

Unconventional Gas: Impact on Gas Markets

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Unconventional resources volume is still uncertain but high

Global gas in place of unconventional gas estimated at ~920 tcm

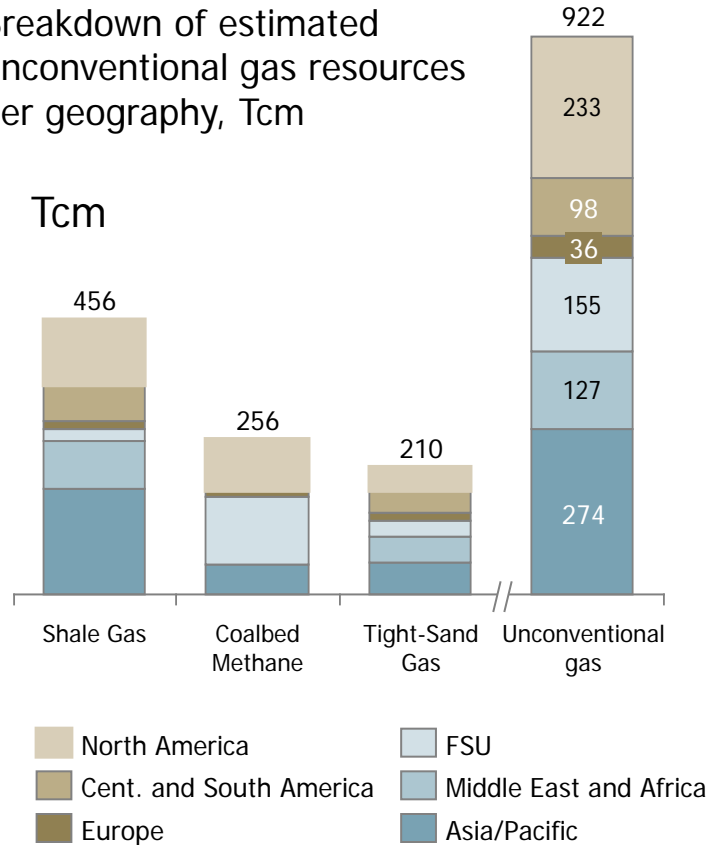
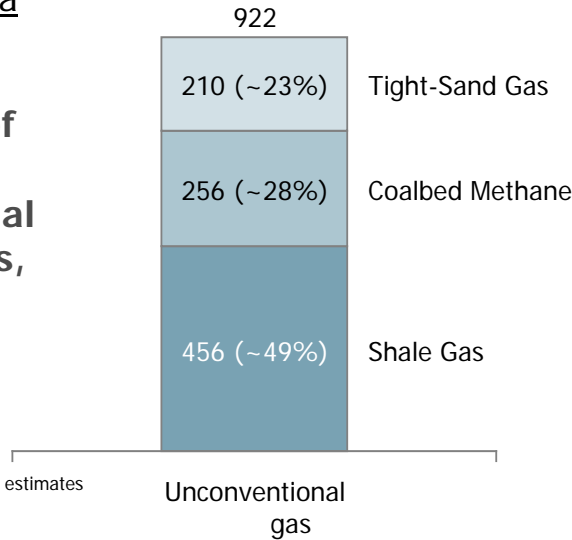
Gas in place mainly localized in North America and Asia/Pacific

Still a lot of uncertainties on unconventional gas resources figures, as production is still limited

- Shale gas production limited to North America
- CBM production limited to North America and Australia

