqueshed and returned to ANP
- During 2006/2014 we had only one bidding round in the area for the Libra block in 2013

Source: Company Information, ANP

Santos Pre-Salt Cluster Area is the Most Successful Current Play in the World



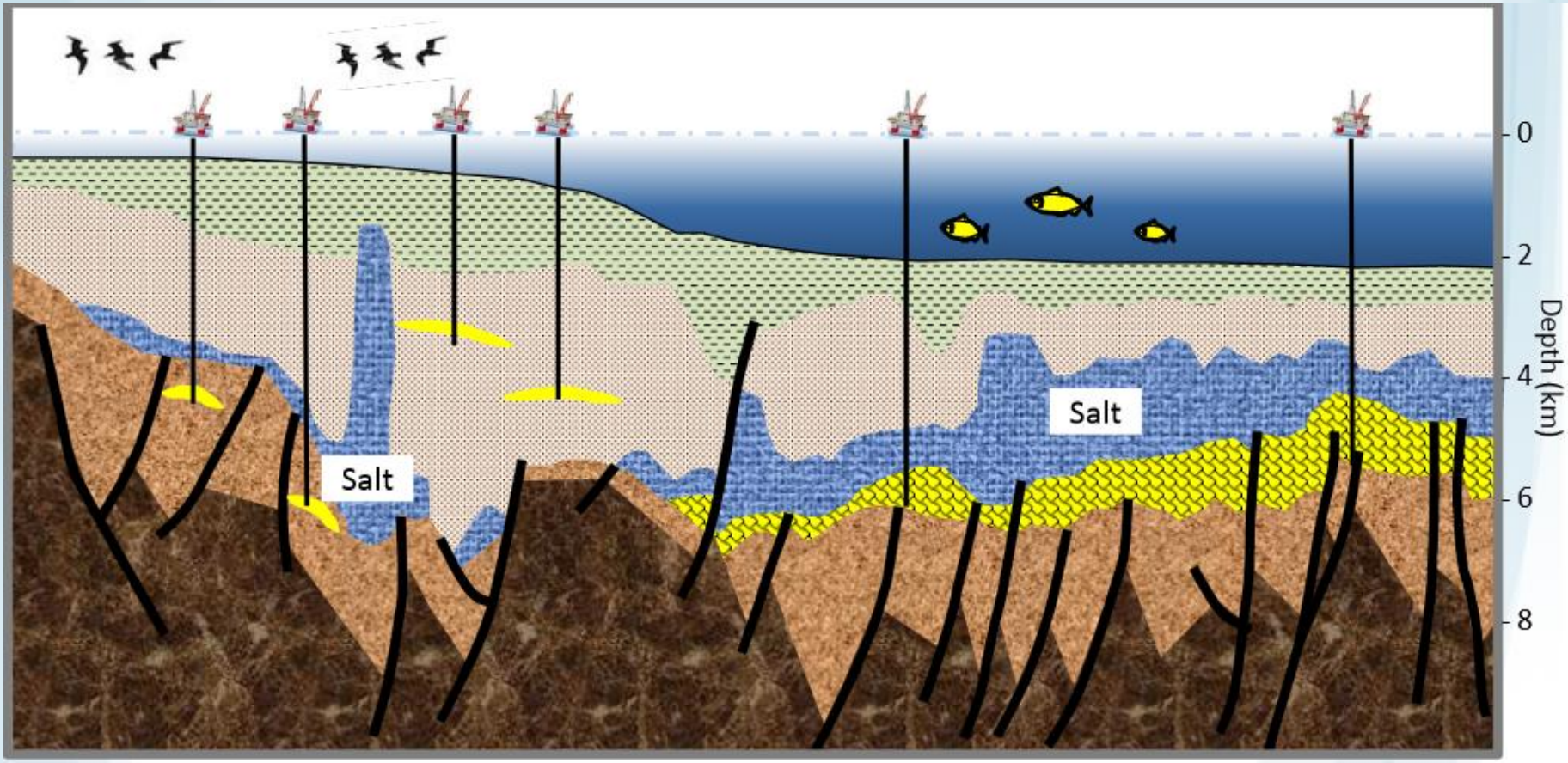
ACCUMULATON	YEAR OF DISCOVERY	OPERATOR	VOLUME (mmboe)
BUZIOS (ex-Franco)	2010	Petrobras	10554
LIBRA	2010	Petrobras	10458
LULA	2006	Petrobras	6500
IARA	2008	Petrobras	3800
JUPITER	2008	Petrobras	3600
IARA	2008	Petrobras	3800
SAPINHOA	2008	Petrobras	2100
CERNAMBI	2006	Petrobras	1800
LAPA (ex-Carioca)	2007	Petrobras	459
GATO DO DO MATO	2010	Shell	300
FLORIM	2013	Petrobras	250
SAGITARIO	2013	Petrobras	250
TOTAL			**43871**

Companies in the Santos Pre-Salt
PETROBRAS (Brazil)
BARRA ENERGIA (Brazil)
QGEP (Brazil)
REPSOL/SINOPEC
GALP
BG
SHELL
TOTAL
CNPC
CNOOC

Few Opportunities with high Value Entrance Tickets !

Source: Company Information, IHS, ANP, WoodMaac, Upstream, Petrobras

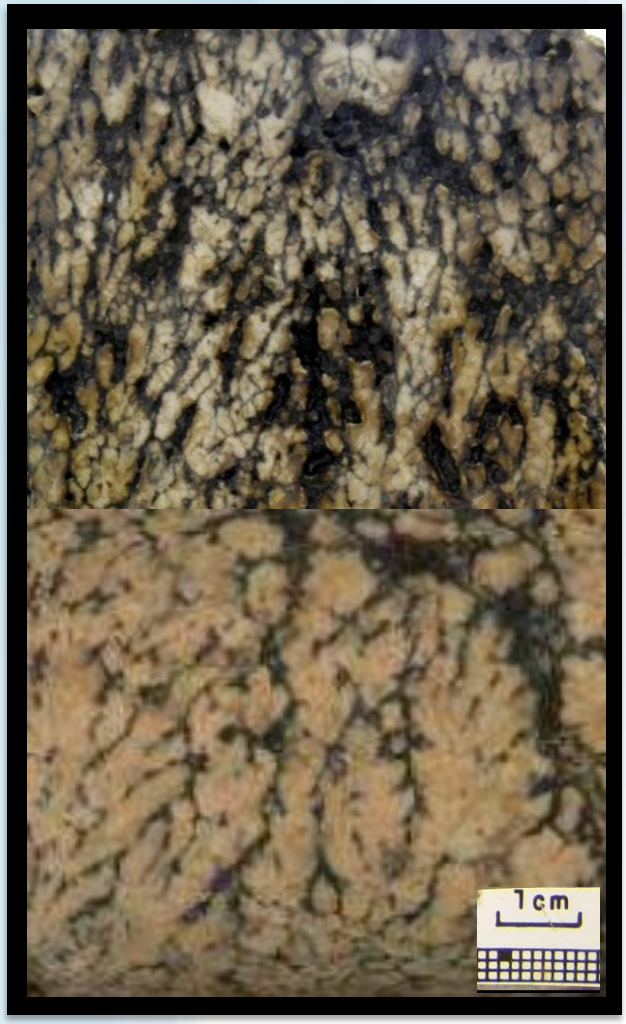
Brazil Pre-Salt Petroleum System
General Regional Geological Section – Santos Basin



Carbla Point - Austrália

Main Pre-Salt Carbonate Reservoirs

SAG Microbiolites (Shrubs)



SAG Microbiolites (Spherulites)

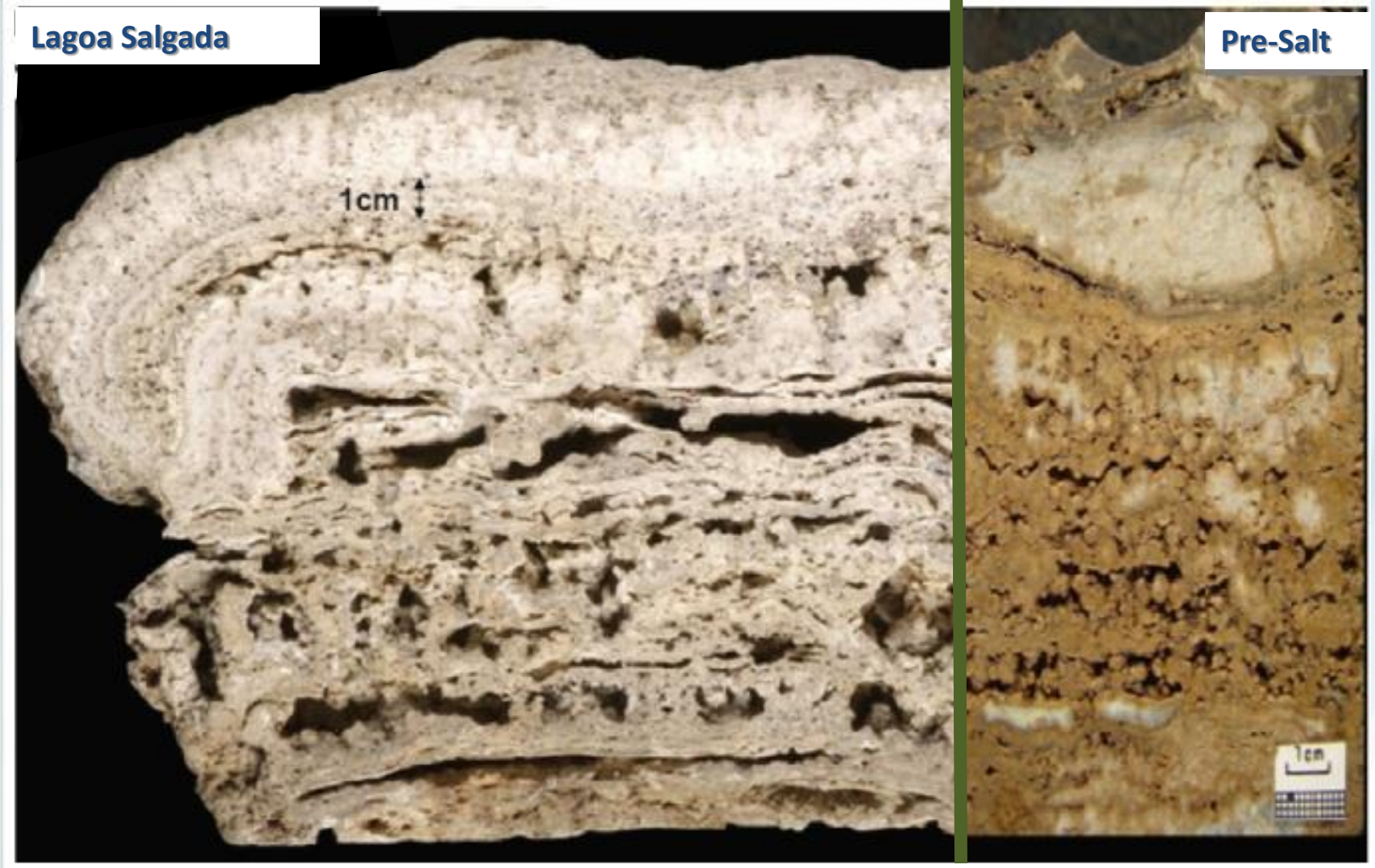
RIFT Coquinas

Source: Company Information, ANP

Regional Geology

The Present is the Key of the Past!

