The Critical Future of Ghana's Energy Industry and How to Avoid More Surprises to Ghana's Growth Prospects

IMANI Fellowship Public Lecture

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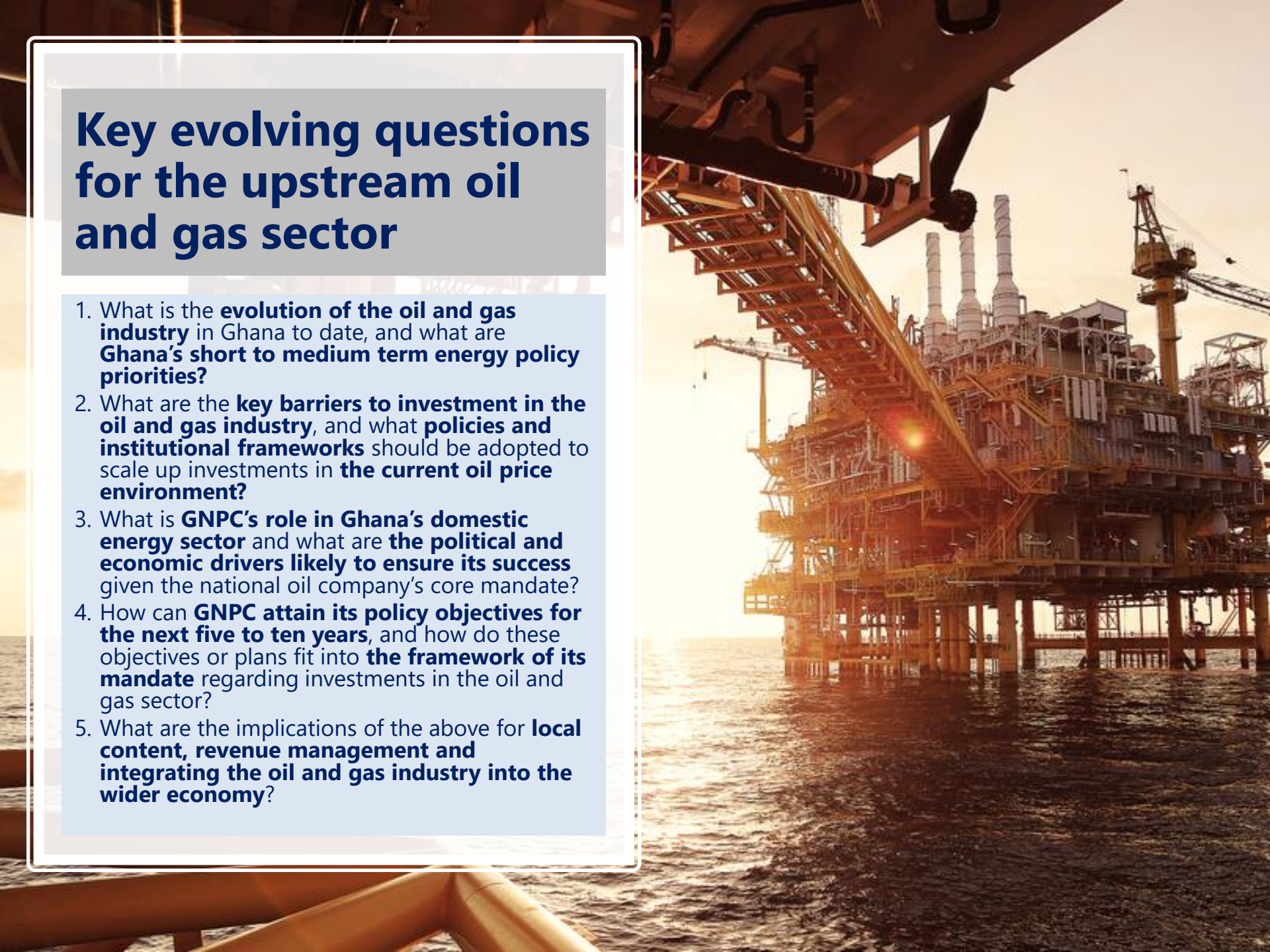
Key evolving questions for the upstream oil and gas sector

1. What is the **evolution of the oil and gas industry** in Ghana to date, and what are **Ghana's short to medium term energy policy priorities?**
2. What are the **key barriers to investment in the oil and gas industry**, and what **policies and institutional frameworks** should be adopted to scale up investments in **the current oil price environment?**
3. What is **GNPC's role in Ghana's domestic energy sector** and what are **the political and economic drivers likely to ensure its success** given the national oil company's core mandate?
4. How can **GNPC attain its policy objectives for the next five to ten years**, and how do these objectives or plans fit into **the framework of its mandate** regarding investments in the oil and gas sector?
5. What are the implications of the above for **local content, revenue management and integrating the oil and gas industry into the wider economy**?



Key evolving questions for the power sector

1. What is the country's strategy for **increasing energy supply** without **increasing energy related input costs to production**?
2. How will integrated regional gas and power infrastructure projects such as the Sankofa Gas Project in Ghana, the Songon Power Project in Cote d'Ivoire and **LNG imports impact domestic gas pricing policies and the electricity tariff pricing** structure including contractual commitments in securing commercially-viable **offtakers**?
3. What is the role of **market reform** and the **unbundling of services** including the issue of **private participation in electricity distribution**?
4. What is the **outlook post-privatisation** and the **implications for economic growth?**

Outline

1

Ghana's Economic Context

2

Upstream Oil and Gas Sector

- Oil prices and upstream investments
- Evolution of the oil and gas industry in Ghana
- Barriers to investment in the upstream oil and gas industry
- Scaling up investments
- Integrating the oil and gas industry into the wider economy

3

Power Sector

- Demand and supply trends
- Tariff structure and institutional setup
- The role of gas in Ghana's energy security
- Regulatory framework for private investments and barriers

4

Recommendations

Ghana: Economic Context

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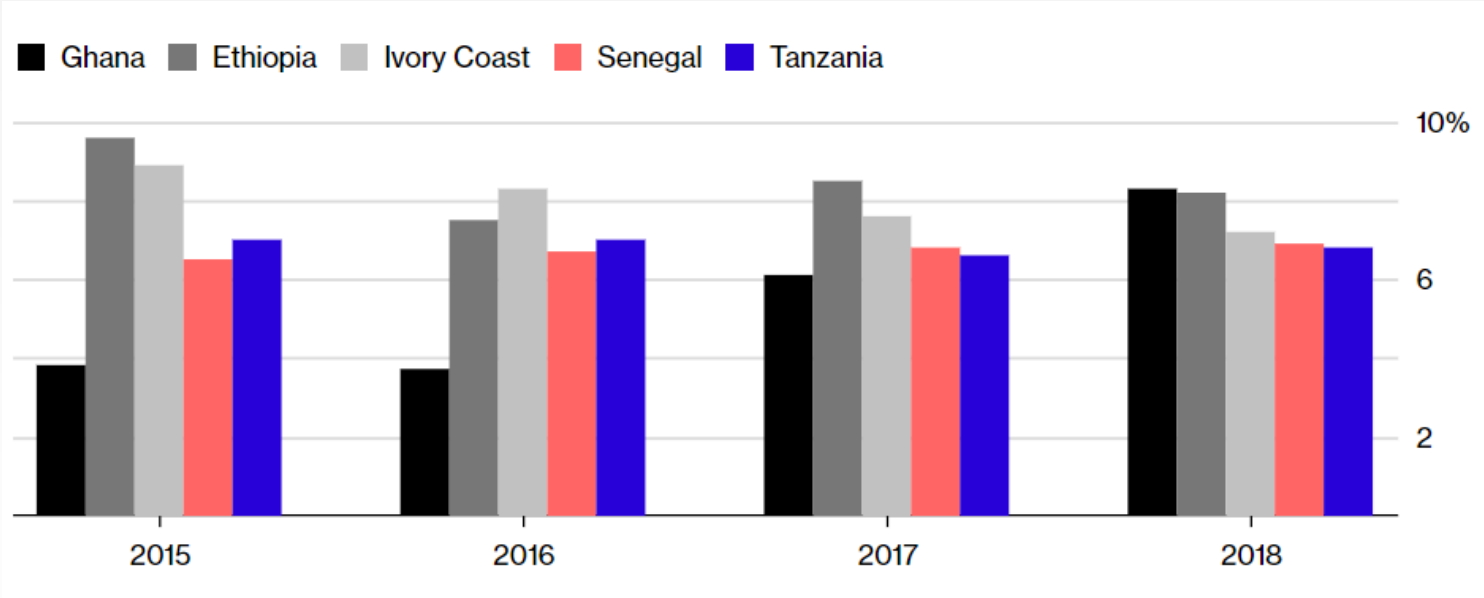
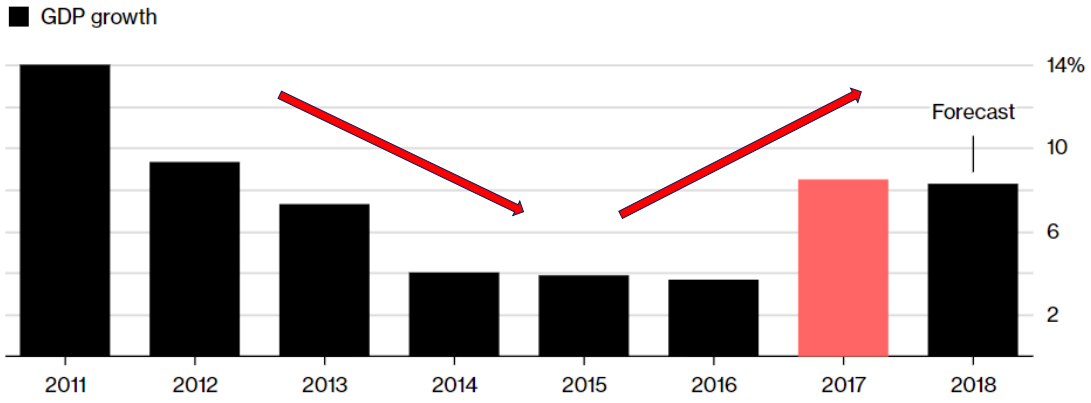
Ghana will remain one of the fastest growing countries in SSA



Source: World Bank
Note: 2017, 2018 data are estimates

Growth Surge
Ghana's GDP growth rate more than doubled in 2017



Source: World Bank and Ghana Statistical Service
Note: 2018 number is World Bank forecast

Growth underpinned by improving fundamentals

- Increasing demand for natural resources
- Improvements in governance and macroeconomic management
- Rapid urbanisation and increasing domestic demand

Ghana: Upstream Oil and Gas Sector

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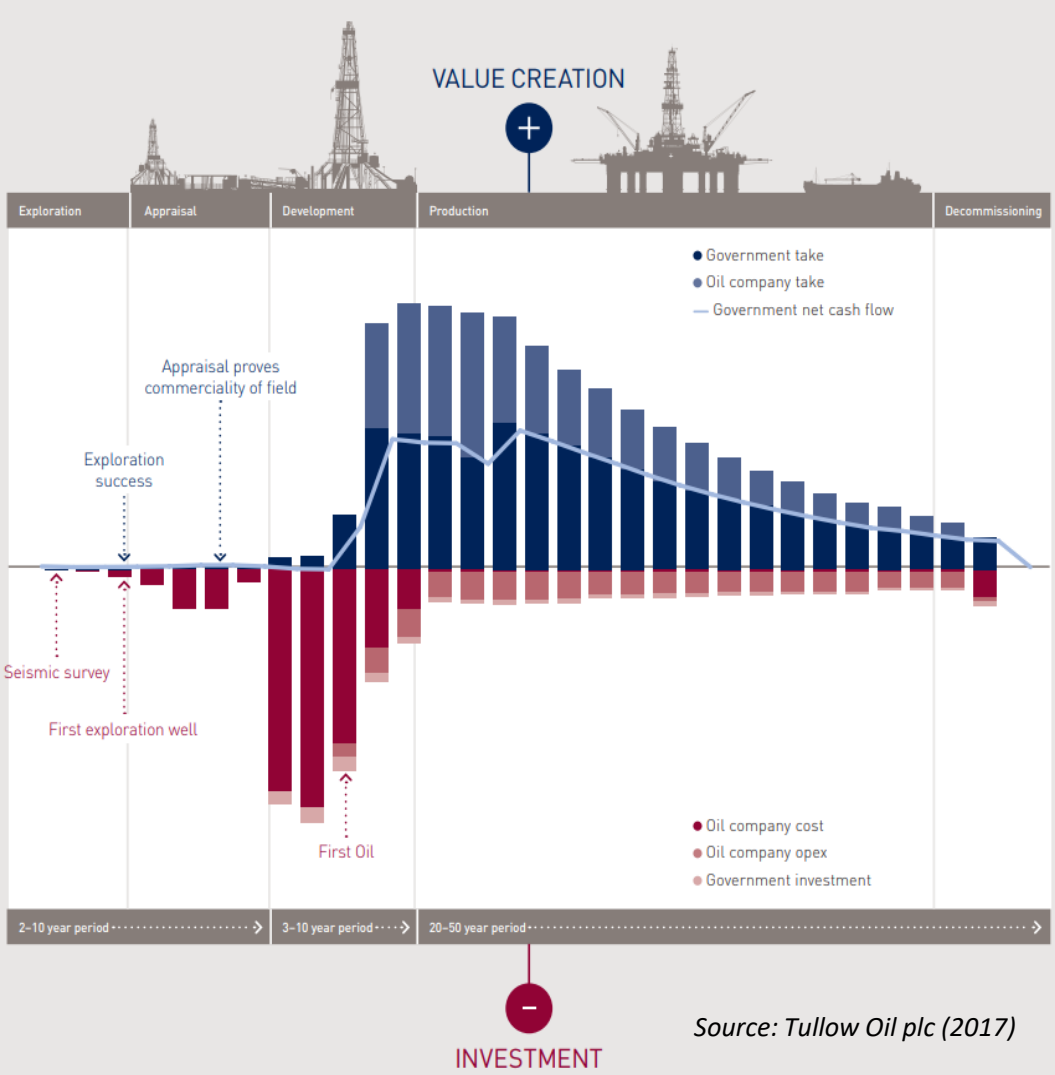
Ghana's oil and gas industry offers good lifecycle opportunities