Breakdown of estimated unconventional gas resources per geography, Tcm

Estimation of global unconventional gas resources, Tcm



Source: H Rogner 1997; GDF SUEZ estimates

Key environmental issues

Environmental issues	Description	Mitigation possibilities
Huge water needs	<ul style="list-style-type: none"> • 15 to 20,000 m³ water per well 	<ul style="list-style-type: none"> • Re-use as much water as possible • Diversify supply over long time-period – limit impact over other usage
Aquifer pollution	<ul style="list-style-type: none"> • Fraccing requires chemical additives: risk to contaminate aquifers • Variability of water recovered 	<ul style="list-style-type: none"> • Environmental friendly fluids (water based) with chemically inert propanant • Extra-care given during casing cementation. • Fraccing monitored in real time (micro-seismic) • Robust water treatment solution
Footprint	<ul style="list-style-type: none"> • Typical project includes hundreds of wells • Water storage 	<ul style="list-style-type: none"> • Well clusters: up to 24 wells based on reservoir depth • Underground piping system network • Gas processing facilities with limited visual impact (mobile systems, biphasic transport with minimum facilities at well site...)
Others	<ul style="list-style-type: none"> • Noise during fracturing • Flaring when testing (visual flame and toxic emissions) • Visual impact 	<ul style="list-style-type: none"> • Sound-proofing walls around well site • Mobile flare system: smokeless operations with optimum burning minimizing toxic emissions and shrouded flame ensuring low noise and heat radiation • Use of small rigs

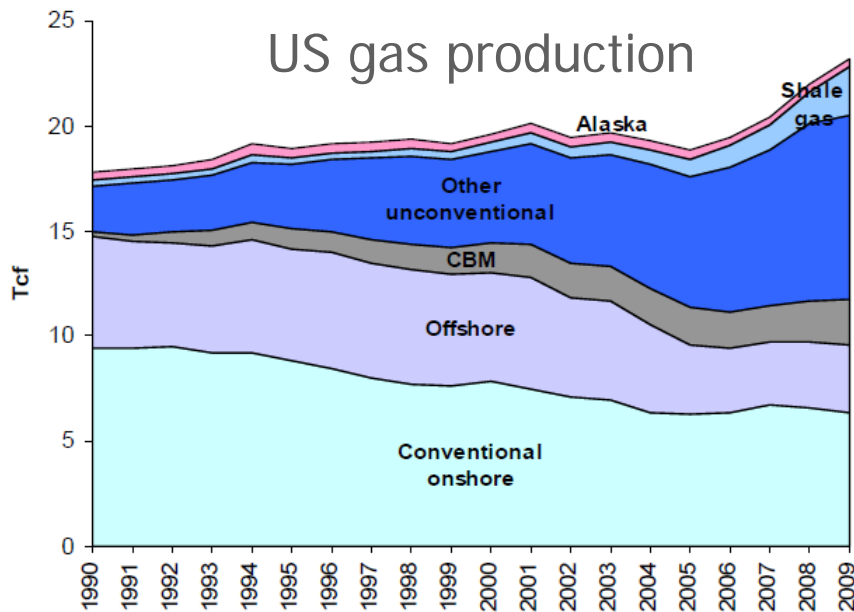
COMMUNICATE & EDUCATE - GET INVOLVED IN COMMUNITY DISCUSSION

United States: Unconventional gas status

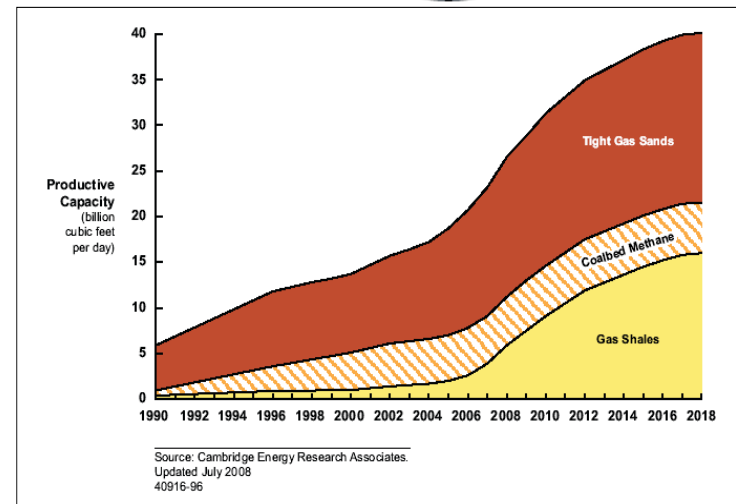
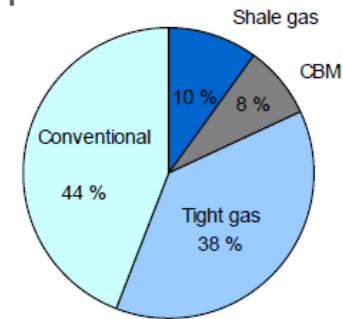
In the United States, unconventional gas : 56% of 2009 production

