GHANA GAS FORUM - 2021

GAS SECTOR OVERVIEW & ROADMAP

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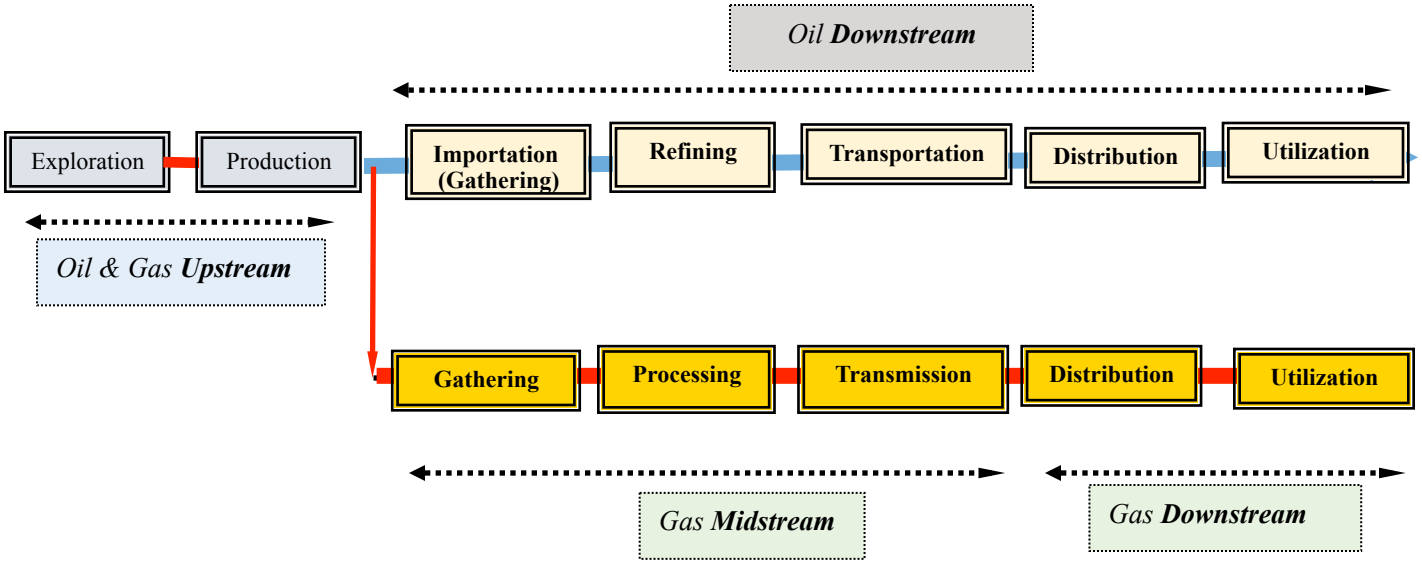
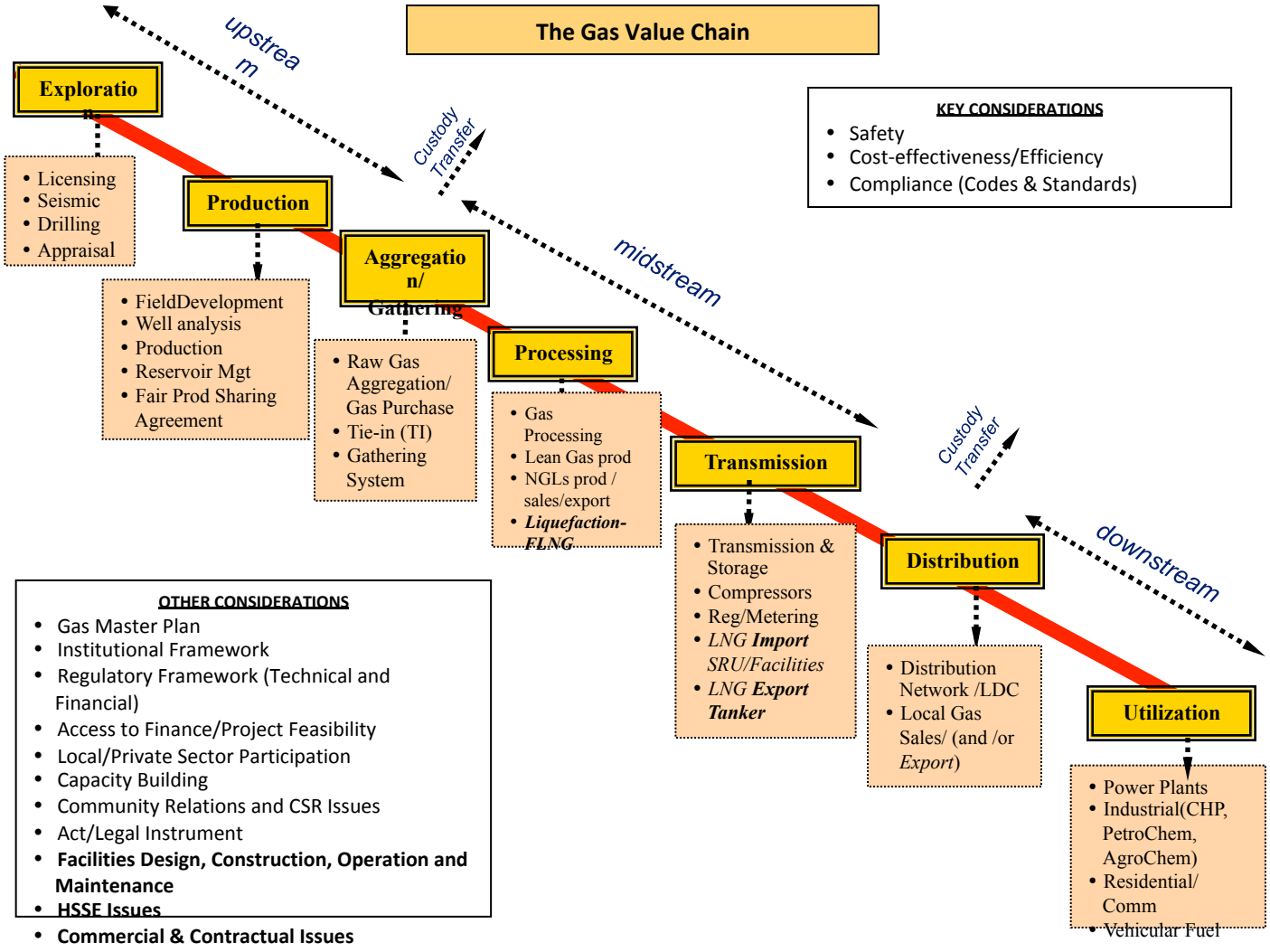
29TH Nov, 2021