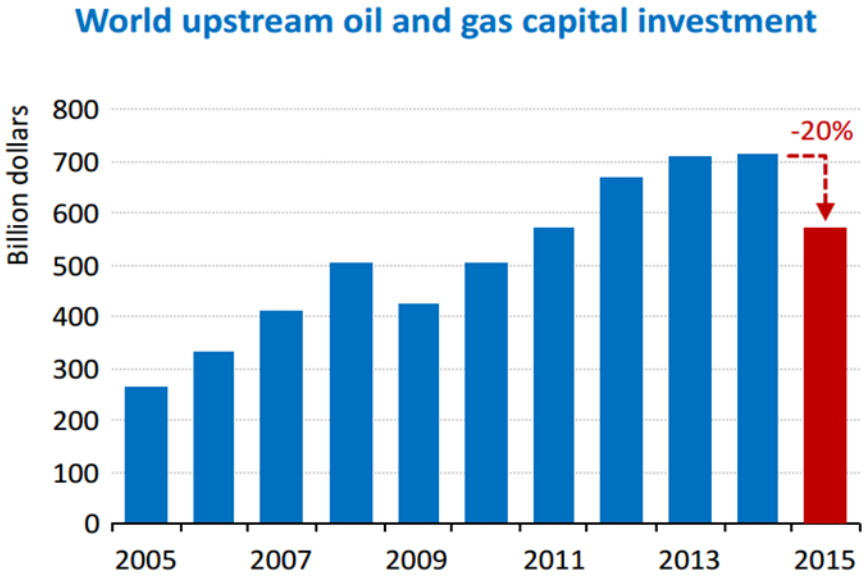
Source: Tullow Oil plc (2017)

Ghana's potential

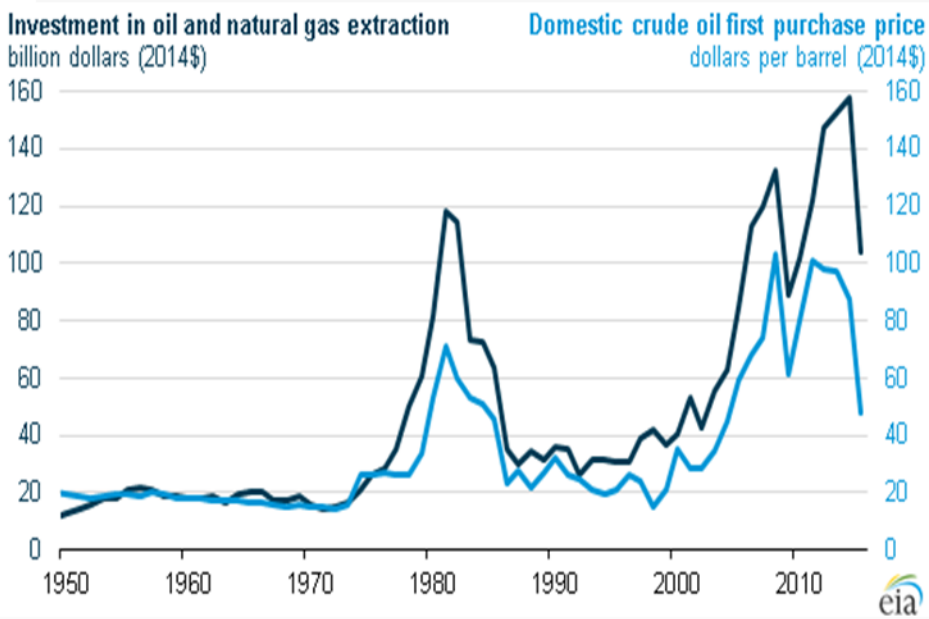
Full Asset Life Cycle

- Government benefits from production agreement via oil gas revenues, taxes and economic spin-offs.
- Skill development through working with partners and supply chain.
- Growth into indigenous Ghanaian companies with specialist expertise.
- International opportunities for Ghanaian workforce and specialists.

However, declining oil and gas prices have negatively impacted upstream investments

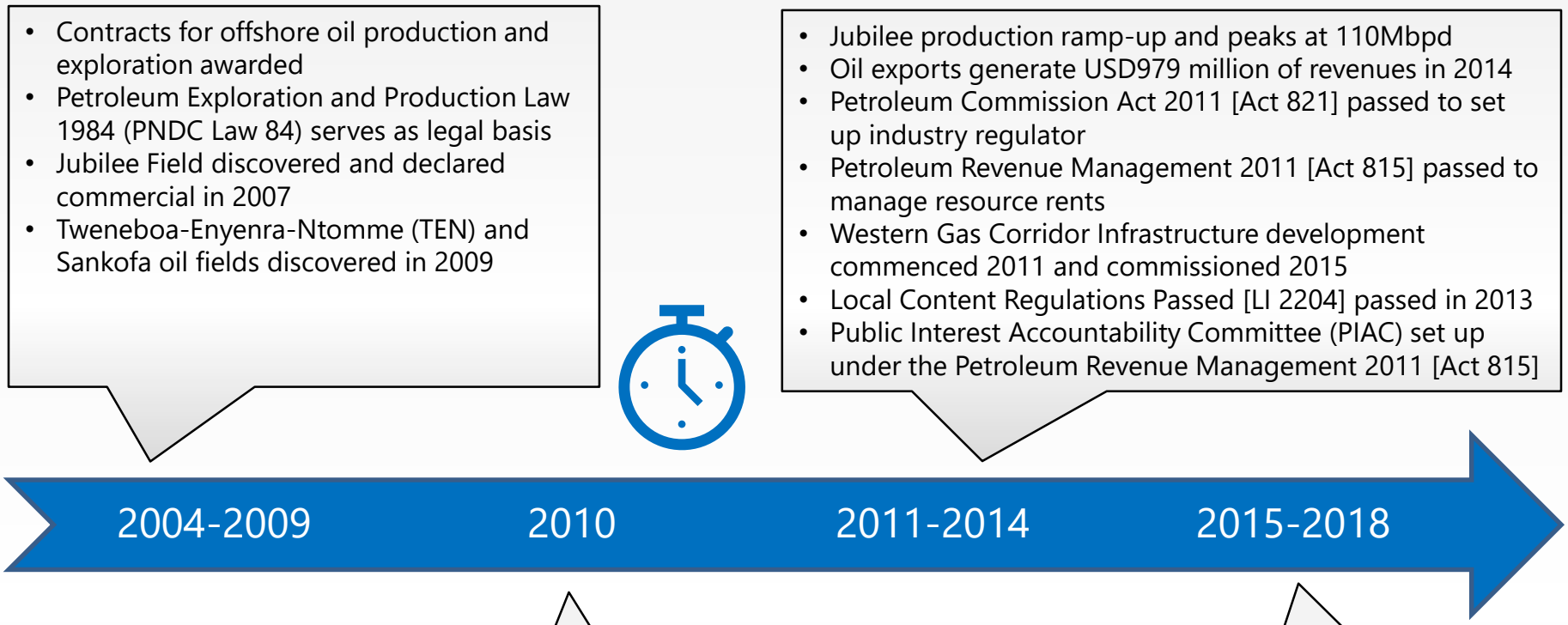


Source: IEA (2015)



Source: US BEA and EIA (2015)

Key milestones in Ghana's upstream oil and gas industry



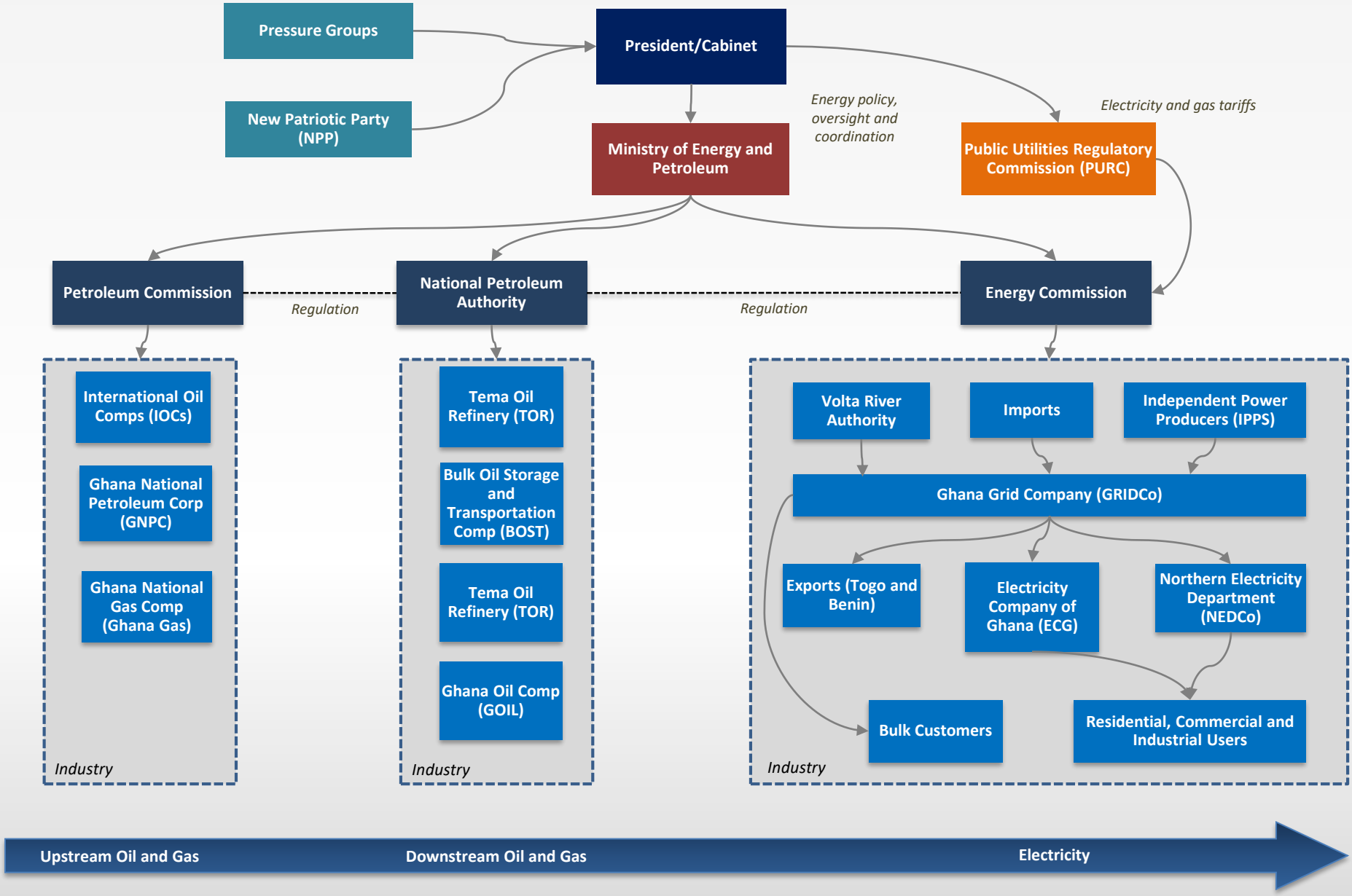
- Contracts for offshore oil production and exploration awarded
- Petroleum Exploration and Production Law 1984 (PNDC Law 84) serves as legal basis
- Jubilee Field discovered and declared commercial in 2007
- Tweneboa-Enyenra-Ntomme (TEN) and Sankofa oil fields discovered in 2009

- Commencement of production from Jubilee Field (First Oil)
- Increased calls to set up right regulatory and institutional structures

- Jubilee production ramp-up and peaks at 110Mbpd
- Oil exports generate USD979 million of revenues in 2014
- Petroleum Commission Act 2011 [Act 821] passed to set up industry regulator
- Petroleum Revenue Management 2011 [Act 815] passed to manage resource rents
- Western Gas Corridor Infrastructure development commenced 2011 and commissioned 2015
- Local Content Regulations Passed [LI 2204] passed in 2013
- Public Interest Accountability Committee (PIAC) set up under the Petroleum Revenue Management 2011 [Act 815]

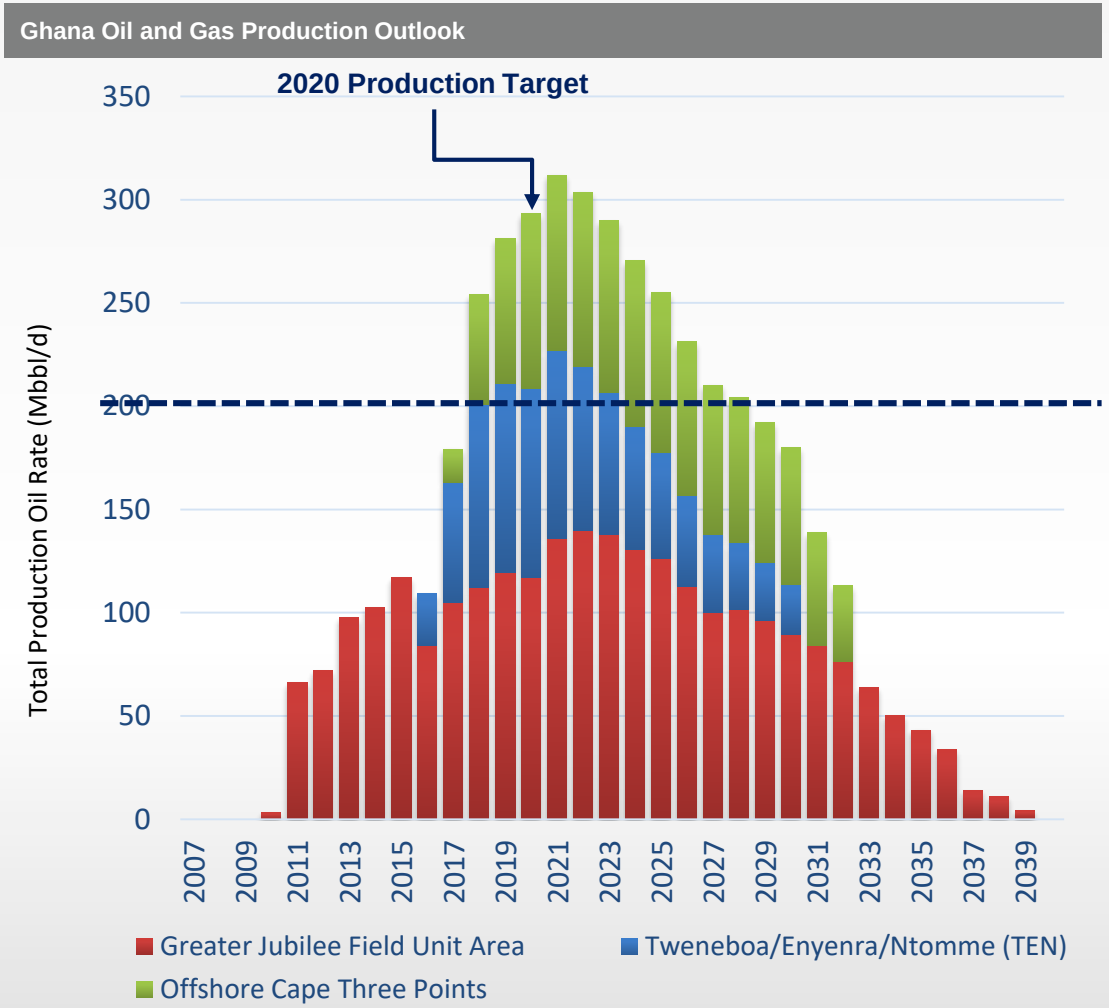
- Low oil prices impact Ghana's economy
- Petroleum Revenue Management Act 893 (Amendment) 2015
- New Exploration and Production (E&P) Law passed in 2016 to replace PNDCL 84 but allows ministerial discretion allowing for direct negotiations in some circumstances - Exxon Mobil Contract for DWTCP
- TEN and Sankofa come onstream (2017) with production ramping up to ~170Mbpd