Shale gas : strongest growth potential in terms of production

2009 US gas production breakdown



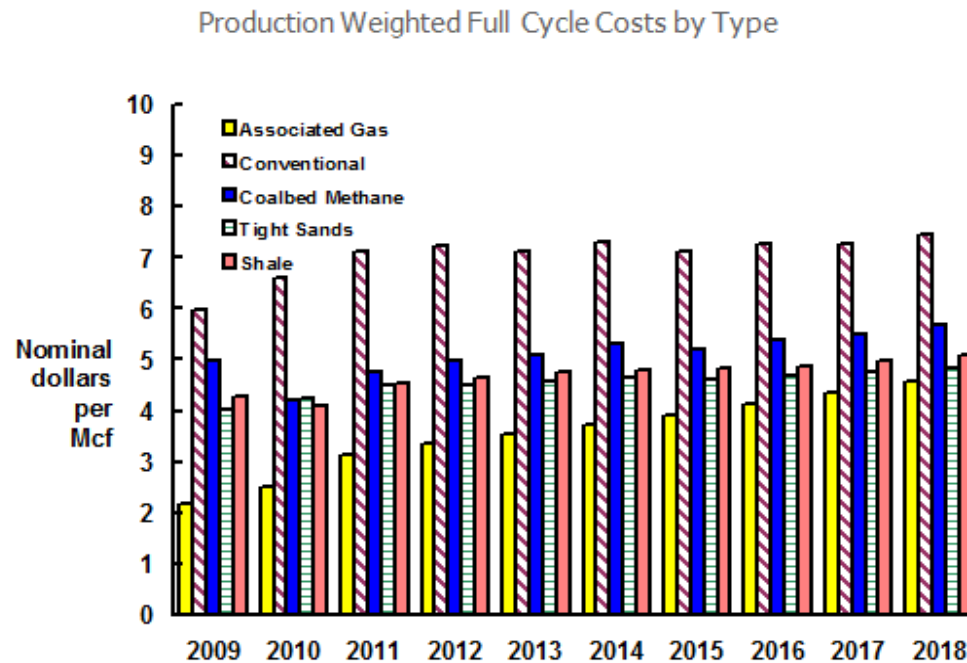
Source: EIA



United States: Unconventional gas status

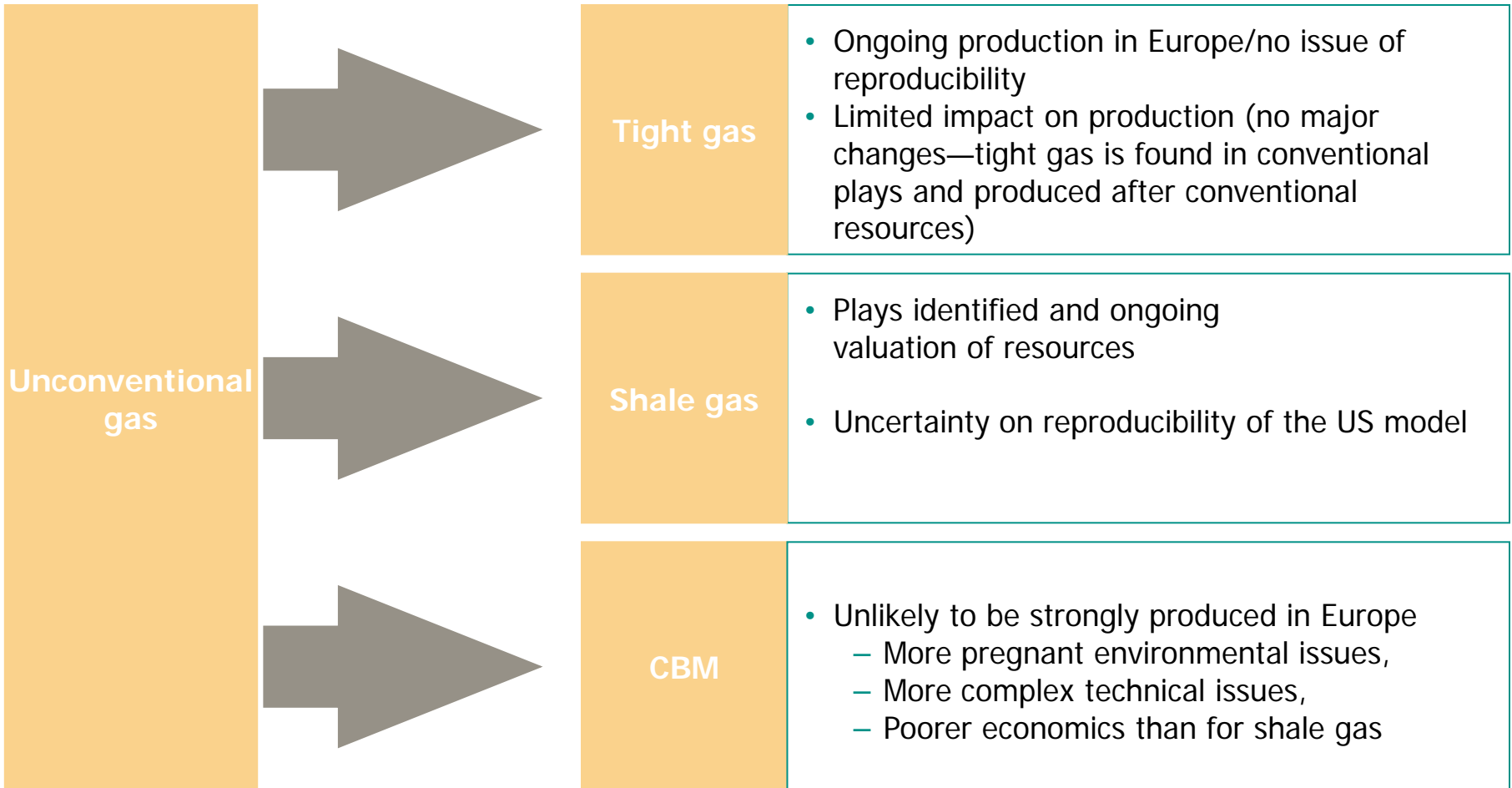
Unconventional gas costs competitive with conventional sources (most of the remaining US conventional sources are deep offshore with high exploration and development costs)

=> LNG limited to niche markets and last resort markets

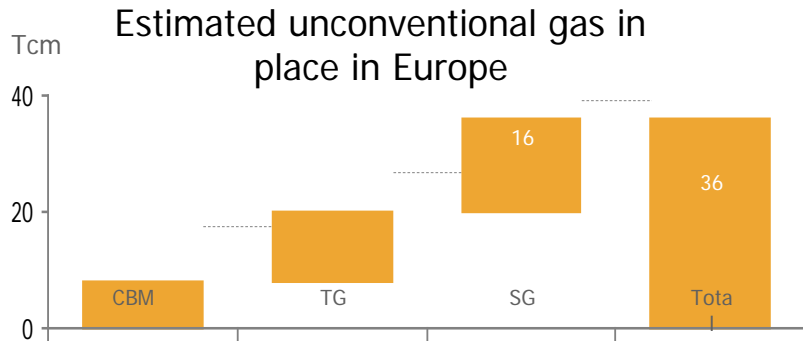


Source: Cera

Reproducibility of US model success story



Unconventional gas unlikely to be a game-changer in Europe ...but potential valuation ongoing