Today | **120 million years ago!**



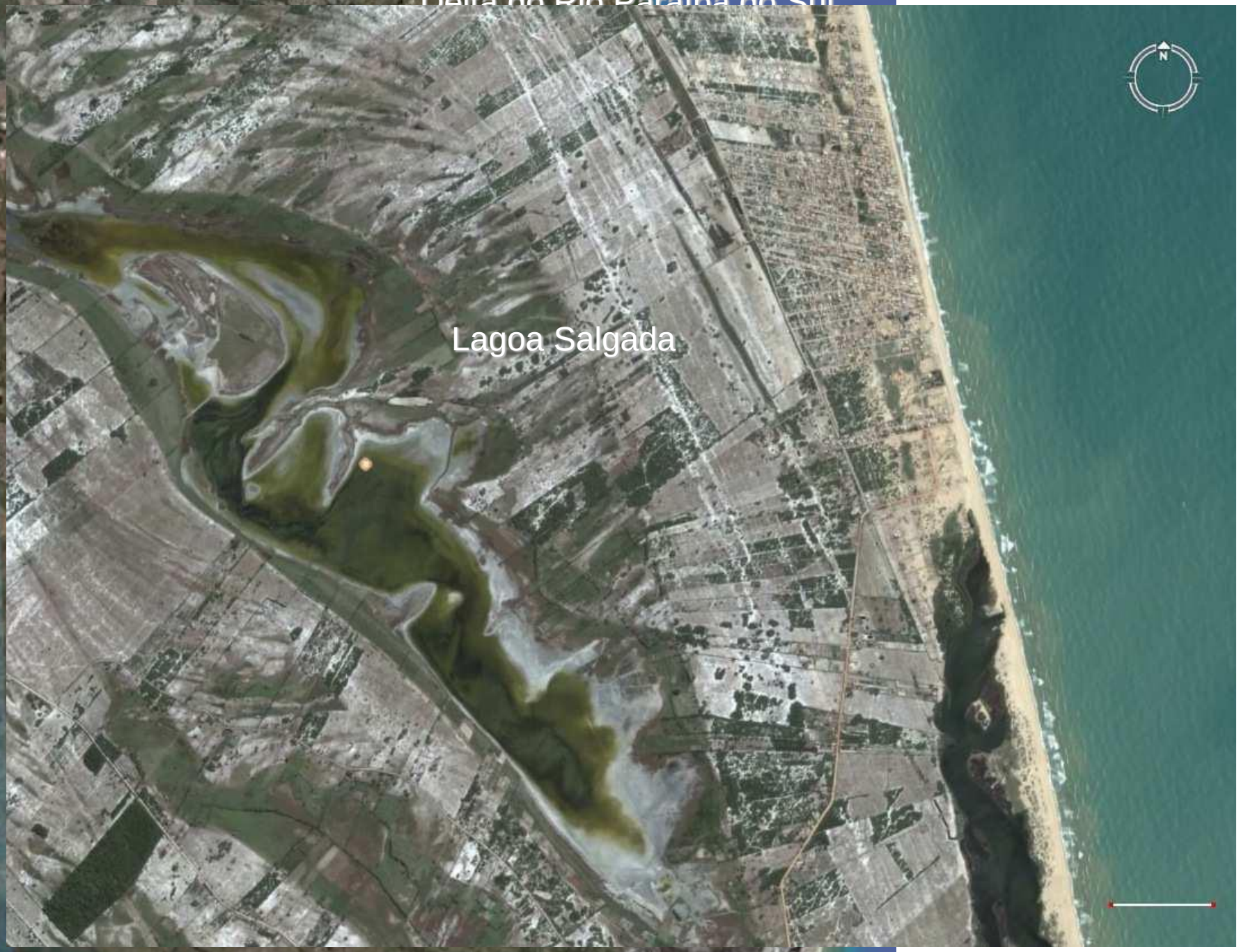
Source: Company Information

ESTEIRA MICROBIAL = USINA E MOTOR DOS ESTROMATOLITOS

Gosma/ Gelatina de Cianobacteria

Cristais dispersos e camada de $CaCO_3$

Delta do Rio Paraíba do Sul

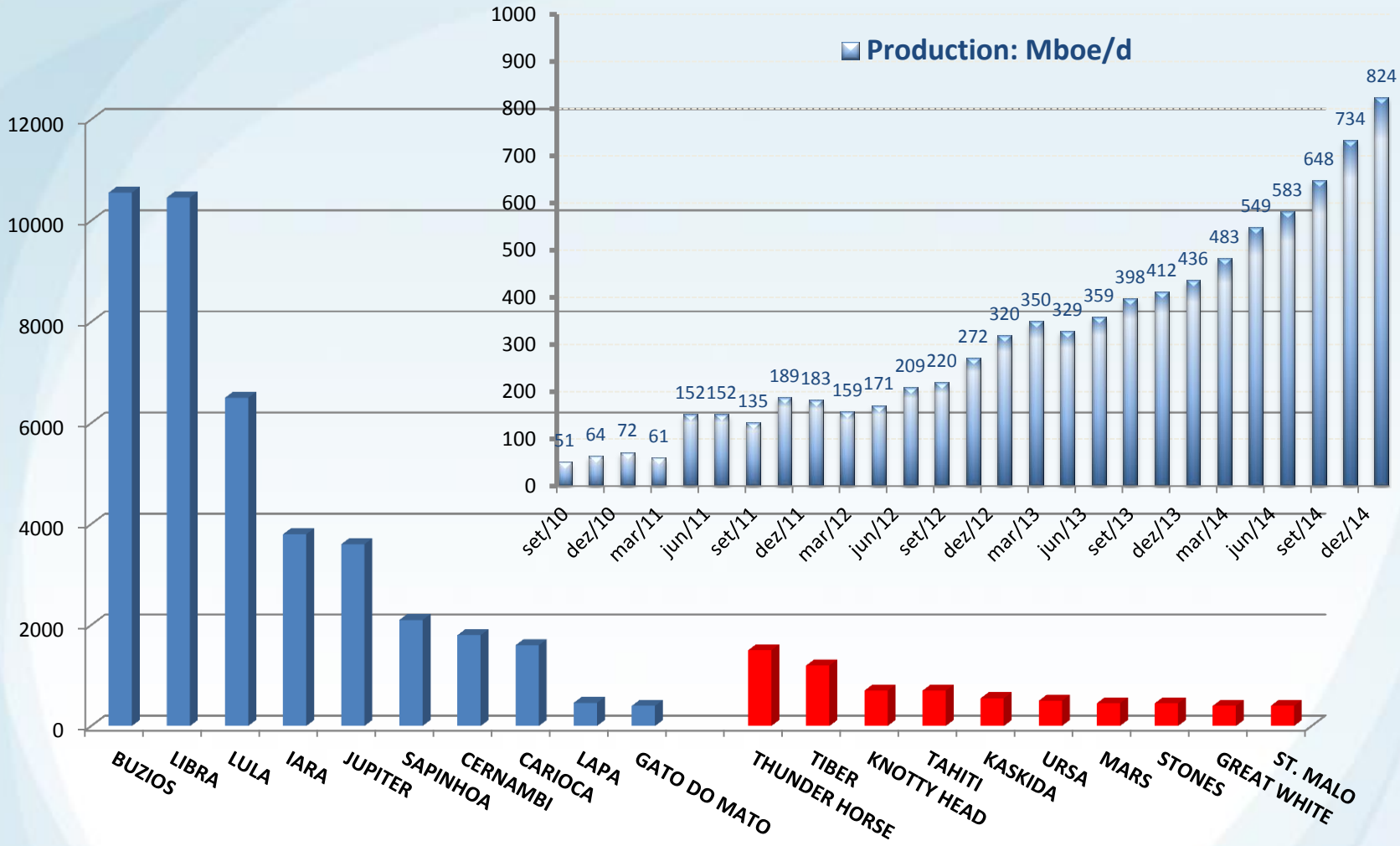


Lagoa Salgada - Brasil

Foto cedida por Sampaio

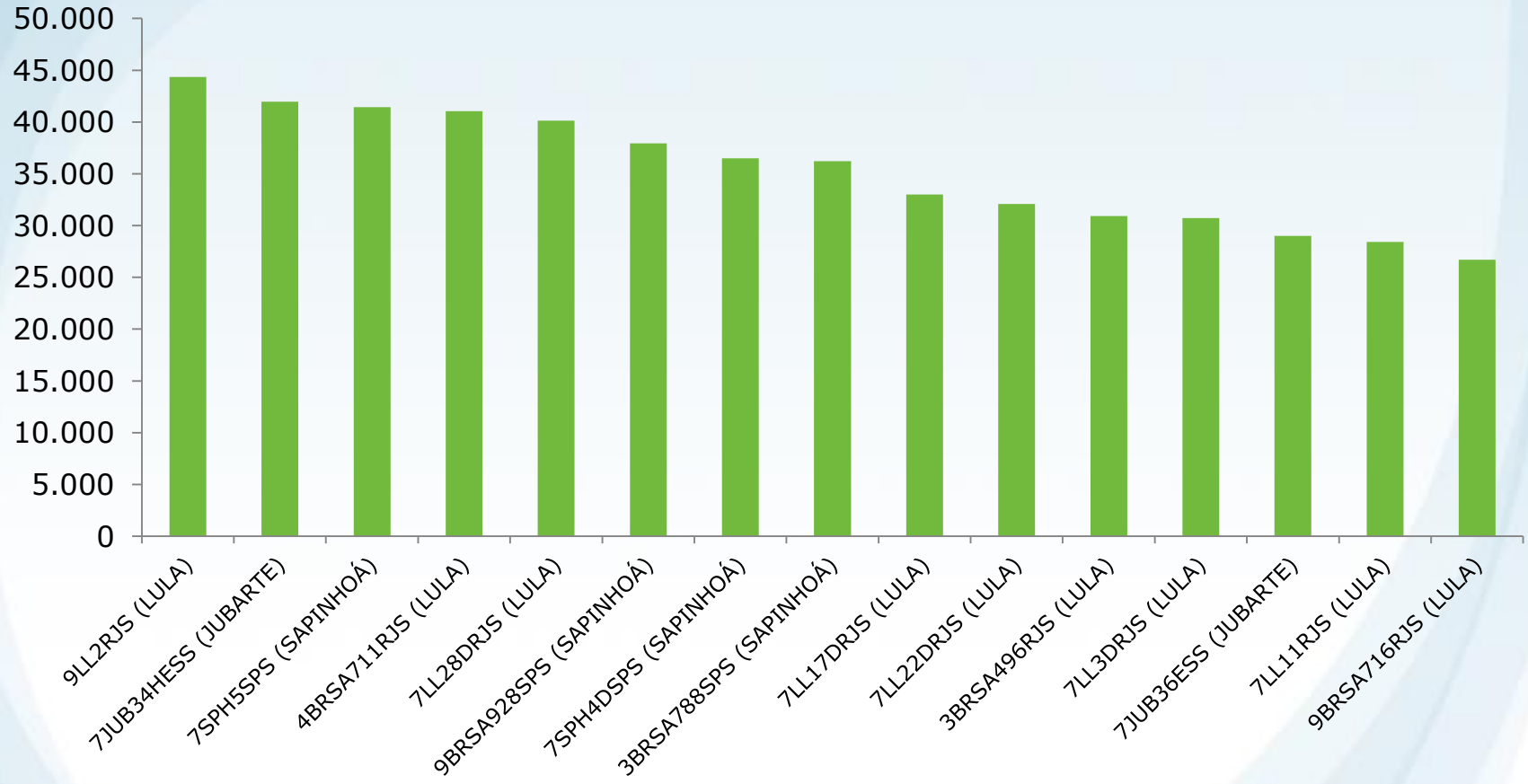
Brazil Pre-Salt Petroleum System

Comparison of Ten Largest Accumulations in Santos Basin Vs. Gulf of Mexico