Ghana's energy sector – political and economic drivers

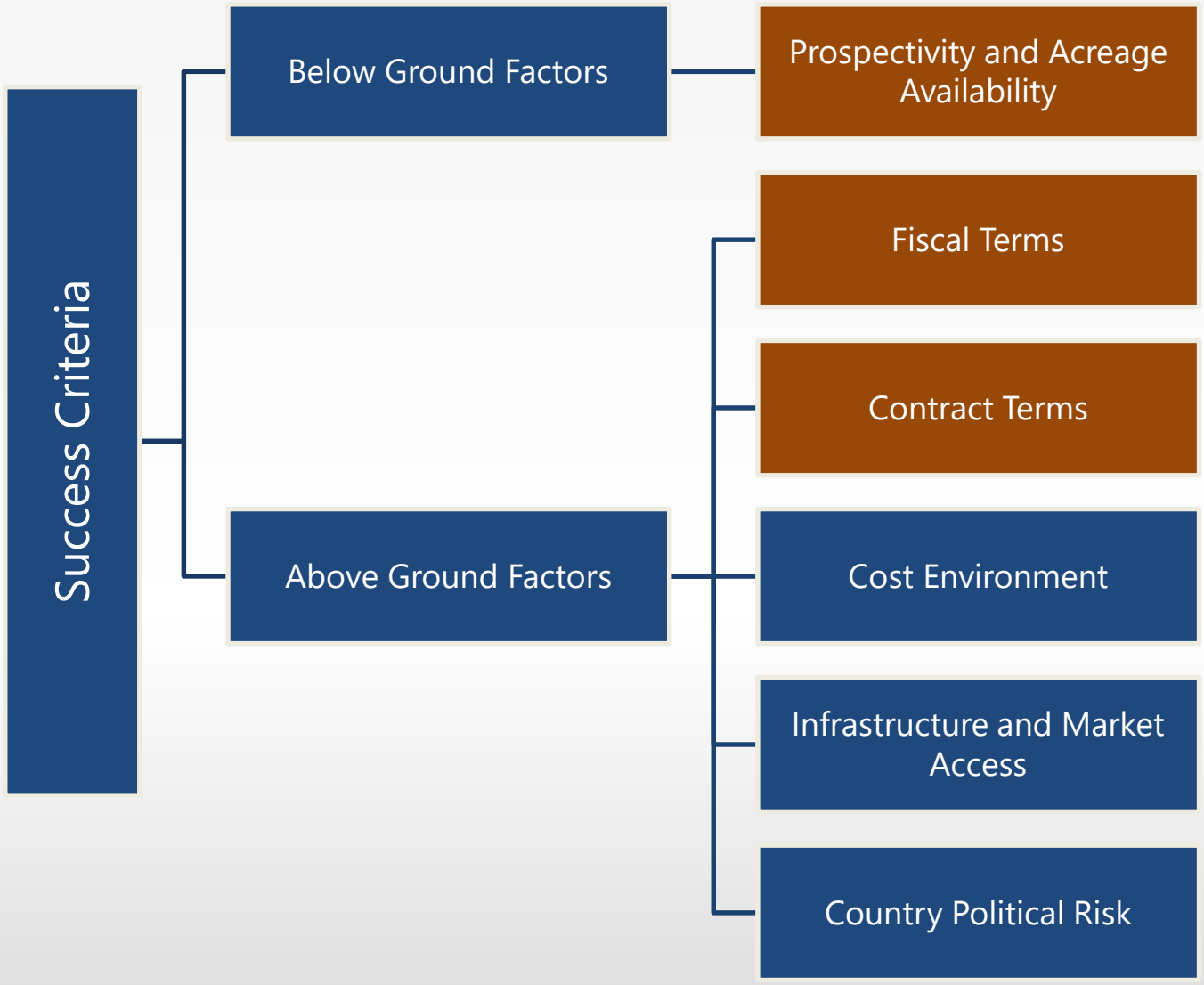


Higher crude oil and gas output critical to sustaining growth momentum

- Some government pledges are anchored **on increasing drilling activity and meeting production targets** in excess of 200Mbpd
  - 'One district, one factory, one warehouse'
  - 'Free secondary school'
  - 'USD1 million per constituency per year (275 x 1 x 4 years = USD1.1 billion (~2.5% of GDP)

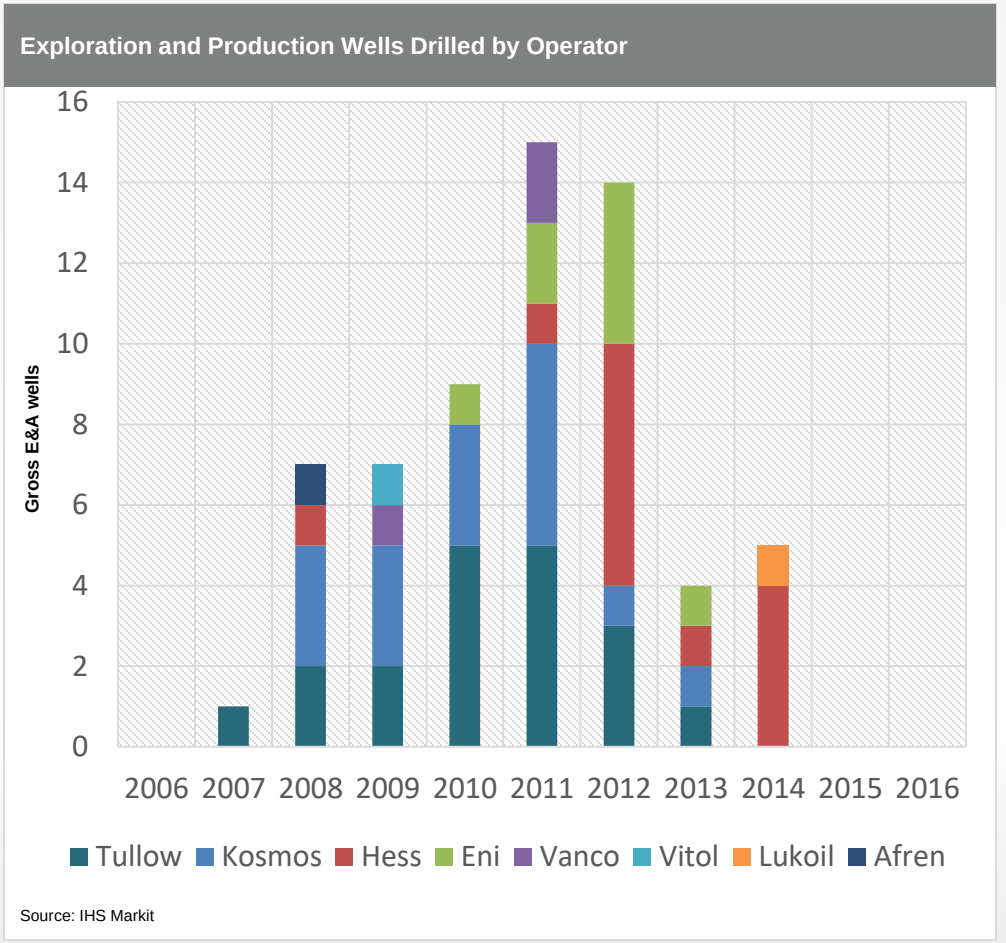


Strategic factors affecting upstream investment decision making

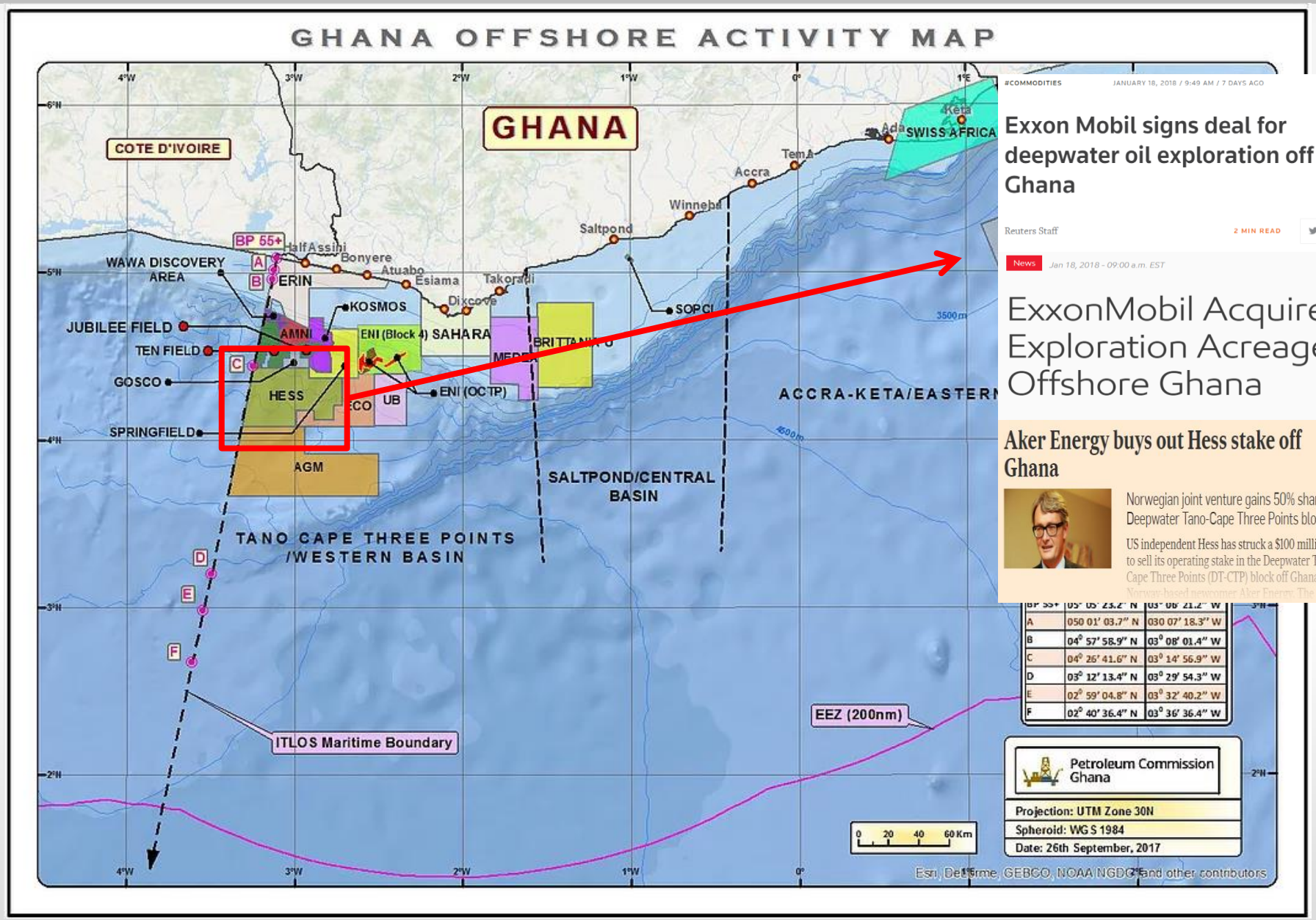


Focus on revamping stalled oil and gas exploration activity while commercialising existing producing assets

- Exploration activity **stalled since 2014** in response to **low oil price, capital rationing and maritime border dispute** with Cote d'Ivoire
- Shift from **direct negotiation**s to **open and competitive public** tendering under the new **Petroleum (Exploration and Production) Act, 2016 (Act 919)** but **ministerial discretion** allowing for direct negotiations in some circumstances – e.g. Exxon Mobil Contract for DWTCP
- Provision of **fiscal and non-fiscal incentives to attract upstream investments**, particularly targeting larger IOCs following the derisking of Ghana's western petroleum basin



Upstream oil and gas operations



#COMMODITIES JANUARY 18, 2018 / 9:49 AM / 7 DAYS AGO

Exxon Mobil signs deal for deepwater oil exploration off Ghana

Reuters Staff 2 MIN READ

News Jan 18, 2018 - 09:00 a.m. EST

ExxonMobil Acquires Exploration Acreage Offshore Ghana

Aker Energy buys out Hess stake off Ghana

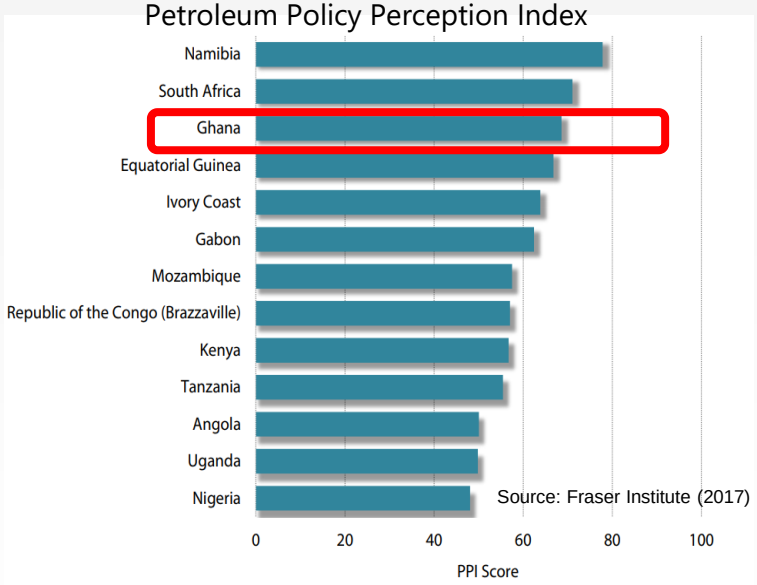
Norwegian joint venture gains 50% share of Deepwater Tano-Cape Three Points block

