Establishing a viable gas sector in South Africa

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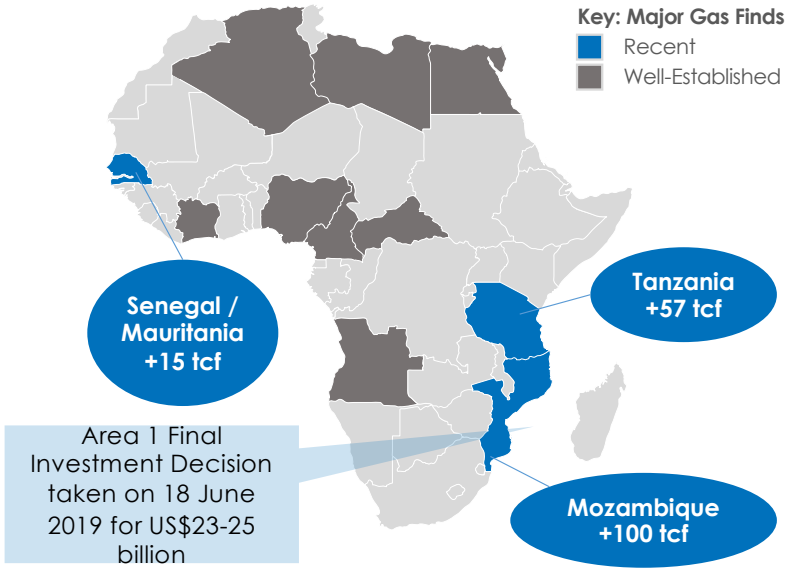
The Case for Gas

- ***Meeting Africa's Growing Demand for Power***: The scale of increases in power generation required to meet Africa's current and future energy needs is such that utility-scale non-renewable plants are a necessity - Gas-fired power provides a relatively green, flexible and cost-effective option to significantly increase generation capacity (and it complements renewables allowing the maximisation of renewables where possible)

- ***Gas-Fired Power Complements an Energy Mix Increasingly Focused on Renewables***: Gas fired power a flexible and relatively green solution for addressing the intermittency of renewables while providing grid stability

- ***Gas-Fired Power Will Play a Critical Role in Decarbonisation*** - Gas-fired power offers significant decarbonisation benefits relative to coal, oil and wood burning.

- ***Recent Discoveries Allow Gas to Power Africa's Economic Development***



*"Power stations fired by natural gas are regarded as the most **market-ready solution for closing the supply-demand gaps** that arise when the sun sets or during wind-still periods. Gas plants are good complements to [renewables] plants as they are able to respond immediately to variability, and they are capital-light (that is, inexpensive to build)."*
-- Tobias Bischof-Niemz, CEO of ENERTRAG and author of 'South Africa's Energy Transition'

The Case for Gas

A Critical Bridge in the African Context – And a Longer One than Elsewhere Given Development Need

The Bridging Role for Gas

Countries with Significant Domestic Gas Resources

1

- These countries benefit from a relatively low domestic cost of gas, making gas-fired generation the least cost, or at a minimum a competitive, generation option
- Gas-fired generation should therefore make up a significant portion of the country's energy mix
- Example: Mozambique

Countries Without Gas Resources

2

- Host countries without gas resources will likely prioritize renewables as the least cost generation option
- However, gas-fired power (made possible through imported LNG or cross-border pipelines) remains a critical complementary generation technology to address the intermittency of renewables for the system (and to meet variable demand economically) – and will continue to play this role until battery technology further evolves and reduces significantly in price
- Example: South Africa

The future of new build generation in both cases will see gas-fired power playing a significant role in host countries' energy mixes for the coming period

What Others Are Saying

> *Natural gas is a **critical bridge fuel** for the global transition to a low carbon future. An abundant, relatively clean energy carrier that is easy to produce, store and transport at various scales in most countries.*
>
> — Africa 50, Investing in Natural Gas for Africans: Doing Good and Doing Well (2018)

*Demand for natural gas grew 4.6% in 2018, its fastest annual pace since 2010 [and] **accounted for almost half the increase in primary energy consumption worldwide**. Demand is expected to **rise by more than 10% over the next five years**, reaching more than 4.3 trillion cubic metres in 2024.*

— International Energy Agency, Gas 2019 Report(2019)

> *Renewables and natural gas together account for the great majority of the growth in primary energy. In our evolving transition scenario, 85% of new energy is lower carbon.*
>
> — BP Energy Outlook(2019)

Key Challenge to Establishing a Gas Sector in South Africa: Constraints on Gas Supply

- PetroSA offshore block depleted
- ROMPCO pipeline supply limited in the absence of additional upstream discoveries / alternative sources of supply
- Recent delays to LNG import initiatives (IPP office led procurement; Western Cape exploration of alternative model, Transnet initiative, etc.)
- Challenging regulatory (and oil price) environment for development of South Africa's upstream potential
- Overall energy planning challenge in South Africa, particularly given viability concerns around key energy state entities – ESKOM, etc.

