

GUYANA: GAS TO POWER IMPLICATIONS



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Guyana: Gas to Power Implications

GLOSSARY OF TERMS

DBIS	Demerara-Berbice Interconnected System (Guyana's main electricity grid)
DE	Department of Energy
EEPTGL	Esso Exploration and Production Guyana Limited, local affiliate of ExxonMobil
GDP	Gross Domestic Product
GHG	Green House Gas
GPL	Guyana Power and Light Inc.
GTT	Guyana Telephone & Telegraph Co Ltd.
HDI	Human Development Index
HECI	Hinterland Electrification Company Inc.
HFO	Heavy Fuel Oil
IDB	Inter-American Development Bank
IMF	International Monetary Fund
KWH	Kilowatt-hour
LAC	Latin America and Caribbean
LCDS	Low Carbon Development Strategy
LCP	Local Content Policy
LNG	Liquefied natural gas
LPG	Liquefied petroleum gas
MMscfd	(MCFD) Million Standard Cubic Feet per Day
MSMEs	Micro, small, and medium sized enterprises
MW	Megawatt
NGL	Natural Gas Liquids
NRF	Natural Resource Fund
O&G	Oil and gas
PPA	Power Purchase Agreement
SMEs	Small and medium sized enterprises
SWF	Sovereign Wealth Fund

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EXECUTIVE SUMMARY

Guyana discovered offshore oil reservoirs in 2015, and the first barrel of oil was produced in December 2019. Guyana's new oil sector will transform the structure of the economy, including boosting Guyana's export earnings. Guyana has been here before with the exploitation of its other natural resources, but this has not translated into significant benefits for the people of Guyana. This time could be different, with Guyana's GDP per capita expected to increase from US\$6,953 per capita in 2020 to US\$15,153 per capita in 2023, and the country could become the world's largest oil producer in per capita terms by 2030. However, if the benefits are to be equitably distributed, significant investment in human capital and physical infrastructure is required, including within the hinterland and rural areas.

Guyana's plan to improve the reliability of its electricity and lower the cost of electricity through a gas-to-power project could be a critical pillar that ensures that the benefits of natural resource exploitation are broad-based this time around. The gas-to-power project has two phases:

1. A minimum of 50 million standard cubic feet of gas per day will be transported via the offshore to onshore pipeline by 2024, with a maximum capacity of 130 million cubic feet. The expectation is that the associated gas from this phase 1 will be utilized for power generation.
2. The second phase will start after phase one, with gas production expected to take the supply to 2040.

Although Guyana is following an overall low carbon development plan, the gas to power project can be an essential bridge to a low carbon future, since natural gas replaces more polluting hydrocarbons such as diesel and heavy fuel oil, while the country invests in and develops its renewable energy potential in hydropower, wind power, ocean power, and solar power.

The gas to power project could alleviate many worrying statistics that plague Guyana's electricity supply. These include the most power outages in the Caribbean (8 per month compared to 2 per month in Suriname), duration of outages (3.4 hours compared to 1.8 in Jamaica), and an estimated 1.6% of sale losses due to power outages compared to 0.3% in Suriname. Gas to power could reduce the cost of electricity from US\$0.25/0.36 per kWh to US\$0.06/0.07 per kWh.

Combining these benefits of the gas to power project and the overall growth in the economy from oil and gas production, it is likely that electricity demand will increase by 100% over the next decade (Brugman 2018)¹.

The gas to power project will have significant transformational benefits for Guyana:

1. Affordable, accessible, and more reliable electricity;
2. Economic diversification and job creation;
3. Savings in foreign exchange;

¹ Brugman, Burgman, Mejia, Rodriguez, & Vargas, "Government of thUpdate of the study on system Expansion of the Generation System - Final Report".

4. Environmental benefits

The gas to power project is expected to support diversification and a competitive economy. Investment in gas to power generation to lower electricity prices could foster development in new industries and sectors. The project also presents opportunities for investment and expansion in manufacturing, particularly in agro-processing and new products. This can support broad-based job creation and inclusive growth. As rents from the new hydrocarbon sector are spent, the currency could appreciate leading to Dutch Disease effects; however, investment in gas to power generation will lower electricity prices, potentially drive development in new industries and sectors, and offset these effects.

International and regional experience shows that there could be pitfalls as Guyana follows this development path. To avoid costly errors, including Dutch Disease, Guyana should consider the following policy imperatives:

1. Adequate grid infrastructure, policy, and legislative changes are required to ensure that all Guyanese benefit from the gas to power project.
2. Avoid gas oversupply and unnecessary government liabilities by ensuring that the fiscal incentives, purchase agreements for gas and power purchase agreements should be grounded in comprehensive demand and supply analysis.
3. Given the government's commitments under the Paris Climate Change accord and the desire to follow a low carbon development path, gas to power should be considered as a bridge to a low carbon future while renewable energy is developed.
4. Gas to power must benefit the most deprived populations living in the hinterland and rural communities, directly or financing decentralized grids.
5. Gas to power, including ancillary services and latent economic activity, should be compatible with the government's local content legislation.
6. Any adverse environmental and social implications from the project should be mitigated as far as possible.

CHAPTER 1: INTRODUCTION

Energy Context

For decades, the country has remained dependent on imports of liquid fossil fuels to satisfy its energy needs. The electricity sector in Guyana runs 97% on fossil fuels. As a net importer of liquid fossil fuels, Guyana is impacted by fuel prices' volatility, which puts further pressure on the country's fiscal expenditures. This dependence on imported fuel contributes in part to the high levels of debt to GDP and depletion of foreign reserves.

As a result of its dependence on expensive heavy fuel oil and diesel for electricity generation, Guyana faces unstable, unreliable, and high electricity and internet costs. The country currently ranks among the worst for electricity costs in CARICOM, with an estimated electricity cost of US 32 cents per kilowatt-hour (kWh)². This is eight times higher than the electricity rates in Trinidad and Tobago, another regional energy powerhouse, of US 4 cents per kWh. Guyana's electricity cost is also higher than the Average Electricity Rate in the United States of US 10.42 cents per kWh.

The major internet service provider is Guyana Telephone & Telegraph Co Ltd (GTT). GTT's internet packages range from US \$33 to US \$100 monthly, which is quite costly for many households and, thus is primarily accessible to middle and high-income households only. Additionally, GTT's coverage only spans the coastland region in Guyana. Therefore residents in the more rural and hinterland regions must use their phones and other internet service providers, which can be unreliable and expensive.

High electricity costs make it hard for many businesses, particularly energy-intensive industries, to thrive in Guyana as it ultimately restrains their profit margins. For example, the industrial sector, which consumes the most energy among the main economic sectors due to the heavy intensive production industries of raw materials, namely gold and bauxite, is heavily affected by high electricity costs³. Furthermore, the unreliability in electricity supply is a significant challenge for Guyanese businesses. Guyana's worst performance in the 2020 Ease of Doing Business Index is "Getting Electricity," ranking 170 out of 190 countries.

However, according to the IDB (2021)⁴, access to energy in Guyana has expanded over the last decade, increasing from 79% in 2008 to 92% in 2018, while over the same period in the LAC region, it increased from 90.5% to 96% and in the Caribbean as a sub-region it increased from 94% to 98%. Additionally, the gap in access to energy between urban and rural communities has narrowed, but the widespread use of generators to supplement transmission represents a significant economic challenge. More Guyanese businesses currently rely on generators for intermittent power than any other country in the CARICOM region.⁵ This results in higher costs for businesses, which are eventually passed down to consumers.

The high cost and unreliability of electricity have ultimately slowed economic development and private sector investment. The Government of Guyana has embarked on an ambitious

² International Trade Administration, "Guyana – Renewal Energy".

³ Wood & Rowena, "National Energy Efficiency Report of Guyana".

⁴ Inter-American Development Bank, "Caribbean Quarterly Economic Bulletin: Digital Infrastructure Development in the Caribbean".

⁵ Deakin, "Golden opportunity for Guyana's energy grid"

strategy to improve overall competitiveness and diversify the energy mix to reduce the cost of electricity and enhance the reliability of its energy supplies to its citizens and businesses. The government has crafted a Low Carbon Development Strategy (LCDS) to implement a comprehensive energy mix driven by hydro, wind, solar and natural gas produced by the oil production activities off-shore Guyana.

Guyana also seeks to minimize its carbon footprint and meet its climate goals by reducing its dependence on fossil fuels. According to Guyana's LCDS, if the electricity supply mix remains as it is today, greenhouse gas emissions will triple by 2027 and increase steadily thereafter. Thus, transitioning to renewable energies is a key priority for Guyana. If the LCDS' proposed energy mix is implemented, it is expected to transform the country energy consumption to 75% renewable by 2030.⁶

The country has an abundance of natural resource capacity which positions it to tap into more renewable sources of energy to meet its growing electricity demand, reduce its emissions footprint, and reduce its electricity costs. Specifically, the Government of Guyana has allocated GY\$29.4 billion (US \$141.2 million) to the energy sector in 2022⁷.

Natural Gas Overview

The offshore petroleum reservoir in Guyana is primarily developed for crude oil production. However within the deposits of crude oil are gas molecules, called associated gas, which range from light hydrocarbon molecules such as natural gas, to heaviest molecules (if present) in the form of liquefied petroleum gas (LPG)⁸. Currently the offshore block, called Stabroek block, is operated by Esso Exploration and Production Guyana Limited (EEPGL) and holds a 45% interest in the Stabroek block. Hess Guyana Exploration Ltd. holds a 30% interest, and CNOOC Petroleum Guyana Limited holds a 25% interest.⁹

Although the associated gas can be used, they require specific equipment to be captured and transported to market. Given the offshore location of Guyana's oil reserves and the lack of gas infrastructure, the natural gas available in the oil reserve has been treated as a by-product. Field development plans for the Stabroek block has called for the gas to be reinjected into the petroleum reservoir, which is a sound petroleum engineering practice,¹⁰ as it increases recovery rates of oil. However EEPGL has encountered problems in reinjecting the gas due to equipment issues, so in the interim the gas is simply burnt off in gas flares, commonly referred to as flaring. As of June 2020, 9 billion cubic feet of natural gas has been flared.¹¹ Beyond wasting the natural gas, a natural resource with commercial value, the process of flaring also emits carbon dioxide into the atmosphere without serving any functional purpose while further contributing to global warming. Nonetheless, these issues have since been rectified and since August 2021, at least 96 percent of associated natural gas has been re-injected¹².