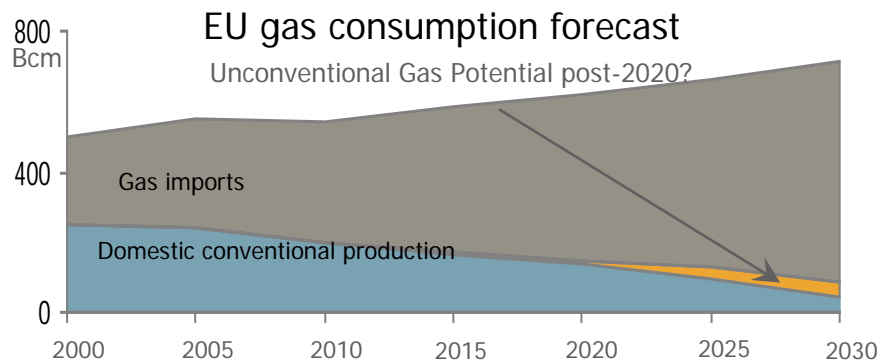


Rogner 1997

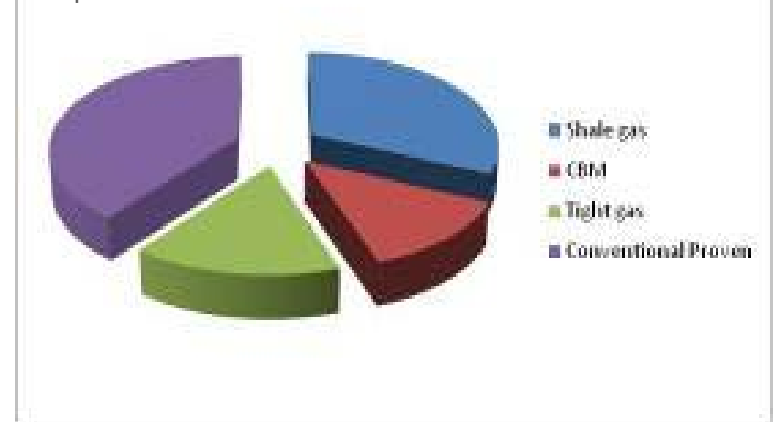
- GIP Europe 36 tcm: CBM (8), TG (10), SG(16)

Further research programmes ongoing to establish the evidence base

- GASH, funded by the Industry
- GeoEn, funded by the German state



European Resources estimate TCM



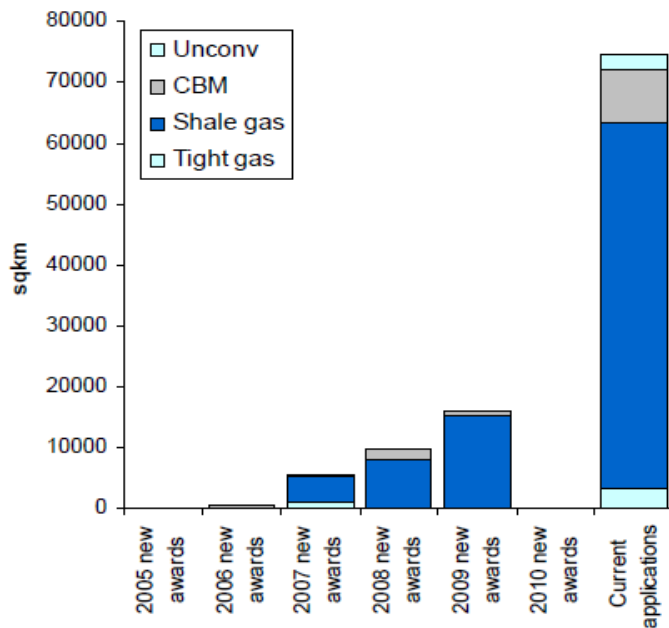
1. 1254 Tcf Source: Cambridge Energy Research Associates, H. Rogner "An Assessment of World Hydrocarbon Resources"