Barra's Position Offers Exposure to Both the Pre- and Post-salt with a Significant Prospect Inventory

Fifteen Largest Pre-Salt Individual Well Production (Jan/15)

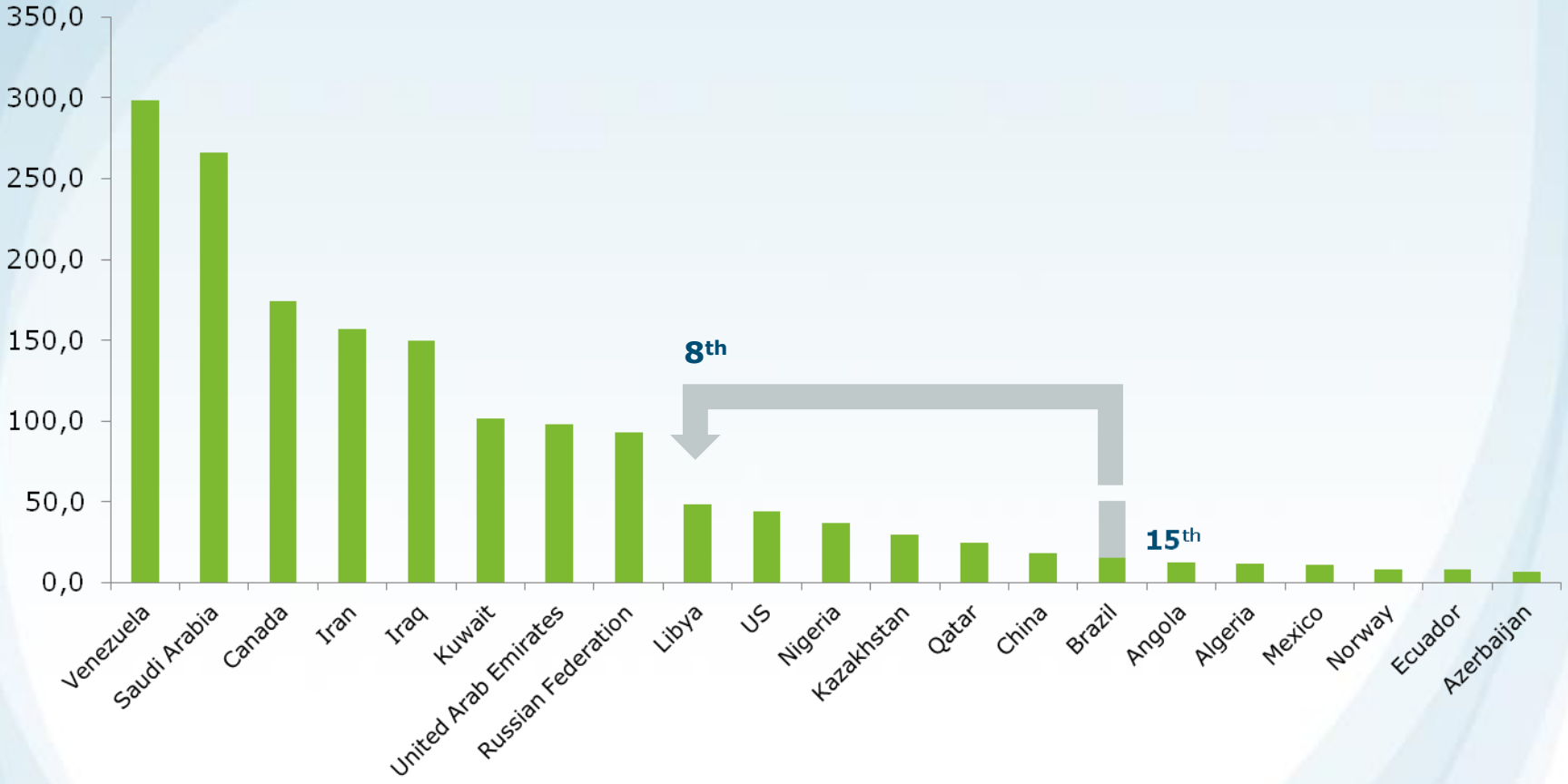


Pre-Salt Development Challenges

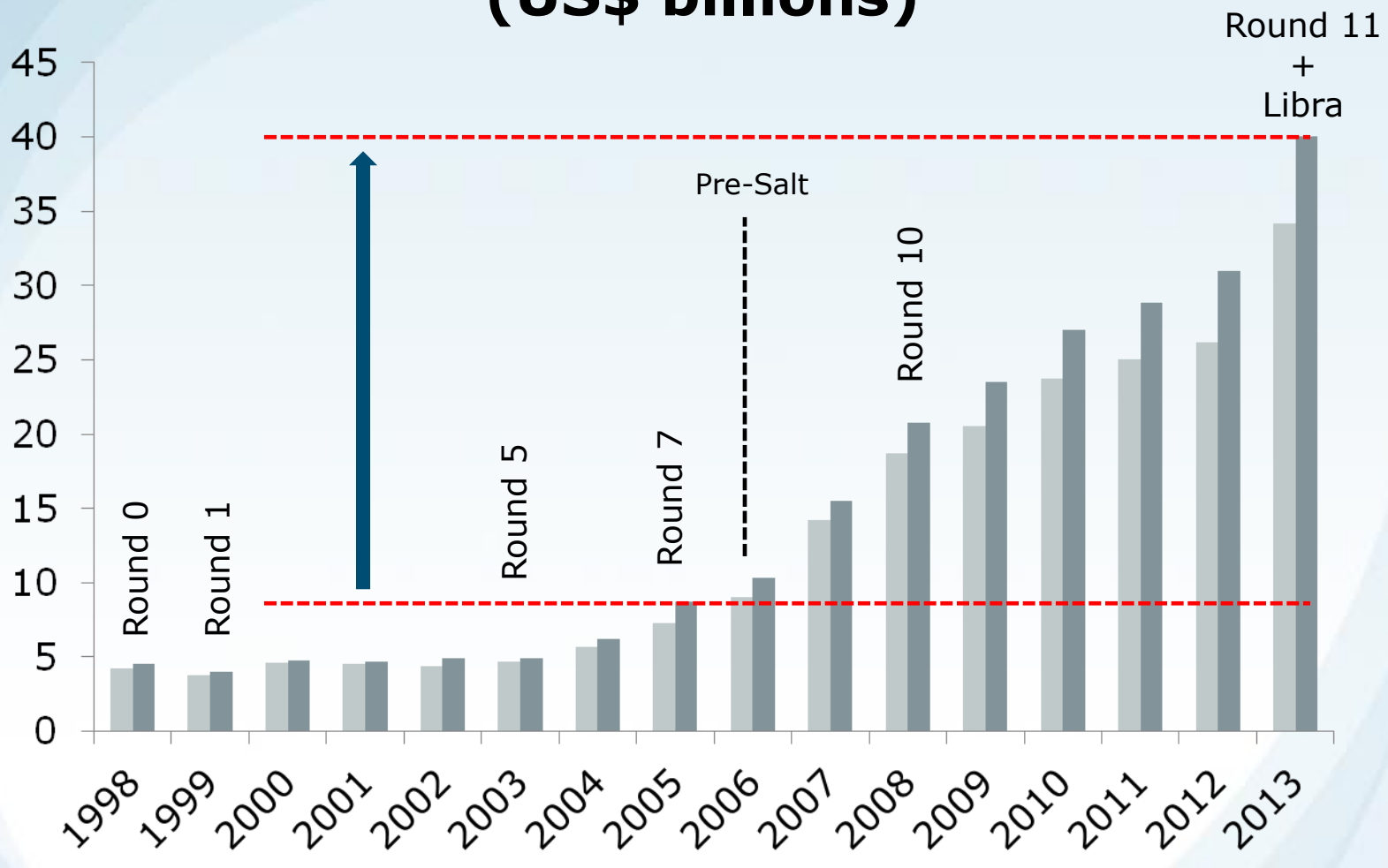
- Wells Drilling = thick salt column & high pressure
- Logistics = up to 300km offshore
- New materials = presence of CO2
- Natural gas gathering = pipeline or FLNG?
- Local content = Engineering & equipment
- Financial= Investments and operational expenses in the order of US$ 1,0 trillion

