

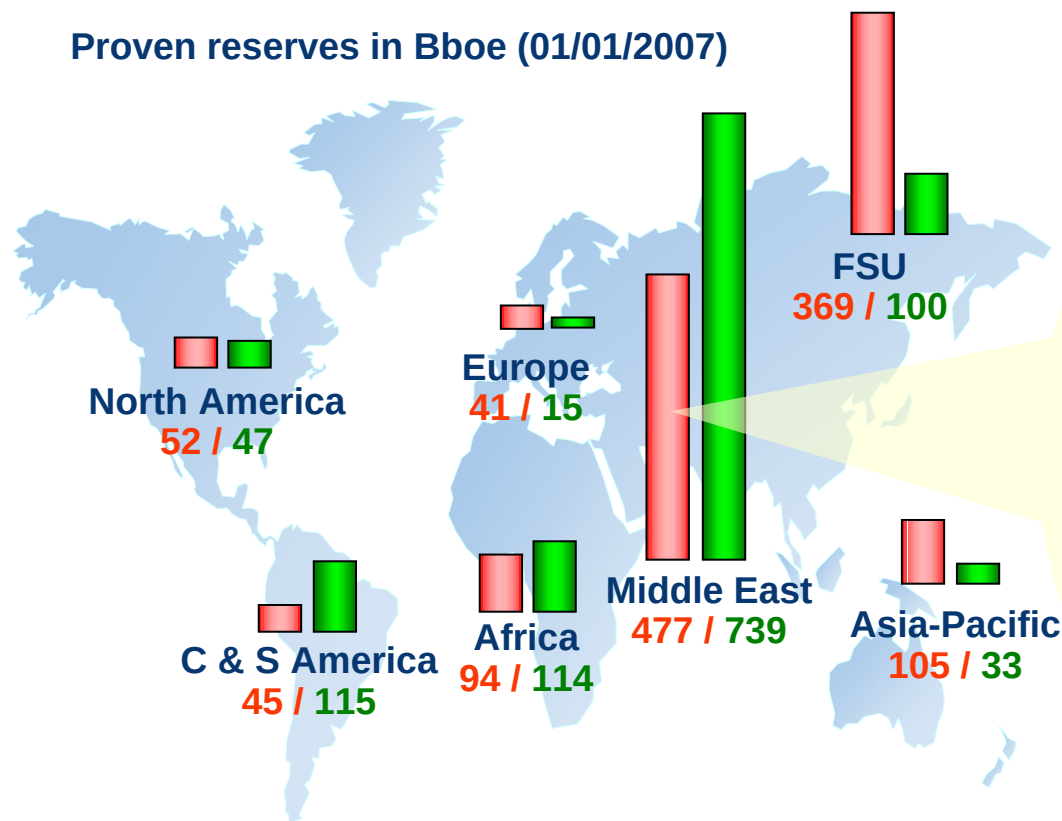
Producing gas to markets: The end of easy gas?