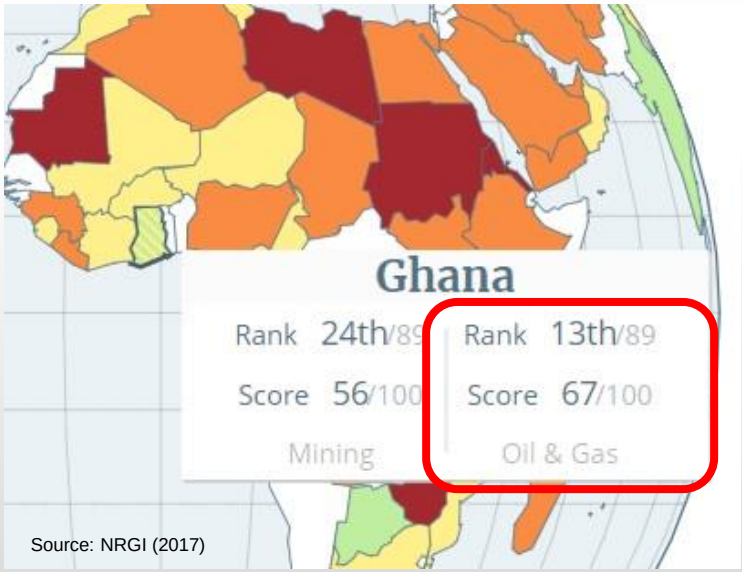
US independent Hess has struck a $100 million deal to sell its operating stake in the Deepwater Tano-Cape Three Points (DT-CTP) block off Ghana to Norway-based newcomer Aker Energy. The

Despite improved policy environment, barriers to investments likely to persist

Ranked 34 out of 97 jurisdictions globally, and third in Africa (out of 13 countries); PPI score better than Western Australia and Brazil (Offshore concession contracts) but investment barriers still persist

1. **Licensing**: Lack of clarity around licensing criteria and bid assessment parameters
   - Technical competence and financial capacity evaluation criteria
2. **Local content:**
   - Supply chain contractors struggling with restrictive local content obligations
   - Technical and financial capacity of local firms to hold min 5% equity in licenses
   - Lack of skilled workforce – disparate training regime
3. **Fiscal regime:** Overall regime favourable compared to regional peers but…
   - High 12.5% royalty for new contracts vis-à-vis country's low resource base
   - IRR-based AOE profit sharing discriminates between PAs for similar geological risks
   - AOE does not adequately capture windfall profits – e.g. w.r.t. field sizes
4. **Institutional framework:**
   - Some overlapping mandates between government agencies – e.g. compliance and monitoring: Ghana Maritime Authority vs EPA vs Petroleum Commission
   - Framework for private investment in gas-to-power sector insufficient – no reliable offtakers



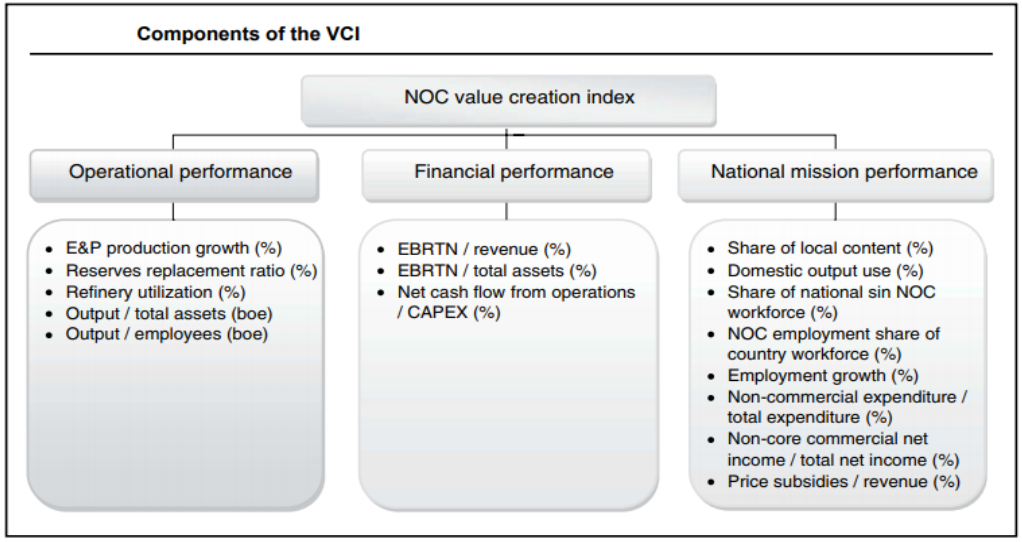


Fiscal terms have improved and favourable compared to peers

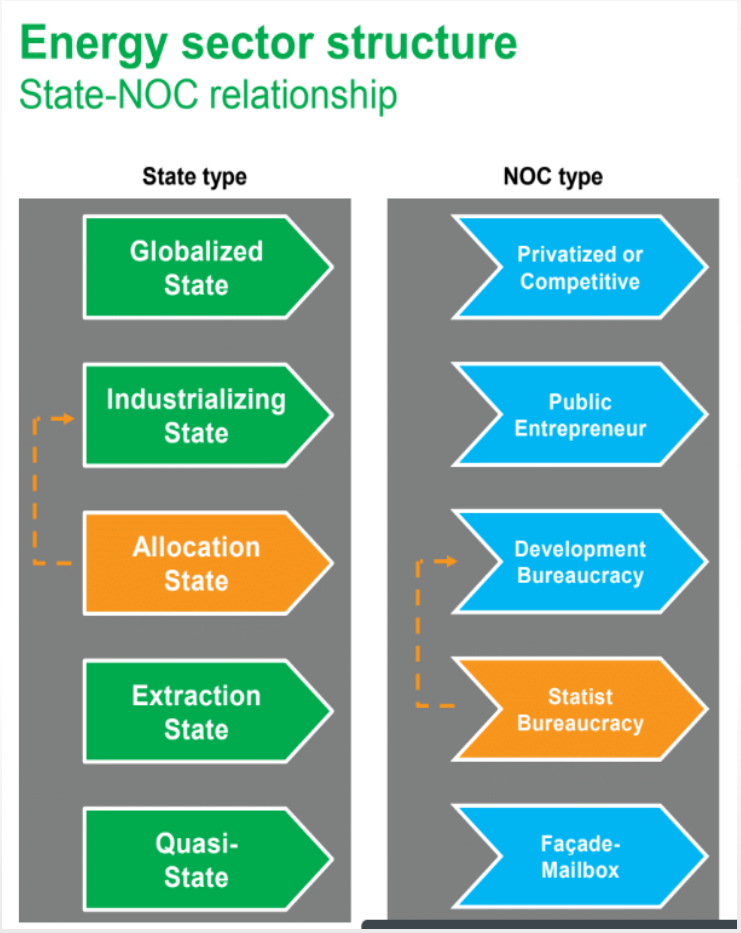
BLOCK	West Cape Three Points	Deepwater Tano	Jubilee Unitised (DWT_WCTP)	Deep-water Tano	Deepwater Tano-Cape Three Points	Offshore Cape Three Points	East Cape Three Points	Expanded Shallow Water Tano	Central Tano
DENOMINATION	WCTP	DWT	JUBILEE UNIT-ISED	TEN	HESS	OCTP	COLA	ERIN	AMNI
OPERATOR	Tullow	Tullow	Tullow	Tullow	Hess	Eni	Cola	Erin	Amni
FISCAL PACKAGE									
ROYALTY OIL	5.00%	5.00%	5.00%	5.00%	4.00%	7.50%	10.00%	12.50%	12.50%
ROYALTY GAS (Domestic)	5.00%	3.00%	4.08%	3.00%	3.00%	5.00%	5.00%	7.50%	5.00%
ROYALTY GAS (Export)	-	-	-	-	-	-	10.00%	7.50%	10.00%
INITIAL GNPC PARTICIPATION	10.00%	10.00%	10.00%	10.00%	10.00%	15.00%	10.00%	10.00%	10.00%
ADDITIONAL PARTICIPATION	2.50%	3.64%	3.64%	5.00%	3.00%	5.00%	17.50%	10.00%	20.00%
COMMERCIAL INTEREST [EXPLORCO]	-	-	-	-	-	-	-	25.00%	-
PETROLEUM INCOME TAX	35.00%	35.00%	35.00%	35.00%	35.00%	35.00%	35.00%	35.00%	35.00%
ADDITIONAL OIL ENTITLEMENT:									
Rate of Return Thresholds									
<12.5%	-	-	-	-	-	-	-	-	-
12.5%	-	-	-	-	5.0%	10.0%	12.5%	12.5%	12.5%
17.5%	-	-	-	-	10.0%	12.5%	15.0%	15.0%	15.0%
19.0%	-	5.0%	5.0%	5.0%	-	-	-	-	-
20.0%	-	10.0%	10.0%	10.0%	-	-	-	-	-
22.5%	-	-	-	-	15.0%	16.0%	17.5%	17.5%	17.5%
25.0%	7.5%	15.0%	15.0%	15.0%					
27.5%					20.0%	20.0%	22.5%	22.5%	22.5%
30.0%	15.0%	20.0%	20.0%	20.0%					
32.5%	-	-	-	-	-	-	27.5%	30.0%	27.5%
40.0%	25.0%	25.0%	25.0%	25.0%	-	-	-	-	-
REMARKS	22-Jul-2004	10-Mar-2006	13-Jul-2009	10-Mar-2006	8-Feb-2006	02-Mar-2006	Ratified in 2013	Ratified in 2014	Ratified in 2014

GNPC's role in Ghana's energy sector

- Ghana National Petroleum Corporation (GNPC) established in 1983 by (PNDC Law 64) as a **commercial strategic vehicle for state participation in the oil and gas industry**.
- The Objects of GNPC as enshrined in section 2(1) of PNDC Law 64 are: **"to undertake the exploration, development, production and disposal of petroleum."**
- Under **the new Petroleum (Exploration and Production) Act, 2016 Act 919**, GNPC remains a partner in all Petroleum Agreements with a **minimum of 15% initial carried interest (not including Additional interest);** permitted to **undertake petroleum activities in an open area** which is not covered by a PA; has **preemption rights** if contractor is **selling any stake.**
- However, GNPC's performance as an NOC needs to be **benchmarked utilising a Value Creation Index (VCI):** operation performance variables, financial performance variables, and national mission variables

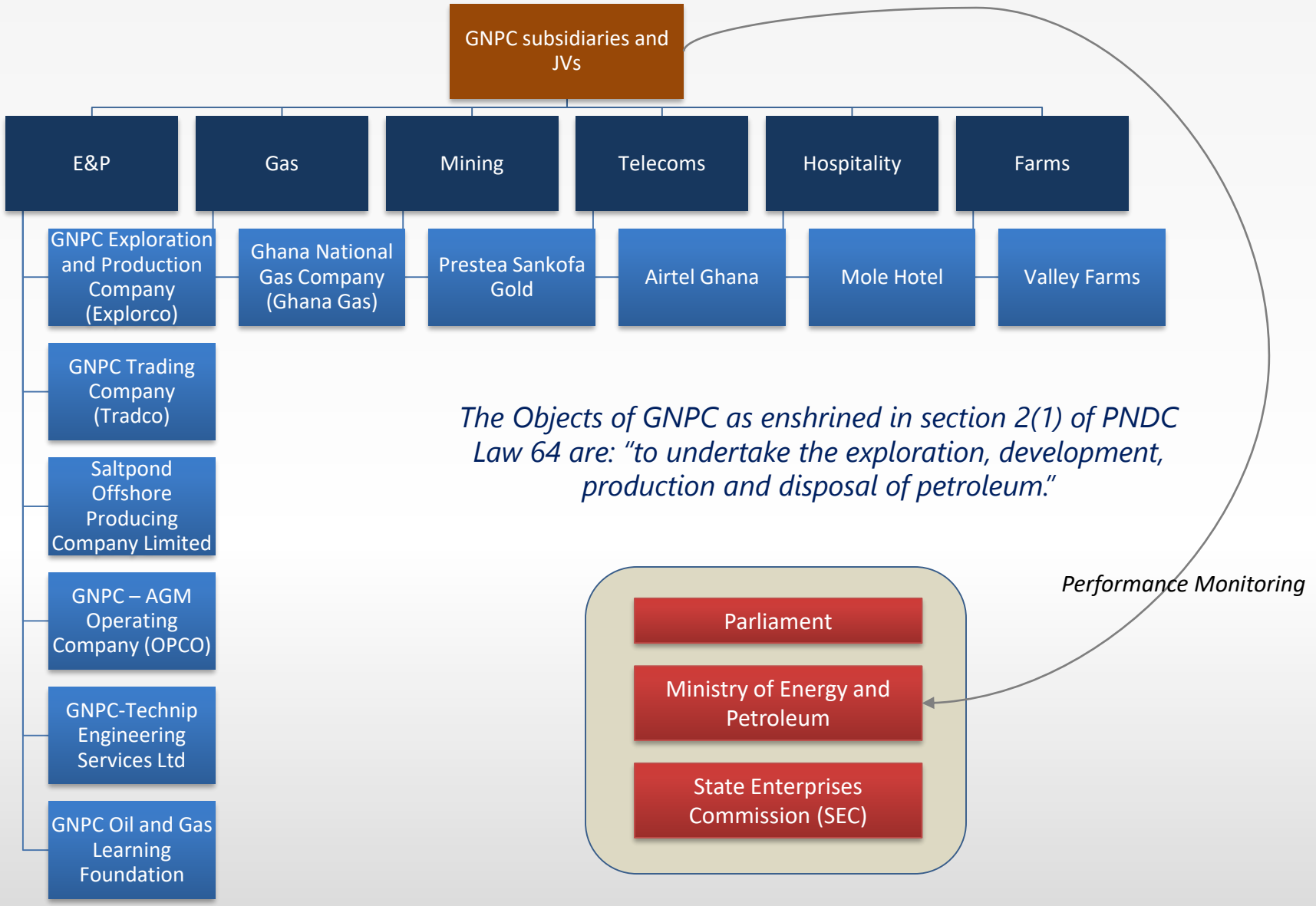


Source: Adapted from Wolf, 2009.