⁶ Guyana Chronicle, "Energy diversification is key to national development".

⁷ Government of Guyana, "Guyana Energy Brief 2022"

⁸ Gazprom, "What is associated petroleum gas"

⁹ Davis, "ExxonMobil Boosts Potential for Guyana's Offshore Stabroek Oil, Gas Block to 10 Billion Boe"

¹⁰ Kleinberg, "Flaring of Natural Gas in Guyana: Why is it happening, and how can it be minimized?"

¹¹ Moe, "ExxonMobil says working 'fervently' to fix compressor issues - in order to cease gas flaring"

¹² Kaieteur News, "Exxon now using, re-injecting 96% of Natural gas from Liza Destiny"

Meanwhile, Guyana seeks to minimize its carbon footprint and meets its climate goals through reduction on its dependence on fossil fuels. According to Guyana’s Low Carbon Development Strategy (LCDS), if the electricity supply mix remains as it is today, greenhouse gas emissions will triple by 2027 and increase steadily thereafter. Thus, transitioning to renewable energies is a key priority for Guyana. The country has an abundance of natural resource capacity which positions it to tap into more renewable sources of energy to meet its growing electricity demand, reduce its emissions footprint, and reduce its electricity costs. Specifically, the Government of Guyana has allocated GY\$29.4 billion (US \$141.2million) to the energy sector in 2022.¹³

Against this backdrop, capturing the natural gas in the crude oil extraction so that it can be used to generate electricity through a gas to power system can significantly benefit Guyana and combat the existing challenges in the country’s energy sector. Using natural gas can dramatically reduce energy costs and increase the reliability and efficiency of energy for households and businesses in Guyana.

Gas to Power Project Overview

Natural gas can support and complement the process of changing the energy matrix towards renewable and sustainable sources. The gas will provide a cleaner alternative to the current energy mix and help meet immediate needs while renewable energy initiatives, to which the Government of Guyana remains committed, are pursued. The development of alternative renewable energies, such as solar, wind, hydropower, and biomass technologies, remains a key priority for the future growth of the energy sector in Guyana. Government of Guyana has committed to reducing the cost of electricity by at least 50% over the next five years (Budget 2022).

Estimates of gas reserve are in the range of 16 trillion cubic feet (Tcf), with projections of approximately 70 million (mn) standard cubic feet per day from the Liza 1 and 2 and Payara facilities (Budget 2022).

There are two phases to the gas to power project, with the first phase gas to energy project in Hermitage (part of the Wales Development Zone (WDZ)) expected to cost approximately US\$900mn. The first phase was advertised a second time for the prequalification of firms while ongoing geotechnical and geophysical works for both onshore and offshore operations at advanced stages. Initially, the project was envisioned as separate projects for the power plant and the natural gas liquids (NGL) plants, however, this vision has been revised and companies who had already submitted expressions of interest in September 2021 were asked to re-submit information that considered a combination of the power and NGL plants.¹⁴ In early 2022, new expressions of interest have been received for the project. According to the new pre-qualification advertisement²⁴, the broad scope of the project includes:

1. *Combined cycle turbines, multiple fuel consumption (including rich and lean natural gas, natural gas liquids and diesel) Power Plant to generate up to 300 MW of power with net 250 MW delivered to the Guyana Power & Light grid at a substation located on the East Bank of the Demerara River. The Project shall also include 230 KV substation and back up fuel capacity;*

¹³ Government of Guyana, “Guyana Energy Brief 2022”

¹⁴ (Government of Guyana, 2021)

2. NGL Plant with the capacity to process 60 MCFD in the first phase and up to 120 MCFD in the second phase, capable of conditioning the gas and removing heavier hydrocarbons in the liquid form. Five-day storage for these products to be provided as well as truck or river loading facilities;
3. The Project will include related infrastructure and civil works for the above facilities.

Forecasts and plans for the first product is expected by 2024. A minimum of 50 million standard cubic feet of gas per day is expected to be transported through the pipeline by 2024. The pipeline will have a maximum capacity of 130 million cubic feet. The associated gas from this phase 1 is planned to be utilized for power generation. Once the first phase comes on stream, the second phase will start, and that gas production is expected to take the supply to 2040 based on current estimates. Phase 2 associated gas is planned to be utilized for liquefied natural gas (LNG) production, depending on the capacity.¹⁵

According to the Gas Master Plan Update (2021), the Gas to Power solution is economically viable for Guyana, with the recommendations for a phased development (see Figure 1 below). The study does not identify a significant difference in the economics between onshore and floating gas to power plans, but recognize that the selection will depend on the site selection, complexity of permissions, manpower and other factors.²⁴

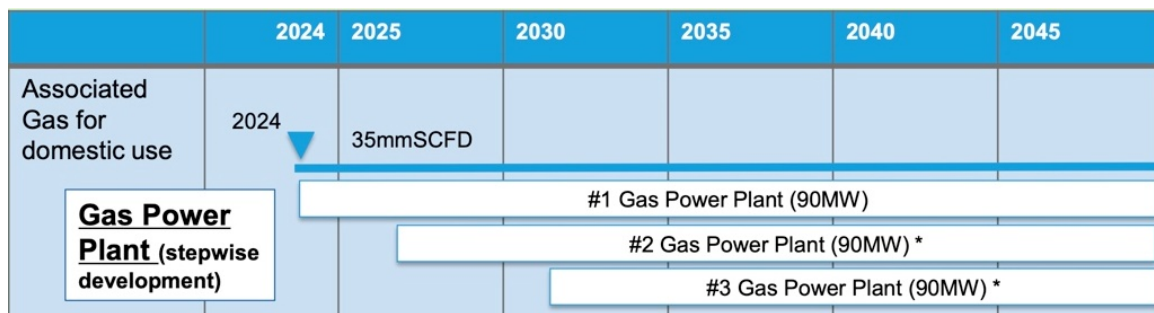


Figure 1: Proposed phased development for the Gas to Power solution

Source: Adapted from the Oil and Gas Master plan Update (2021)

¹⁵ Guyana Ministry of Natural Resources Petroleum Management Programme, “Republic of Guyana Oil & Gas Master Plan Update - Final Report”

CHAPTER 2: IMPLICATIONS OF SWITCHING TO GAS TO POWER

Guyana’s electricity sector is undiversified, expensive, unreliable, and does not contribute to reduction in carbon emissions. Over 90% of Guyana’s total energy is generated primarily from fossil fuels, a mix of diesel and heavy fuel oil (HFO). The remainder is derived from renewables, including wood and sugar cane residue (biogas)¹⁶. In 2020, approximately 92% of electrical generation was from fossil fuels alone (see Figure 2), which are expensive and environmentally harmful. The electricity industry is operated by the state-owned electricity company, Guyana Light and Power Inc. (GPL), with an installed operating capacity of 337 MW in 2020¹⁷. Expenditure on imported diesel and HFO for the electricity generation in the 12 public grids operated by DBIS and the Hinterland Electricity Company Inc (HECI) was approximately US \$100 mn in 2020¹⁸. DBIS is the largest grid and accounts for 78% of the total cost.²³ In addition, the system is widely inefficient, with approximately 25% of electricity being lost during transmission and distribution, due mainly to the quality of the infrastructure¹⁹.

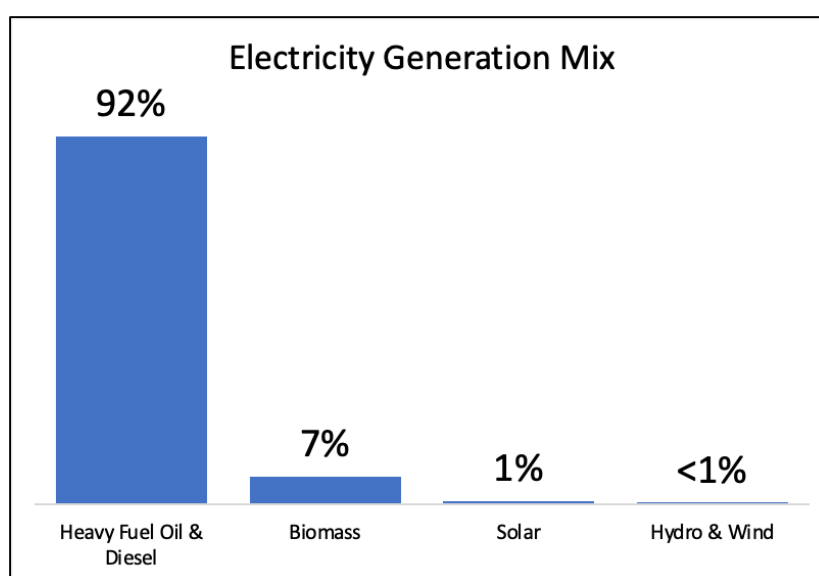


Figure 2: Guyana Electricity Generation Mix 2020

Source: gem.wiki

Guyana has some of the highest electricity rates in the Caribbean (see Table 1), which is an impediment to business competitiveness and growth. Amongst the factors identified as hindrances to business development and growth in Guyana, electricity was the most significant obstacle (Fiestas and Sinha, 2011; IADB 2018). Other factors included telecommunications, transportation, access to land, tax rates, tax administration, customs and trade regulations, labor regulations, labor workforce, business regulations, access to finance, cost of finance, political environment, and the informal sector (Fiestas and Sinha 2011; IADB 2018)²⁰.

This was also confirmed in the 2015-2016 Global Competitiveness Report and the 2014 PROTEqIN survey results, which shows that local firms ranked electricity as the most severe

¹⁶ OLADE, “Panorama energético de América Latina y el Caribe 2021”.

