

Synergies between Gas infrastructure and LNG, FLNG and CNG to unlock gas markets

- Deepwater & pre-salt gas monetisation
- Domestic and export market development
- How to develop synergies between infrastructure development and gas monetisation technologies

Africa Gas Summit
London, 6 April 2011

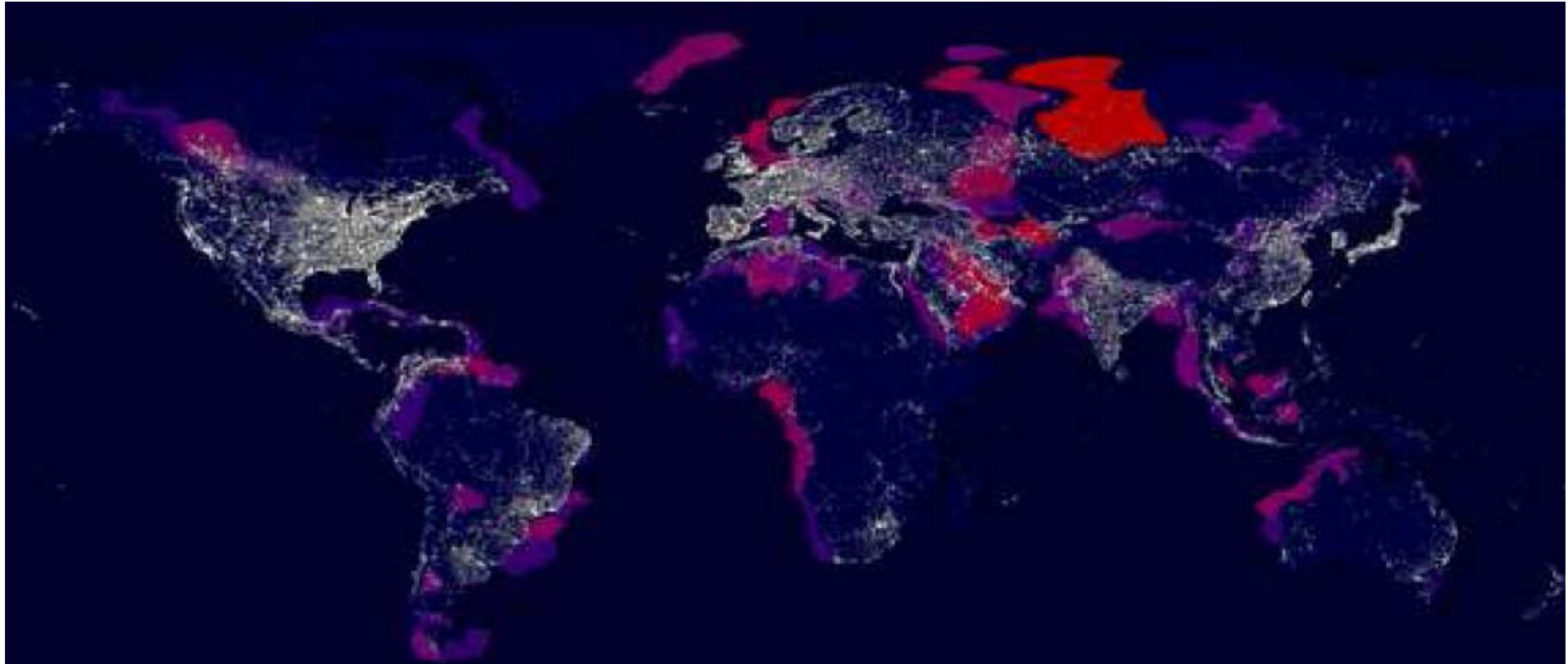
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A brief word about SyEnergy...