Competition in Europe on shale gas

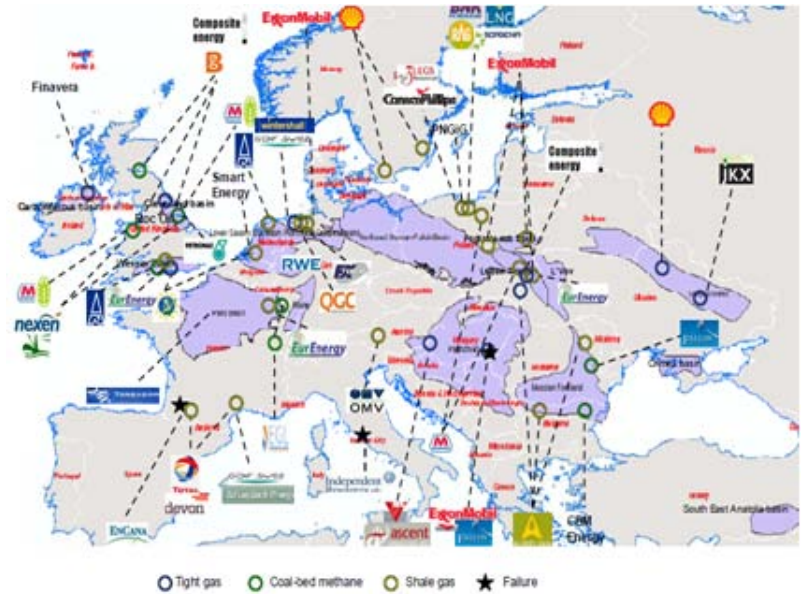
In Europe, competitors are mainly focusing on shale gas

Intense competition on land grabbing

Acreage awards and applications



Source: IHS



Source : WoodMackenzie, IHS, company reports, Bernstein Research

Asia overview

Exporter of LNG

Australia



Australia, huge potential for CBM

Centered in Queensland and New South Wales, CBM output has grown from 1 MMcf/d in 1996 to 450 MMcf/d by end of 2008: Large potential for further growth in production: Total reserves up to 6 Tcm

CBM to LNG: Four projects to convert Queensland's CBM reserves into LNG

Potential to be in the TOP LNG exporter if all CBM to LNG projects materialize.

Indonesia is also producing CBM

Source: Poten

China



China, large potential for unconventional gas

CBM: Output announced goal of 10 Bcm/y in 2010 rising to 30 Bcm/y by 2015 and more than 50 Bcm/y by 2020
Funding of 17 CBM projects by the government

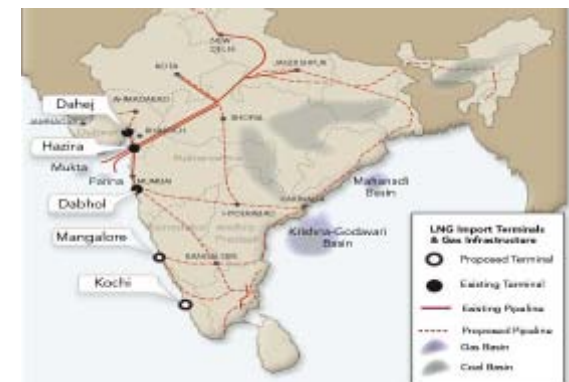
Tight gas and shale gas: Recent project of Shell to develop tight gas and shale gas in China

Uncertainties/challenges

- Many uncertainties and challenges: unreliability of resources data, lack of infrastructures, expertise to develop

Importer of LNG

India



India, potential to be confirmed

- Estimated UG reserves at 13 Tcm countrywide. Jharkhand State has largest potential at 0.7 Tcm and production already underway