World Oil Reserves
Brazil Rank

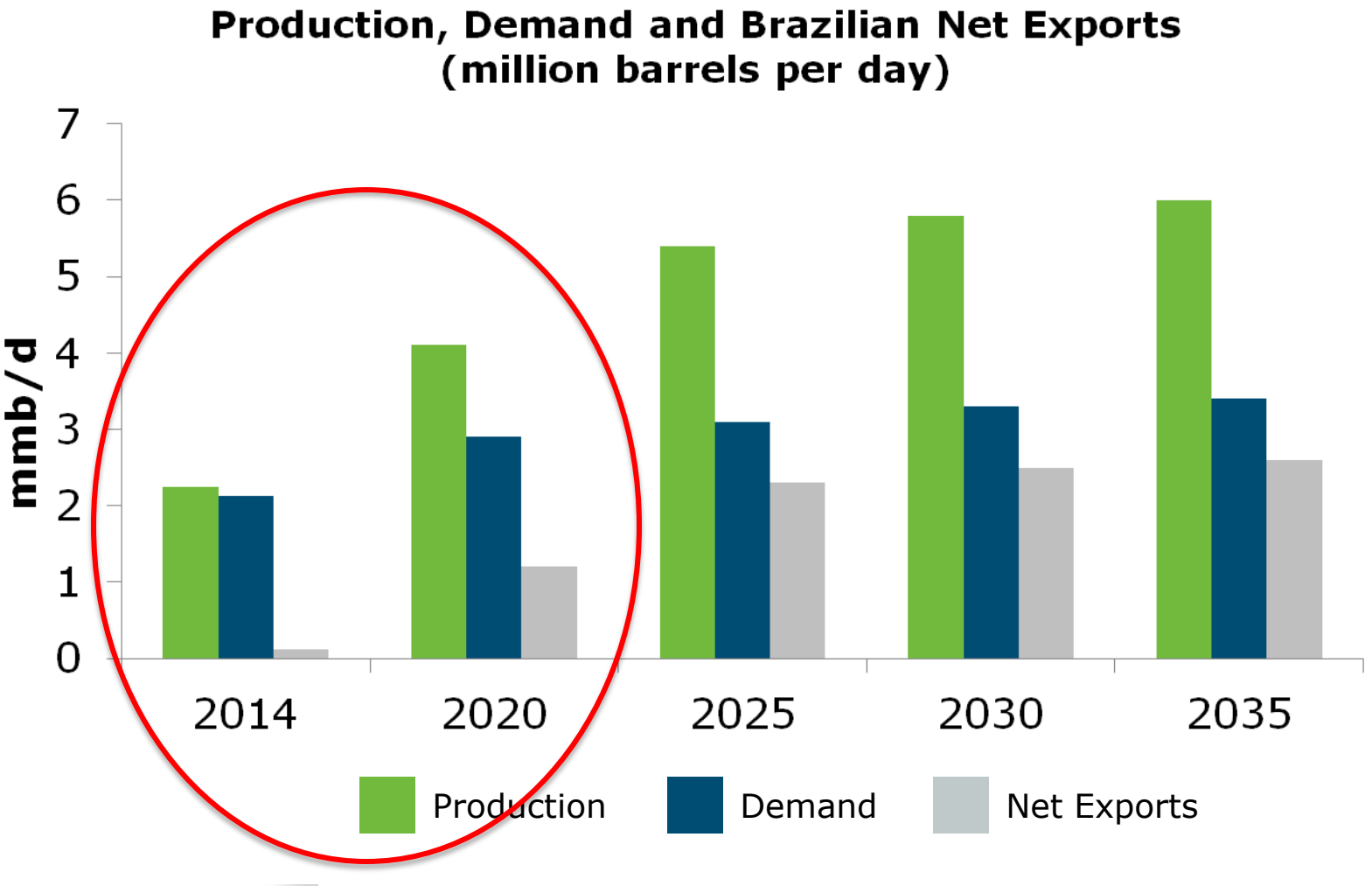
Proved Reserves (billion barrels)



Annual Investment in E&P (US$ billions)



Brazil Oil Production & Demand Forecast



Sources: ANP and IEA´s World Energy Outlook 2013

2015-2019 Business and Management Plan
(US$ Billion)

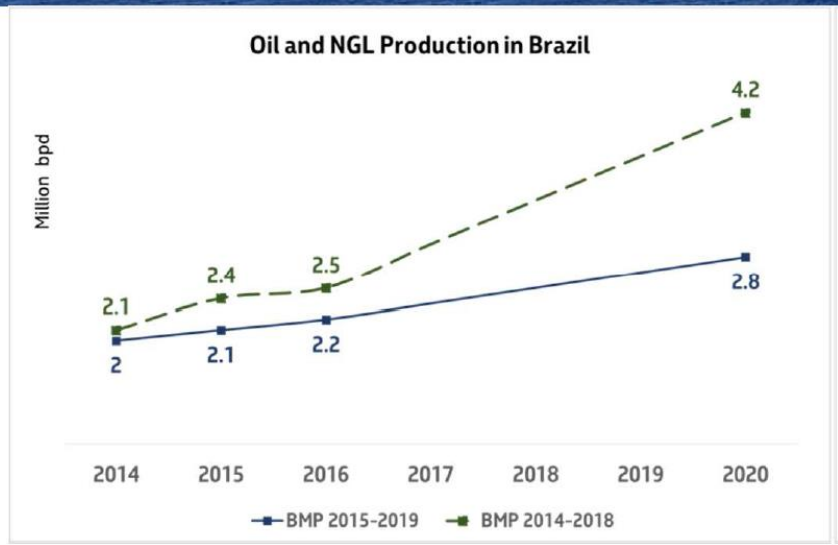
Segments	Capex	%
Exploration & Production*	108.6	83
Downstream**	12.8	10
Gas & Power	6.3	5
Other Areas	2.6	2
Total	**130.3**	**100**

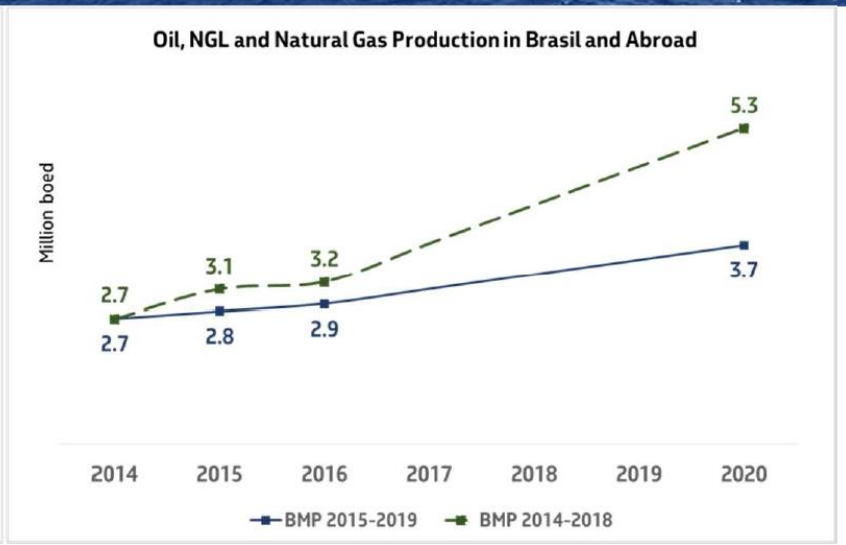
* Includes investment in international business (US$ 4.9 billion).
** Includes Distribution (US$ 1.3 billion).

Of total E&P investments, 86% will be allocated to production development, 11% to exploration, and 3% for operational support. New production systems in Brazil will total US$ 64.4 billion, of which 91% will be for the pre-salt. Exploration activities within Brazil will be concentrated in meeting the Minimum Exploratory Program for each block.

The Downstream segment will receive US$12.8 billion of investments, of which 69% will be for maintenance and infrastructure, 11% for the conclusion of the Abreu and Lima refinery, and 10% for Distribution. The remaining 10% include investments in Comperj for receiving and treating natural gas, maintenance of equipment, among others.

The Gas & Power area has US$ 6.3 billion allocated, primarily for the construction of pipelines and processing units to treat gas from the pre-salt





OPPORTUNITIES:

- Unprecedented opportunities in E&P
- High geological potential in the extraordinary Pré-salt area and also in other sedimentary basins
- E&P investments > US$ 25 billion/year
- Production will grow from 2 to > 3 million bpd in 2020
- Access acreage through new bid rounds, Petrobras divestment program, and others

CHALLENGES:

To explore the extraordinary geological potential, Brazil has to improve business attractiveness for investors.

IBP's Priority Agenda:

- **Bid Rounds:** *previsibility and regularity*
- **Pre-Salt:** *allow multiple operators*
- **Local Content:** *simplify and reflect market reality*
- **Environmental Licenses**: *improve the process*
- **Fiscal & Regulatory Regime:** *stability and previsibility*

Government is giving signals on reviewing these critical issues

CHALLENGES (cont.):

- Current effects of international oil prices + domestic oil sector crisis
- Low oil prices -> lower investments -> cost reduction needs
- "Operação Lava-jato" impacts in the O&G segment
- Regulatory environment uncertainties
- Economic and political crisis

Passion in building a sucess story !

Paixão na construção de uma história de sucesso!

Investment Thesis (2010)

Team with Proven Track Record

Unmatched combination of institutional relations, technical knowledge and operational experience

Underexplored/Underdeveloped Potential Resources

Huge potential still remaining in proven basins in both open and contracted acreage, however understanding the geologic play is critical

Opportunistic Industry Landscape

Contractual stability history, landscape dominated by Petrobras, few well capitalized players

Multiple, Compelling Exit Opportunities

Recent M&A and IPO activity confirm market interest in Brazilian E&P companies with quality assets and management

Team with Proven Track Record

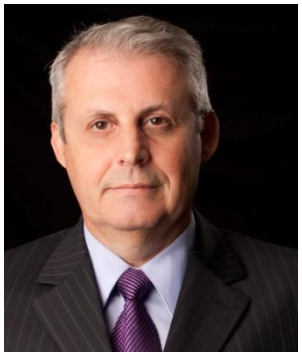
Unmatched combination of institutional relations, technical knowledge and operational experience

João Carlos de Luca, Chairman

- Former President of IBP (Brazilian Petroleum and Gas Institute)
- Former President of Repsol YPF Brazil
- Former E&P Director and a member of the Board of Directors at Petrobras

Renato Bertani, Chief Executive Officer

- Former President of the WPC (World Petroleum Council)
- Former President of Petrobras Americas
- Former Director of Petrobras International



Cesar Cainelli, Exploration & Production VP

- Former Worldwide Exploration Manager of Petrobras International with over 30 years
- Extensive experience in deep-water systems in Brazil, West Africa and Gulf of Mexico including the US discoveries of Cascade, Chinook, Hadrian, St. Malo, Stones, and Tiber

Brian Byrne, CFO & Business Development VP

- 20 years of experience in the oil and gas industry
- Investment banker covering wide array of E&P companies focusing on mergers & acquisitions and capital raising activity
- Started career at ARCO

Main Investors

(Capital commitment of US$ 1.2 billion)