¹⁷ National Renewable Energy Laboratory, “Guyana: Energy Snapshot 2020”

¹⁸ Government of Guyana, “Guyana’s Low Carbon Development Strategy (LCDS) 2030”;
; Kaieteur News, “Guyana spent US\$100M for importing Heavy Fuel Oil and diesel in 2020 – LCDS Draft”

¹⁹ National Renewable Energy Laboratory, “Guyana: Energy Snapshot 2020”

²⁰ Pasha, Bollers, & Wenner, “Constraints Affecting Guyana’s Private Sector: Survey Results”; Fiestas & Sinha, “Constraints to private investment in the poorest developing countries - A review of the literature”.

obstacle to their operation. According to the survey (Figure 3), it takes an average of 104 days to obtain an electrical connection, significantly above the Caribbean average of 62 days. The firms surveyed also indicated that they experience an average of 8 power outages per month with an average duration of 3.4 hours, representing the highest number and duration of outages in the Caribbean. These factors contribute to losses of approximately 1.6% of annual sales, compared to the average of 0.7% across regional counterparts (IADB 2018).²⁰

Table 1: Select Countries Electricity Tariff as of June 2021 (per kWh)

Select Countries Electricity Tariff as of June 2021 (per kWh)		
Country	Household	Business/Government
Trinidad and Tobago	0.05	0.05
Suriname	0.02	0.07
2014 Antigua and Barbuda	0.15	0.17
Belize	0.22	0.17
Saint Vincent and the Grenadines	0.19	0.20
Bahamas	0.26	0.25
Dominica	0.21	0.26
Cayman Islands	0.31	0.27
St. Kitts and Nevis	0.26	0.28
Grenada	0.23	0.32
Saint Lucia	0.28	0.34
Guyana	0.25	0.36

Source: Energy Transitions Initiative (energy.gov); local information and electricity company websites

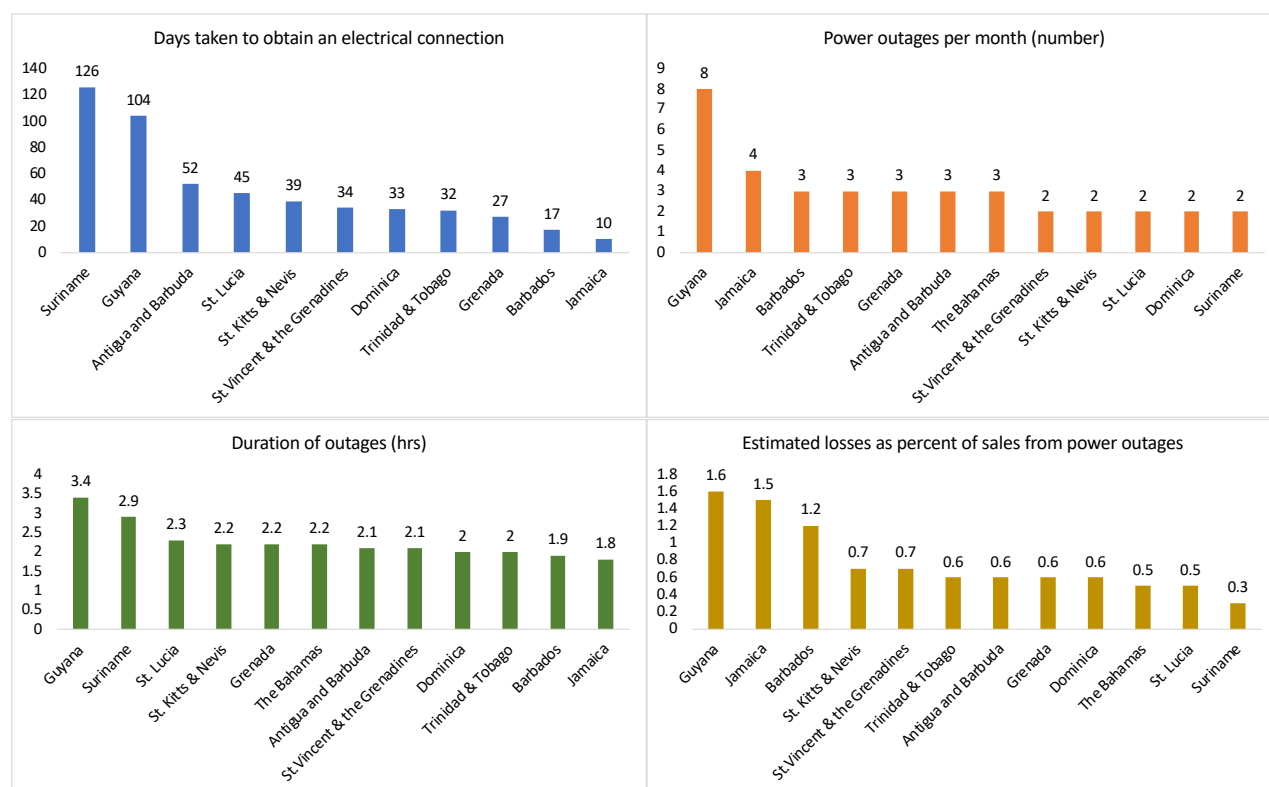


Figure 3: Select electricity indicators

Source: 2014 PROTEqIN survey

In addition to the challenges with regards to electrical infrastructure and reliability, a significant section of the population in the hinterlands and the interior region of the country outside the coastal area have little to no access to the electricity grid.

New Oil Industry’s Impact on Guyana GDP and Electrical Demand

Guyana’s GDP growth has increased as the new oil fields came into production in 2020 and new industries were created. The 20-year historical average real GDP growth for Guyana was 2.8% over the period 2000 – 2019. In 2020, real GDP growth of 43.5% was attributed to the first full year of oil production (see Table 2). That momentum was lost in 2021 due to the onset of the COVID-19 pandemic, although GDP growth was still estimated at 19.9%. Over the next 5 years (2022 - 2026), the average growth rate is projected to be 18.4%. The main economic impact of the oil sector is expected to filter through oil revenues, which will have a knock-on effect on public investment as it allows the government to invest in and upgrade critical infrastructure. Oil revenues could contribute to an increase in government revenues, moving from US \$270 mn in 2020, to an estimated US \$10 billion (bn) annually by the end of the decade (Rystad Energy, 2020)²¹. The impacts of such an increase in government revenues can be multifaceted, especially for a small population of less than 800,000. The public investment in both human and physical capital is expected to have positive impacts on inclusive growth and the removal of key constraints to conducting business. In addition, the growth of the oil and gas sector is also expected to affect the economy through the sector’s demand for services and infrastructure, and the associated job creations. One of the more immediate opportunities emerging from the burgeoning oil economy is developing a gas to power system utilizing the gas molecules that emit during crude oil extraction to supplement Guyana’s growing energy demands. This would also reduce the cost of doing business and carbon dioxide emissions to the environment, especially compared to the cost and environmental impact of using imported diesel and HFO as the main means of power generation.

Table 2: Select Caribbean Islands’ average GDP growth projections

Year	Antigua & Barbuda	Barbados	Grenada	Guyana	Jamaica	Suriname	Trinidad & Tobago
2020	-20.03	-18.0	-13.06	43.50	-10.05	-15.91	-7.85
2021	0.97	3.30	2.68	20.40	4.58	0.68	-1.02
2022	7.02	8.50	6.17	48.70	2.69	1.53	5.42
2023	5.58	4.80-	5.77	32.10	2.40	2.05	2.07
AVERAGE	-1.6	-0.4	0.4	36.2	-0.1	-2.9	-0.3

Source: World Economic Outlook, IMF 2022

²¹ Rystad Energy, “Guyana’s GDP to skyrocket in coming years as oil output gathers momentum”

The increase in economic activity is also expected to increase the electricity demand. According to demand forecasts analysis (Brugman 2016)²² and market analysis commissioned by the Government of Guyana, a significant growth in electricity demand is projected. Early projections point to more than a 100% increase in electricity consumption over the next decade (Brugman 2018)²³. When the discovery of oil and associated natural gas is factored in, the demand could be even higher. According to the Oil and Gas Master Plan Update (see Figure 4), the power demand forecast has been revised upwards from a 3% annual growth rate to 5% annually (under a high case scenario)²⁴.

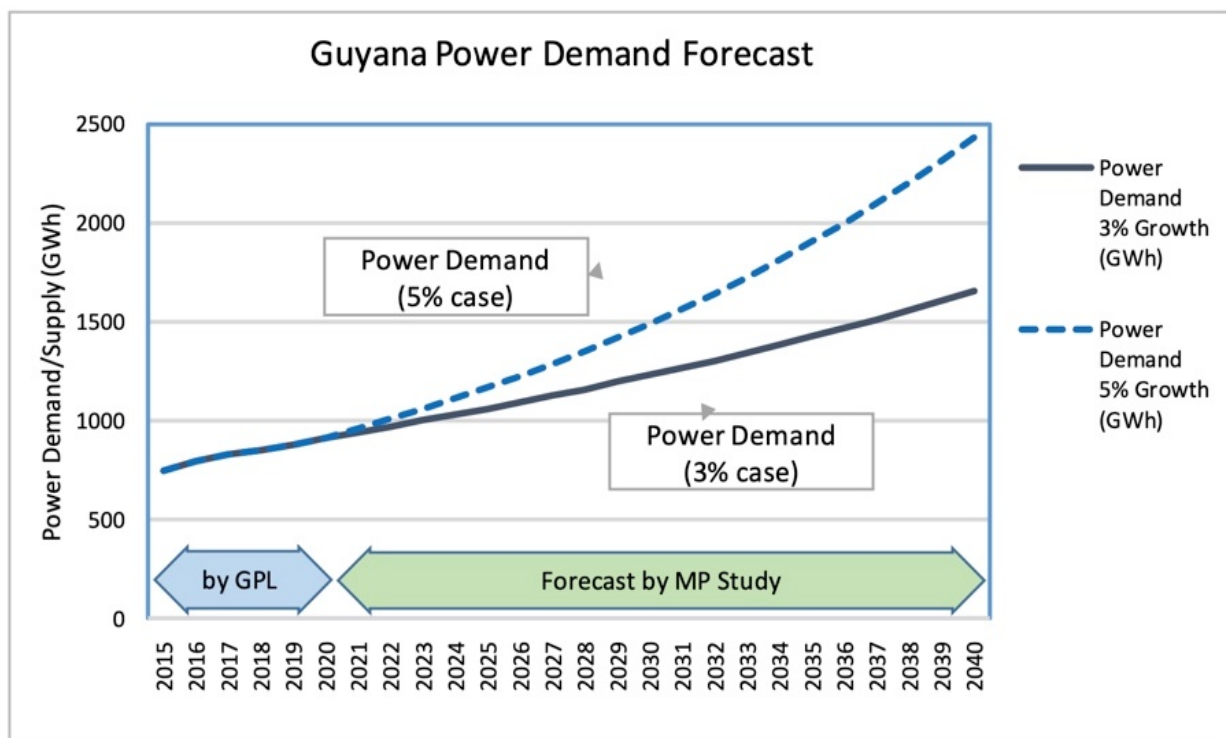


Figure 4: Guyana Power Demand Forecast
Source: Oil and Gas Master Plan Update 2020

Gas to Power

The gas power plant can be built to be a dual-fuel power plant that can burn both natural gas and diesel, thus accommodating disruptions in natural gas supply and delivering reliable power flexibly.²⁵ The use of natural gas, once it is brought onshore, would also serve as a “bridge fuel” by providing a constant supply of electricity while Guyana pursues its transitions to a fully renewable energy mix. Using natural gas can supplement any shortfall in the supply and storage of hydropower, wind, and solar energy while the technology is still being developed.