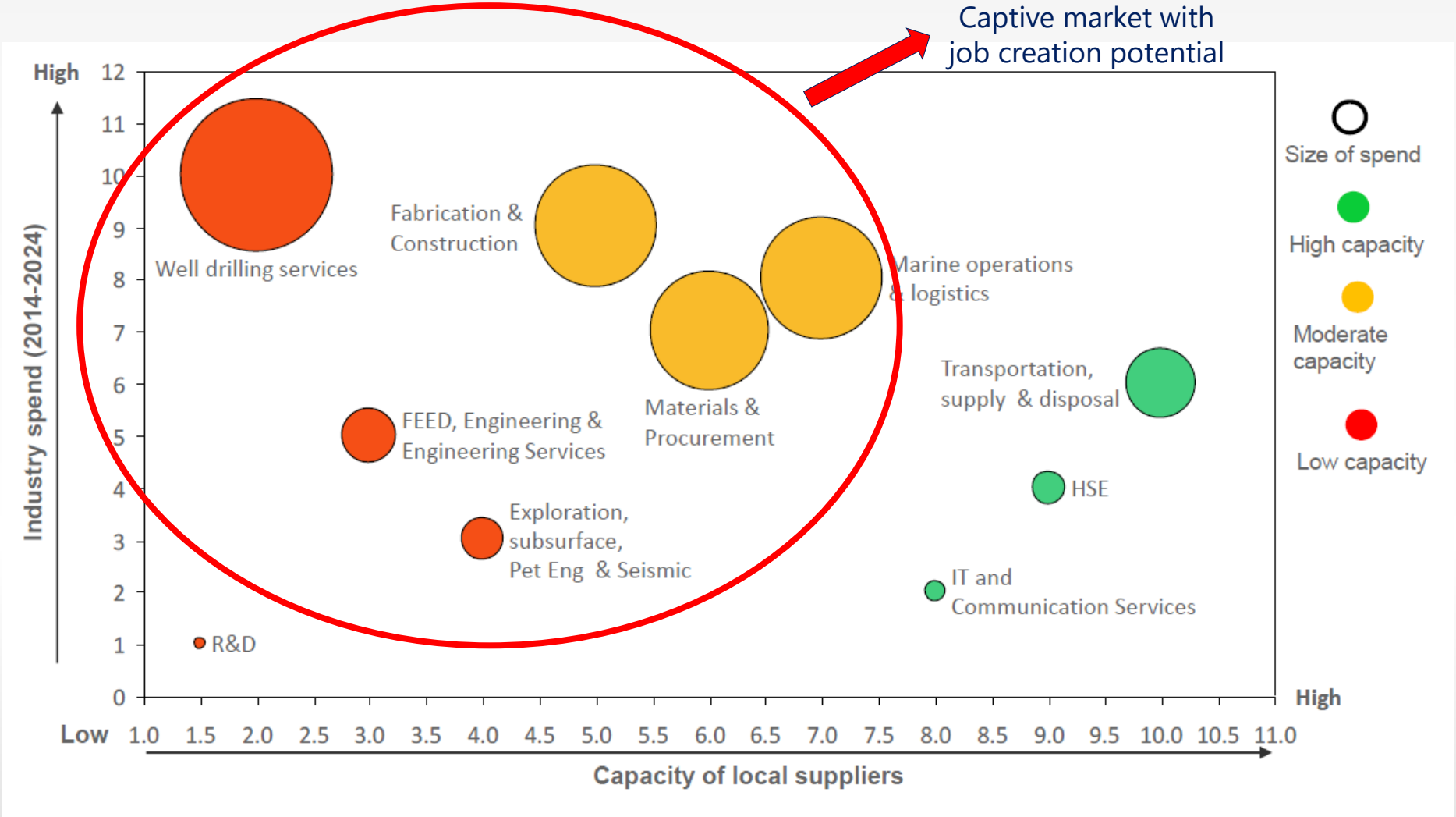


Source: IHS Markit

GNPC's many subsidiaries and investments likely to shift focus away from core mandate



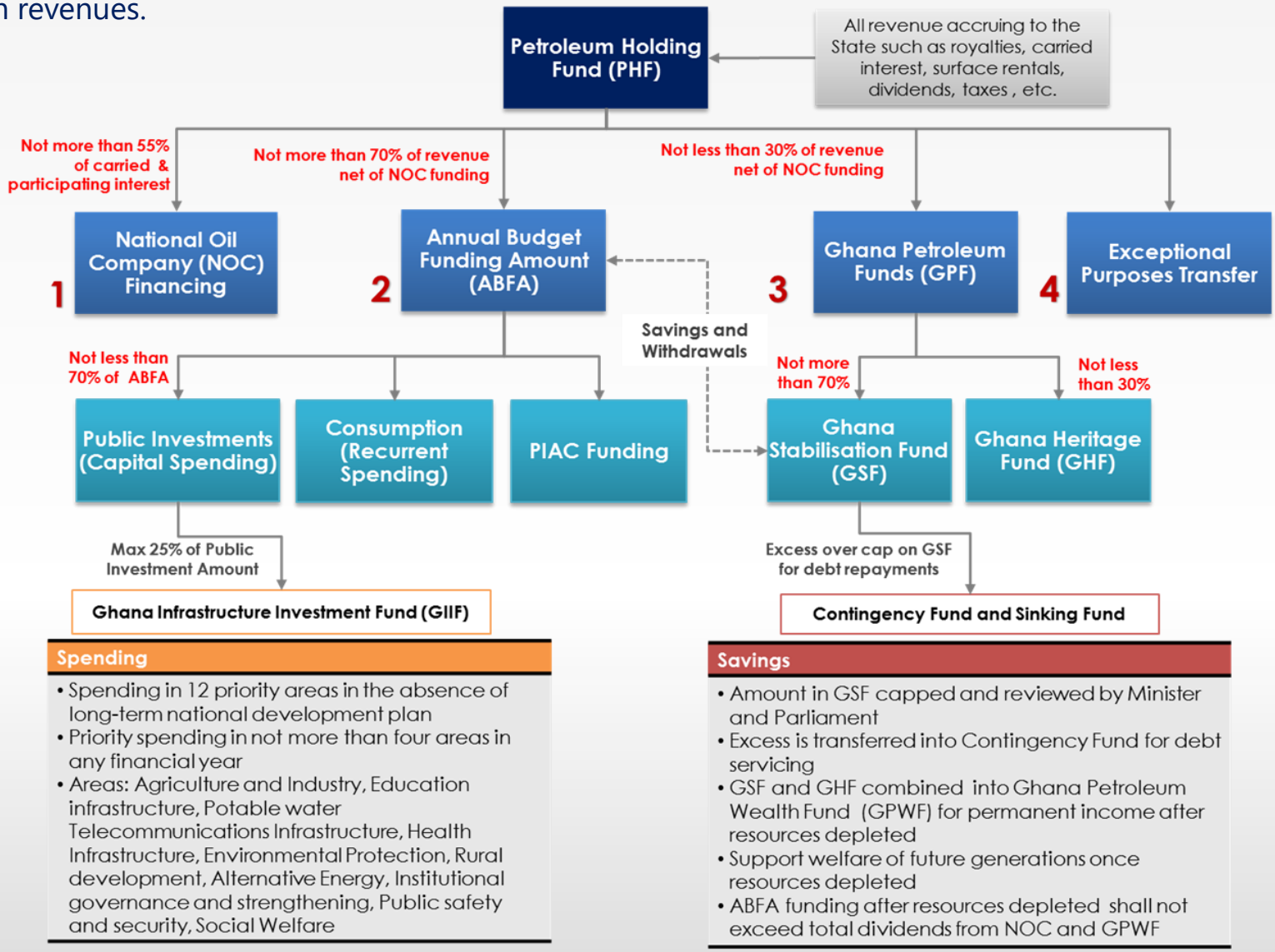
Local content needs to move into knowledge-driven, high-value adding supply chain sectors within the oil and gas value-chain



Source: Ernst & Young (2017)

Spending allocation of oil and gas revenues under the PRMA

The Petroleum Revenue Management Act, 2011 (Act 815 as amended) passed to govern the management of petroleum revenues.



Source: Acheampong et al. for PIAC (2017)

Recommendations

Competitive bidding for licensing rounds:

- Establish clear bidding and evaluation criteria. Publish technical and financial proposal details.
- Actively support local companies to form JVs/consortiums.

Fiscal Regime:

- Urgent need to draft a new Model Petroleum Agreement
- Clarify new fiscal elements in E&P Law and syncs with Petroleum Income Tax law – i.e. bonuses, fixed royalty, acreage fees, ring-fencing provisions and loss carry forwards.

Resolve Eastern maritime border demarcation with Togo

- Use lessons from the Ghana-Cote d'Ivoire Maritime Border Ruling

Institutional framework: The new E&P Law in the right direction but need to…

- Develop sector regulations – Petroleum Regulations, HSSE Regulations, etc.
- Need to clarify roles on compliance and monitoring – e.g. HSE monitoring.

Local content and development:

- Operationalise the Local Content Fund
- Assist local businesses expand into service providers - JVs with foreign partners.
- More strategic capacity development programmes – e.g. Centro de Apoio Empresarial (Angola) and PROMINP (Brazil)

Infrastructure and access to markets:

- Pass Gas Act to give impetus to the Gas Master Plan
- Gas-to-power market investment incentives to enable gas developments

Ghana: Power Sector

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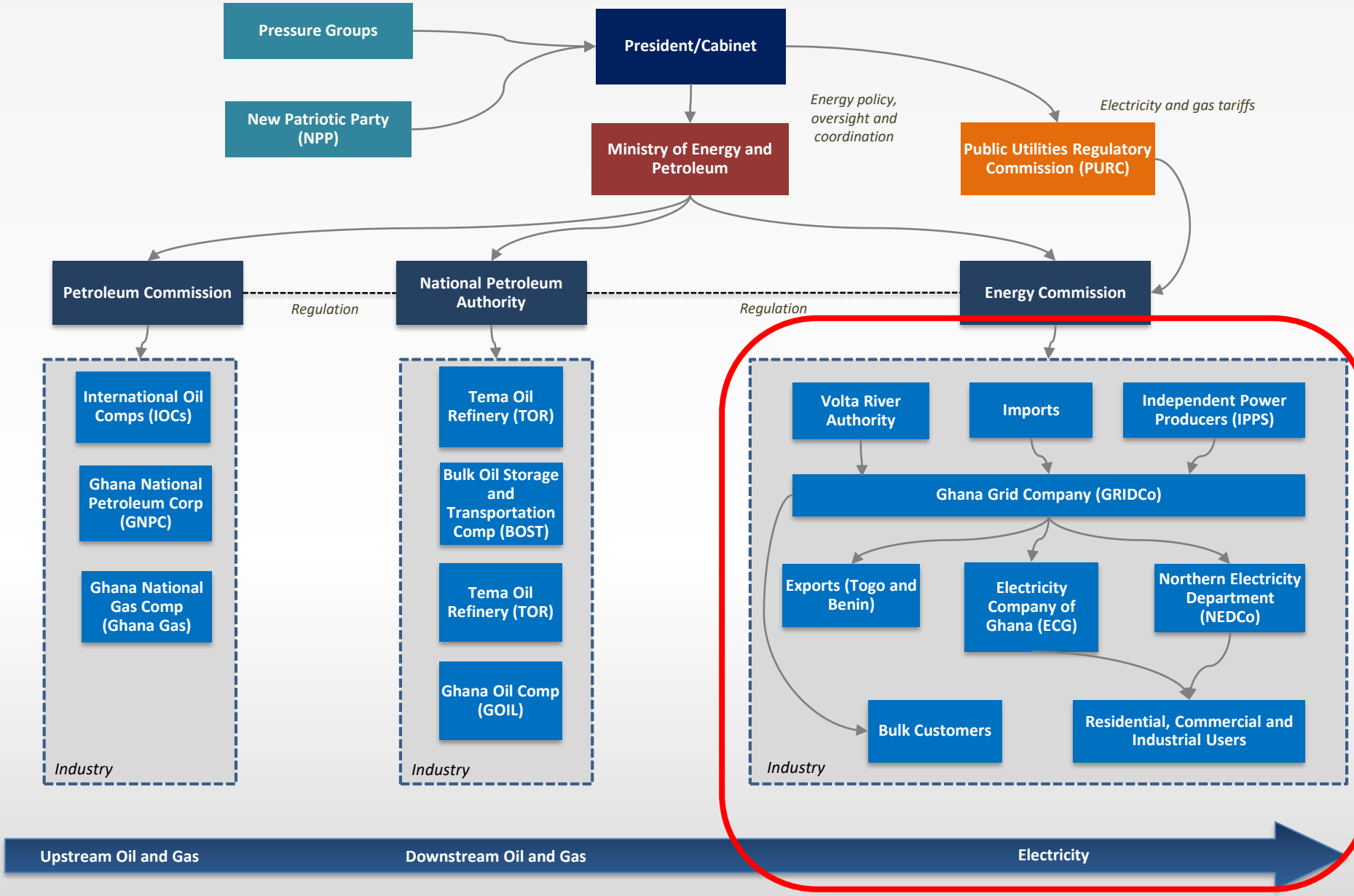
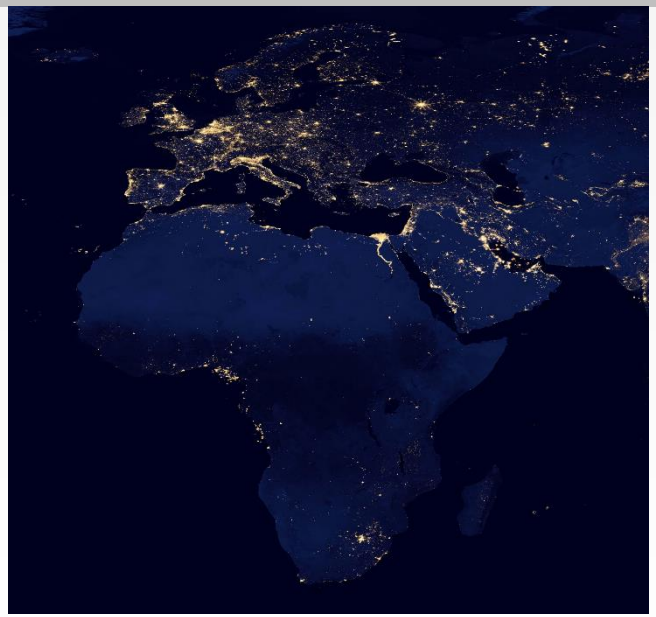
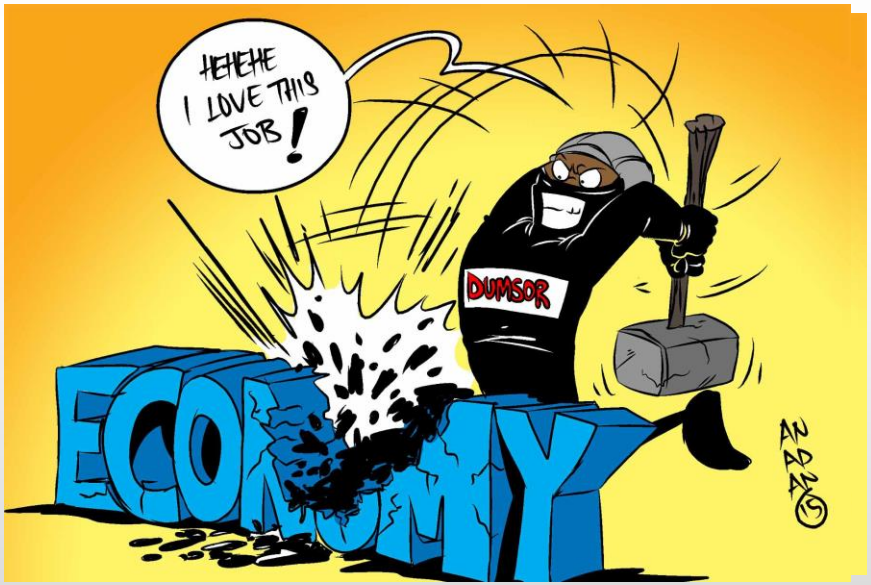
Ghana's energy sector – political and economic drivers