- Energy consultancy on strategy, business development and commercialisation of Gas & LNG
- 25 years of experience with Shell, ENI and consulting clients - advised on energy projects located in West & East Africa, South America, USA, Europe, Caspian, Indonesia and Australia.
- Upstream and midstream gas/LNG business development and commercialisation
- Project contracts, sales & purchase agreements, price reviews, and dispute resolution
- Gas supply planning, infrastructure development, domestic and export gas market studies
- Advice and implementation support focused on long term sustainable value creation
- Independent project assurance reviews and commercial due diligence
- Provision of bespoke energy training

Gas & LNG Business Environment

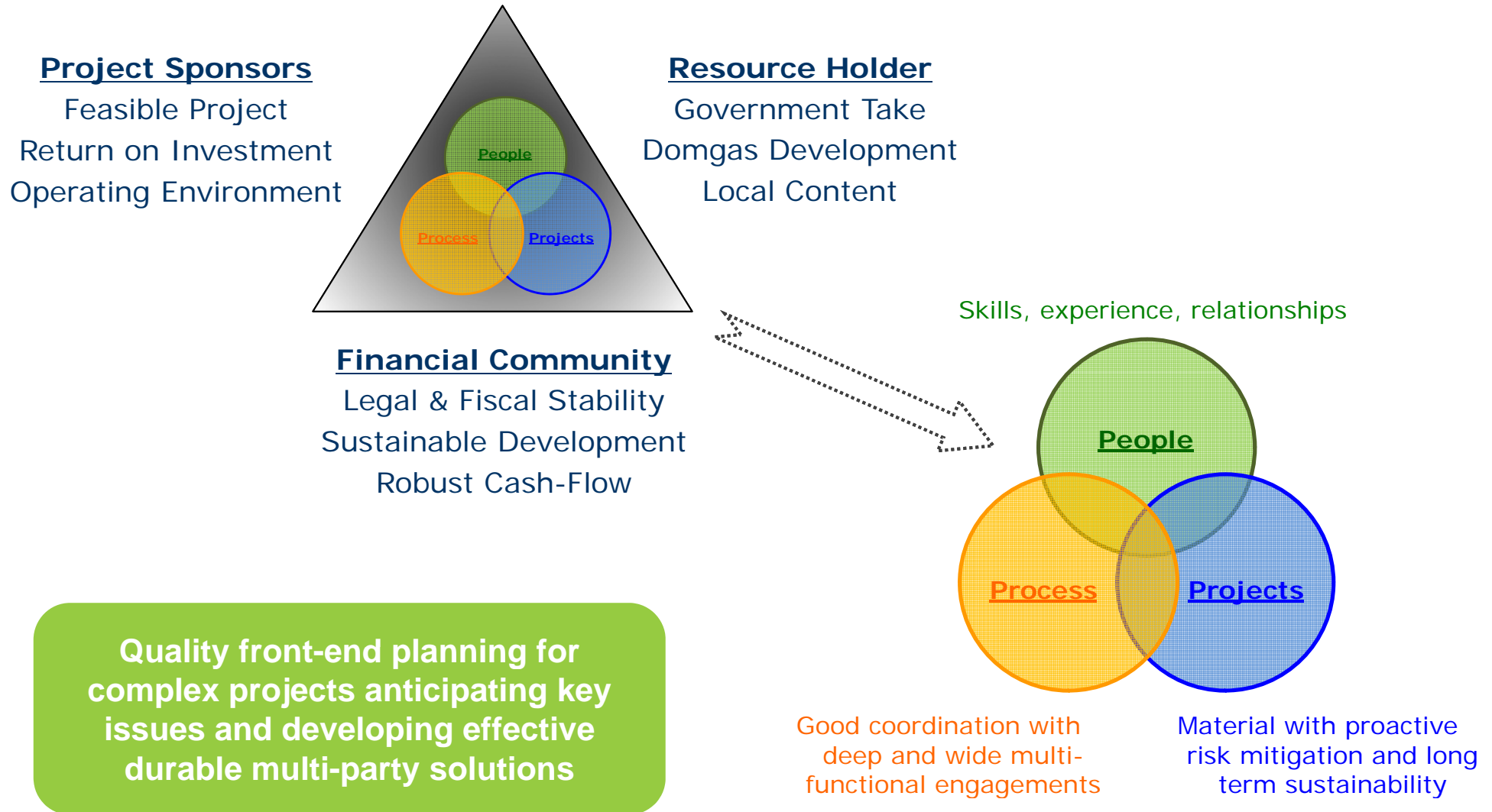


- Electricity consumption is shown in white and gas resources are shown in Blue (small), Purple (medium), and Red (large)
- Medium/large gas resources are far from key gas markets - continued growth for major LNG and pipeline projects
- African gas consumption per capita is ~25% lower than Far Eastern levels and ~90-95% lower than US/EU levels