²² Brugman, “Study on System Expansion of the Generation and Transmission System of Guyana”.

²³ Brugman, Burgman, Mejia, Rodriguez, & Vargas for the Government of the Cooperative Republic of Guyana “Update of the study on system Expansion of the Generation System - Final Report”.

²⁴ Government of Guyana, “Republic of Guyana Oil & Gas Master Plan Update - Final Report”

²⁵ Afework, Hanania, Jenden, Stenhouse, & Donev, “Natural gas power plant”

The reliable supply of electricity is critical to yield the economic benefits, as will be further discussed in the following chapter.

EEPGL’s latest gas production profile information for Liza-1, the first development phase of Liza oil field located in the Stabroek Block, confirmed the availability of ~50 million standard cubic feet per day (MMscfd) of natural gas for commercial sale over a 15-20 year period. Feasibility analysis has considered two natural gas supply cases based on the most recent supply profile and natural gas composition data provided by EEPGL: a lower case averaging 30 MMscfd from 2022 until 2041, and a higher case averaging 50 MMscfd for the bulk of the study period. Based on feasibility studies for the development of the gas to power project, preliminary estimates indicate that the cost of electricity will be reduced to approximately US 0.06-0.07 cents per kWh (see Table 3 below).²⁶

Table 3: Estimated Tariff – Base Demand Case

Power Selling Price for 15% IRR (cent/kWh)			
Study Conditions	Power Demand Forecast	Base Demand (3% growth)	
		Fuel Gas Price	Base Price (4\$/MMBtu)
On-shore	Gas Max	7.02	6.26
Floating	Gas Max	7.11	6.34

Source: Oil and Gas Master Plan Update 2021

²⁶ Government of Guyana, “Republic of Guyana Oil & Gas Master Plan Update - Final Report”

CHAPTER 3: MACROECONOMIC AND SOCIAL ANALYSIS

The gas to power project in Guyana has significant transformational opportunities, particularly in that natural gas is a cheaper, more reliable, and cleaner source for electricity. The expected economic benefits are as follows:

5. Affordable, accessible and more reliable electricity;
6. Economic diversification and job creation;
7. Savings in foreign exchange;
8. Environmental benefits

“As a new oil and gas producer and the country with the 17th largest oil reserves in the world to date, the oil and gas sector promises to be the driver of historically high levels of growth in the Guyanese economy with strong positive spillovers into the non-oil economy.” - President Dr. Irfaan Ali, Budget Statement 2022.

Affordable, accessible, and more reliable electricity

Cheaper and more reliable electricity will be beneficial to both households and businesses. A reduction in the cost of electricity by more than half from over US \$0.30 per kWh to an estimated US\$0.06 to US\$0.07 per kWh, will reduce the cost of doing business and the cost of living.²⁷ According to the IMF, switching to gas and reducing electricity costs could reduce Guyanese residents’ basic living costs by over 5% per month on average.²⁸ Despite its abundant natural resources, Guyana’s per capita GDP in 2018 was just under US\$5,000, and its national poverty headcount rate was among the highest in the Caribbean region at 43.4%.²⁹ For remote communities and different ethnic groups, natural gas would present an alternative to diesel for electricity generation in the hinterlands. This would help reduce the cost of electricity in rural communities, with the option to also subsidize fuel delivery cost in rural communities. Approximately 75% of the population lives in rural areas, and over 80% of the poor population are found in rural communities.³⁰ Rural coastal areas are home to a large share of Indo-Guyanese that are in the agricultural sector, while indigenous Amerindian-Guyanese mostly live inland and are primarily engaged in smallholder agriculture, forestry, craftwork, mining, and traditional livelihoods (World Bank 2020). Therefore, access to affordable and reliable energy is an important component to improving livelihoods and creating opportunities for the poor and vulnerable. Poverty is especially concentrated in the country’s rural interior, with high poverty rates among the indigenous communities. Limited infrastructure in the interior regions, due partly to access to electricity, has affected the availability of health care, education, and other critical services. A gas to power project is expected to improve the availability and quality of social services in many communities. Based on current population

²⁷ Government of Guyana, “Energy costs could be reduced by 80%”

²⁸ Guyana Chronicle, “Gas-to-power feasibility in Guyana”

²⁹ The income poverty headcount rate, measured at US\$5.50 per person per day in 2011 purchasing-power-parity terms, based on the Labour Force Survey 2017.

³⁰ World Bank, “A Pivotal Moment for Guyana : Realizing the Opportunities - Systematic Country Diagnostic Report”

growth rates, Guyana's per capita GDP is projected to exceed US\$16,900 by 2030, enabling the country to reach close to high-income status.³¹

The addition of 250MW of power to the national grid has the potential to catalyse industrial development.³² The lower electricity prices would make the Guyanese economy more competitive and stir growth in new businesses, especially in small and medium-sized enterprises (SMEs). It could also provide an incentive for new productive industries, including light manufacturing, agro-processing, and other industries that depend on reliable and affordable electricity. As a low-cost fuel, natural gas can also support new industrial development, including adding value to bauxite and other raw materials currently produced in Guyana.

“The price paid by Guyana for kilowatt per hour of electricity could be reduced by about 80 percent when the proposed gas-to-energy project comes on stream,with estimates showing that Guyana could pay as low as six to seven cents per kilowatt of power depending on the structure of financing and the ownership of this project” - Vice-President Bharrat Jagdeo³³

Economic Diversification and Job Creation

“One of the key areas in which the proceeds from oil and gas can contribute to bolstering the diversification of other industries is through investment in energy-generating initiatives... and drastically reduce the cost of energy in Guyana and the wider region.” - President Dr. Irfaan Ali.³⁴

The gas to power project will encourage and promote economic diversification and job creation, and foreign exchange earnings. This will mitigate adverse impacts of real exchange-rate appreciation from the booming oil economy. In addition, Guyana has long struggled to transform its resource wealth into inclusive growth and reducing poverty rates, as reflected in decades of relatively jobless resource-driven growth³⁵. Traditionally, Guyana's economy has been focused on primary commodities, with economic activity concentrated mainly in the agricultural and mining sectors. While agriculture employs most of Guyana's workforce, it is especially significant to livelihoods for poor households. The main foreign exchange-earning crops are sugar and rice, and a limited level of agro-processing, which includes rice milling and the production of molasses and rum. Other exports include timber and ocean shrimp, and a small textile and traditional crafts subsectors. Therefore the gas to power project presents opportunities for investment and expansion in manufacturing, particularly in agro-processing and new products.

While bauxite mining has been an economic mainstay in addition to the reserves of gold, diamonds, manganese, and other valuable minerals, there is little value added in Guyana. Gold ore, bauxite ore, and alumina are all exported. Costly and unreliable electricity supply has

³¹ World Bank, “A Pivotal Moment for Guyana : Realizing the Opportunities - Systematic Country Diagnostic Report”

³² Government of Guyana, “Budget Speech 2021 - A Path of Recovery, Economic Dynamism and Resilience”; Guyana Chronicle, “Gov't receives pre-qualification bids for gas-to-energy project”

³³ Government of Guyana, “Energy costs could be reduced by 80%”

³⁴ Guyana Chronicle, “Oil and Gas sector to fuel economic diversification”

³⁵ World Bank, “A Pivotal Moment for Guyana : Realizing the Opportunities - Systematic Country Diagnostic Report”

hindered any sophisticated mineral processing or other forms of energy-intensive manufacturing, which has resulted in a limited industrial base.

A diverse and competitive private sector, which can be attained with the gas to power project, can support broad-based job creation and inclusive growth. This will enable the meaningful participation of Guyana's diverse communities and citizens. However, the binding constraints to private-sector development is increased participation of micro, small and medium sized enterprises (MSMEs). Local innovation and the adoption of new technologies will help to facilitate and accelerate the growth of vital job-creating, business-enabling subsectors such as finance and logistics. Furthermore, booming sectors in construction, with the increased accommodation room stock (including hotels and guest houses), will generate other ancillary support sectors which would benefit from the reduction in electricity costs, as well as an improvement and predictability in electrical supply.

While there are new employment opportunities in the current oil production industry, it is usually in the more technical areas such as engineering, in which these positions are likely to be filled by expatriates in the foreign oil companies. However, providing a gas-to-power system has the potential to create local employment benefits. Building the new gas power plant will create construction-related employment in the development stage. This includes jobs to build infrastructure, including a pipeline to bring natural gas onshore, new gas power plants, and gas-powered generation. The construction jobs from the gas-to-power project will provide opportunities for generally a less-skilled Guyanese labor force, while investment is made in education to upskill the labour force in the more technical positions in the oil and gas industry. Evidence from the mining industry boom between 2006 and 2017 has shown that sustained job creation was not a major benefit from that industry (World Bank 2020). Rather, employment shifted to public sector employment while the agriculture sector continued to absorb labor, albeit at low wages (World Bank 2020). This is partly due to the effects of Dutch disease, which saw a reduction in the country's competitiveness from the appreciation in the exchange rate due to the increase of mining export revenues. The gas to power project can reverse that effect with the prospects for new business growth, creating employment in other areas, and investment in education to upskill the labour force.