Yet Alternative Sources of Gas Supply Attractive and Available . . .

- Regional recent game-changing ***upstream discoveries*** (Mozambique, etc.)

- ***LNG markets remain favorable*** for new importers

- ***Domestic South African upstream opportunities promising***, but long term time frame for development making them an important but medium to long term opportunity
  - Total recent offshore discovery
  - Coal bed methane
  - Karoo shale gas (despite challenges)

- ***Can South Africa anchor development of these new sources of supply to establish a viable gas sector on a sustainable basis?***

Recent Game Changing Regional Upstream Discoveries

- Recent large-scale discoveries have the potential to be a game changer for individual jurisdictions and wider region
  - Mozambique
    - Rovuma Area 1, operated by Anadarko, current estimated recoverable gas reserves 50 tcf
    - Rovuma Area 4, operated by ExxonMobil and ENI, current estimated recoverable gas reserves 45 tcf
    - Many estimate recoverable reserves to approach 200-250 tcf in Mozambique
  - Tanzania
    - Area operated by Shell (also part owned by Ophir), current estimated recoverable gas reserves 11 tcf
    - Area operated by Equinor (also part owned by ExxonMobil), current estimated recoverable gas reserves 10-13 tcf
    - Many estimate recoverable reserves to approach 45-60 tcf in Tanzania
  - Botswana
    - Large reserves of coal bed methane (CBM) gas have been discovered in Botswana
    - The Botswana Department of Geological Survey reports that 196 tcf of "gas in place" is present in the central Kalahari Karoo Basin in Botswana
  - South Africa
    - Karoo Shale Gas: Estimated resources of 390 tcf, which would make it the fifth largest shale gas field in the world – though challenges for large-scale development
    - CBM
    - Active offshore block activity given proximity to other large-scale gas finds in the region – recent Total offshore discovery

Putting the Recent Discoveries in Context

- Pande & Temane total reserves = 3 tcf / Recent Rovuma finds = 150 tcf (probably 250 tcf ultimately)
- 40% of discoverable gas from 2012 occurred in Mozambique (source: Wood MacKenzie)
- Total-led project has taken FID on a US$23 billion basis for onshore LNG project; ExxonMobil/ENI led project to take FID 2020 for an additional ~US$20+ billion onshore; Mozambique's GDP in 2018 – ~US$15 billion
- Mozambique is likely to become the world's third largest exporter of LNG, behind Qatar and Australia
- Statoil, Shell and ExxonMobil have announced plans to eventually develop an approximately US$14 billion LNG plant in Tanzania, though significant ongoing project delays