Far East can grow electricity consumption/capita by 3-6 times to approach EU & USA levels
Energy infrastructure drives economic growth, improves income distribution, and accelerates gas consumption

Source: *Stanford Program on Energy and Sustainable Development, IMF/World Bank, EIA / IEO 2008, ENI World Oil & Gas Review 2010*

Gas & LNG Business Development



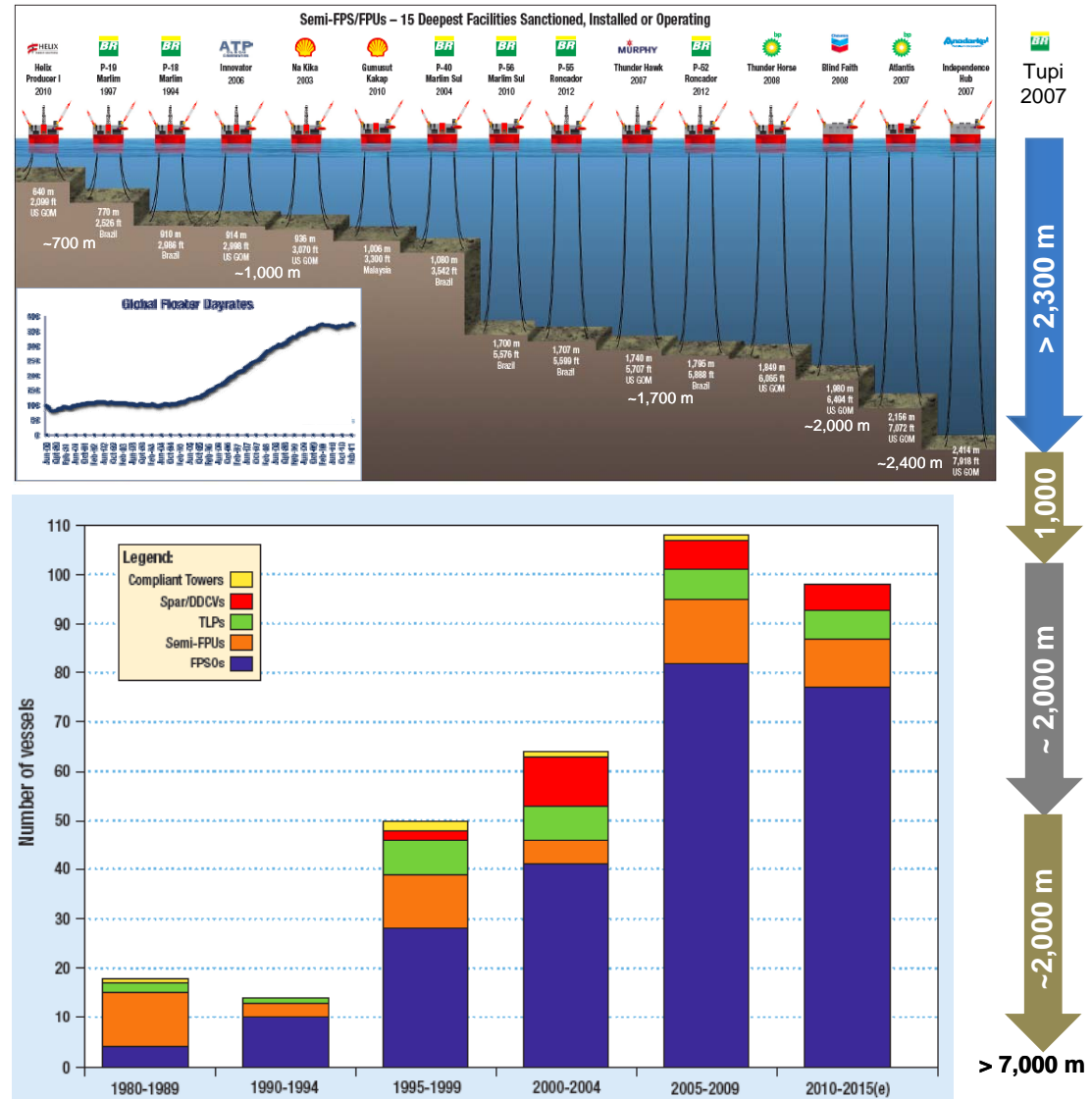
Deepwater & Pre-salt Exploration & Production