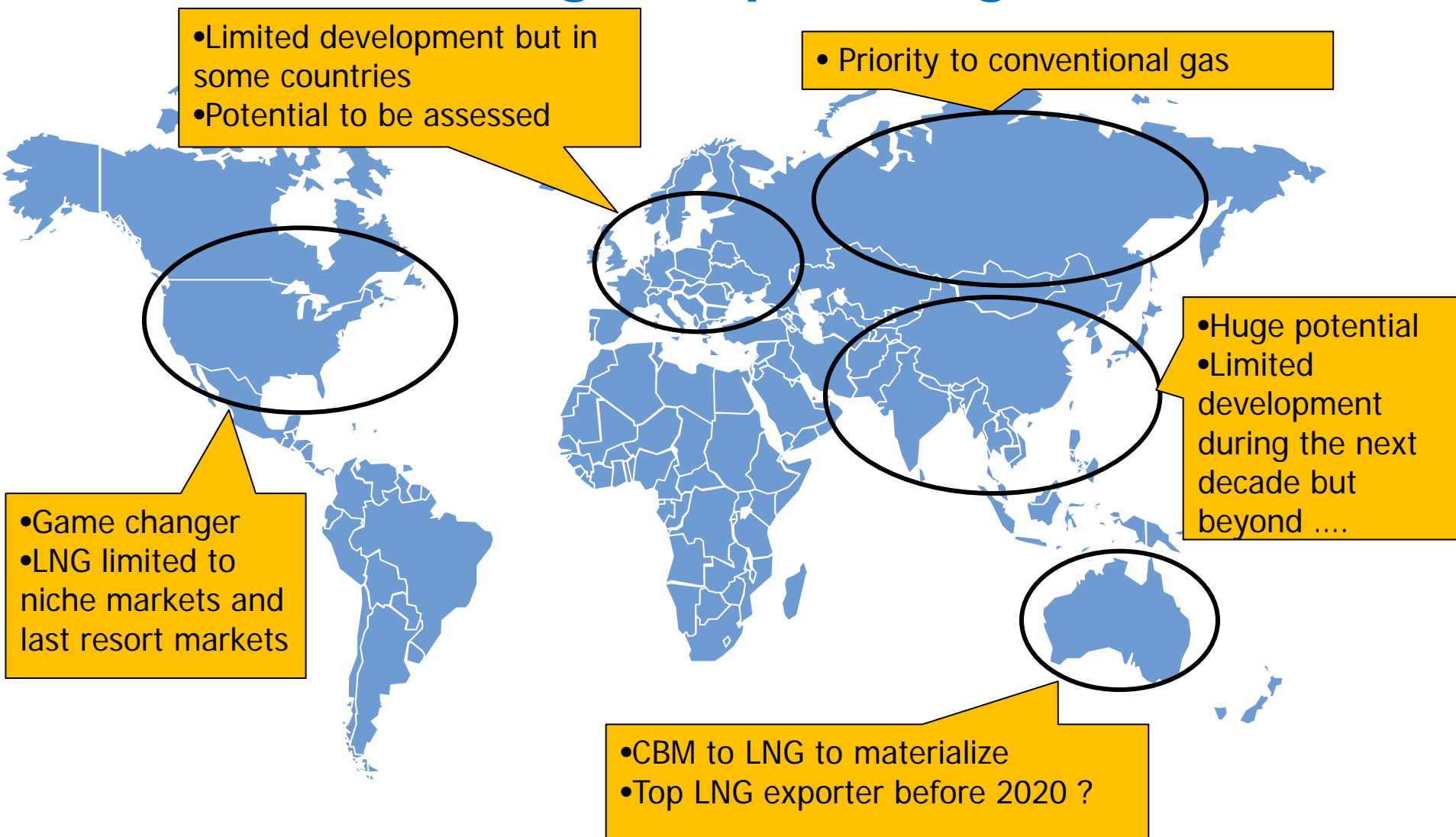
Development is at its early stage

India's first CBM project started production in late 2007 and a number of uncertainties surrounds the startup of production at other CBM projects

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Thank you for your attention!