**By Bernard Clément,
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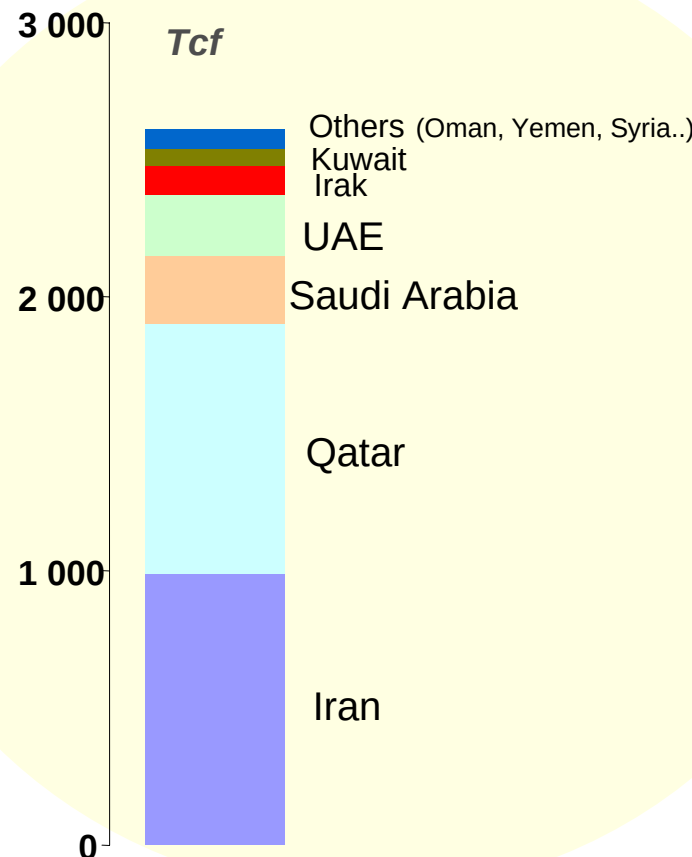


Conventional oil & gas proven reserves

Proven reserves in Bboe (01/01/2007)

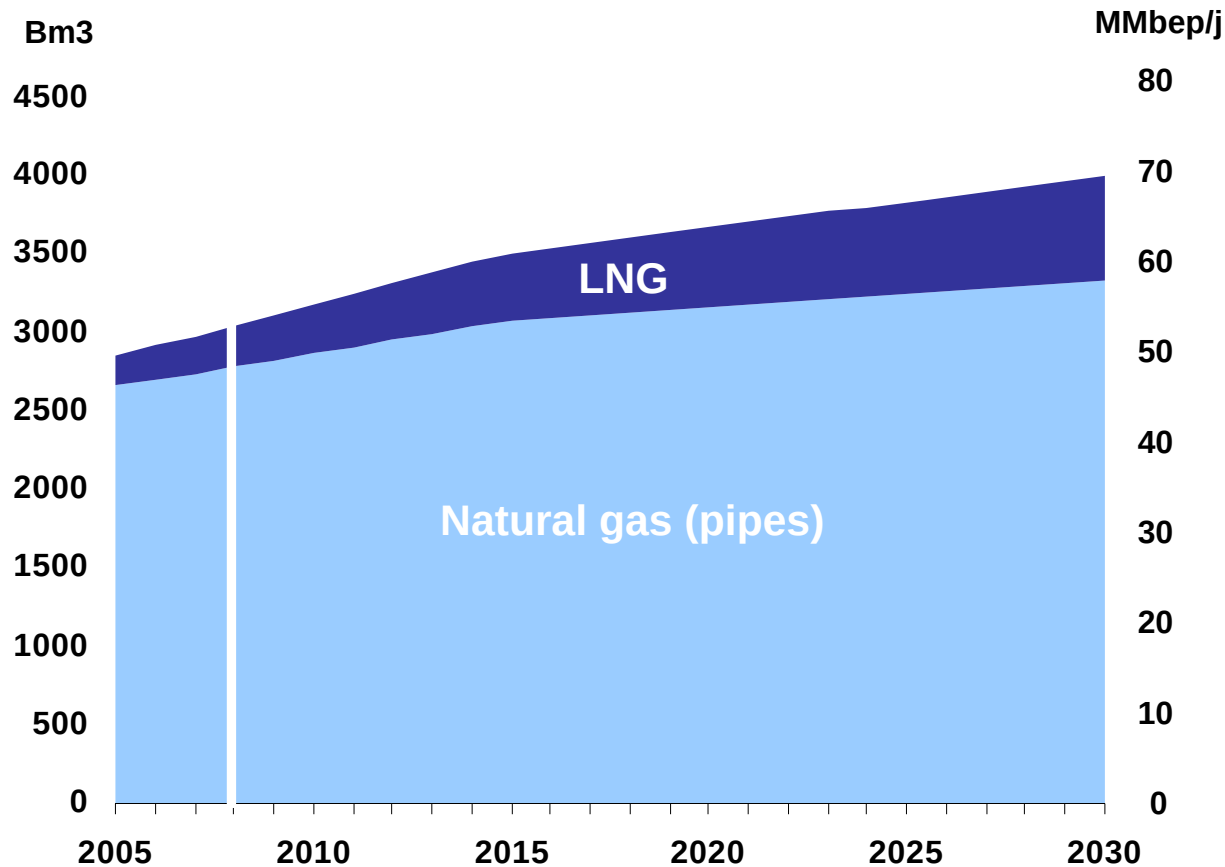


Sources : **CEDIGAZ**, **AIE**
O & G Journal



- Worldwide : 6 470 Tcf (1200 Bboe)
- Middle East : 40% of proven gas reserves
- Qatar + Iran amount to 73% of Middle East reserves