- Remote locations ~150-300 km offshore with multiple challenges:
 - water and gas injection
 - well engineering (hydraulic fracture, salt layer approaching granite hardness, high pressure and CO2 content)
 - flow assurance issues (near freezing temperatures, paraffin deposition, hydrate and scaling control)
 - associated gas handling
- Very expensive and complex submarine gas transmission lines
- Greater safety concerns post GOM / Macondo
- Over last 5 years, supply of floating production systems +27%... utilisation ~84%... day rate +42%
- “Dry Hole” can cost up to \$150 - 200 million

An updated technical and commercial business model with fit for purpose solutions and flexibility is needed

Source: Quest Offshore, RigLogix, Mustang, Petrobras, LNG Business Review

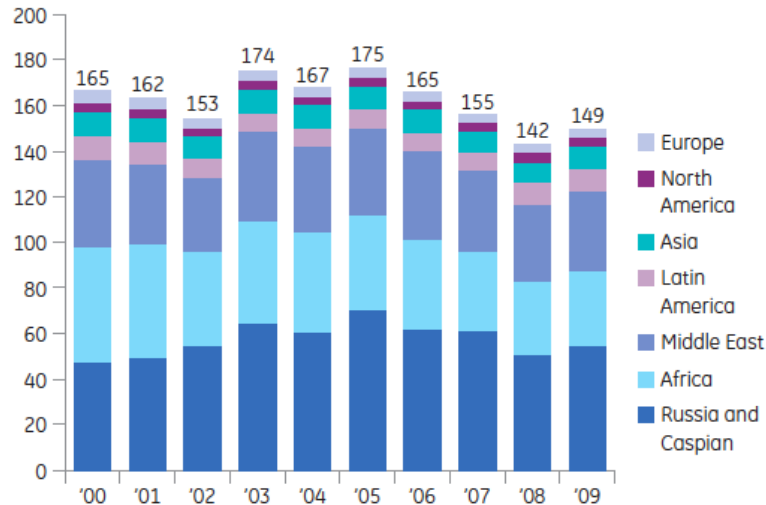


Gas Flaring – A Wasted Opportunity



Gas Flaring GGFR – Satellite

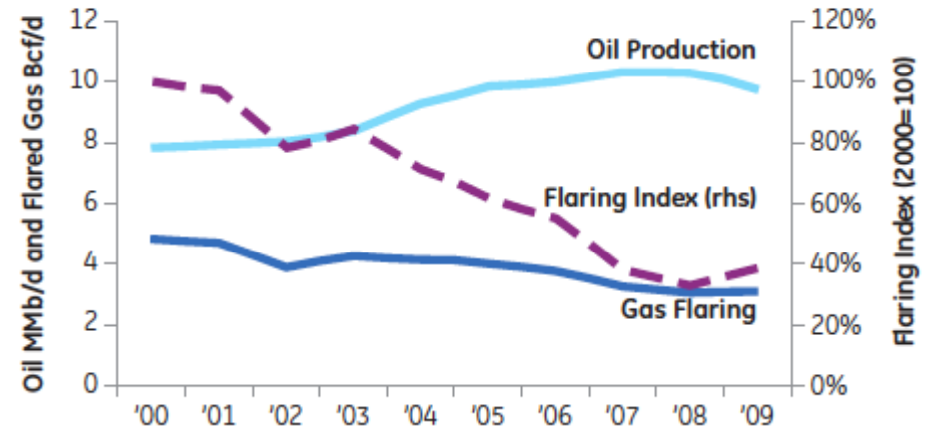
BCM per Year



- ~145 Bcm/yr flared or ~2.3 mmbbl/d or ~3% of production
- ~33% of European consumption ~ \$28 bn @ \$5/mmbtu
- African gas flaring watch - Angola, Cameroon, Congo, Equatorial Guinea, Gabon