First Reserve Corporation

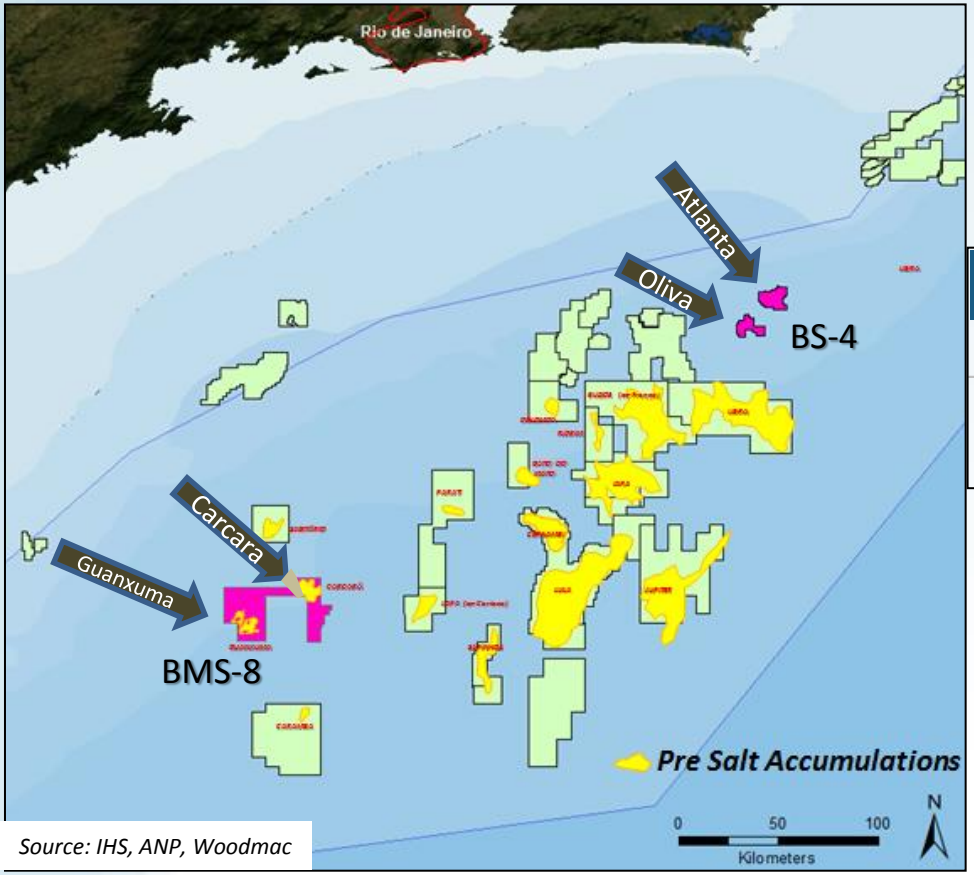
With over US$ 23 billion of raised capital since inception dedicated exclusively to the energy and natural resources industries, First Reserve is a premier private investment firm, making both private equity and infrastructure investments throughout the energy value chain. For 29 years, it has invested solely in the global energy industry, and has developed a preeminent franchise, utilizing its broad base of specialized energy industry knowledge as a competitive advantage. The firm is currently investing its most recent private equity fund, which closed in 2009 at approximately US$ 9 billion and its most recent infrastructure fund which closed in 2011 at approximately US$ 1.2 billion. First Reserve invests strategically across a range of energy industry sectors, backing talented management teams and building value by building companies. Further information is available at www.firstreserve.com.

Riverstone Holdings LLC

Riverstone Holdings LLC, an energy and power-focused private equity firm founded in 2000, has approximately US$ 18 billion under management across seven investment funds, including the world's largest renewable energy fund. Riverstone conducts buyout and growth capital investments in the midstream, exploration & production, oilfield services, power and renewable sectors of the energy industry. With offices in New York, London and Houston, the firm has committed approximately US$ 16.4 billion to 80 investments in North America, Latin America, Europe and Asia. For more information, visit www.riverstonellc.com.

Portfolio Overview

Overview of Barra's Assets

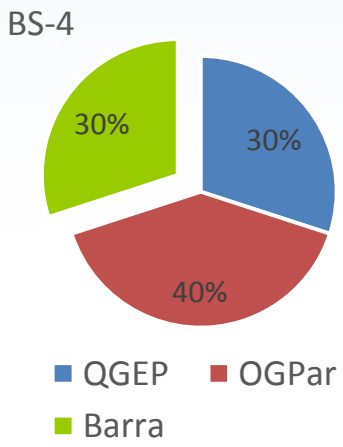


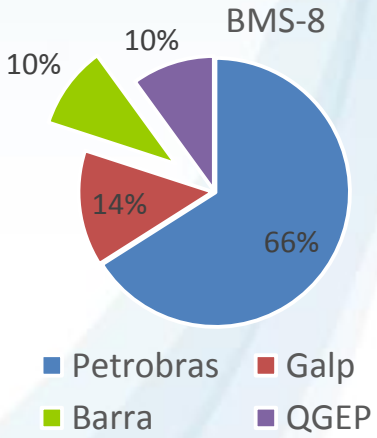
Source: IHS, ANP, Woodmac

Summary

- Non operated interest in two ultra deepwater Santos Basin blocks
- Portfolio includes fields under development, discoveries under appraisal and high impact low risk exploration prospects

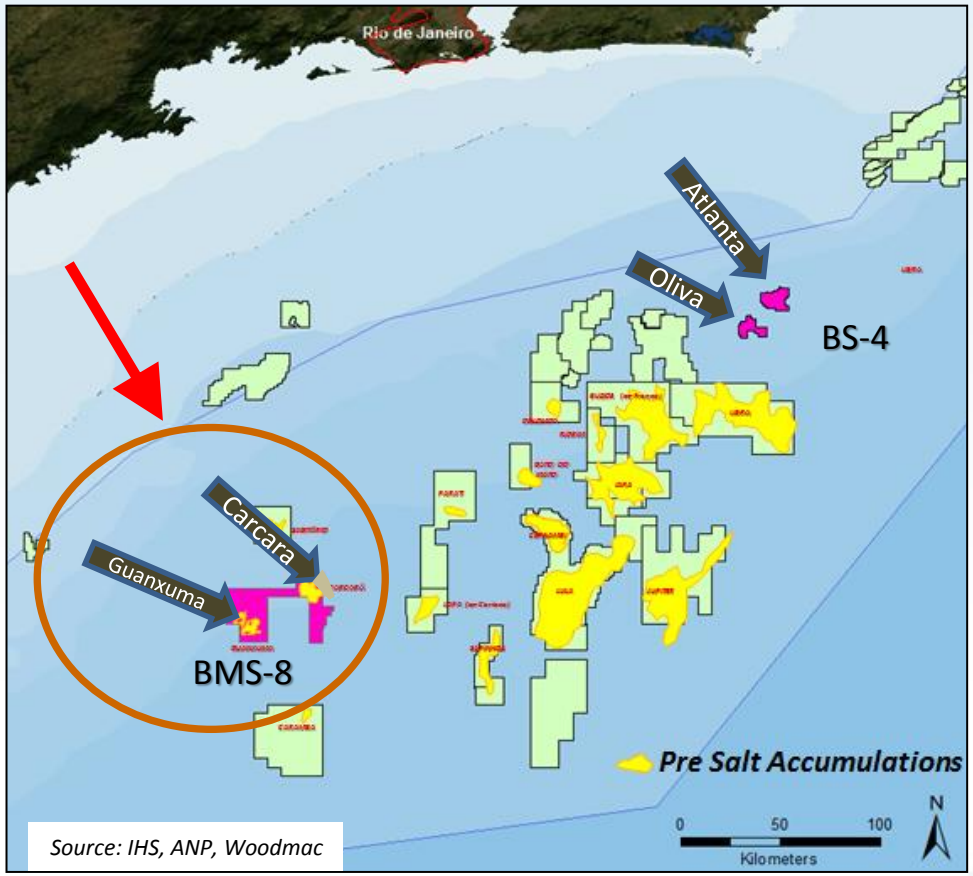
Block	Working Interest	Acquired From	Acquisition Agreement Reached	Acquisition Approved by ANP
BM-S-8	10%	Shell	Jul '11	Dec '11
BS-4	10%	Shell	Aug '11	Dec '11
	20%	Chevron	Aug '11	Feb'12