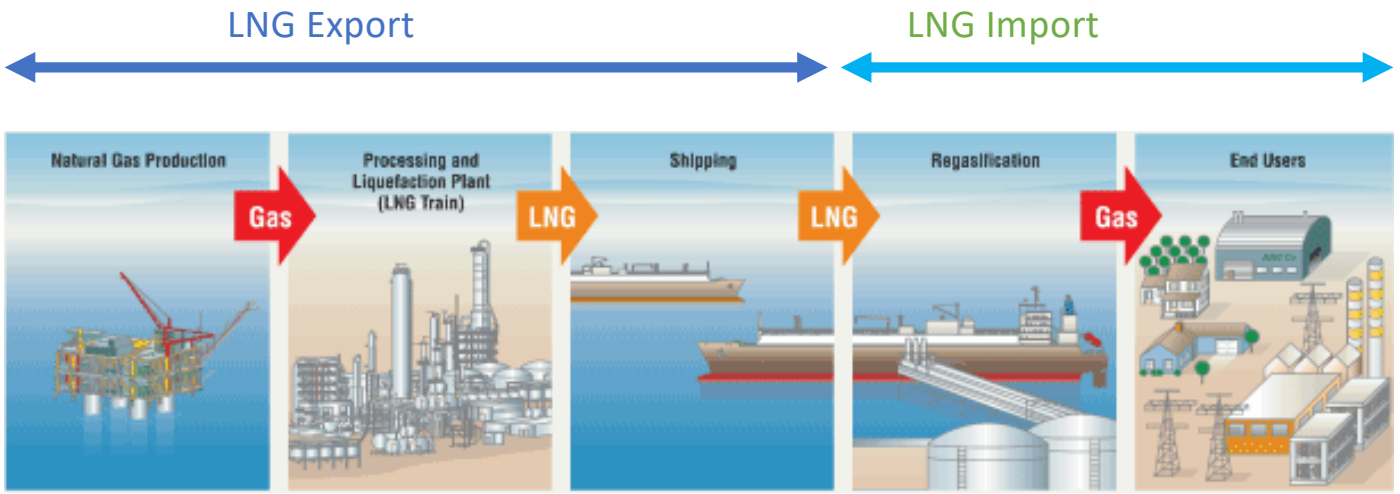
- The estimated shale gas reserves in the Southern Karoo area are at 390 tcf, which would make it the fifth largest shale gas field in the world – despite significant challenges for development
- Qatari gas reserves = 990 tcf / Recent regional finds = 800-990 tcf

Multiplier Effect of Gas

Qatar (2001 – 2011) – Domestic Gas Resources

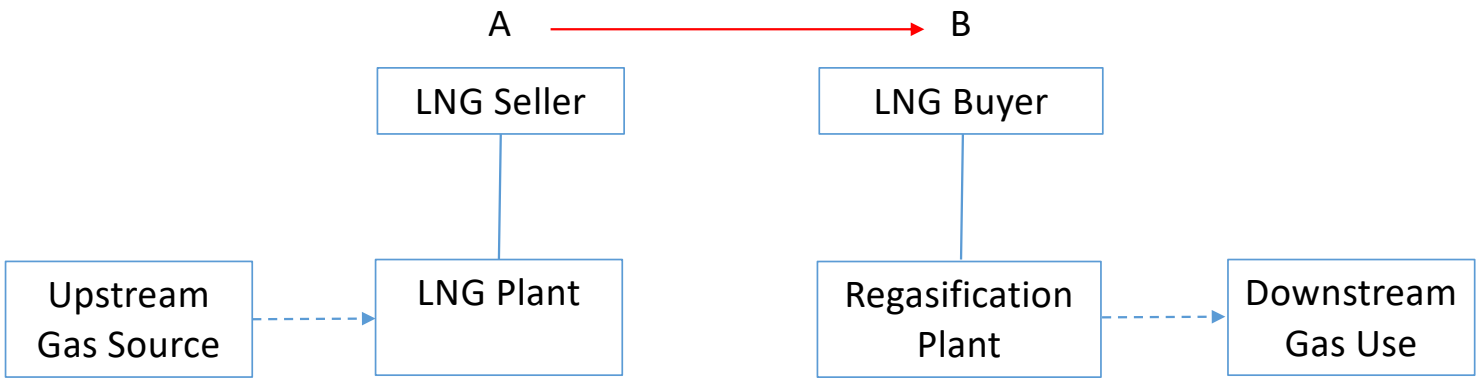
	2001	Multiplier	2011
GDP (US$ bn)	17.5	9.7x (or 25% pa)	170
GDP per capita (US$)	27,000	3.6x (14% pa)	98,000
Qatar Stock Exchange Market Cap (US$ bn)	12	10x	125
Banking assets (US$ bn)	16	12x	190