Natural gas: a sharp increase in LNG production

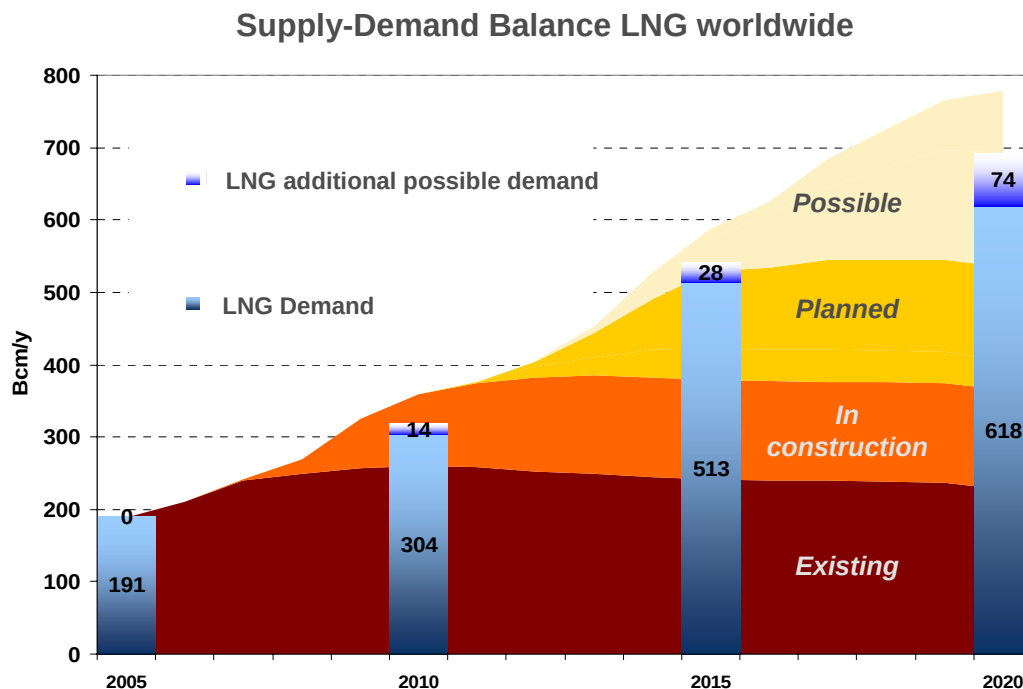


- ▶ Significant increase in natural gas; from 2850 Bm3 (2005) to 4000 Bm3 (2030)
- ▶ LNG share increases more than 5% per year
- ▶ But...

LNG supply could fail to meet surging demand

- Numerous start-ups scheduled until 2010

- Increase in worldwide LNG demand : +10% per year until 2015



source : Total

- Cost increase, environmental issues, permitting => many FID's are currently being delayed

***- Delays in Taking FID Will Probably Result in a Tighter Situation.
- In the Longer Run, Current Growth Rate Will Hardly be Reached Again.***

Middle East is blessed with various gas opportunities

- ▶ Middle East share in world gas production is much lower than its share of proven reserves. The region could profitably meet world's growing need for energy, but also satisfy growing domestic demands.
- ▶ LNG will further expand in Qatar, Iran and Irak. But pipelines will continue to develop (Dolphin)
- ▶ Gas unbalances in some countries will re-orientate new productions towards local markets :
 - Regional prices will increase near to world prices.
 - Technologically challenging unconventional reserves (tight and acid gas) are going to become economical to develop.
- ▶ In this context, bringing new gas to markets will definitely require:
 - Technological skills and innovation abilities
 - Project management capabilities to handle costs and schedule in a moving market
 - Contractual imagination to structure international projects taking into account each State sovereign interests

Technological challenge: tight gas production

Tight gas challenges: 2500 to 4500 tcf of unconventional reserves

► Many technological challenges in a broad range of disciplines

► Additional challenges outside US : local market development, gas price, major uncertainties at decision stage (appraisal) ...

