



# GAS TO SHORE

APRIL 2021

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# Executive Summary

- i. This project has been underway since 2016; in 2020 when the PPP came to power, no major decisions had yet been made.
- i. This GOG immediately engaged Exxon and started negotiations in October 2020. By the end of 2020, the following key decisions were arrived at and publicly communicated:
  - a. Location of the termination of the gas to shore at Wales (determined to be the most economic solution). The selection of the location was critical to start the detailed studies such as the ESIA and the Geophysical and Geotechnical Studies (G&G) at a specific location versus 20 locations.
  - b. Increase in the minimum commitment of gas from 30 MCFD to 50 MCFD (equivalent to providing net 150 MW to providing net 250 MW).
  - c. Agreement on a timetable to achieve the project by 2024, with approximately the first 18 months to complete studies, complete engineering, and conducting a competitive tender for the construction of the pipeline
  - d. Broad agreement on the key financial considerations including:
    - i. Estimated outerlimit on the capital cost of the project
    - ii. Funding of the pipeline by Exxon out of Cost Oil
    - iii. Estimated cost per kwh delivered at the gate of the power plant at approximately 3.5 cents per KWH
  - e. Definition of the project to cover:
    - i. Construction of the pipeline by Exxon based on a competitive tender
    - ii. Natural Gas Liquids (NGL) that will allow GOG share of the NGL to be sold whereby such revenue expected to exceed the cost paid for the gas;
    - iii. Construction of a gas power plant (in phases)
    - iv. Layout of Wales Development Authority to cater for a large expansion covering all of the above plus residential development, mixed use, and industrial demand.

# PREVIOUS STUDIES

## SUMMARY OF STUDIES: ASSOCIATED NATURAL GAS

	Study	Entity	Summary of Study & TOR
1	Update of the Generation Expansion Study (2017)	Brugman SAS (IDB)	In 2014, the Inter-American Development Bank (IADB) commissioned an Initial Study on System Expansion of the Generation and Transmission System of Guyana with the objective of developing guidelines for the most adequate infrastructure for power generation and transmission in Guyana. In 2015, this study was updated at the request of the Government of Guyana to incorporate and consider the projected evolution of the national power system in light of regional initiatives. Having regard to the recent commercial discoveries, an update of the study is required. The purpose of this updated Study was to conduct a review and further analyze the further development of Renewable Energy in the country when the current expansion plan may change as a result of the potential use of domestic natural gas in electricity generation. The necessity of this update is further emphasized in the context of the future National Renewable Energy Strategy having considered the promotion of RETs, increasing the quality of energy access and reduction of Greenhouse Gas emissions.
2	Desk Study of the Options, Costs, Economics, Impacts & Key Considerations of Transporting and Utilizing Natural Gas from Offshore Guyana	Energy Narrative (MNR)	This study examined the options, cost, economics, impacts, and key considerations of transporting and utilizing natural gas from offshore Guyana for the generation of electricity. The primary objective of the study was to determine if offshore natural gas can be used to reduce electricity costs in Guyana. Supporting this primary objective, the study addressed the associated technical and operational challenges of using the natural gas, the associated costs and benefits of producing electricity with natural gas, and the long-term strategic fit between natural gas and renewable energy development.
3	Overall Feasibility Study for Guyana's Offshore Natural Gas Pipeline, LPG Separation Plant and Related electricity infrastructure (2018)	Energy Narrative (IDB)	The objective of this study was to update the desk study that was completed in June, 2017 and to determine the overall feasibility of the project as a whole, evaluated through each of the project components. The primary objective of this Study was to determine the overall feasibility of transporting natural gas from offshore Guyana, building an LPG separation plant to market the liquids from the natural gas stream, and building a new electricity generation station to use the remaining dry natural gas. This study further provided an overview of the economic and financial feasibility of the project overall and provide guidance for more detailed studies of the individual project components (natural gas pipeline, LPG separation facility, and electric power plant) that the Government of Guyana may wish to commission.
4	Gas to Power Feasibility Analysis (2019)	K & M Advisors (IDB)	Elaboration of a technical and economic feasibility study to for the development of natural gas use in electricity generation in Guyana. The study includes: (i) potential conversion of existing oil-fired generators to dual fuel operation (fuel oil/natural gas); and (ii) development of a new natural gas power plant with best technology generation options. Moreover, the study will identify and analyze related infrastructure, and technical and investment requirements including the onshore transport best option, power transmission system infrastructure, land availability for the new plant and gas purity requirements for power generation.
5	Oil and Gas Master Plan Final Report (2018 + 2019)	Mitsubishi/Chiyoda Corporation (MoFA)	This was not undertaken by Government directly. Objectives of this Study included development of the domestic industry, harmonization with Guyana's policy for a clean and green society, developing feasible oil and gas utilization for exporting to Central and South America region, quantification of the economic feasibility of the plans based on the oil and gas utilization.