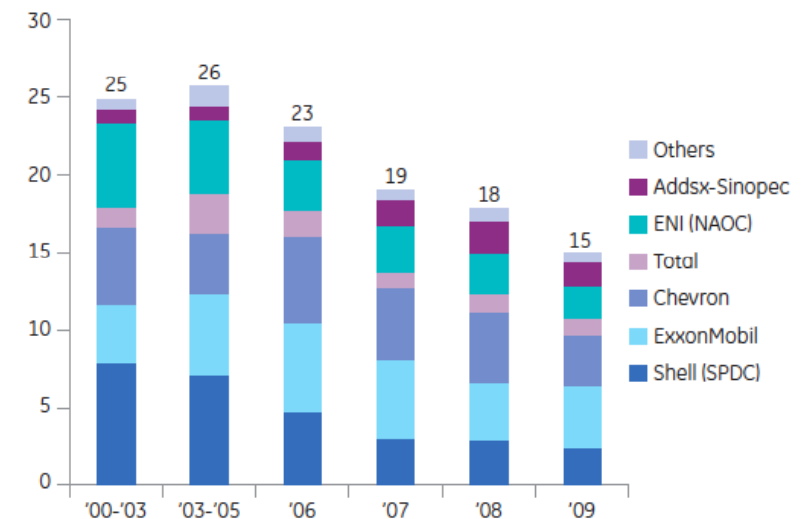
Energy policy, investment decisions and industry governance - early planning and consistent rules - to stimulate quality development and execution