While the new oil economy has created an immediate boom to job creation, as stated above, the increase of oil export revenues could severely undermine the competitiveness of other sectors. Investment in gas to power generation to lower electricity prices could drive development in new industries and sectors and offset the Dutch disease effect. Approximately 3,850 direct jobs and 23,100 indirect jobs (0.7 and 3.9 % of the workforce respectively) are expected to be created by 2025 (World Bank 2020).³⁶ When this is combined with the potential of the gas sector expansion and other derived benefits, the impact on employment could be significant. However, these jobs must be sustainable and inclusive. While the Government of Guyana has adopted a prudent approach to the development of local content³⁷, the job-creating

³⁶ World Bank 2020. Guyana's working-age population (ages 15 and above) is projected to reach 595,000 in 2025 (UN Population). These estimates are for five floating production, storage, and offloading facilities and one non-Stabroek project. The multiplier effect for indirect job creation is six, which is based on data from Mozambique (<https://www.theigc.org/blog/multiplier-effect-mozambiques-natural-gas-discovery-fdi-bonanza/>)

³⁷ The local-content policy aims to provide for the implementation of local content obligations on persons engaged in petroleum operations or related activities in the oil and gas sector. It is designed to promote backward linkages between the oil sector and the non-oil economy. The policy is informed by international experience, the novelty of the country's oil sector, the limitations of the domestic labor market, and the country's undeveloped industrial base. It prioritizes Guyanese nationals and companies in the procurement of goods and services, and enables local capacity development.

potential of the oil sector is limited by its capital- and skill-intensive nature. The benefits deriving from the gas to power system will provide a wider range of opportunities for inclusivity. For example, reducing electricity prices and improving electricity reliability will help the relatively small, undiversified manufacturing base in Guyana better cater to the wide range of sophisticated inputs that the oil sector requires. In 2019, spending by oil companies accounted for almost 2.5% of GDP and created over 1,700 jobs with only 250 petroleum-related service jobs.³⁸ The oil sector has had a significant spinoff impact on the travel and hospitality industries, boosted wages for workers with specific skills, and created valuable new opportunities for Guyanese firms and entrepreneurs (World Bank 2020). The gains of the gas to power system will help to amplify these benefits.

While the international experience highlights the limited employment potential of offshore oil production in comparable countries, Guyana has a unique opportunity due mainly to the relatively underdeveloped private sector and the possibilities of the gas to power system. In Trinidad and Tobago, where the oil and gas sector is more well-developed, the sector accounts for over 32 % of GDP but only 3.4 % of employment (see Table 4).

Table 4: The Global Experience with Job Creation in the Oil and Gas Sector (extracted from World Bank 2020)

Country	Population (millions)	Contribution of the oil and gas sector (%)		Year
		GDP	Employment	
Equatorial Guinea	0.99	78.0	4.0	2011
Iraq	34.4	65.0	1.0	2014
Timor-Leste	1.2	48.0	2.0	2016
Trinidad& Tobago	1.4	32.1	3.4	2016
Norway	5.2	15.0	5.0	2018
Ghana	27.2	6.0	0.02	2014

Source: EITI, IFC, ILO, AfD

³⁸ World Bank 2020 - in 2019, oil-related jobs employed 0.5 % of the labor force from the current 2 oil fields; with more oil fields under development, this is likely to increase

Foreign Exchange Savings

Savings in foreign exchange is another benefit from the gas to power project. In 2021, approximately \$500mn was spent on importing fuel oil (67.2 % of total net hard currency payments). Using natural gas for power would reduce the need for imported fuel; these savings in foreign exchange will enable Guyana to build reserves. Meanwhile, high-value mining exports, and now the export of crude oil, will continue to put upward pressure on the real effective exchange rate. This will further weaken the competitiveness of firms in non-resource tradable sectors and undermine the development of more sophisticated forms of agriculture and manufacturing. However, the gas to power system could counter some of these impacts by increasing the competitiveness of firms as it relates to the cost of doing business aspect. Evidence from the mining sector between 2006 and 2017 shows that while the sustained growth of the capital-intensive mining sector yielded limited employment creation, the real exchange rate appreciation over that period damaged the manufacturing sector's competitiveness (World Bank 2020).

In 2021, Guyana's current account deficit moved up to US\$1.5 bn from US\$823 mn in 2020 on account of the importation of a second floating production storage and offloading vessel.³⁹ Crude oil exports accounted for 68.4% of all export receipts in 2021 which contributed to an increase in total export earnings from US \$2,590 mn in 2020 to US \$4,352 mn.⁴⁴ The surplus on the overall balance rose by 24.4% to US\$130.2 mn in 2021. Meanwhile, gross international reserves grew to US\$810.8 mn, equivalent to 1.4 months of import cover.⁴⁴

Environmental Benefits

The gas-to-energy project represents the most environmentally sustainable option for Guyana. Guyana's current strategic plan envisions moving closer towards 100% renewable power supply by 2025. While natural gas is still a fossil fuel, it emits less carbon dioxide than diesel and fuel oil and serves to supplement renewable alternatives as the country moves closer to that transition target. Based on current estimates of electricity generation from natural gas, it is anticipated that Green House Gas (GHG) emissions will reduce by half with the electricity generation in the main DBIS plant alone by 2025.^{40;46}

According to K&M Advisors (2019)⁴¹, the new Natural Gas power plant will replace most of existing HFO generation. The environmental benefits resulting from the new gas plant are:

1. A reduction of greenhouse gas (GHG) emissions from power generation, due to the comparatively lower carbon content of Natural Gas. The total GHG emissions reduction for a period between 2023 and 2035 expressed in tonnes of carbon dioxide (CO₂) equivalent (CO₂-e) are estimated at approximately 8.7 mn tonnes for the 30 million standard cubic feet per day (MMscfd) gas supply scenario and 6.1 mn tonnes for the 50 MMscfd gas supply scenario;
2. A significant reduction of sulphur oxide (Sox) and nitrogen oxide (Nox) contaminant emissions. The amount of SO_x emissions reduction between 2023 and 2035 are approximately 198,000 and 200,000 tonnes for 30 and 50 MMscfd gas supply scenarios,

³⁹ Government of Guyana, "Steadfast Against All Challenges, Resolute in Building Our One Guyana-Budget Statement"

⁴⁰ Guyana Chronicle, "More gas-fired power plants to drive down costs, emissions"

⁴¹ K&M Advisors, "Gas to Power Feasibility Assessment in Guyana. Final Report"

respectively. Similarly, the NO_x emissions are reduced by 58,000 and 47,000 tonnes for the 30 and 50 MMscfd gas supply scenarios, respectively;

3. The economic benefit due to reduction in emissions for a period between 2023 and 2035 is estimated, depending on the technology and available gas quantities, between approximately US\$150 and US\$234 mn due to greenhouse gas reductions and between approximately US\$70 and US\$80 mn due to NO_x and SO_x emission reduction.

CHAPTER 4: PUBLIC POLICY ASSESSMENT

The O&G sector activities in Guyana are subject to a number of different legislative tools and policies including (see Figure 5 below):

1. The Guyana Energy Act 1997
2. The Public Utilities Commission Act (PUCA)
3. The Electricity Sector Reform Act of 1999, amended in 2010
4. The Hydro Electric Power Act of 1953
5. Petroleum (Production) Act of 1938,
6. Petroleum (Exploration and Production, E&P) Act, Cap. 65:10 of 1986 and related Regulations of 1986
7. The Upstream Legal Requirements for Petroleum (2004)
8. The Guyana Geology and Mines Commission Act
9. The Mining Act
10. The Environmental Protection Act 1996
11. The Occupational Safety and Health Act
12. The Model Production Sharing Agreement (1986).