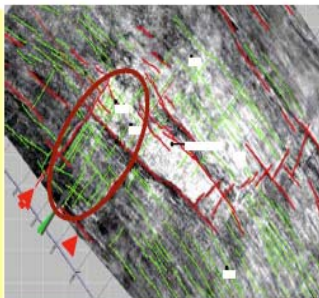
RESERVOIR EVALUATION CHALLENGES

- Often complex reservoirs
- Major uncertainties : productivity, spacing...
- Specific know how required in data acquisition and simulation



RESERVOIR CHARACTERIZATION CHALLENGES

- Identification of sweet spots thru advanced seismic, & integration of geological information
- Locate wells in areas of best potential



Example of fracture identification through advanced seismic

DRILLING COMPLETION CHALLENGES



- Optimize productivity
- Avoid liquid loading
- Drive down costs
- Minimize footprint

Total current Tight Gas portfolio

► Current portfolio

- Algeria : Timimoun basin
- Argentina : Neuquen basin
- China : Ordos basin
- Indonesia : Mahakam basin
- Venezuela : Guarico basin

► Previous experience in TGR

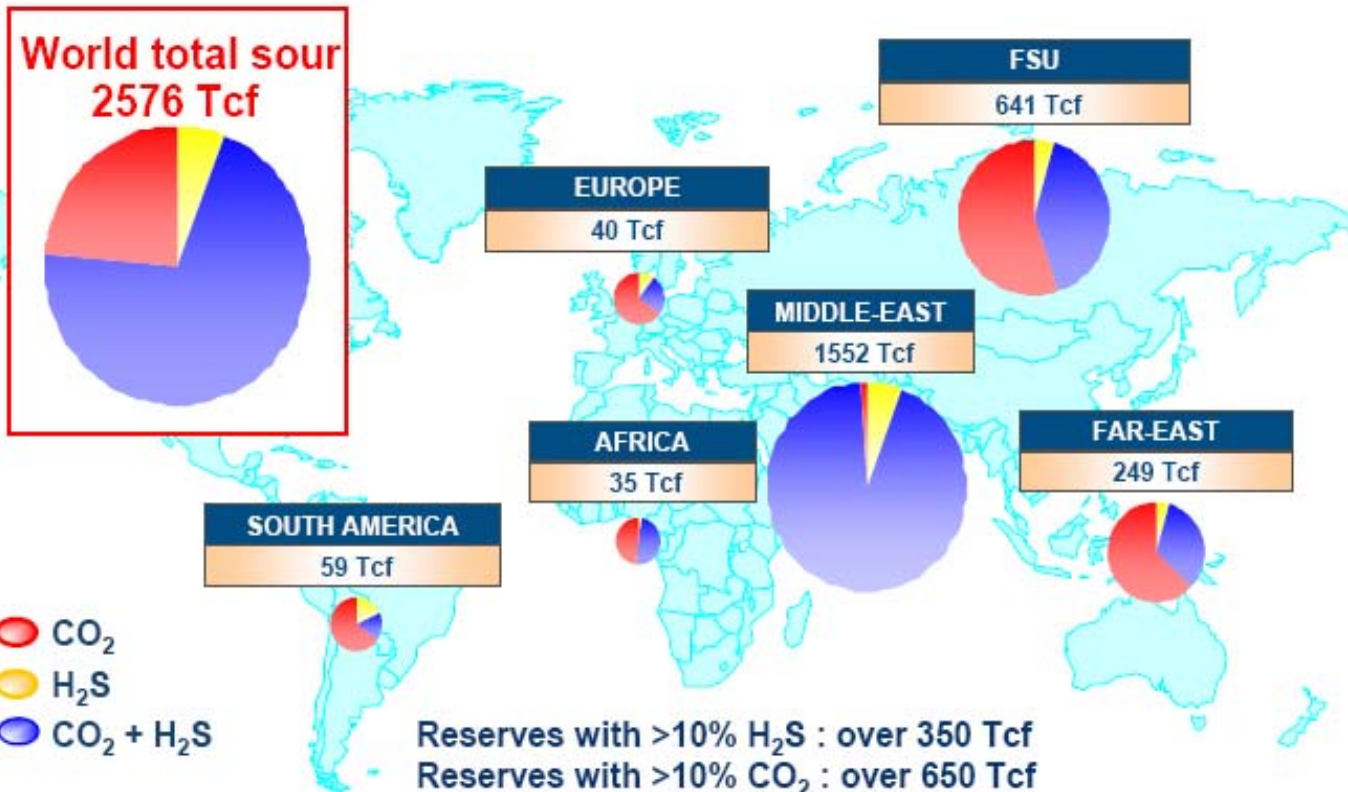
- Onshore US mainly Texas



Technological challenge: sour gas production

6500 tcf.... among which, 40% are sour (North America excluded)