for sustainable and cost-effective gas delivery for power and industry

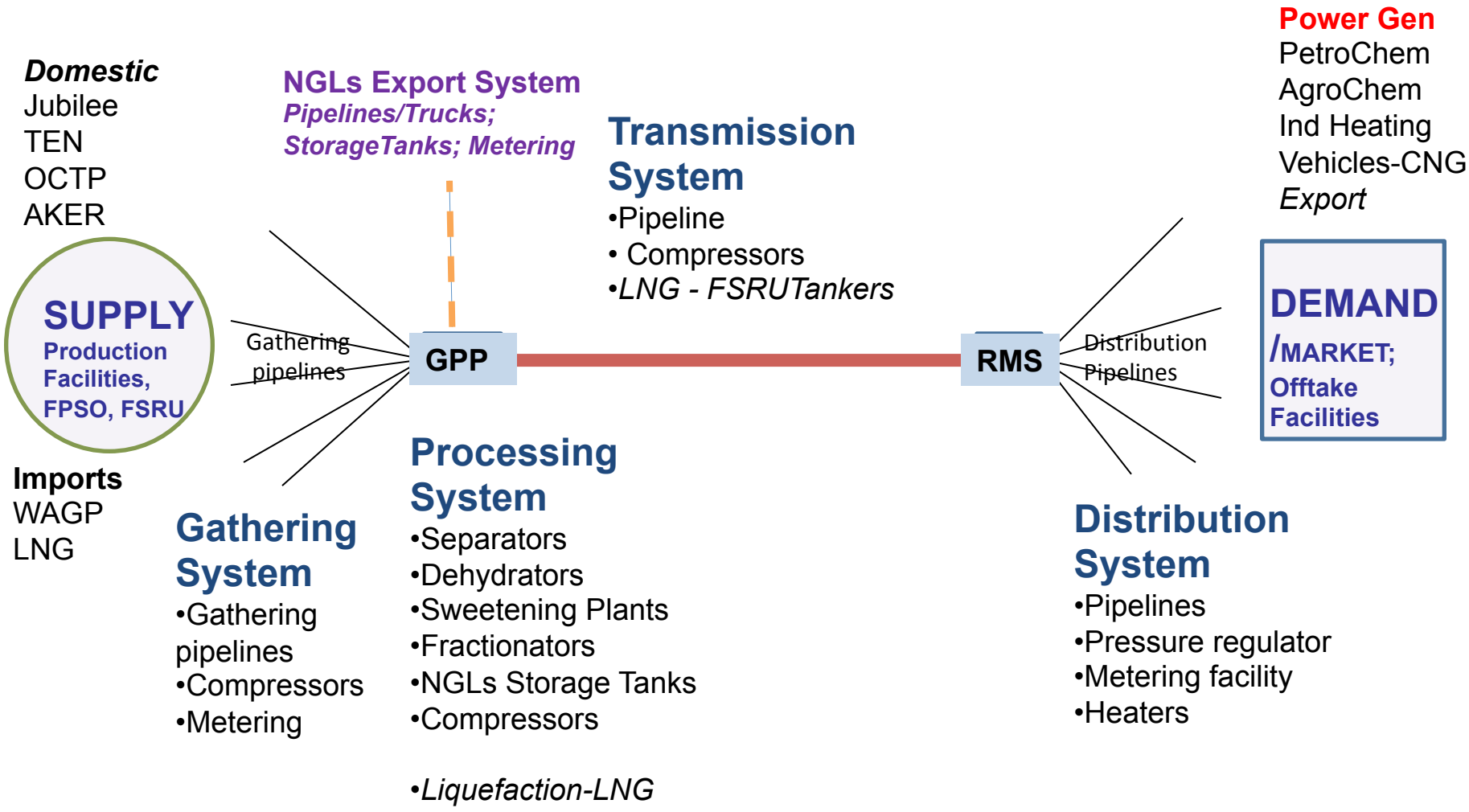
The Petroleum Sector Value Chain Streams



- Chain requires a continuous track of the *commodity*; discernible interface between *infrastructure* gates
- The **U-D model** is a discontinuous chain; with respect to the commodity
- The **U-M-D model** is a continuous chain; with respect to the commodity


The Gas Value Chain
upstream
midstream
downstream
Custody Transfer
Custody Transfer
Exploration
• Licensing
• Seismic
• Drilling
• Appraisal
Production
• FieldDevelopment
• Well analysis
• Production
• Reservoir Mgt
• Fair Prod Sharing Agreement
Aggregation/ Gathering
• Raw Gas Aggregation/ Gas Purchase
• Tie-in (TI)
• Gathering System
Processing
• Gas Processing
• Lean Gas prod
• NGLs prod / sales/export
• Liquefaction-FLNG
Transmission
• Transmission & Storage
• Compressors
• Reg/Metering
• LNG Import SRU/Facilities
• LNG Export Tanker
Distribution
• Distribution Network /LDC
• Local Gas Sales/ (and /or Export)
Utilization
• Power Plants
• Industrial(CHP, PetroChem, AgroChem)
• Residential/ Comm
• Vehicular Fuel
KEY CONSIDERATIONS
• Safety
• Cost-effectiveness/Efficiency
• Compliance (Codes & Standards)
OTHER CONSIDERATIONS
• Gas Master Plan
• Institutional Framework
• Regulatory Framework (Technical and Financial)
• Access to Finance/Project Feasibility
• Local/Private Sector Participation
• Capacity Building
• Community Relations and CSR Issues
• Act/Legal Instrument
• Facilities Design, Construction, Operation and Maintenance
• HSSE Issues
• Commercial & Contractual Issues