Africa



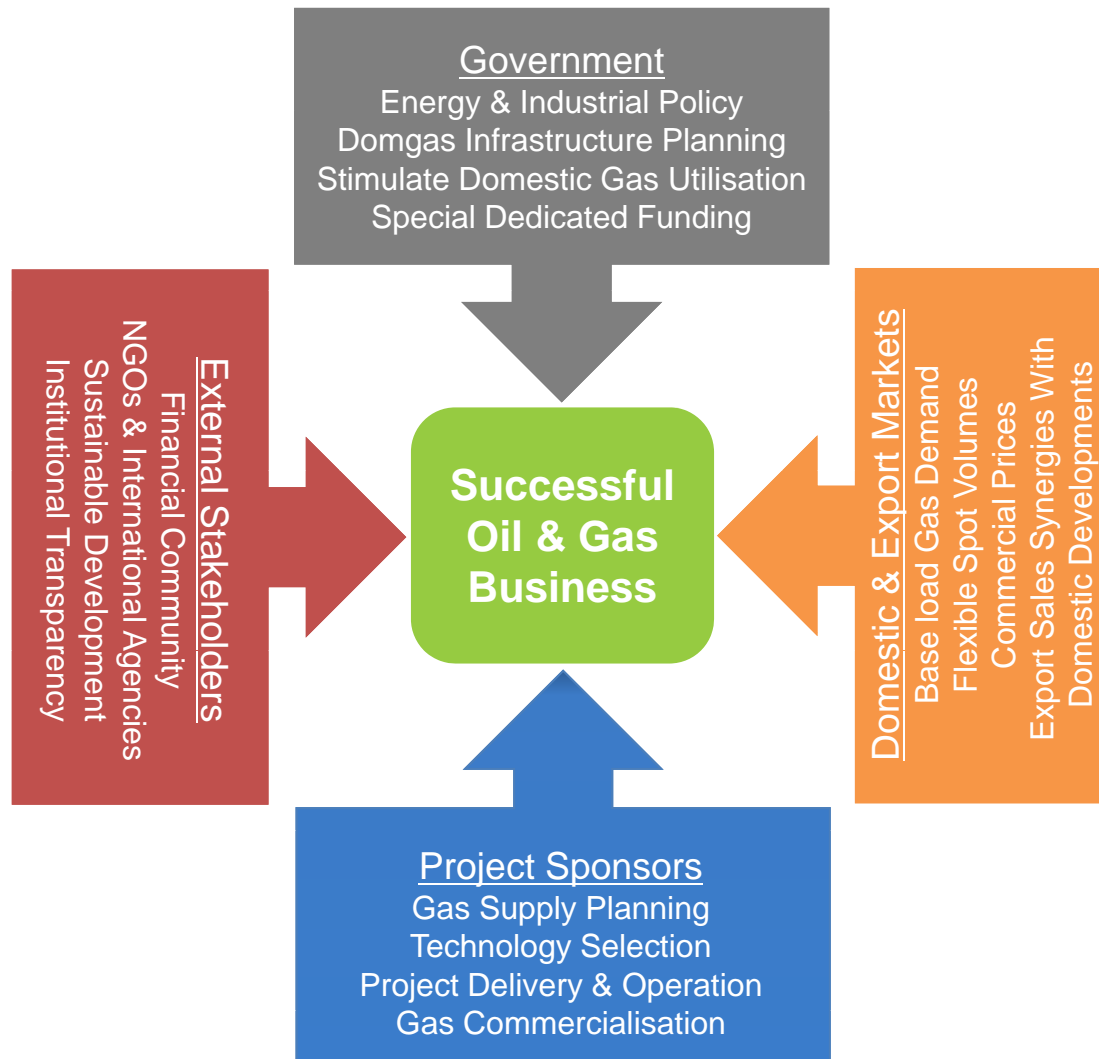
Nigerian Gas Flaring by Company

BCM per Year



Source: World Bank GGFR, BP Statistical Review of World Energy 2010, GE Energy, NNPC

Synchronize & Synergize Oil & Gas Investments



- O&G on-shore & off-shore urban planning
- New oil projects with “zero routine flaring”
- Flexibility to inject/store gas in early phase
- Synergies between new floating solutions and existing infrastructure
- Phased connection of legacy projects
- Develop scalable on-shore solutions
- Portfolio of export and domgas sales
- Leverage export market capture to underwrite domestic infrastructure development and domgas expansion