# Location: Selection of Wales



## Evaluation criteria

Length of pipe
Community/thoroughfare crossing
Road access to site
Land cover suitability
Bridges/stream crossings
Site topography/roughness score
Soil and land conditions
Site accessibility via water
Distance of river travel to ocean
River is navigable by medium- or large-sized vessels
Construction and maintenance dredging requirements
Water quality (discharges)
Habitat type (natural vs modified)
Habitat quality
Mangrove crossing required?
Distance to support services
Potential for physical resettlement
Potential for economic resettlement
Vulnerable populations within 10 km of site
Population density within 10 km of site
Flood risk
Proximity to transmission

1. Exxon studied over 20 potential locations and performed a thorough evaluation
2. In the final analysis, two locations were ranked most suitable (Ogle (behind Eccles) and Wales Industrial. Ogle land was considered a lot more valuable (significant opportunity cost) and closer to major population areas.
3. Wales was selected due to the low risk of flooding, relatively low cost of land, suitability for planned development, location away from population centers, ability to construct (constructability), and overall economics.

# PROJECTED CAPEX

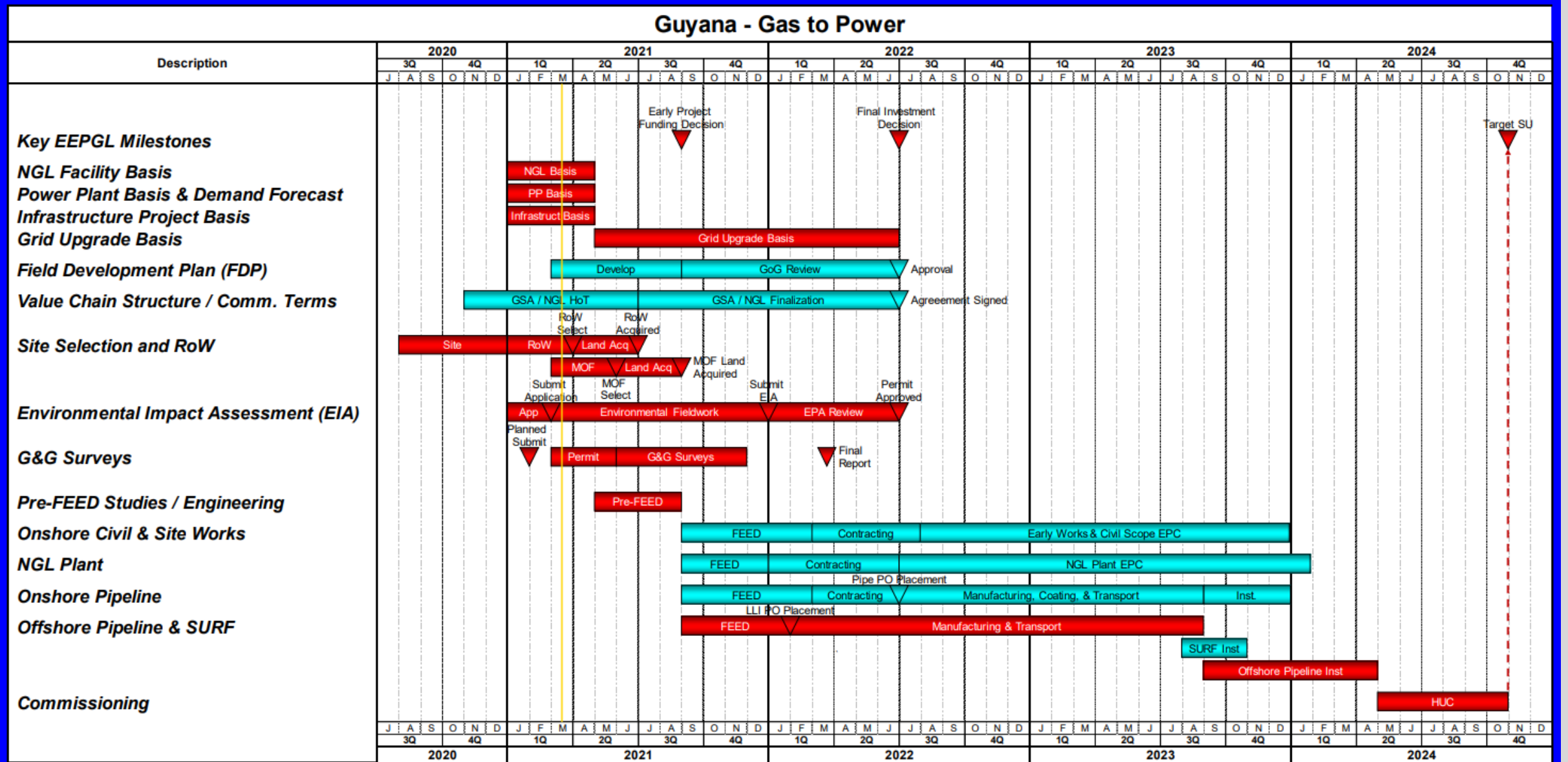
## ***Screening Level Cost Estimate***

<b>Component</b>	<b>\$M</b>
Offshore Pipeline & Riser	570-630
Onshore Pipeline	80-100
NGL / Gas Plant	120
Infrastructure	40-50
<b>Total</b>	<b>810-900</b>