Ghana's Gas Industry – Value Chain



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Sustainable Fuel Supply & Delivery

Power Supply Portfolio – Thermal (60%); Hydro+Other Renewables (40%),
And when we talk about Power Generation for our Discussion today, we are indeed talking about Thermal Generation; and

So When we talk about **Sustainable Fuel Supply & Delivery**:

- **Supply** [represents Commodity; gas source] : Domestic, Imports
- **Delivery** [represents Infrastructure]: Processing, Gathering, Transmission, Distribution

- **Fuel Sources**: **Gas**; **Liquid Fuel** (*typically LCO, Diesel, HFO*)
- But **Fuel of Choice is Gas – Reasons: *Availability, Cost, Environment***

So Sustainable and Reliable Gas Supply and Delivery, is critical for a Sustainable and Reliable Power Sector & Industry– Given its Domestic Availability, Lower Cost and Environmental responsiveness

[Insert]

Gas Vrs Oil - Cost Savings for Takoradi Enclave

Power Required, MW		**1000**
Availability		85.0%
Days in period		30
Operating Hrs/period		612
GWh	for period	**612**
Thermal Efficiency		40.0%
BTU/kWh	Heat Rate=3412/Eff	8,530
MMBtu/d		**174,012**
GAS		**NGas**
Gas Rate, MMBtu/d		174,012
HV,Btu/scf		1100
Gas Flow,MMscfd		**158.19**
DeliveredGasPrice, S/MMBtu		**7.00**
Delivered Gas Cost, $/d		1,218,084
	$M/month	***36.54***
OIL		**C8**
Oil Reqd	MMBtu/d	174,012
Oil HV, Btu/lb		19097
Oil Density, lb/ft3		44.12
Oil HV, Btu/bbl		4.73
1 bbl =	5.614 ft3	
Oil Flow, BBLs/D		**36788**
Delivered Oil Cost, $/bbl		**70**
Oil Cost, $/d		2,575,160
	$M/month	***77.25***
Savings using Gas $M/month		**40.71**
	$M/year	**489**
Cost % Decrease using Gas		**111%**

Gas Vrs Oil - CO2 Emissions in Takoradi Enclave

For a linear alkane with n carbon atoms, the stoichiometry for complete combustion is

$$C_nH_{2n+2} + (3n+1)/2\ O_2 \longrightarrow n\ CO_2 + (n+1)\ H_2O + \text{Energy}$$

Total Power Generation in Takoradi Enclave – 1000 MW

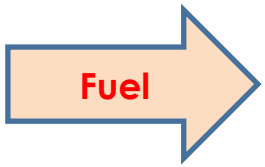
Gas

Gas Rate required	*168 MMscfd*
Tons/day of CO2 [produced]	*3,620*
CO2, Tons/year	*1,321,707*

Oil

Equivalent Oil Rate	*38,960 bbls/day*
Tons/d of CO2 [produced]	*22,834*
CO2, Tons/year	*8,334,374*

Elimination of Power Outages-*Dumsor* (3Fs)