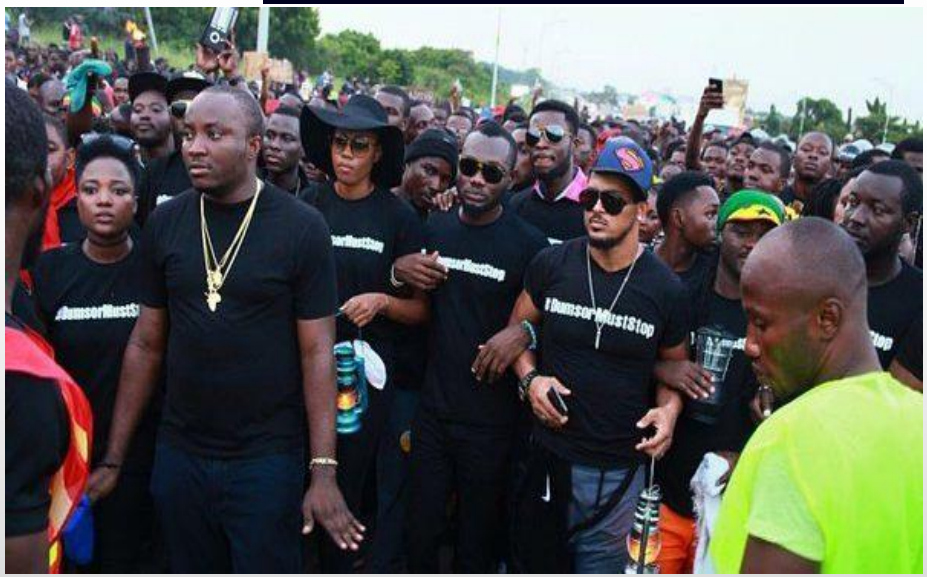


Energy security and access: Unreliable power is major impediment to economic growth

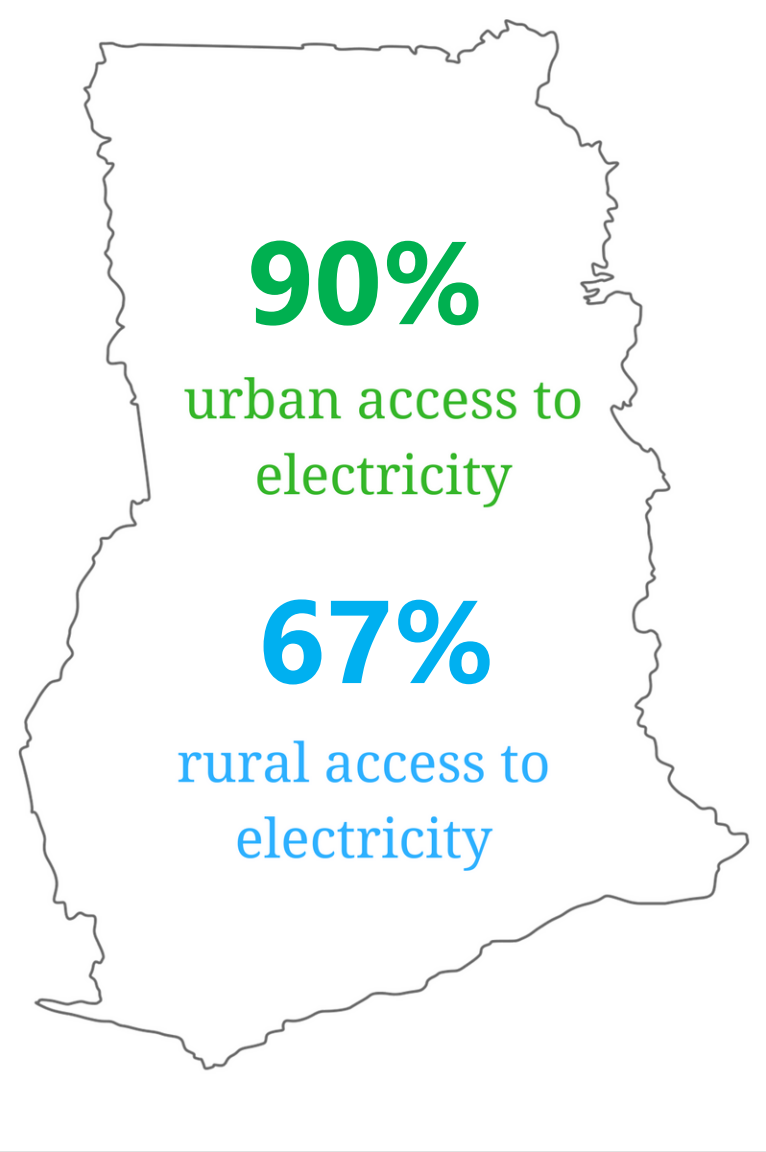
- **About 634 million people (32% electricity access)** in Sub-Saharan Africa without electricity (IEA, 2015).
- Most countries with appreciable access rates (>50%) have **security of supply issues** which manifest through **frequent power outages**.
- Most SSA countries **spend less than 3% of their GDP on power investments**: <2% as operational costs (thermal plants) and >1% for infrastructure expansion.
- **Electricity generation capacity** will **need to grow at over 13% per year if SSA** is to achieve universal access by 2030 (Bazilian et al. 2011) .
- **Financing gap** of about **USD23 billion annually**, emphasising the need for increasing investment (Duarte et al., 2010; Kingombe, 2011).

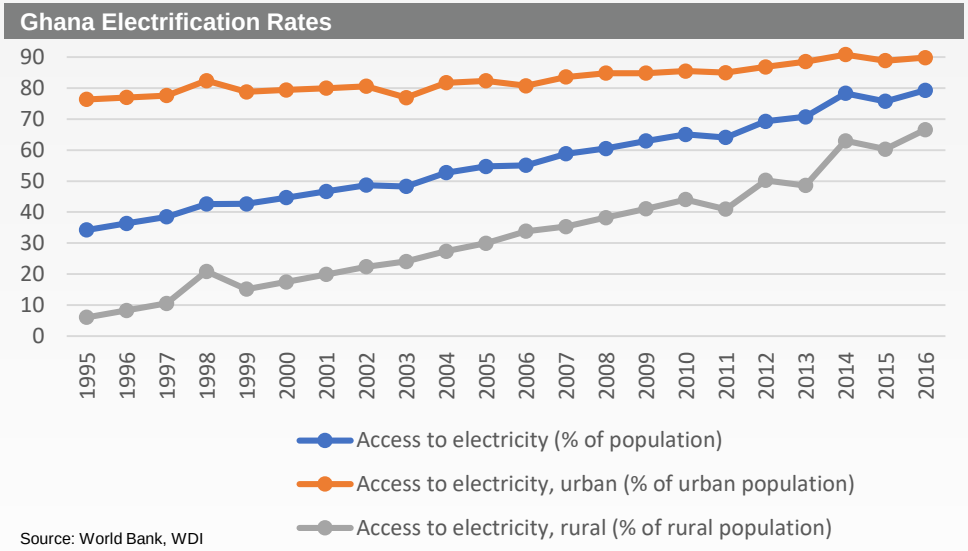




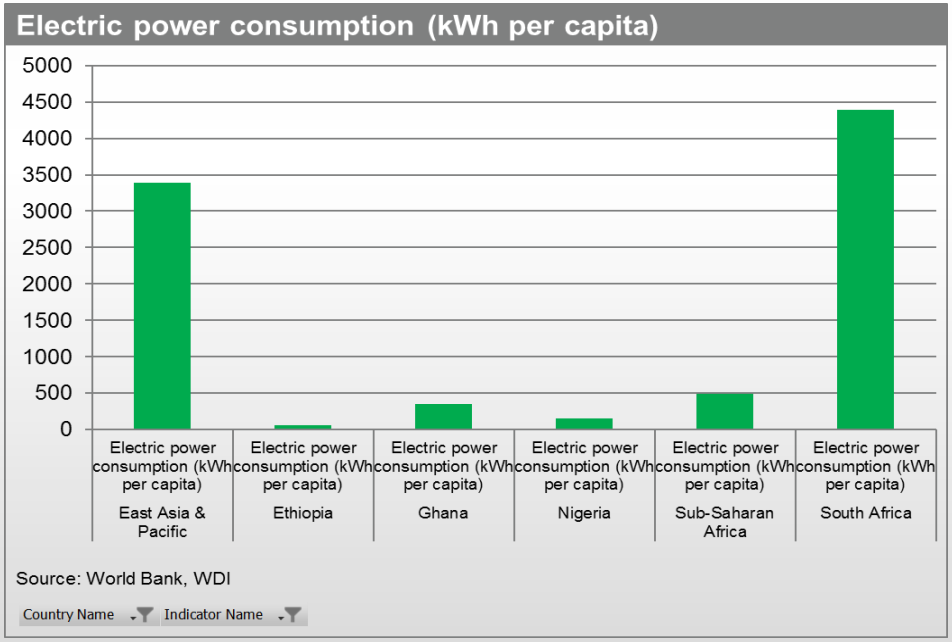


Electrification rates and power consumption





Source: World Bank, WDI



Source: World Bank, WDI

Country Name Indicator Name

Ghana government response to crisis

1. **Liberalisation and expansion of generation to eliminate power shortages**
   - Development of IPPs especially in thermal and hydro – sovereign guarantees, LCs, higher tariffs, BOOTs
   - Creation of regional power pools – e.g. West African Power Pool (WAPP)
   - West African Gas Pipeline (WAGP) to provide cheap natural gas

2. **Independent transmission company to manage the national transmission grid - GRIDCo created in 2006**

3. **Demand side management via energy efficiency to minimise energy waste**
   - Replacement of incandescent bulbs with CFLs
   - Public education on energy usage
   - Introduction of the lifeline tariff (subsidy for poor consumers)

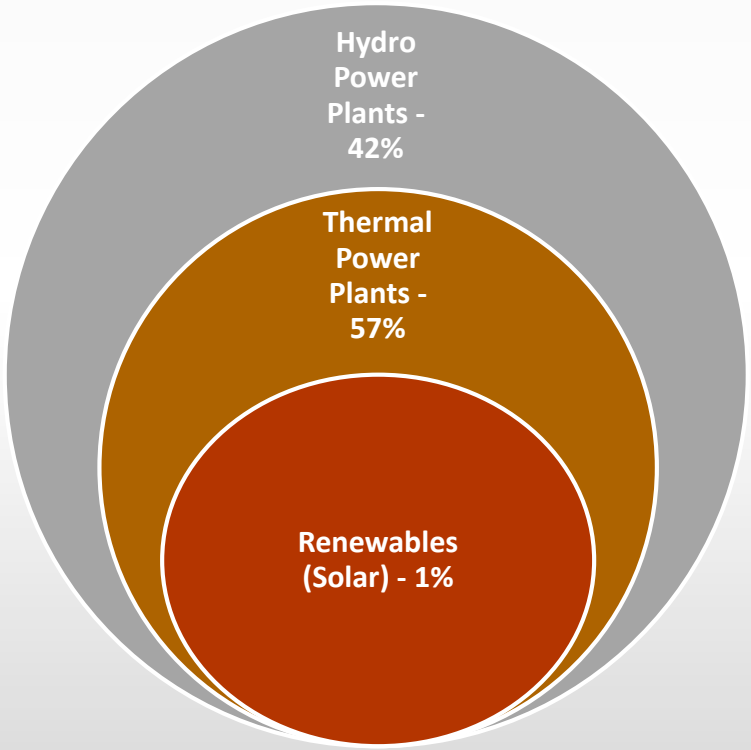
4. **Expansion of the national grid to all communities**
   - 500 people in a distance of up to 20 km from an MV line (All 110 district capitals and about 2500 towns now connected)
   - Smaller communities adopting micro-scale generation (renewables) – e.g. under the SHEP (Proposed 80MW wind farm at Ada, Ghana)

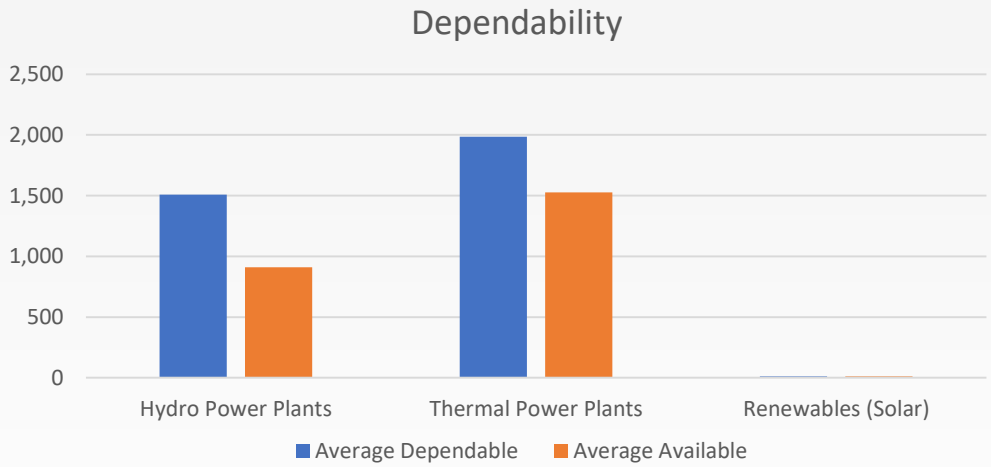
Power demand and supply balance

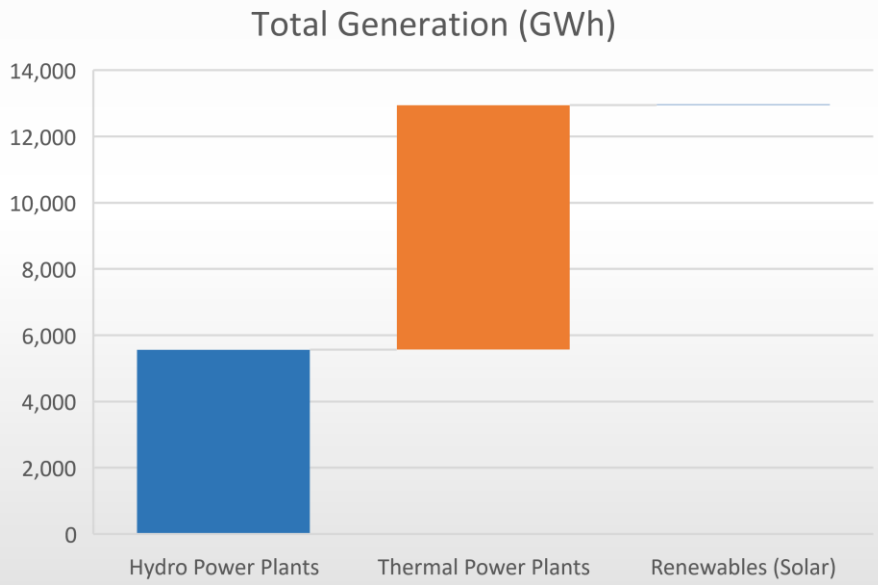
Total generation in 2016 of 12,979 GWh (1,500 MW) vs. 3,505 average dependable and 2,448 MW average available. Peak load demand.