# PRICE PER KWH

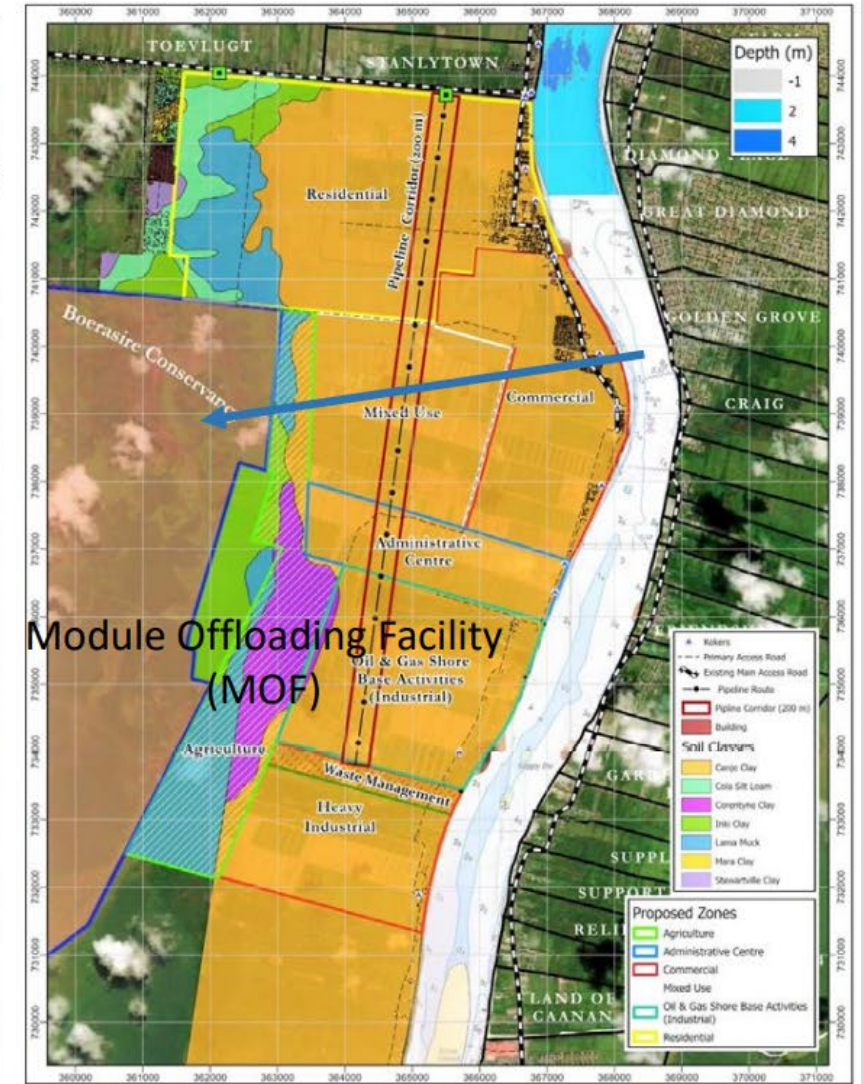
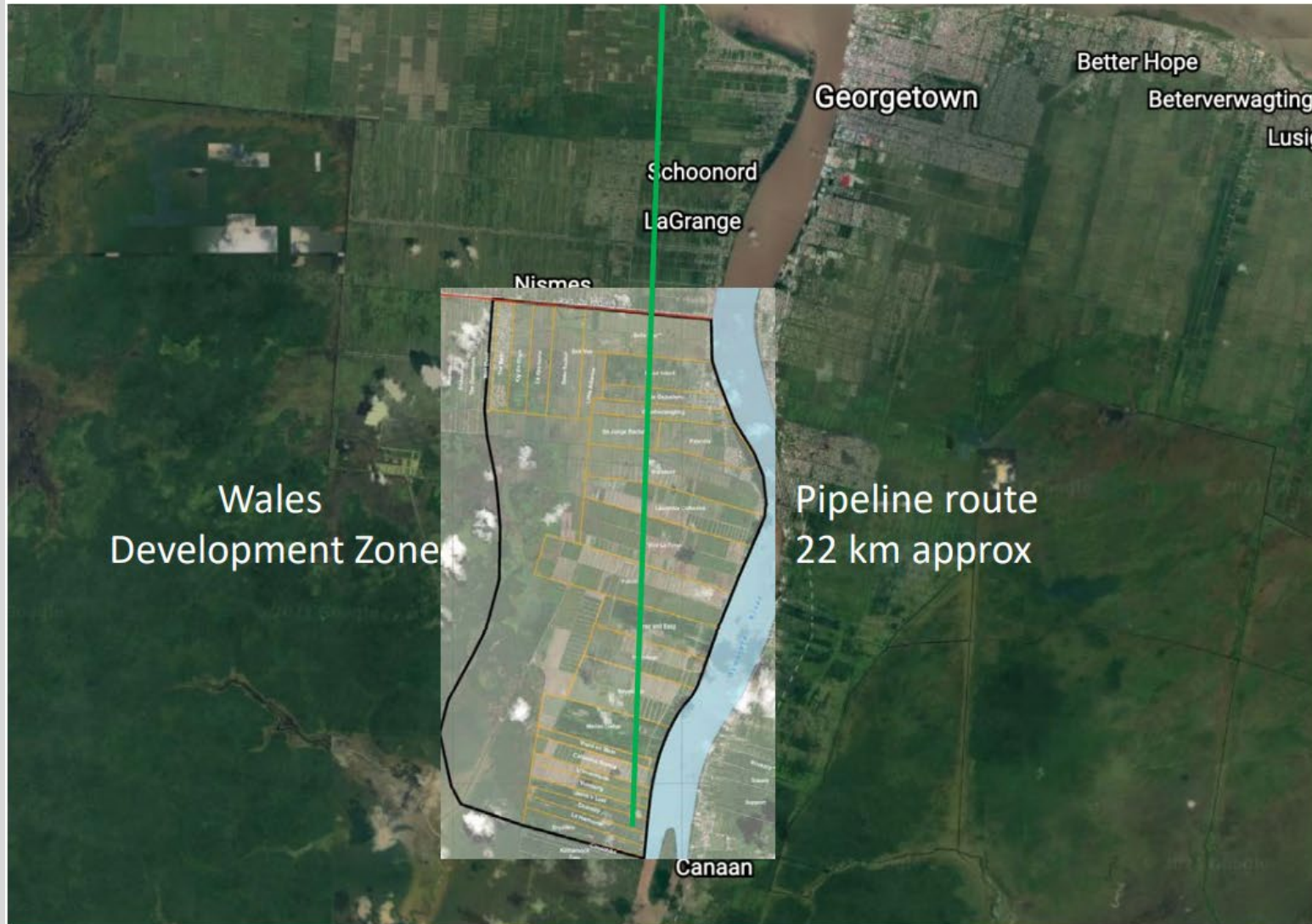
HFO Generation cost per kWh				NATURAL GAS Estimated costs per kWh		
HFO CIF Cost	per barrel	US\$	75.00	Natural Gas cost US\$	per mmbtu	4.00
Quantity of Imperial Gallons	per barrel	IG	34.9723	1 kWh requires	btu	3,412
HFO CIF Cost	per Imperial Gallon	US\$	2.14	WARTSILA engines conversion efficiency		40%
Fuel Efficiency	Imperial Gallons per kW	IG/MWh	0.05	To generate 1 kWh, WARTSILA engines requires	btu	8,530
				1 MMBTU of Natural gas, will therefore produce	kWh	117.23
Cost of Fuel		US cents per kWh	10.72	Cost of Fuel	US cents per kWh	3.41
Operation and Maintenance Costs		US cents per kWh	2.50	Operation and Maintenance Costs	US cents per kWh	2.50
Capital costs		US cents per kWh	1.00	Capital costs	US cents per kWh	1.00