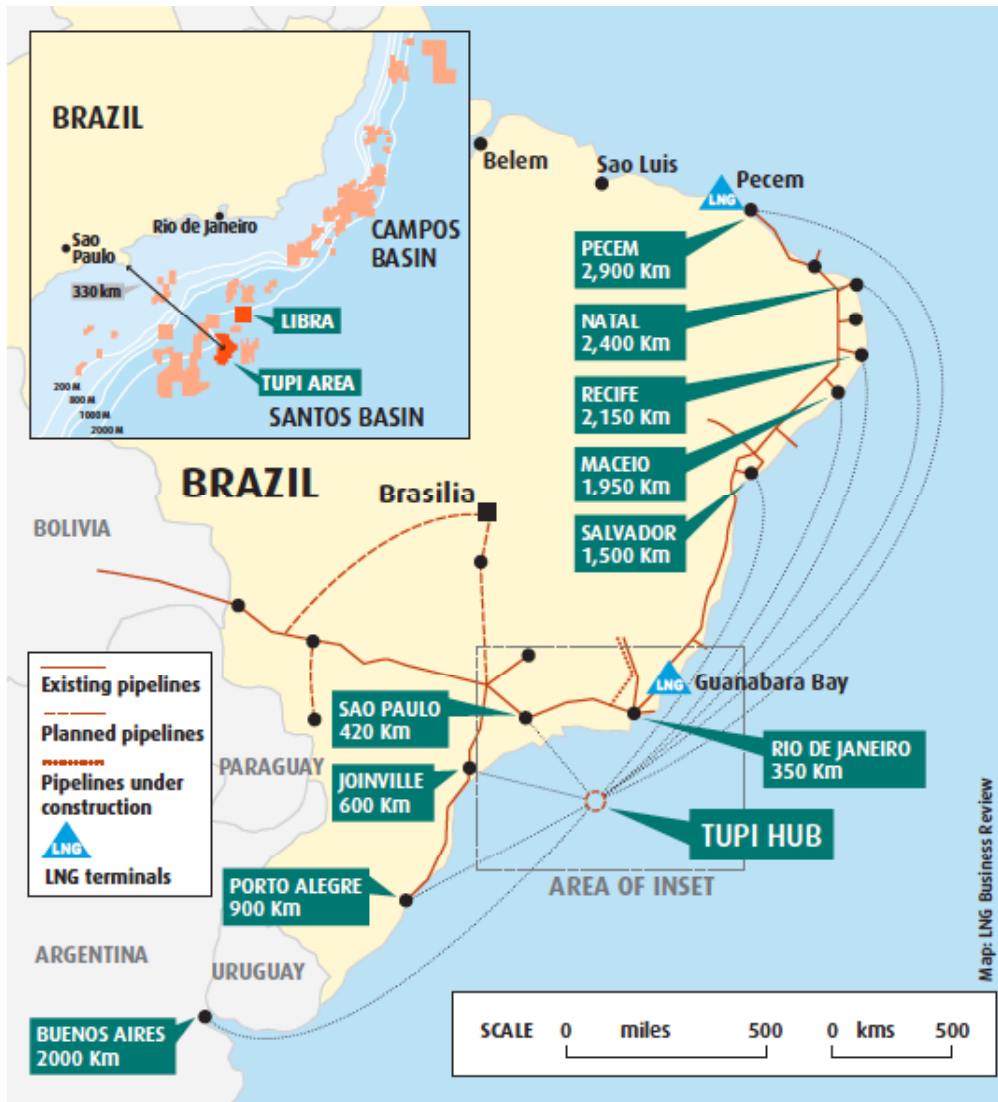
Gas & LNG Floating Solutions



- LNG Tankers and FSRU are well established and soon small, medium and large scale LNG FPSOs will be a reality
- Marine CNG should find a good application complementing offshore gas gathering and floating production systems
- Refrigeration & pressure have improved CNG compression ratios from 250:1 to 450:1
- Range of CNG ship designs and cargo containment systems transports ~1/5 the gas volume as LNG ships of equal size
- Delivery system commercial feasibility estimated up to ~2,000 to 3,000 km
- Enables connection of smaller stranded gas fields to onshore or floating production systems. Delivers to smaller local / regional markets saving capex of LNG regas terminals.

Source: Hoegh LNG, EnerSea, Sea NG, Transocean

Brazil Deepwater & Pre-Salt Oil & Gas



- Campos & Santos fields* hold ~42 billion barrels of gross recoverable oil reserves and ~38 Tcf of gas reserves (~24 Tcf associated)
- Deepwater & pre-salt gas supply potential ~20 mtpa onshore LNG project *and* a world scale GTL plant capable of producing 120,000 bbl/d of Ethane and NGLs and 140,000 bbl/d of middle distillates (Shell's Pearl GTL in Qatar) or a ~30 mtpa onshore LNG plant
- Gas capex estimated at ~\$32-44 billion
- ~5 Bcf/d gas gathering system not included
- Marine CNG, FLNG and on-shore LNG systems offer complimentary synergies
- Upstream gas gathering for floating and on-shore LNG production systems, and gas delivery to local, regional and export markets

Note: SyEnergy estimate for Lula, Iracema, Guara, Iara, Jupiter, Parati, Caramba, Carioca, Bem-Te-Vi, Mexilhao, Franco, Sabia & Libra fields

- Gas & LNG business fundamentals remains strong – gas into power and BRIC drives growth
- Deepwater & Pre-salt gas monetisation needs planning and new technical & business model
- Complexity and capital intensiveness of deepwater and pre-salt E&P places premium value on quality upfront planning, flexible and intelligent integration of production assets
- Portfolio of floating gas production and transport solutions can help reduce gas flaring
- Synergies in oil, gas and LNG investments can leverage export market capture unlocking domgas infrastructure development and growth
- Marine CNG can complement offshore gas gathering and floating production systems adding value to FLNG, onshore LNG plants, and supply local/regional smaller gas markets without high terminal capital expenditure.

Thank You !

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