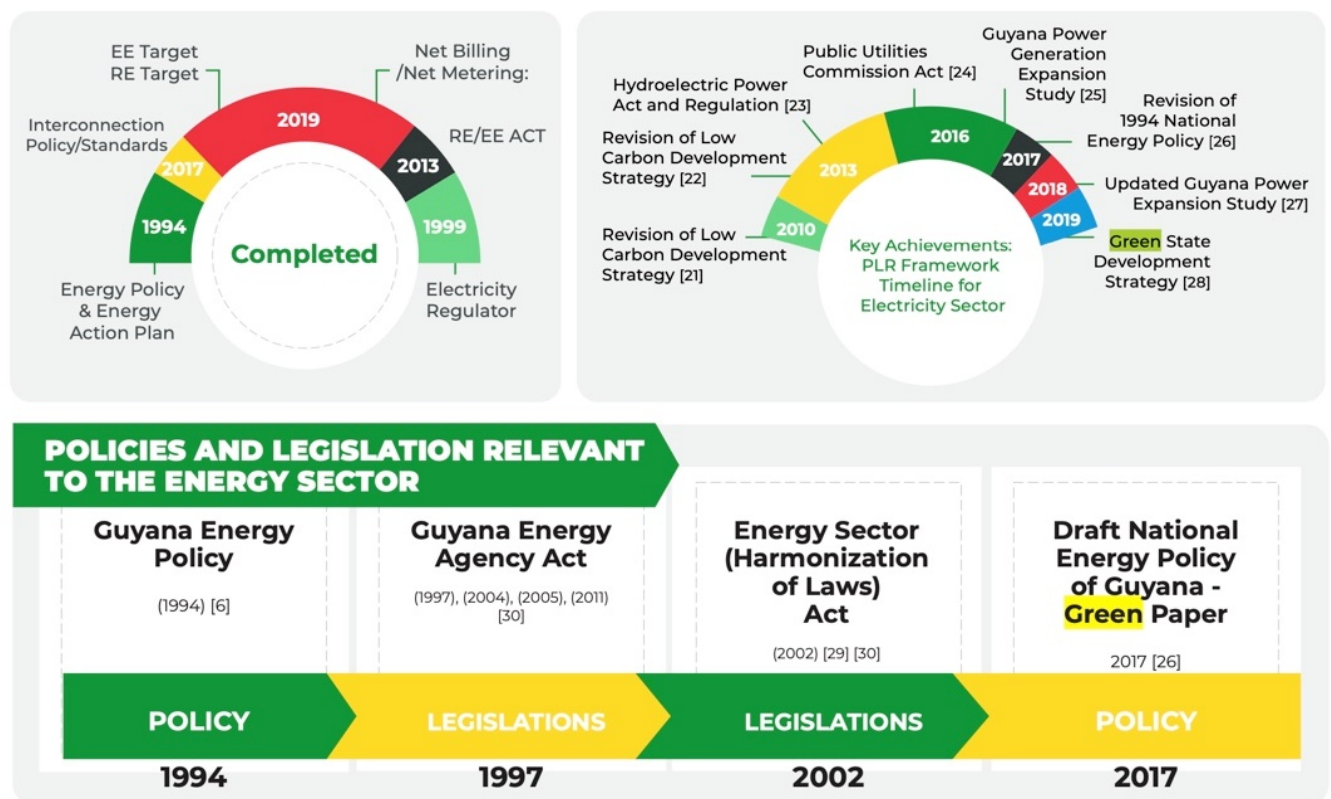


Figure 5: Policy, Legal and Regulatory (PLR) Framework

Source: Adapted from 2020 Energy Report Card -Guyana⁴²

⁴² Caribbean Centre for Renewable Energy & Energy Efficiency (CCREE) , “2020 Energy Report Card – Guyana”

In terms of stakeholders in the energy sector, there is a wider cross-section which will be key to the success of the Gas to Power project (see Figure 6 below).

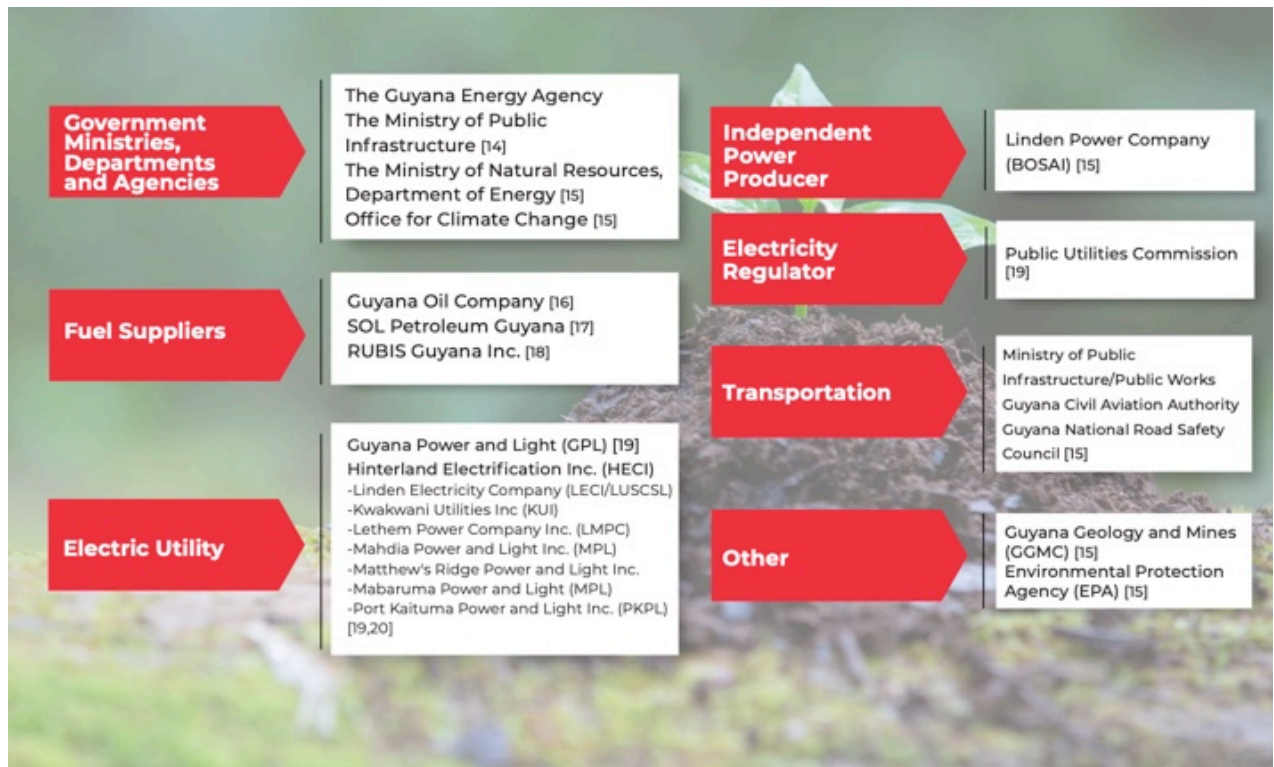


Figure 6: Key Energy Stakeholders

Source: Source: Adapted from 2020 Energy Report Card -Guyana⁴³

The Guyana Green State Development Strategy (GSDS) and the 1994 Guyana Energy Policy set out the policy objectives for energy supply in Guyana, including the electricity sector. Most of these pre-date the discovery of oil and gas, so the policy objectives are outdated and need to be adjusted to support the enhancement of the transparency, governance, legal, regulatory and institutional frameworks for the oil and gas sector in Guyana. Some of the critical areas which need further development (see Figure 7) include those that guide the legal and regulatory frameworks for oil revenue management, licensing, models (PSA), local content, and Health, Safety, Environmental and Social (HSES) management.

⁴³ Caribbean Centre for Renewable Energy & Energy Efficiency (CCREE) , “2020 Energy Report Card – Guyana”

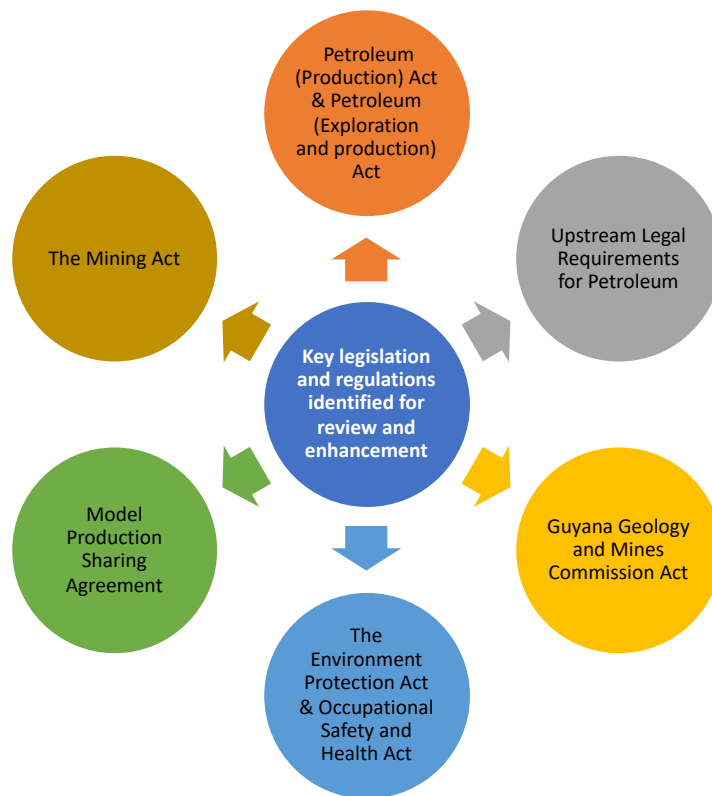


Figure 7: Key legislation and regulations identified for review and enhancement

Source: Guyana Energy Brief 2022⁴⁴

According to K&M (2019), the electricity regulations and the Guyana Power Limited (GPL) the GPL National Grid Code will require an update after the contract has been awarded for the plant construction of the gas to power project. However, no immediate updates are envisioned to the current electric sector regulations to make the gas-fired power plants operational. Notably the Petroleum (Exploration and Product) Act 1986 which sets the overall framework for hydrocarbon regulations, it does not adequately address the transportation, connections, and metering of natural gas in Guyana. As such, the Government of Guyana will need to make the necessary amendments and consider the development of gas tariff regulations for the supply and transportation of natural gas now that the project has moved from concept to investment. This can be done in a separate regulatory document as a derivative to the existing Petroleum Act 1986.

Apart from the legislative and policy framework, institutional capacity is limited. Personnel for key ministries, commissions and other departments lack the capacity at both technical and administrative levels for managing and providing oversight to the O&G sector. Recognizing this deficiency, Government of Guyana allocated GY\$420.5 mn in the 2022 Budget to train approximately 1,000 Guyanese in areas related to the oil and gas sector (welders, stevedores, heavy duty operators etc.). Over a period of 4 years, approximately 4,500 persons are expected to be trained and certified.

⁴⁴ Government of Guyana, “Guyana Energy Brief 2022”

The establishment of a Sovereign Wealth Fund (SWF) was delayed initially since 2016 despite assistance from different agencies. This is an important tool to manage the wealth resources from the sector. However, the Natural Resource Fund Bill 2018 paved the way for the SWF and has now been operationalised.