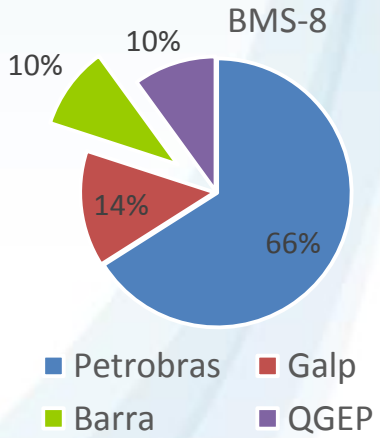




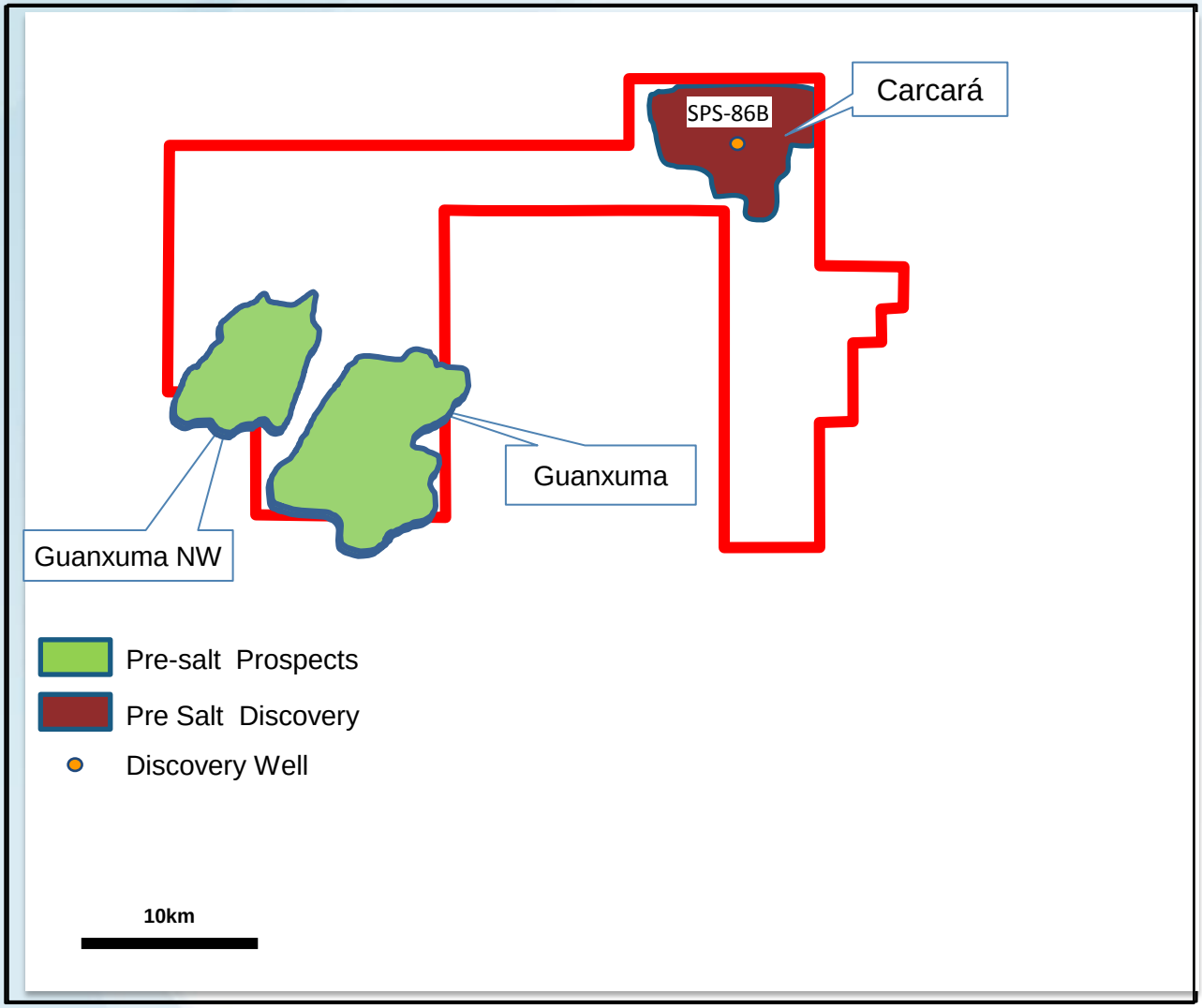
Portfolio Overview

BM-S-8





BM-S-8 Key Assets: Carcará Discovery and Guanxuma Prospects



Carcará Discovery Well (SPS-86B)

- 402 m of continuous, porous limestone reservoirs with high net-to-gross
- 31o API, no contaminants (CO2, H2S) recovered throughout the pay zone;
- No oil/water contact, >900m oil column

Pre-salt Prospectivity

- Guanxuma, Guanxuma NW prospects, geologically similar to Carcará

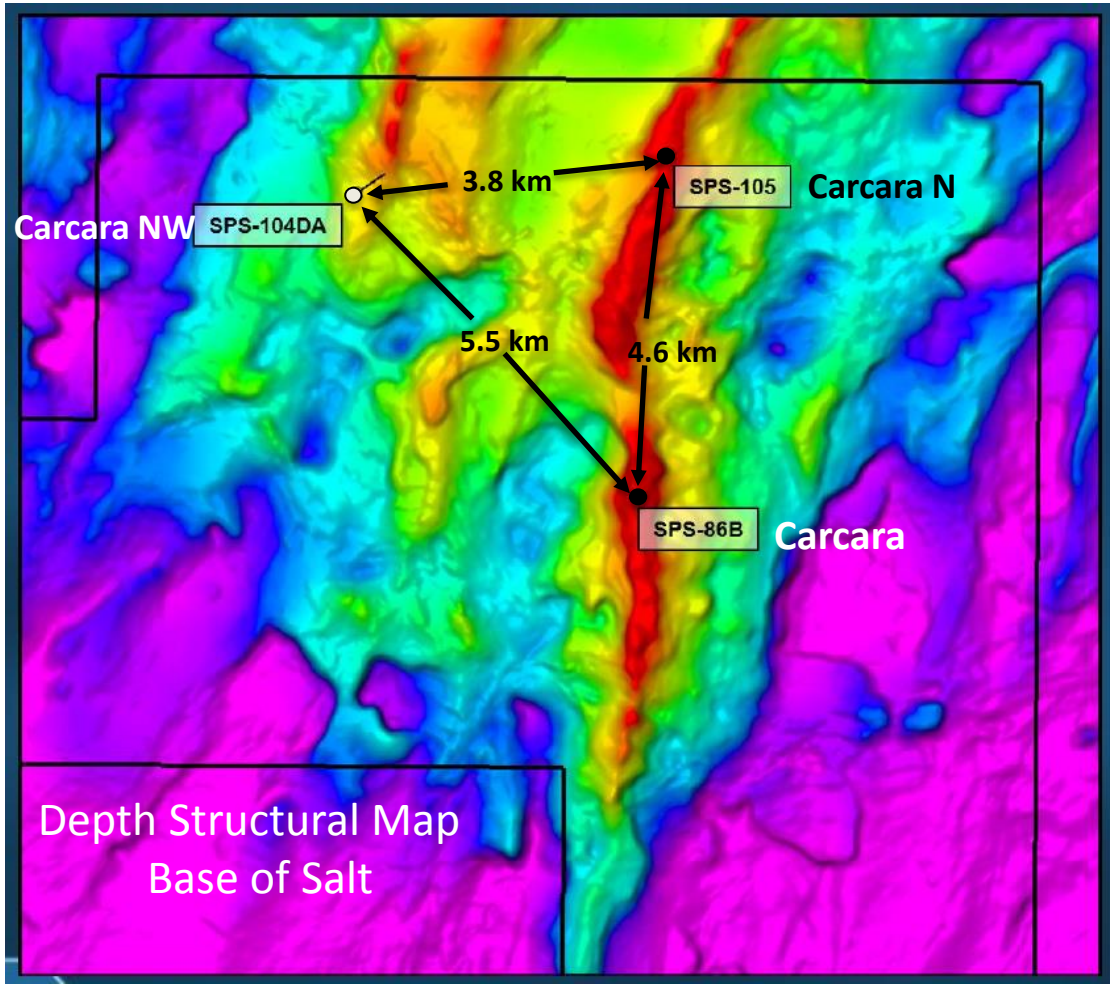
CARCARA APPRAISAL PLAN

Carcará N (SPS-105)

- 352m m of continuous, porous limestone reservoirs with high net-to-gross
- 31o API, no contaminants (CO2, H2S) recovered throughout the pay zone; identical crude recovered from undelying volcaniclastic layer
- No oil/water contact, consistent with >900m oil column established in discovery well
- Determined reservoir and pressure gradient continuity between Carcará and Carcara N
- DST planned 3Q 2015

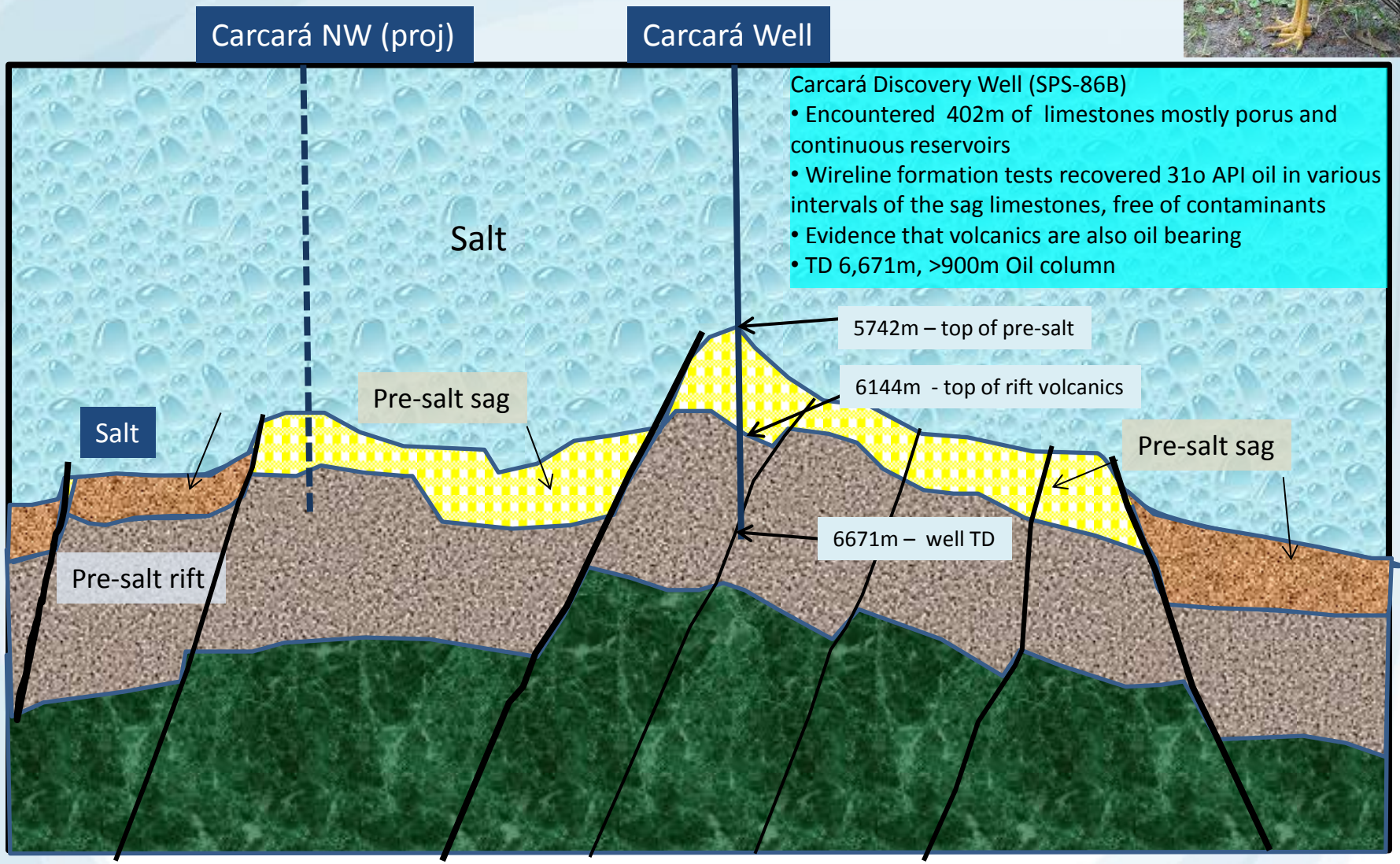
Carcará NW (SPS104DA)

- Drilled to base of salt, drilling through reservoir planned 3Q2015
- DST planned 4Q 2015