"Sour: CO₂>2% and/or H₂S>100ppm"



Strong positions for Total

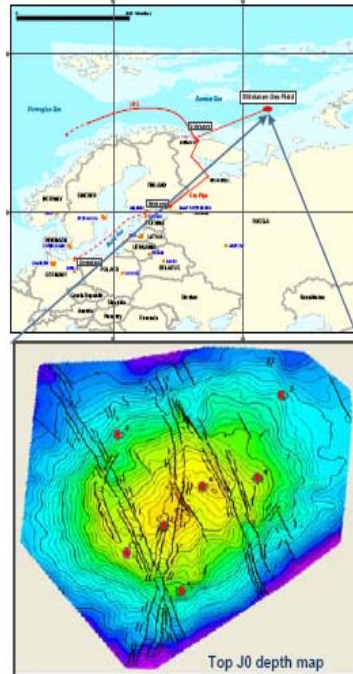
- Broad amine license portfolio (Advamine series HiLoad DEA®, MDEAmax®, energizedMDEA®)
- Operational track record : Lacq, Tchibouela, Middle-East, Sleipner...
- Sprex® pilot in Lacq: validated
- R&D : Sprex® CO₂, new hybrid solvent, membrane technology

Project management challenge: innovation for Arctic gas

Shtokman: A worldwide strategic energy project

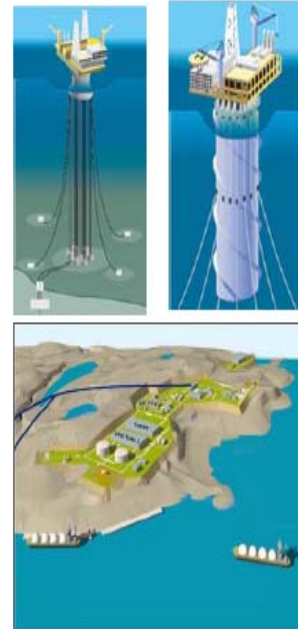
- ▶ Field discovered 1988
- ▶ Barents Sea, 550 km offshore
- ▶ Water depth 340 m
- ▶ 7 wells drilled between 1988 & 2006
- ▶ 3D seismic shot (1700 km²) 2003
- ▶ Good petrophysical characteristics

Gas in place: 3 700 billion m³ gas



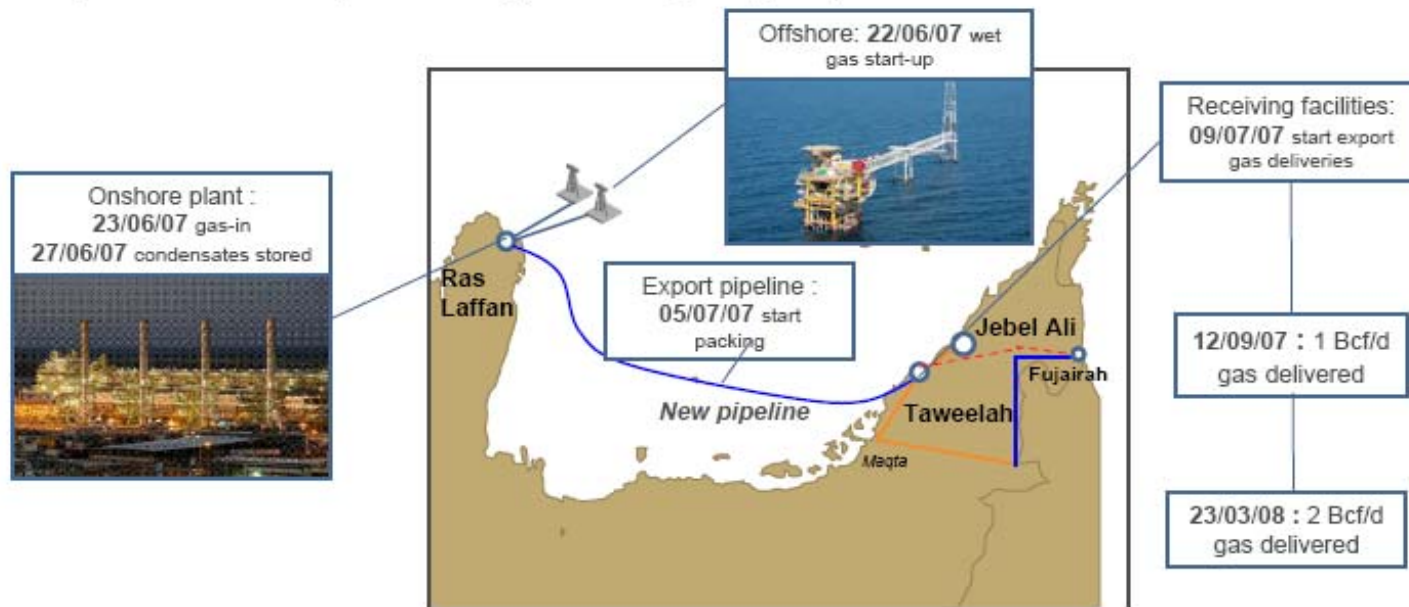
Shtokman Field phase 1 development options