LNG Value Chain



Evolution of LNG market

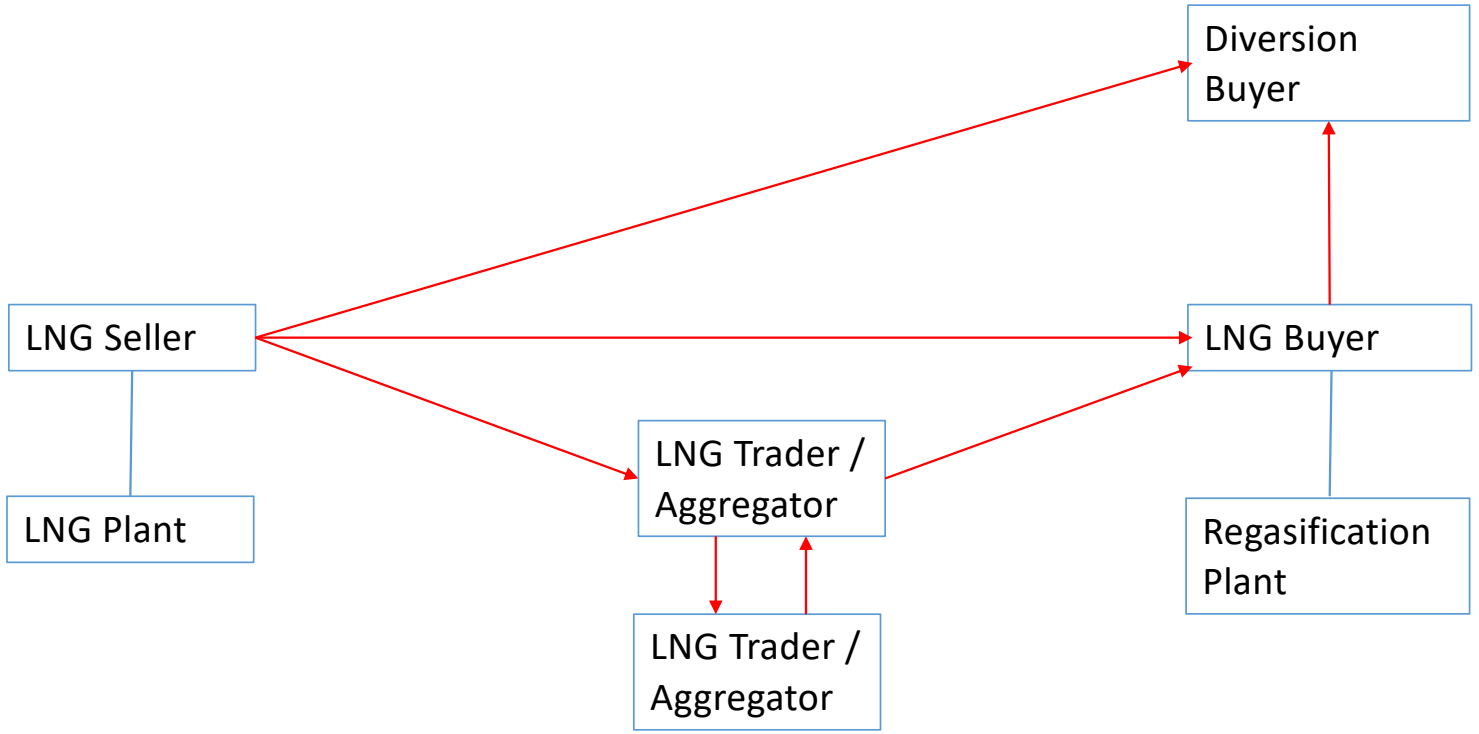
- Historically, a large portion of LNG volumes have been traded under long-term, fixed destination contracts



- Security of revenue enabled financing of capital intensive development of new LNG plants
- Security of supply supported development of new regasification plants