Total electricity required in 2017:

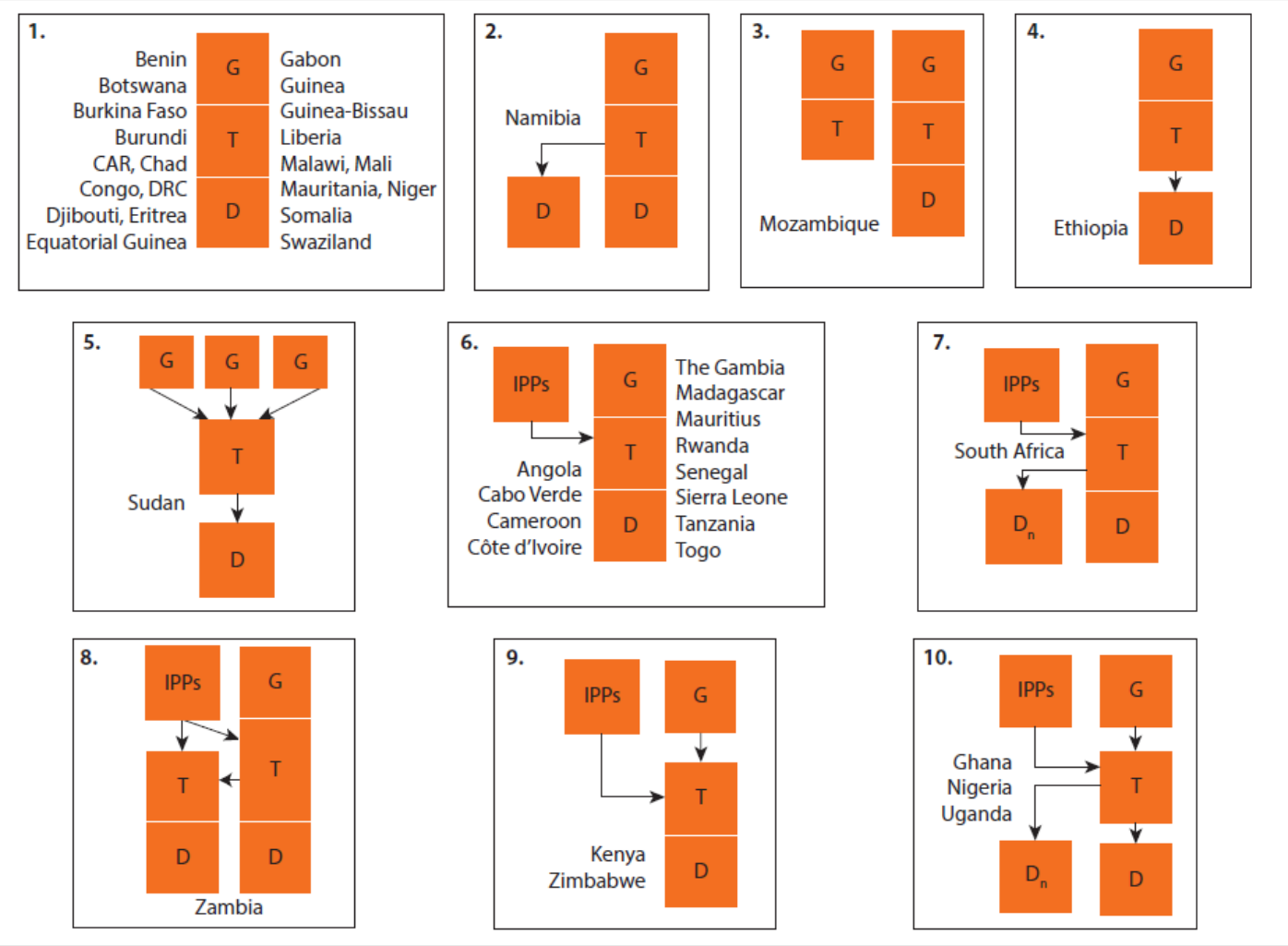
- 2,480-2,500 MW with VALCO at one potline.
- 3,000-3,500 MW with VALCO at two potlines.







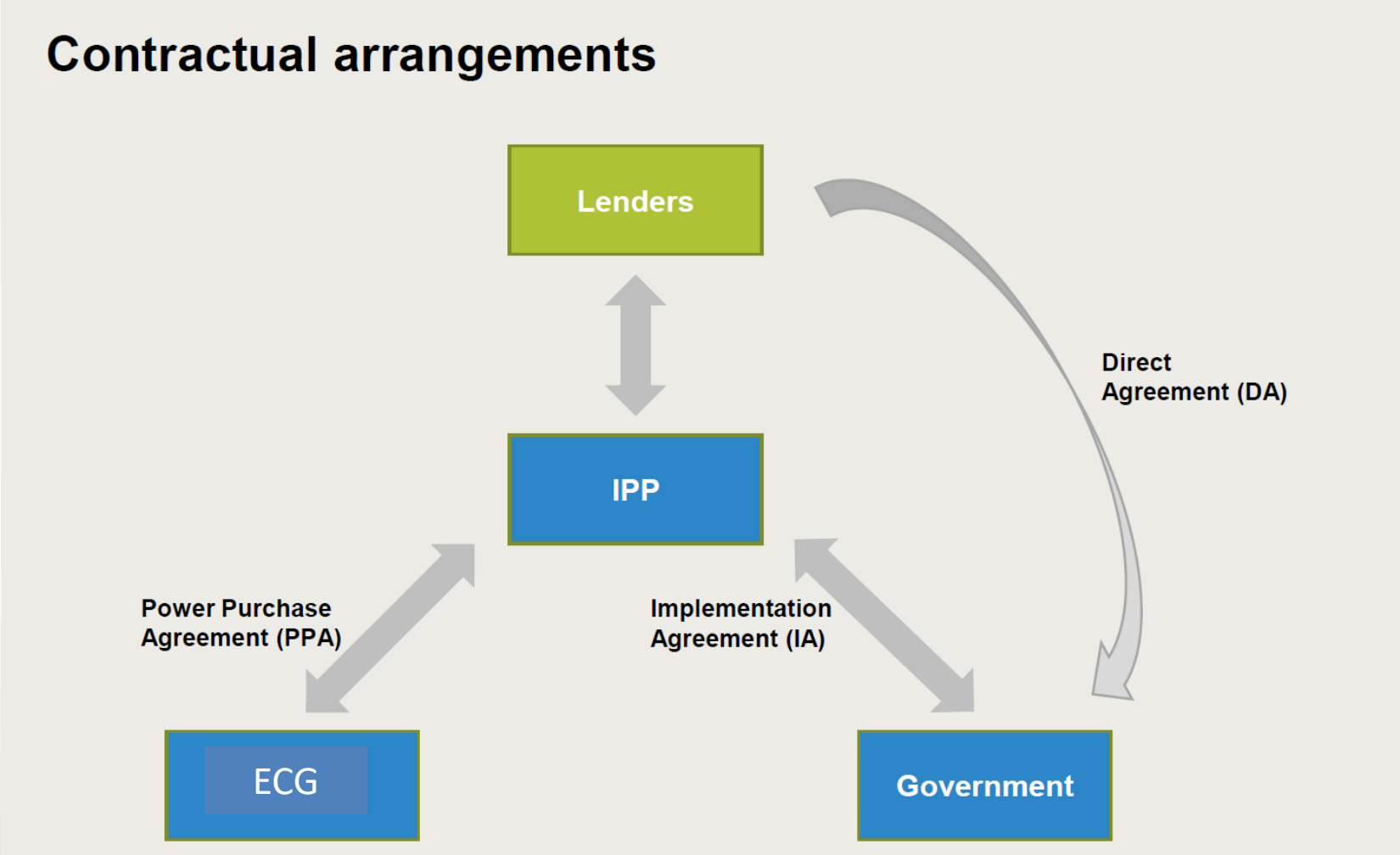
The role of market reform and the unbundling of services



Note: Includes vertical integration or unbundling of generation (G), transmission (T), and distribution (D) and presence of IPPs.

Source: World Bank, 2016

Political and commercial risks in developing power markets and regional gas markets



Political, economic and social risks in developing power markets

- Series of crisis created political opportunities for reform - e.g. move to cost reflective tariffs.
- Peak optimality at the economies of scale frontier – SOEs running the power system squeezed between declining revenues and rising costs.
- Two key elements of power market reform: raising tariffs and privatising SOEs.

Political

- Policy instability - regulatory uncertainty, lack of political commitment and government intervention in domestic markets (e.g. subsidies)
- Government instability – political uncertainty, contract revisions
- Obstacles in the planning process - excessive bureaucratic procedures and overlap of mandates
- Unclear arbitration procedures

Economic

- Access to finance – insufficient capacity addition
- Inability to recover cost of new generation via current electricity tariffs
- Inefficient fuel mix in the generation and inaccurate prioritization of investments
- Nonexistence of wholesale electricity market
- Ageing infrastructure across value chain – transmission and distribution losses
- Inflation, poor macroeconomic conditions

Social

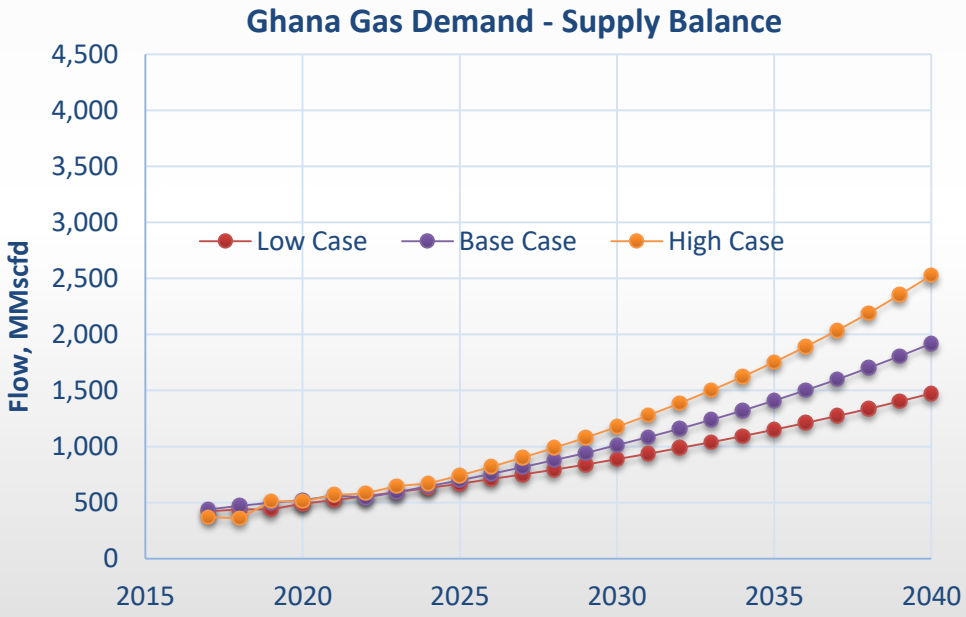
- Rapid population growth and the rise of 'megacities'
- The poverty paradox – affordability driving protests and riots

Economic growth and unreliable output from hydroelectric dams means Ghana needs to fuel power expansion

- **Ghana targeted pipeline imports from Nigeria** via the WAGP **but deliveries often below contractual commitment** even when pipeline was opened to other shippers in June 2014; coupled by **VRA's inability to pay for the gas.**
- **Significant gas discoveries** offshore Ghana **lessened the impetus to quickly bring LNG imports online.**
- **Tano Basin has aggregate 2P gas reserves of ~ 5.7 Tcf**; Jubilee (90-120 MMscfd) + TEN (40-70 MMscfd) + Sanfoka (155-180 MMscfd) + Aker (50-100 MMscfd).
- **Domestic gas is likely to meet Ghana's base-case** demand through the mid-2020s but need to be supplemented by LNG imports from mid-2020s (Gas Master Plan, 2014).