		<b>US cents per kWh</b>	<b>14.22</b>		<b>US cents per kWh</b>	<b>6.91</b>
<b>ESTIMATED ANNUAL SAVINGS</b>						
250 MW Natural Gas Power plant	250	MW				
Hours per Annum	8760	Hours				
Utilization	95%					
KWh generated	2,080,500,000	kWh				
Annual Cost if HFO is used	295,904,772	US\$				
Annual Cost if Natural Gas is used	143,804,160	US\$				
<b>Annual Savings</b>	<b>152,100,612</b>	<b>US\$</b>				

# Time Schedule





# LAYOUT OF WALES DEVELOPMENT



# RENEWABLE POWER AND GAS

1. GPL DEMAND AND EXPANSION PLAN FOR 2021 TO 2026 PROJECTS BY 2026
  - Peak DEMAND >480 MW
  - LOAD of > 3000 GWH
2. GPL Energy mix assumes the following by 2026:
  - At least 250 MW from Gas
  - Amalia Falls Hydro Project of 165 MW
  - Other renewables—solar and wind.
3. IDB funded 2019 study concluded that gas vs HFO will reduce Guyana emissions from electricity by approximately half.

# CONCLUSION

1. Project has many studies dating back over the last 5 years
2. Final studies on G&G and Environmental ongoing by Exxon; to be completed by 2022.
3. Cost of gas at gate or power plant expected to be less than 3.5 cents per kWh
4. Overall cost of power from gas expected to be less than 7 cents; less than half of the current cost of electricity from HFO
5. GOG will derive revenue from natural gas liquids (NGL's) that will partially offset the cost of gas.
6. Wales Development will create significant additional investment in gas related investments
7. All components of the Project to be completed by 2024
8. Project will significantly reduce carbon emissions