CHAPTER 5: ENVIRONMENTAL IMPLICATIONS

A Low Carbon Development Strategy (LCDS) 2030, a revision of an earlier document⁴⁵, has been elaborated by Guyana to set out a vision for inclusive, sustainable development, while simultaneously maintaining the country's forests, about 85% of the country's territory.⁴⁶ The revised LCDS puts into focus the considerable forest resources of the country, the related biodiversity potential, the extensive water and marine resources, and the capacity to generate significant financial resources using mechanisms such as carbon pricing. According to the updated LCDS, Guyana intends to work with partners to maintain 99.5% of that forest. The maintenance of Guyana's forest stand will allow it to absorb approximately 19.5 billion tons of carbon dioxide equivalent.⁴⁷

In 2009 the Government of Guyana and Norway concluded an Agreement in which Norway would provide Guyana with result-based payments for forest climate services and cooperation in the fight against climate change, the protection of biodiversity, and the enhancement of sustainable development. Guyana has been identified within the international community as a "carbon sink", meaning it is a country that absorbs more carbon dioxide from the atmosphere than it produces. The Agreement between Guyana and Norway according to LCDS has yielded some US \$212.6 mn between 2009 to 2015. The Agreement was not renewed after 2015 but has become a template for designing measurement and verification systems for emissions reduction.⁴⁸

Guyana at the twenty-sixth session of the Conference of the Parties (COP 26) of the UN Framework Convention on Climate Change (UNFCCC), through its President, H.E. Dr. Mohamamed Irfaan Ali, reaffirmed its commitment to the goals of the Paris Convention.⁴⁹ Guyana, at the same time, has become one of the fastest growing economies in the world with its discoveries since 2015 of 10 billion barrels of recoverable oil equivalent located in its offshore blocks, including the the 6.6 million-acre Stabroek block.

The discovery of the huge deposits of oil and gas provides an excellent opportunity for Guyana to raise the living standards of its people and spur sustainable and inclusive economic development in several sectors. The Low Carbon Development Strategy (LCDS) recognizes the potential of oil and gas, but balances this with plans for a comprehensive energy mix, and a gradual but focused shift from almost total dependence on HFO. The LCDS envisions that the electricity supply in Guyana will eventually be dominated by renewable energy.

As for all new oil-producing countries, the challenge for Guyana is in how the country deals with soaring expectations, greater electricity demand, greater housing demand, exponential increase in conspicuous spending, and the intensified strain on infrastructure and social services. Guyana must avoid becoming "infected" with the Dutch Disease, in which the rapid development of the oil economy precipitates the decline in other sectors, often characterized

⁴⁵ Government of Guyana, "Guyana's Low Carbon Development Strategy (LCDS) 2030"

⁴⁶ Government of Guyana, "Guyana's Low Carbon Development Strategy (LCDS) 2030"

⁴⁷ Government of Guyana, "Guyana Energy Brief 2022"

⁴⁸ Lieberman, "Pros and Cons: Promise, pitfalls of natural gas"

⁴⁹ United Nations Framework Convention on Climate Change, "COP 26 Speeches and Statements"

by a substantial appreciate of the domestic currency.⁵⁰ The IDB in a 2020 report has reminded that the discovery of natural resources has often been associated with weakened economic performance and an inability to translate natural resource rents into improved social and economic realities.⁵¹

The creation by the Government of Guyana of a Natural Resource Fund (NRF) in 2019 is a positive development in terms of macroeconomic policy, which should mitigate some aspects of the Dutch Disease. The NRF was updated in 2021 by the new NRF Act 2021 which closed many of the loopholes in the initial legislation. The NRF, as strengthened, has explicit rules that limit the size of withdrawals to be utilized in the national budget. In equal measure, to underpin this piece of policy there is a need for advances in urban development, immigration policy, and environmental risk for example.⁵²

The provision of low-cost petrochemical products on the Guyanese market could be a disincentive to use renewable sources particularly in the transport sector and for electricity generation. It is to be noted that both sectors are heavily dependent on the utilization of diesel fuel. In addition, at the moment, due to the absence of off-shore and onshore infrastructure to capture and store natural gas some of this product is being flared. The flaring of natural gas will eventually have an impact on Guyana's carbon footprint since the burning of natural gas, although not as hazardous as the burning of crude oil, will release methane and other gases into the atmosphere.⁵³ The Centre for International Environmental Law (CIEL) has brought the issue of the flaring of natural gas to the attention of the authorities of Guyana and the impact on the carbon footprint of Guyana.⁵⁴

Natural gas should be used as a complementary fuel by countries as they transition to a fully renewable energy mix which could include wind, solar, ocean, and hydroelectric power. Advocates for natural gas characterize it as a bridge fuel, since the implication is to use it now, to achieve short-term greenhouse gas reductions by replacing diesel, heavy fuel oil and coal-fired power plants, then reduce or end reliance on natural gas over a specific period to lock in long-term greenhouse gas reductions, (Weissman, 2016). The challenge for the administration in Guyana is to organize their affairs to remain true to the goals and objectives of the Paris Agreement and the LCDS. The LCDS envisions a robust energy mix which includes natural gas (under the gas to power project), solar, hydro, wind, biomass which will meet the rapidly rising demand in electricity and keep GhG emissions low (LCDS 2021).

⁵⁰ Wikipedia, "Dutch disease"

⁵¹ Balza, Brearley, Clarke, & Gauto, "Traversing a Slippery Slope: Guyana's Oil Opportunity"

⁵² Government of Guyana, "Guyana Energy Brief 2022"

⁵³ Thomas, "International Environment Group Calls on Exxon to cease Gas Flaring"; Prince, "Govt receives pre-qualification bids for gas-to-energy project"

⁵⁴ Thomas, "International Environment Group Calls on Exxon to cease Gas Flaring"

Energy Mix to 2041

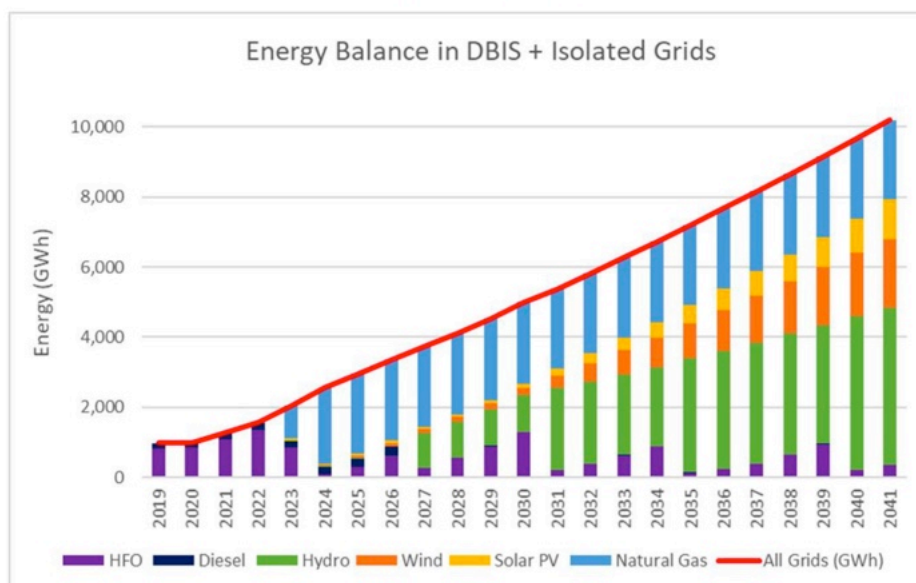


Figure 8: Guyana's proposed Energy Mix

Source: LCDS⁵⁵

CHAPTER 6: BEST PRACTICE AND AVOIDING MISTAKES

As a late entrant to the oil and gas market, Guyana can benefit from the experiences of other states that have developed infrastructure to exploit the discovery of these resources. The considerable quantities of natural gas associated with these discoveries can be utilized to fire electrical generation plants. These plants can be run solely on natural gas or on a mix of different fuels. Natural gas, while a fossil fuel, is cleaner than diesel and can be used as feedstock while the country ramps up and partly transitions to renewable sources. One of the challenges faced by the country to exploit this resource is that of transporting it onshore, storing it, and transforming it for electrical generation.

Lessons from Trinidad and Tobago

Trinidad and Tobago is one of the largest trading partners in CARICOM and has maintained its position as the number producer of natural gas. Trinidad and Tobago is one of the oldest petroleum producing countries in the world. Although oil was first discovered in 1857 the first drilling operations did not commence until 1866 and commercial production in 1913. Initially, natural gas which was a by-product was flared throughout the industry (Espinasa and Humpert 2016). The operators in Trinidad and Tobago were primarily multinational firms including British Petroleum, Royal Dutch Shell and Texaco. With the exit of British Petroleum in 1969, the Government of Trinidad and Tobago (GOTT) purchased the assets of the company, and entered the sector. At that time, the GOTT had already made a conscious decision since 1962 to utilize the revenue from oil actively support and finance the commercialization of natural gas and develop the gas reserves at the Point Lisas Industrial Estate. The policy decision then was to develop both the national natural gas resources and its associated infrastructure, including roads, ports, and power generation. Following the

⁵⁵ Government of Guyana, "Guyana's Low Carbon Development Strategy (LCDS) 2030";

discovery of key gas reserves in 1971, GOTT sponsored these surveys, there was a rapid expansion in the gas industry from then. As such, the National Gas Company (NGC) was formed in 1975 as a wholly government-owned company, which was charged with the responsibility for the purchasing, selling, and distribution of natural gas to industrial and commercial customers. Efforts to reduce the flaring of natural gas started in 1979, and the subsequent construction of a 24-inch cross-island natural gas pipeline to supply the then newly created Point Lisas industrial estate.

From the 1980s onwards, the natural gas sector has continued to expand, moving Trinidad and Tobago away from crude oil, and supported by government policies related to the hydrocarbon sector as well as investments and industrial activities. GOTT made several attempts to fund the gas sector, without much success. The first of three attempts at LNG projects was in the early 1970's with Amoco, and another followed in the early 80's with Tenneco and Amoco once again in 1990 (Shepherd and Ball 2006). GOTT's efforts were frustrated by rising costs and a lack of political will. Finally, Cabot LNG approached the government of Trinidad and Tobago in 1992 to renew the discussion on developing an LNG export terminal. Subsequently, construction of train 1 began in the town of Point Fortin on Trinidad's southwest coast in 1996, and the first carrier vessel shipped in 1999. A two-train expansion project began in 2000.

The authorities in Guyana can learn from these experiences and should seek to create an enabling environment that would encourage the private sector to prioritize these types of investments. In the oil and gas sector there is a need for structured economic and budgetary planning given that there is a time lag between identification, conceptualization and implementation.