Evolution of LNG market

Shift away from the ‘virtual pipeline’ model, from A to B

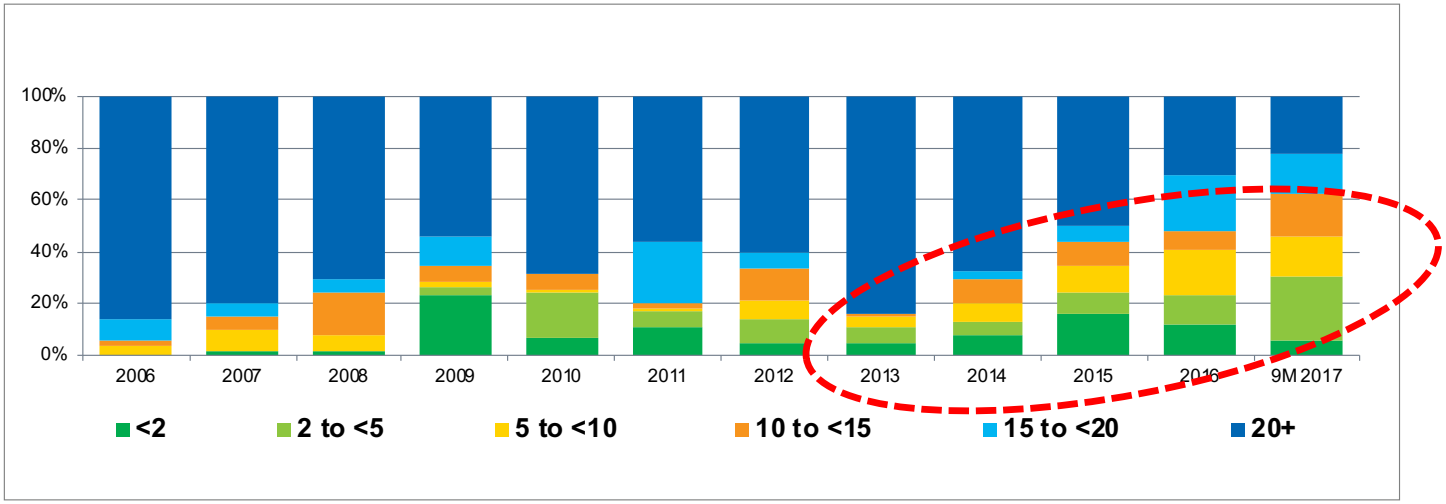


LNG spot market is evolving

- Spot market LNG accounts for a quarter of LNG volumes traded
- Increase in short-term sales over last decade caused by:
  - Increased demand (e.g., Post-Fukushima demand for short-term sales)
  - Destination-free LNG supply from new US projects
  - Increase in number of market participants, including LNG traders / aggregators
  - Diversion of volumes away from Europe (cheap coal) and US (cheap domestic gas)
  - Arbitrage opportunities between Pacific and Atlantic basin
  - Increase in LNG shipping capacity
  - FSRUs encourage new market entrants
- Recent extraordinary Asian spot LNG pricing – US$3!! in February 2020

Increasing flexibility in LNG value chain – but long term contracting still prevalent

Overall trend towards shorter-term contracts, despite recent downward trend in spot trading



- However, long-term LNG SPAs remain critical to the industry:
  - Underpin the financing of new liquefaction plants (e.g., Russia; Australia; Mozambique)
  - Support the development of new regasification plants (e.g., Pakistan; Bangladesh)

African LNG Activity

Critical Bridge to Host Country Domestic Gas Utilisation or Future Regional Pipeline Supply

Greenfield LNG Projects in Africa (Export and Import)

MOROCCO
Government of Morocco has announced a procurement for a large scale LNG to power program

SENEGAL / MAURITANIA
GTA Field discovered by **Kosmos** and now operated by **BP** with recent agreement reached with **Golar** to implement an FLNG export project but with possible onshore applications

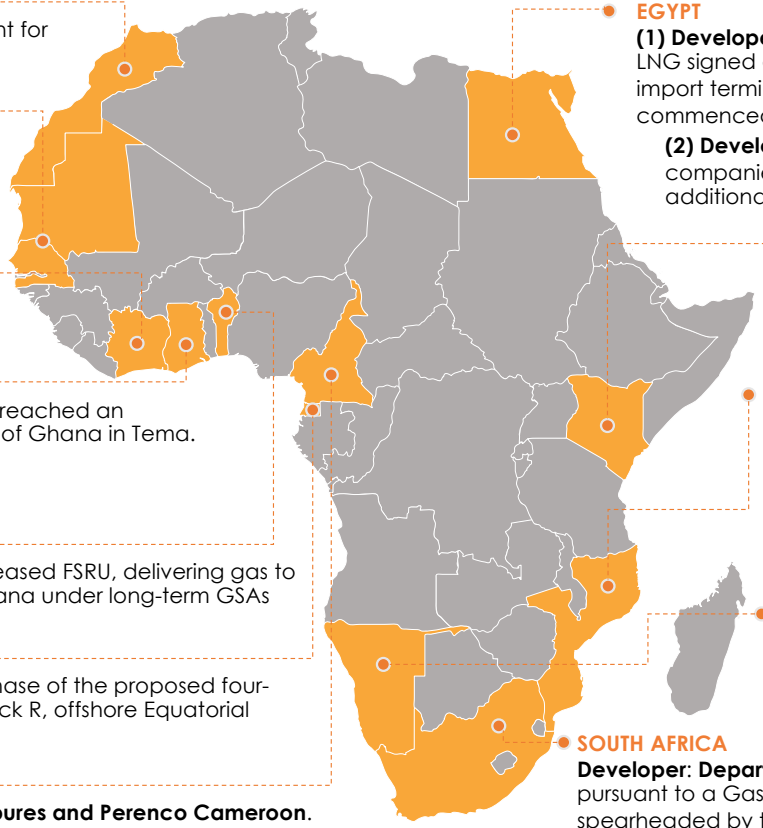
COTE D'IVOIRE
Developer: Total, Shell and Ivorian partners. Integrated LNG/gas and infrastructure FSRU import project