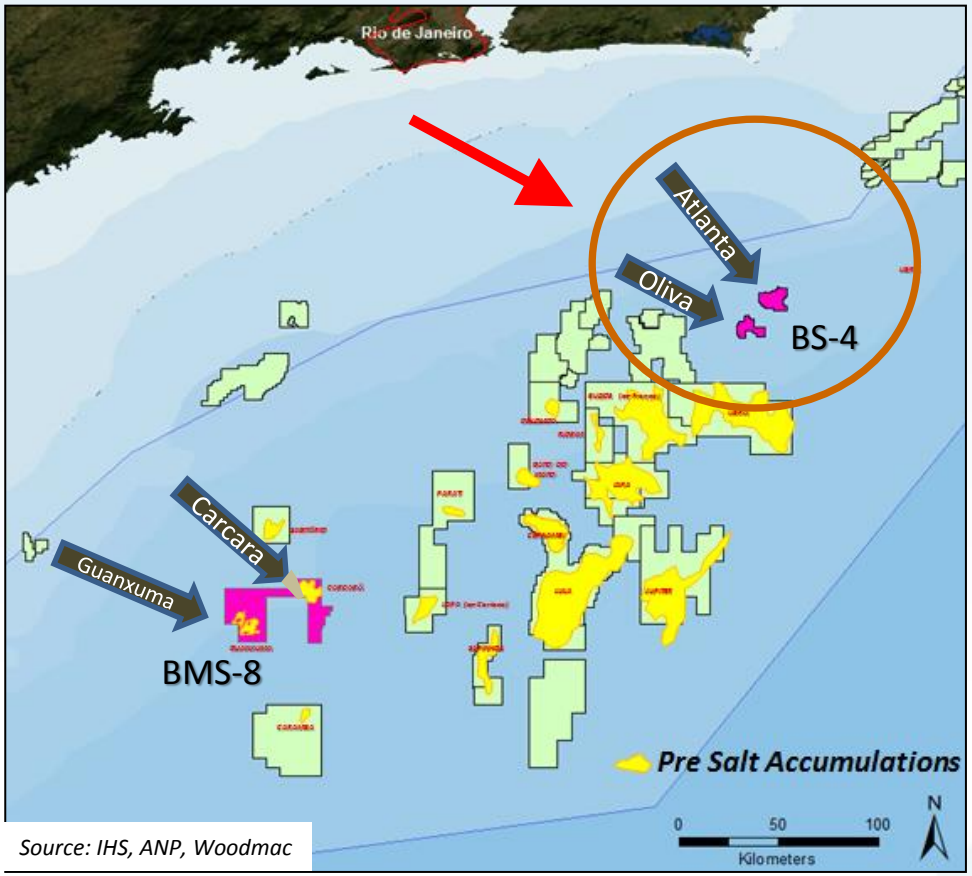
Source: Company Information

BM-S-8 Carcara Pre Salt Discovery

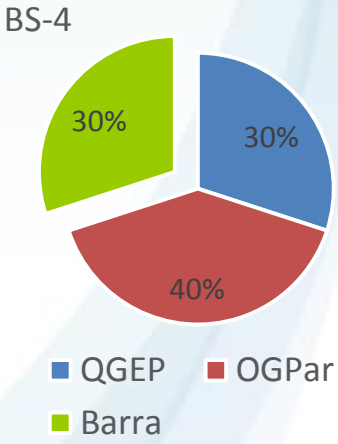


Portfolio Overview

BS-4



Source: IHS, ANP, Woodmac

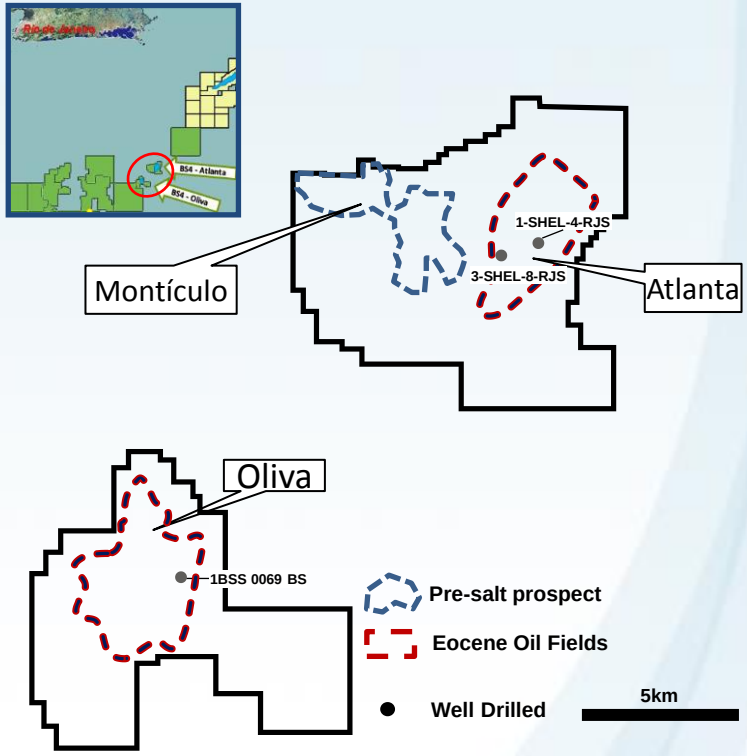


BS-4: Atlanta and Oliva Fields

Summary

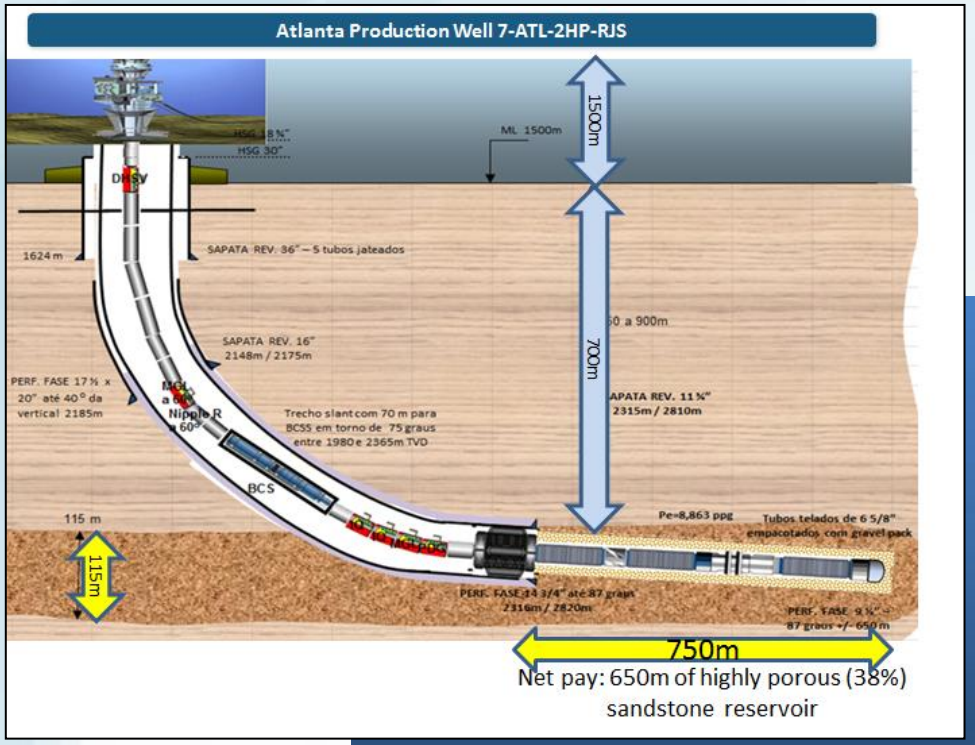
- Two post-salt, heavy oil fields: Atlanta and Oliva
- Recent drilling activity substantially de-risked reservoir flow rates with drilling and testing of two Atlanta horizontal production wells
- Development on track for Mid 2016 first oil
- Total oil in place in excess of 2,100 MMboe, with Atlanta accounting for 80% of the volume
- Pre-salt Montículo low risk prospect, attractive tie back potential to Atlanta
- No local content requirement critical to achieving scheduled timetable

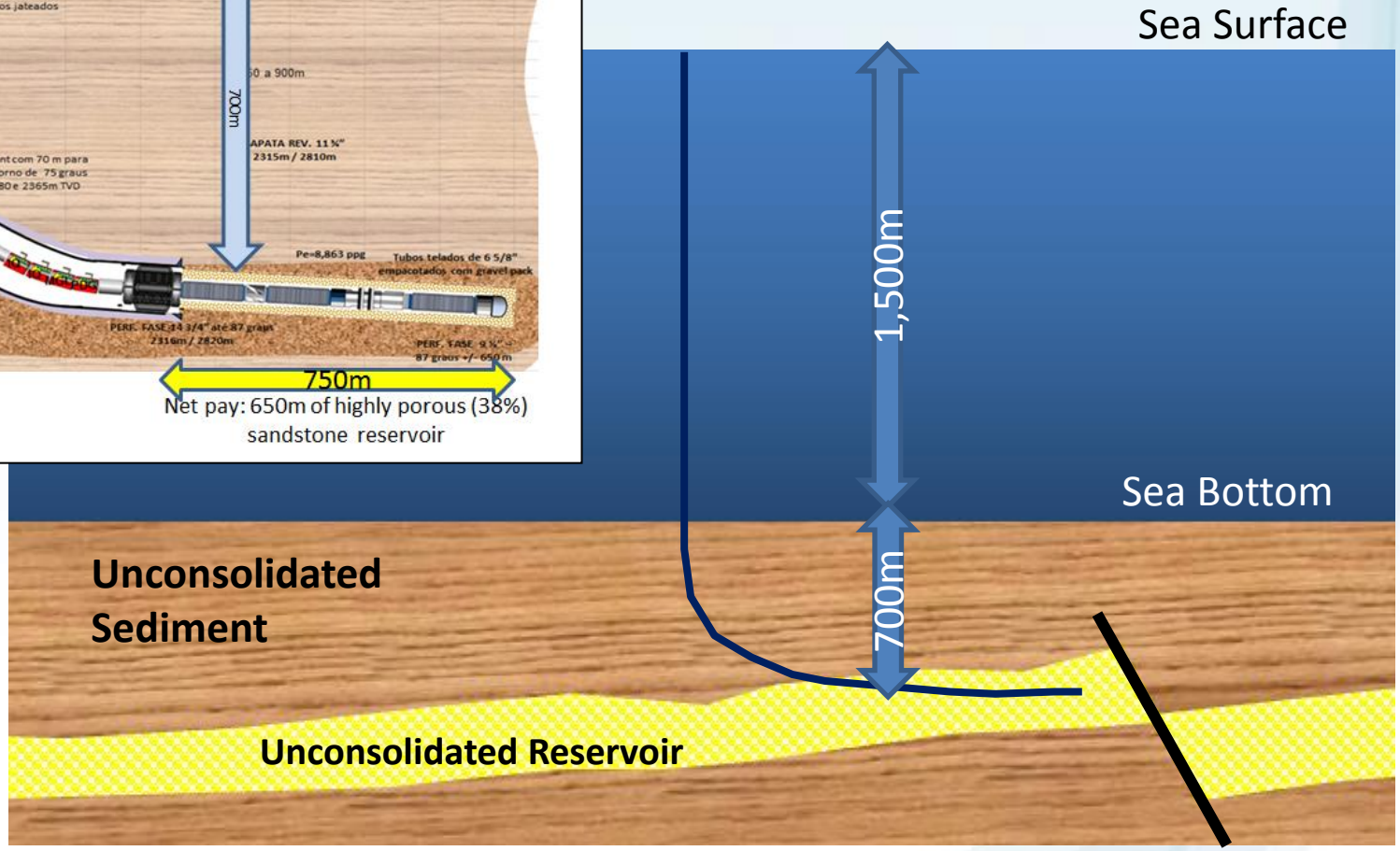
Atlanta and Oliva Fields



Source: Company Information.