- ▶ Phase 1 production 23.7 Gm³/an
 - 45% LNG
 - 50% exported to W. Europe via Nord Stream
 - 5% domestic markets
- ▶ Upstream
 - 3 submarine well clusters (20 wells)
 - Floating processing platform (SPAR or TLP)
 - 2-phase transport onshore via 600 km pipeline
- ▶ Onshore terminal near Murmansk
 - Gas & condensate storage & treatment
 - Liquefaction (1 train 7.5 Mt/year)
 - Export compression
 - Harbor & LNG export facilities
- ▶ 1st pipeline deliveries 2013, LNG 2014



Contractual challenge: structuring integrated projects

Dolphin : a unique integrated gas project across Middle East



► Dolphin (Total : 24.5%)

- Operations led by Dolphin Energy Ltd
- Capacity > 2 Bcf/d

► Vertical integration

► 25-year sales contracts

A unique tri-State integrated gas project, currently producing 2 bcf/d

Contractual challenge: creating new framework

- Stakeholders to have the capacity to create innovative contractual structure and business model.
- Example: Shtockman, taking into account Gazprom and Total objectives:
 - Russia & Gazprom: sovereignty on licence holding and products
 - Total:
 - Participation in production process, sharing risk and reward
 - Participation in decision process and project management
- But operating excellence is not enough in today's world
 - IOC's to think and act like local players ⇔ stability and long term visibility
 - IOC's to make effective contributions to the local economy (training, employment, knowledge transfers, financial transparency)
 - Contribute to turning hydrocarbon wealth into a pillar of sustainable development



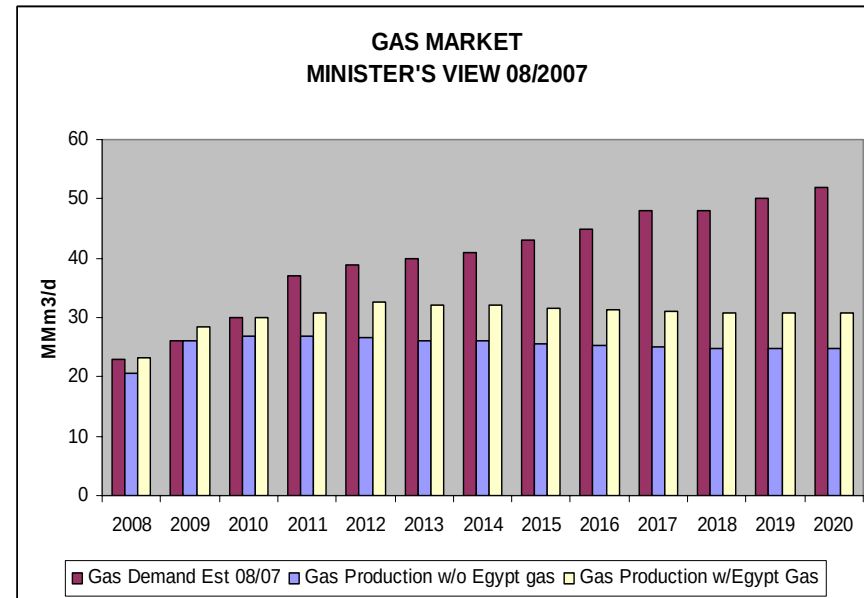
Gas potential in Syria

Supply side

- Proved gas reserves in Syria ~ 10 tcf (50% associated gas)
- Without gas exploration upside