GHANA
Developer: Helios and the Ghanaian government have reached an agreement to build a LNG import terminal off the coast of Ghana in Tema.

BENIN
Developer: Gasol Plc. Gasol plans to regasify LNG in a leased FSRU, delivering gas to power plants and industrial users in Benin, Togo and Ghana under long-term GSAs

EQUATORIAL GUINEA
Developer: Ophir Energy. Fortuna FLNG forms the first phase of the proposed four-phased development of the fields discovered within Block R, offshore Equatorial Guinea – possible onshore applications

CAMEROON
Developer: Golar LNG, Societe Nationale de Hydrocarbures and Perenco Cameroon. Consideration of an FLNG export project but with possible onshore applications



EGYPT
(1) Developer: Egyptian Natural Gas Holding Company (EGAS). Höegh LNG signed an LOI with EGAS for the use of one of its FSRU as an LNG import terminal in the port of Ain Sokhna (Gulf of Suez). Hoegh LNG has commenced commercial operations at its Gallant FSRU vessel in Egypt

(2) Developer: EGAS. EGAS is reportedly in negotiations with foreign companies with a view to securing a second FSRU to import an additional 500 MMcf/day

KENYA
Developer: Government of Kenya. Government procured LNG to power project utilizing an FSRU import facility with Qatari procured gas by the government. Project on hold pending further developments

MOZAMBIQUE
(1) FLNG: ENI and its Area 4 partners have obtained approval for an FLNG option to monetize part of the Area 4 gas for export ; **ExxonMobil** leading onshore LNG plans; **Anadarko** and partners reached FID in June 2018 for Area 1 onshore export project
(2) FRSU: Consideration of two FSRU LNG import projects in Mozambique, one in Maputo harbour and one further north

NAMIBIA
Developer: NamPower. **Excelerate Energy** will provide the FSRU and source the LNG to-power project in Walvis Bay

SOUTH AFRICA
Developer: **Department of Energy (DoE).** SA plans to import LNG via FSRU pursuant to a Gas IPP procurement program for 3000 MW of power spearheaded by the DoE with National Treasury support. A portion of the imported gas may be used for non-power utilization

How do we anchor the establishment of a gas sector for South Africa?

Possible catalytic projects/scenarios

1

LNG Import from international markets as a bridge to unlocking regional supply and domestic upstream potential

Key considerations:

- Anchored by Power, but potential for alternative utilisation
- Price
- Volume flexibility
- Greenfield value chain risk

2

Regional delivery of gas via virtual LNG pipeline (potentially replaced by physical pipeline over time; connect to ROMPO)

Key considerations:

- Alternative pricing to international priced LNG
- Available supply and what timeframe
- **Relevant project**: Karpowership and Mitsui recent announcement

3

Small scale LNG, a fit for purpose solution for the African context that enables displacement of existing liquid fuel power generation

Key considerations:

- Available supply in small scale volumes?
- Proven technology?
- **Case Study**: New Fortress Energy in the Caribbean

[See next slide]

4

Build gas utilisation plants in Mozambique using domestic gas obligation gas or new discoveries with export of resulting products to South Africa and world markets

Key considerations:

- Electricity: Globeleq, EDM and Sasol's Temane 420MW CCGT project
- Ammonia: key ingredient for fertilizer
- GTL

Discussion

- Where do we go from here?
- Key regulatory / policy interventions, updates?
    - MPRDA – Standalone oil & gas upstream legislation
    - Gas Act
    - Integrated Resources Plan (IRP) / Integrated Energy Plan (IEP)
    - Emergency Power Request for Information (RFI)
    - Round 5 renewables procurement
- Regional vs. Domestic engagement / action?
    - Mozambique gas developments
    - Southern African Power Pool (SAPP)
- Role for private investment versus government led?
- BUSA strategy?