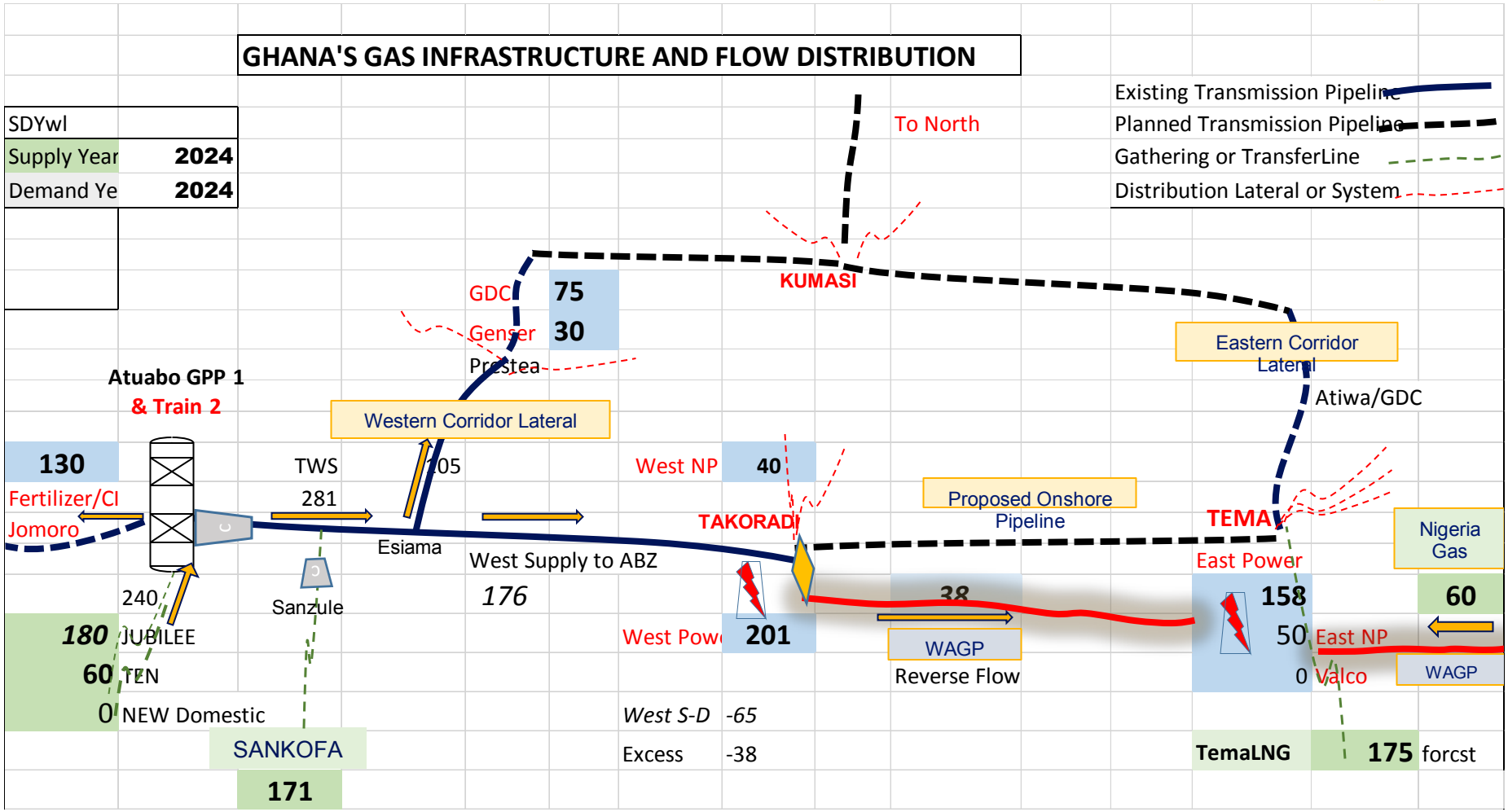


- Ensure adequate **Gas Supply** and security – Domestic and Regional;
- Ensure adequate reserve margin for protection for both planned and unplanned outages (MP) – GNPC/GNGC

- Ensure *availability* and *reliability* of **Gas Delivery Facilities:** Processing and Transportation. (HP) - GNGC
- Ensure *availability* and *reliability* of **Power Delivery Facilities**: Generation, Transmission and Distribution. (HP) –VRA/ GridCo/ECG

- Ensure availability of **Funds** to cover purchases for Fuel – Gas, & Liquid Fuel where required. (**LP**)
- Address debts owed Fuel Suppliers (MP) Commodity/Service Providers

Ghana Gas - Existing and Planned Infrastructure



Thank You!