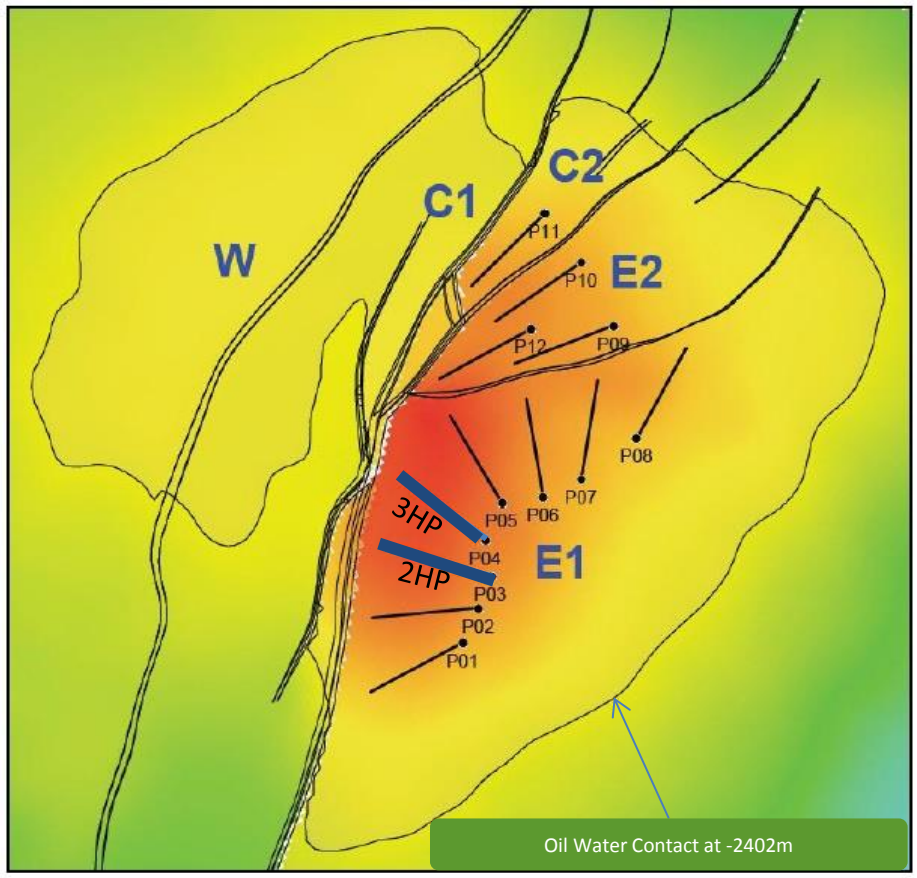
BS-4 Atlanta Field – Production Well 7-ATL-2HP-RJS





Atlanta Field Development

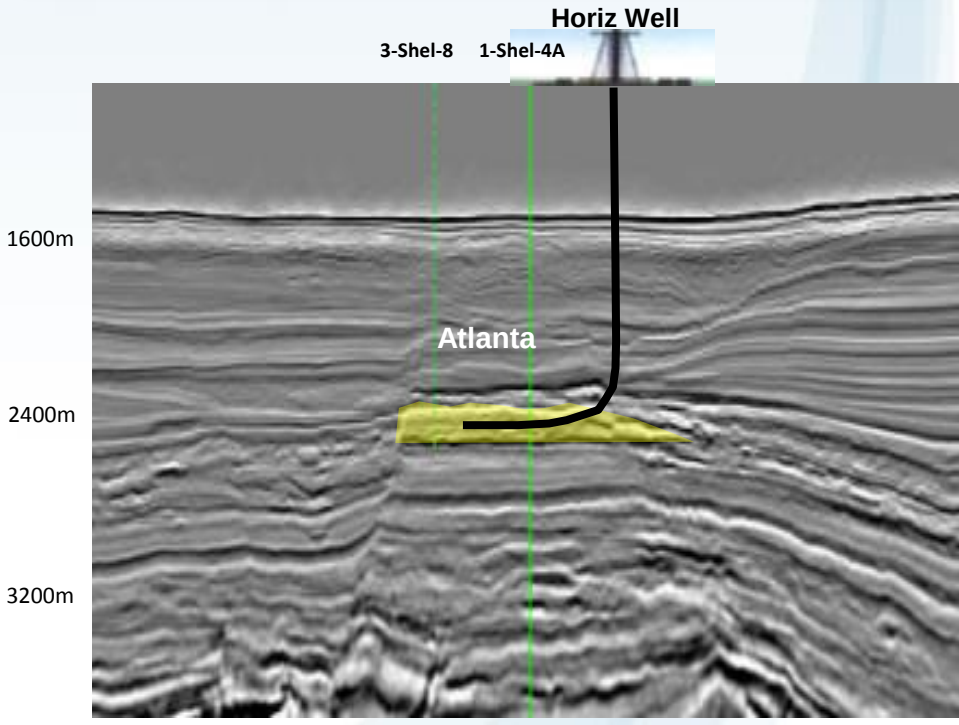
Atlanta Reservoir Drainage Map



Horizontal Production Wells Drilled and Completed

- First two production wells indicated ~12k b/day at normal operating condition
- Early Production Phase
  - FPSO contracted, eta Q1 2016
  - One more well planned for 2Q2016
  - First oil: mid 2016 (25k to 30k bopd)
- Full field development
  - 9 additional production wells
  - Peak Production: 80k bopd (2018)

Seismic Cross Section



BS-4 OVERVIEW
Teekay – Petrojarl 1 FPSO

Heavy Oil Development

Atlanta Development – Cameron X-Tree

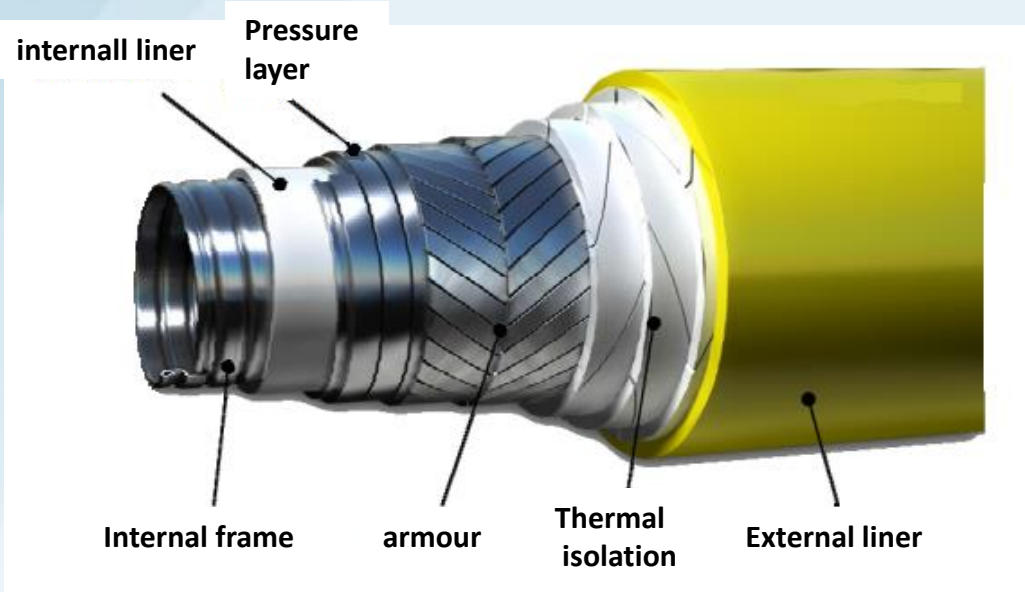
Capping System

Wet X-Tree

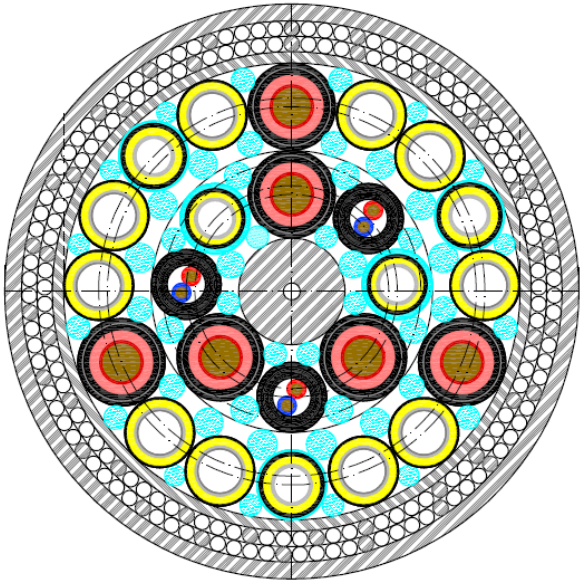
Source: Company Information

BS-4 OVERVIEW
Recent Bid Results

Flexible line
Flowlines and riser



Umbilicals



Source: Company Information

ATLANTA FIELD DEVELOPMENT

- **UTAs (**Umbilical Termination Assembly):

OSR (Oil Spill Response Vessel

AHTS (Anchor Handler Tug Supply Vessel

Source: Company Information

Business Overview

In less than two years (2010-2012) Barra Energia could:

- Attract strong funding commitment (1.2 U$bn) from industry (leading US energy equity funds, the First Reserve and the Riverstone);
- Establish a strong position in the pre-salt exploration play;
- Reunite a growing skilled team of professionals in all key E&P disciplines;
- Beef up a large data base of seismic (112,000 km 2D and 30,000 km^2 3D), and well data;

Business Overview

Barra Energia constructed a diversified portfolio of E&P assets in Santos Basin, one of the most prolific and still under explored oil provinces in the world

- **Atlanta**: proven reserves under development; first oil → mid 2016
- **Carcará**: world class pre salt accumulation under appraisal; potential for huge productivity and reserves
- Low risk, high impact exploration and development upsides: **Guanxuma** pre salt prospect, **Oliva** tie back, Atlanta improved recovery factor, cost rationalization and reduction
- Attractive concession terms
- Team with proven track record

High ethical and governance standards

Going Forward

BE constructed an attractive business:

- Balanced and focused portfolio including fields under development, discoveries under appraisal and an inventory of high impact, low risk exploration opportunities
- Operations focused in further de-risking current portfolio
- Well funded to meet current portfolio capex
- Rigorous capital discipline in further portfolio growth

Source: Company Information, IHS, ANP, WoodMaac, Upstream, Petrobras

Thank you!

Obrigado!

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