Demand side

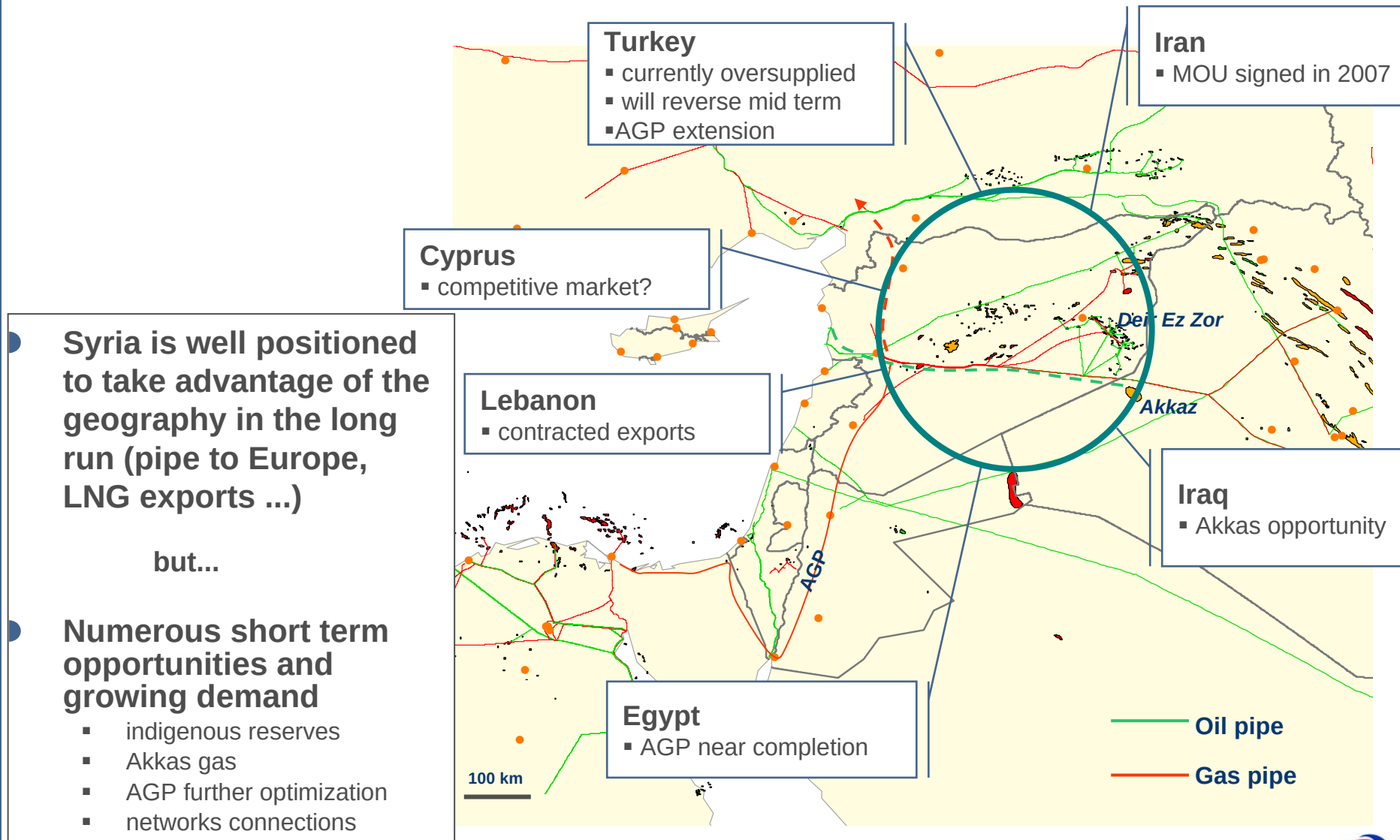
- Fastly growing demand (SGC figures Aug 2007):
 - 35 MMm3/d in 2012
 - 50 MMm3/d in 2020
- Fuelled by power needs
 - Approximately 80% of gas consumption



Confirmation of an existing domestic shortfall, which will:

- Encourage the development of regional gas systems
- Trigger bi- or multi- lateral commercial agreements

Syrian position in the regional context



THANK YOU