Year	Power demand (mmcfd)	Industrial and transport demand (mmcfd)	Total demand (mmcfd)
2015	190.6	10.0	200.6
2020	265.3	35.0	300.2
2025	409.9	60.0	469.8
2030	583.9	85.0	668.8
2035	821.9	110.0	931.8
2040	1,019.1	135.0	1,154.1

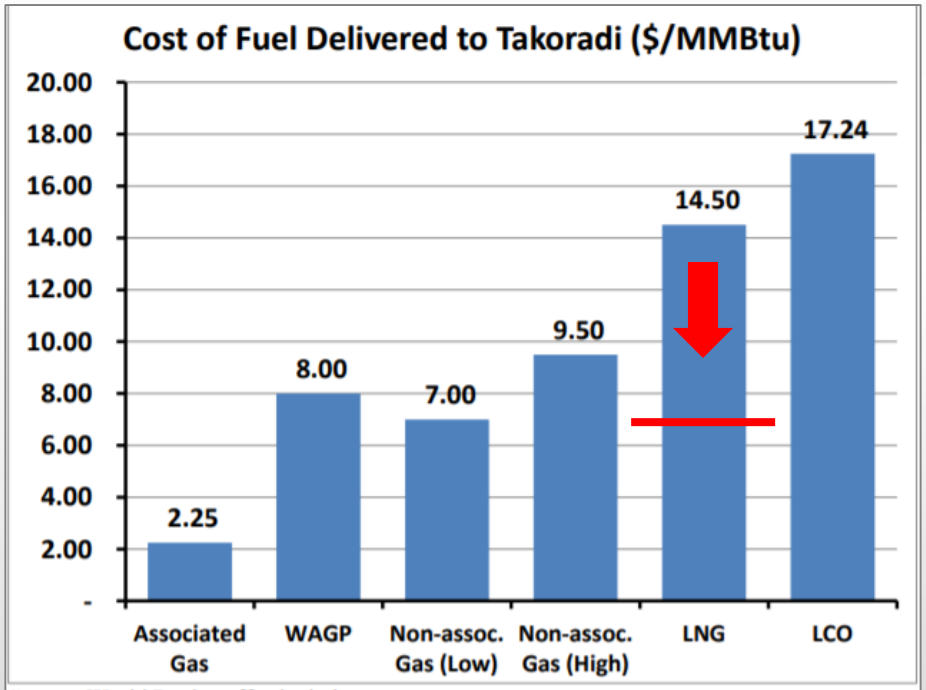
Source: Ghana Gas Master Plan, 2014



Source: Ghana Gas | NDPC Petroleum Report - June 2017

LNG regasification options for domestic supply will need to be competitively priced than LNG or WAGP supply

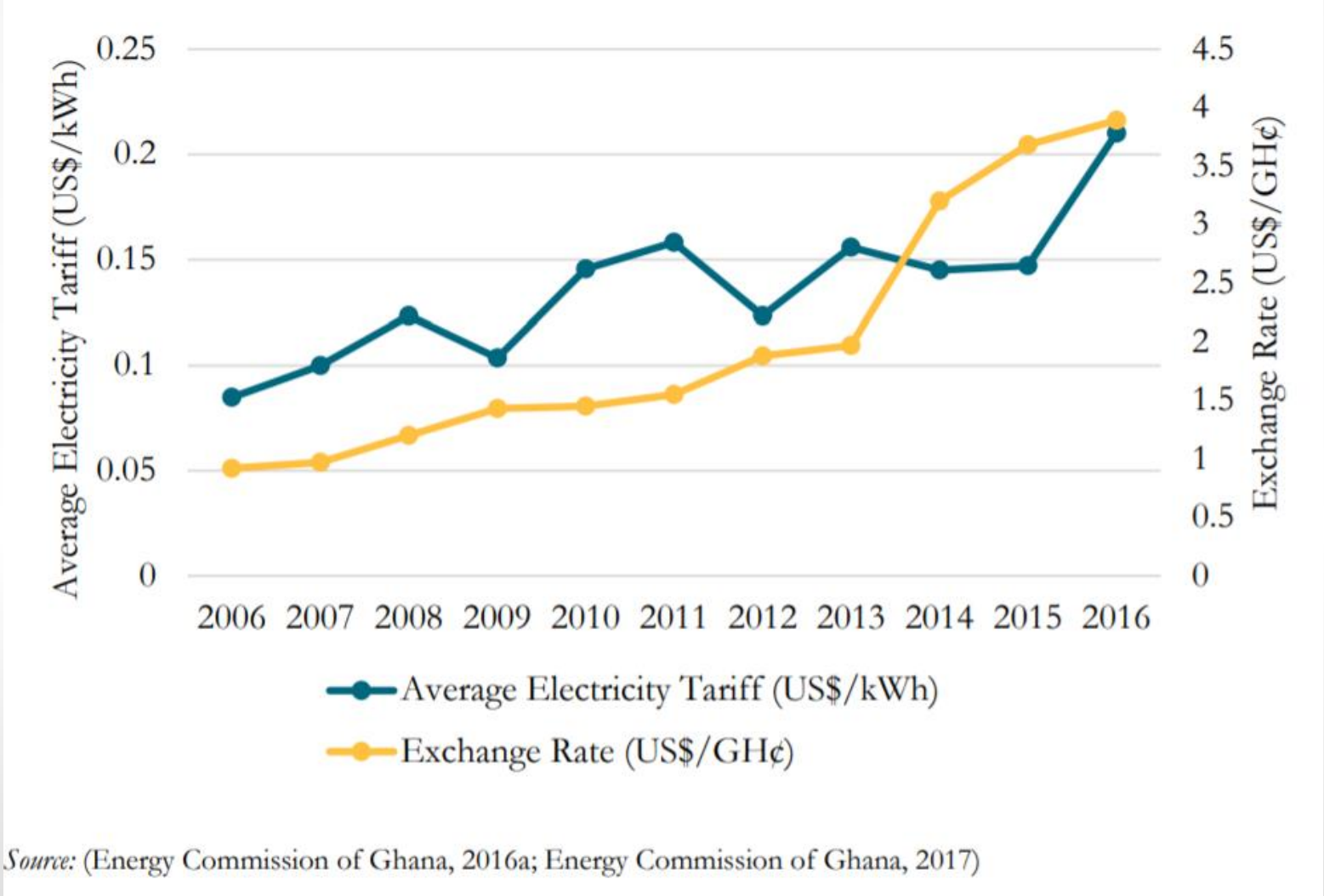
- **Ghana is progressing with three separate LNG import proposals**: Quantum Power, WAGL (Sahara Energy and NNPC), Gazprom.
- **Gazprom's new supply agreement creates confusion over Ghana's potential LNG terminals** as the government-backed agreement reportedly involves a new LNG terminal, despite construction already ongoing on rival Quantum Power project.
- **Key Policy Considerations:**
  - Delivered LNG price (bilateral or spot markets)
  - LNG Price Indexation
  - Regasification, transmission and distribution costs
  - FX Risk (selling in cedis or dollars?)
  - Contract Terms and Conditions – take or pay?
  - Government, levies, margins and taxes
- **Main customers:** VRA and IPPs but GRA has non-payment risks (debt burden) and thus purchasing large-scale LNG volumes will have to be accompanied by government support or payment guarantees or GNPC does this on its behalf and supplies industry through its subsidiary, Ghana Gas but issue of market oversupply.
- **Long term implications** for **cost pass-through and subsidies in the power sector.**



Source: World Bank staff calculations.

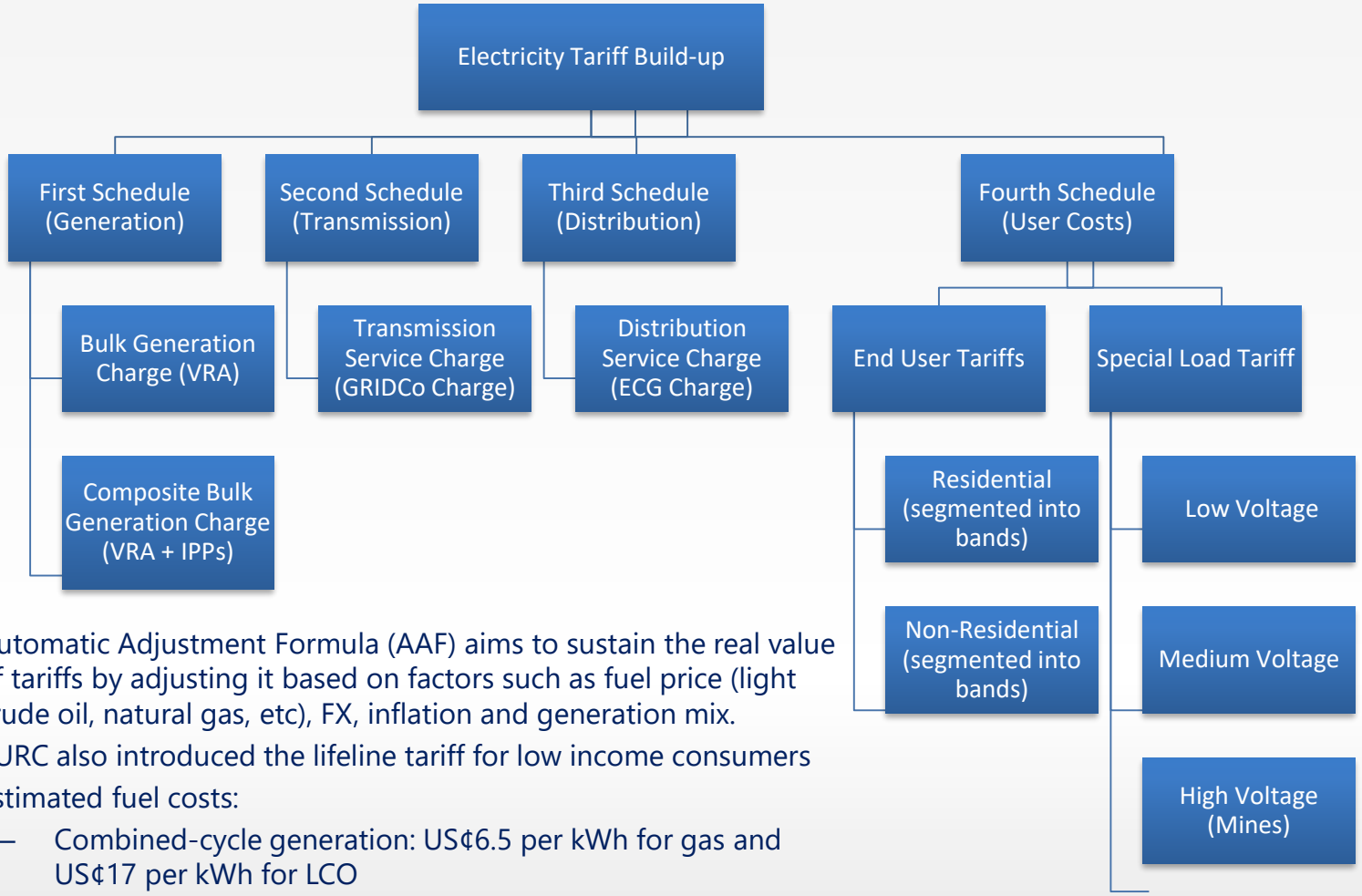
The automatic adjustment formula and the rising cost of electricity

Average end user electricity tariff for Ghana from 2006 to 2015 (Kumi, 2017)



Source: (Energy Commission of Ghana, 2016a; Energy Commission of Ghana, 2017)

Fuel generation mix likely to drive tariff increments via the automatic adjustment formula



- Automatic Adjustment Formula (AAF) aims to sustain the real value of tariffs by adjusting it based on factors such as fuel price (light crude oil, natural gas, etc), FX, inflation and generation mix.
- PURC also introduced the lifeline tariff for low income consumers
- Estimated fuel costs:
  - Combined-cycle generation: US¢6.5 per kWh for gas and US¢17 per kWh for LCO
  - Simple-cycle generation: US¢9.5 per kWh for gas and US¢26 per kWh for LCO.
  - Stand-alone diesel generators: US¢40 per kWh.
  - Solar Feed-in-Tariffs (FiT): US¢20 per kWh [World Bank, 2013].

Source: PURC, 2017

Will privatization be the answer to ECG's woes?

- The biggest dimension of the debt problem in the power sector is the inability of the ECG monopoly to settle its indebtedness to VRA and IPPs.
- ECG's operations suffer from technical and commercial losses estimated at 25% of all power procured.
- ECG management also claims that government agencies, among its top customers, do not pay their bills on time.
- The 20-year Private Sector Participation (PSP), part of the USD498 million US-backed MCC Power Compact to address distribution challenges is welcome…
  - Includes 51% minimum Ghanaian private equity participation (from an initial 20%).
  - Improvement in revenue collection levels, reducing commercial losses.
  - Investments in core network infrastructure upgrades to reduce technical losses.
  - Adoption of better procurement management and working capital practices.
- However, improving the power sector's sustainability long term requires…
  - A rigorous application of the AAF.
  - The elimination of subsidies.
  - Government settling its indebtedness on time.
  - Adopting green and smart building designs to reduce energy use (demand side load management).

Recommendations

1. **Determine energy strategy that is independent of political cycle**
   a. Develop an integrated long term energy roadmap (Master Plan) and financing strategy that offers 'fair' returns to all stakeholders (government, investors and end-users).
   b. Develop enabling policies across the energy value chain , particularly the gas sector – passage of the Gas Act and follow-on regulations clearly defining the roles of the sector agencies, pricing and tariffing methodology, and third party access to infrastructure to operationalise the Gas Master Plan.
   c. Gas pricing policy and regulatory framework: gas prices are yet to be specified and commercial agreements established. Any agreed commercial and regulatory framework should be stable, including predictable fiscal conditions and gas prices, for the upstream, midstream and downstream components of the gas industry.
   d. The regulatory framework to ensure cost reflective pricing and thus financial viability of entities along the gas to power value chain must be of paramount concern.

2. **Create an enabling environment for both on and off-grid initiatives**
   a. Policy support – e.g. Adopt a competitive auction system to deploy large scale solar given limited success of Feed-in-Tariffs; provide tax waivers to make local manufacturing cost effective.
   b. Alternative financing models for renewable energy.
   c. Establish an off-grid innovation and development fund.

3. **Need for innovation in the market place**
   a. Recognise the value of and promote the use of mobile infrastructure, microloans and payment solutions in supporting energy access.
   b. Distributed (on-site modular) generation can help low-income consumers and consumers in remote areas gain access electricity - e.g. Translight Solar (Ghana) and M-KOPA (Kenya)

Bottom line: Ghana's economy likely to sustain momentum over the medium term; however, the robustness of recovery depends on…

- **Ability to deliver on oil and gas** production targets.
- **Leverage oil receipts** to **grow the non-oil sector of the economy**, particularly developing value chain linkages.
- **On growth sectors: clearly mapping out the opportunities in govt industrialisation programmes** to allow private sector to favourably identify niche areas to participate in – e.g. agriculture and manufacturing chains.
- **On power sector: boost ECG's revenue mobilisation** via concessionaire agreement while **addressing recurrent non-payment risks** in the value chain.

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Dr. Theo Acheampong is an energy economist and political risk analyst with over seven years' experience in providing economic and investment analysis as well as research and strategic advisory for projects in the global energy industry. His work focusses on fiscal and other regulatory issues in upstream oil and gas, power and downstream energy markets. He has extensive consultancy experience in building fiscal models, performing macroeconomic analysis and working with governments and international institutions in developing countries.

Theo's political risk analysis experience includes working as the lead Sub-Saharan African country analyst covering political and business developments in Botswana, Ghana, Guinea-Bissau, Equatorial Guinea, Malawi, Zambia and Zimbabwe. This includes providing risk forecasts and analysis of the impact of business risks - tax, legal, operational on industry sectors and companies, including of war, terrorism, and political unrest. He has worked as a senior analyst and consultant for firms such as IHS Markit, Crystol Energy and Kina Advisory among others. Theo provides regular commentary to international media such as the BBC, Bloomberg, AFP and CNBC. He has been a fellow of IMANI since 2009.

Theo has a PhD in Petroleum Economics and an MSc in Petroleum, Energy Economics and Finance from the University of Aberdeen, Scotland. He has a BSc in Chemical Engineering from the Kwame Nkrumah University of Science and Technology, Kumasi, Ghana

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