Notwithstanding the continued expansion of the natural gas sector in Trinidad, there have been several challenges over the last few years. These are with respect to aging equipment, and low maintenance which has led to breakdowns, and shortages in supply. With natural gas being used locally as feedstock to produce downstream petrochemicals including ammonia, urea, and methanol at the Point Lisas Industrial Estate (PLIE) in addition to being sold in the international market as cargoes of liquefied natural gas (LNG), there are serious implications when supply is interrupted. It is important to note that gas is guaranteed to all independent power producers (IPPs) for their power production requirements and is supplied to the IPPs at no cost (Trinidad and Tobago Gas Master Plan 2015)⁵⁶.

In addition, power generation is the least profitable of its uses as the natural gas supplied to the Trinidad and Tobago Electricity Commission (T&TEC) from the National Gas Company (NGC) is sold for far less than the value it could sell either as feedstock for petrochemical plants at the PLIE or as LNG cargoes (Trinidad and Tobago Gas Master Plan 2015). As such, the recent reduction on the production of native natural gas has also led to significant concerns in the energy sector of Trinidad and Tobago (Javeed 2021). This local shortage of natural gas on the Point Lisas Industrial Estate (PLIE) has led to the shut down or mothballing of some petrochemical plants, including Yara, Methanex and Proman (Javeed 2021) resulting in a reduction of downstream petrochemical products, a loss of taxes collected and a reduction of foreign exchange from a loss of export sales of these commodities.

Furthermore, Trinidad and Tobago demonstrated that significant increases in government spending run the danger of exacerbating macroeconomic imbalances and inflationary

⁵⁶ Poten & Partners, "Trinidad and Tobago Gas Master Plan - Final Report"

pressures, as well as diminishing competitiveness. Guyana can learn from Trinidad and Tobago's experience to avoid falling in the same trap.

The island benefited from rising oil prices in the 1970s. Surpluses from oil revenues allowed the Government to invest in large projects in steel and petrochemicals, in an attempt to reduce the country's heavy dependence on oil. However, as public expenditure grew significantly and wage awards rapidly exceeded productivity increases, inflationary pressures arose, weakening the competitiveness of the non-oil economy.

Moreover, in 1982-83, when global oil prices declined, and petroleum output fell from peak levels of 1978, the island began to experience severe economic difficulties. In 1983, the economy shrank by 7.5% year over year, as the reduction in petroleum output was compounded by a drop in non-petroleum output. With an appreciating real exchange rate, the country became increasingly uncompetitive, putting significant strains on the balance of payments. As a result, the substantial foreign exchange reserves amassed during the oil boom were depleted. Major adjustments began in the mid-1980s, when the government tightened import and exchange controls and devalued the currency⁵⁷ (IMF, 2019).

Lessons from Venezuela

Venezuela's economic mismanagement during the oil boom and the subsequent collapse of the Venezuelan economy can provide useful lessons for Guyana.

With oil sales representing 99% of export earnings and roughly one-quarter of gross domestic product (GDP), Venezuela represents a country that is overdependent on oil. Venezuela benefited greatly from the boom in oil prices during the 2000s and the Government used the oil windfall to spend heavily on social programs and increase subsidies for food and energy. However, it failed to allocate funding toward investment that could have fostered economic productivity and reduce its reliance on oil. The Government also borrowed heavily against future oil exports, resulting in budget deficits. Venezuela's public debt more than doubled between 2000 and 2012, from 28% of GDP to 58% of GDP.⁵⁸

Consequently, when oil prices fell in 2014, Venezuela had minimal savings and no other buffer. This led to the country's inability to pay for imports, repay international creditors or maintain oil production.⁵⁹ Between 2014 and 2019, GDP contracted significantly by 75%.

Venezuela's problems were further worsened by internal political turbulence and massive public demonstrations which prompted economic sanctions from the United States and other Western democracies, which led to severe shortages of food, medicines and basic supplies resulting in a humanitarian crisis in the country. The Covid-19 pandemic, which has affected all countries, was particularly severe on Venezuela.

Lessons from Ghana

⁵⁷ International Monetary Fund. Western Hemisphere Dept., "Guyana : 2019 Article IV Consultation-Press Release; Staff Report; and Statement by the Executive Director for Guyana"

⁵⁸ Nelson, "Venezuela's Economic Crisis: Issues for Congress"

⁵⁹ Flowers & Mackenzie, "Venezuela's Collapse Holds Lessons For Neighboring Guyana"

A country that provides a relevant example of utilizing natural gas onshore is the African state of Ghana. It should be recognized that the state of Ghana is a much larger country with a more diversified market. Despite these realities, some of the challenges faced by Ghana can provide useful lessons for Guyana. In 2007 Ghana made a significant off-shore discovery of natural gas in the Sankofa Field located 60 kilometres off-shore with the potential to support power generation. The project, according to the World Bank was estimated to fuel up to 1,000 MW of clean power. In addition, the project was calculated to cut crude oil imports by 12 million barrels per year and cut carbon emissions by 1.6 million metric tons of CO² annually. This project received partial funding of US \$700 mn in guarantees from the World Bank with the participation of two international gas companies. The Project Development Objective (PDO) was to increase the availability of natural gas for clean power generation by leveraging private capital investment.⁶⁰

The authorities of Ghana began its arrangements with the international gas companies with a take-or-pay Power Purchase Agreement (PPA) which required them to pay for 90% of the gas produced from the off-shore field. This arrangement which was not supported by an awareness of consumer demand led to the oversupply of gas, and the government ran up a bill of US\$500mn for unused energy.⁶¹ In addition, several Ghanaian analysts held the view that the royalties paid by the international gas companies were too low and bore little relation to the global market.⁶²

In the case of Guyana, attention must be paid to the elaboration of fiscal and other incentives such as PPAs which if not well articulated can cause the authorities to amass massive debts to the gas producers and seriously limit the value capture from the acquisition of the resource. In many cases, the Governments, which are the main drivers, are not always in possession of the necessary investment resources and are therefore reliant on foreign investors.

PPAs, at the same time, if too restrictive, can be a disincentive to investors and may not serve the interests of the country. It is suggested using the Ghanaian experience that these Agreements be elaborated with some built-in flexibility and be related to the prices in the global market.

Best Practices and Other Considerations

The size and scale of the investment in the movement of natural gas from off-shore to onshore and related storage and production infrastructure can pose a major challenge. If it is truly committed to renewable energy and a low carbon future, Guyana must have a clear strategy with a mix of energy sources that allow such a transition. Too large an investment in natural gas could slow the transition to renewables. The large discoveries of crude oil and related natural gas will challenge policymakers to achieve this balance.

It is incumbent on Guyana, for instance, to carefully estimate its peak electricity demand to ensure that it does not create a situation of oversupply of gas. In addition, natural gas production should be accompanied by a robust research and development program to explore other secondary uses. The diversion of a portion of the natural gas to secondary sources such as liquefied petroleum gas (LPG) for cooking and fertilizer for instance could be explored.

⁶⁰ World Bank, “World Bank Approves Largest Ever Guarantees for Ghana's Energy Transformation”

⁶¹ Reed, July 2, “Ghana Seeks New Power Balance -News for the Oil and Gas Sector”

⁶² Pros and Cons: Promise, pitfalls of natural gas

The rapid growth of the Guyanese economy triggered by the discovery of oil will attract several regional and international related petrochemical providers to relocate offices and personnel in Guyana. The country, consequently, will be required to provide a range of services in the housing sector, an expanded water network, schools, expanded electrical grid, and related social services. The population of Guyana of which 90% is dispersed in the low-lying coastal zone presents a dilemma for the authorities to address issues such as urban planning to avoid congestion and situations where nationals are in direct competition with foreigners for services.⁶³

Norway has perhaps provided the most successful system of transparency, accountability, sustainability, and value capture. The “Norwegian Model” has devised a system that has disaggregated duties and functions at three levels: Policy Making, Regulatory and Technical Advisory, and finally the Commercial Entity. In a 2020 Report, the IDB acknowledges that “*In practice, the Norwegian approach - often seen as the top performer - has not proved an easy one for other countries to adopt*”.

Guyana, as a developing country and a recent entrant to the oil and gas market, has much to do to put into place a system to maximize value capture and, at the same time, ensure transparent and accountable resource governance. The Norwegian Model provides an example for the Guyanese policymakers to which they can work and aspire. Brazil, Columbia, Peru, and Mexico have in their jurisdictions sought to adopt structures which provide clarity as to the roles and responsibilities of the major stakeholders. These countries have essentially sought to separate the areas of policy, regulation, and the commercial aspects of the sector in such a way as to avoid overlap of responsibilities, conflict of interest, and corruption.⁶⁴ However, these countries also have a longer history of being in charge of their affairs and more developed legislative and institutional systems.

Guyana established a Department of Energy (DE) but this has been dissolved and its responsibilities fully integrated within the Ministry of Natural Resources responsible for the management of the sector. The existing legislative framework in Guyana gives responsibilities to various Ministers in areas related to the exploration of oil and gas. The government has also proposed to establish a Petroleum Commission. These areas of overlap need to be clarified and streamlined for efficient management of the sector. It may also be prudent to establish independent entities to treat with regulation and the commercial aspects.⁶⁵

Another challenge for countries that have experienced resource windfalls is moving into a higher income category and becoming ineligible for concessional finance, grant aid, and other assistance. The consequence is that these countries are now required to seek financing from the global market at higher borrowing costs.⁶⁶ Interestingly, borrowings for investments in the oil and gas sector have faced some new barriers since COP 26. Countries and international lending agencies have been encouraged to limit and restrict lending in this area in keeping within their commitment to the Paris Agreement.⁶⁷

⁶³ Balza, Brearley, Clarke, & Gauto, “Traversing a Slippery Slope: Guyana’s Oil Opportunity”

⁶⁴ Balza, Brearley, Clarke, & Gauto, “Traversing a Slippery Slope: Guyana’s Oil Opportunity”

⁶⁵ Thurber & Hults, “Exporting the Norwegian Model”

⁶⁶ Melina, Yang, & Zanna, “Debt Sustainability, Public Investment, and Natural Resources in Developing Countries: the DIGNAR Model”

⁶⁷ Kozak, “US State Dep’t, members of Congress oppose swearing in without credible vote count”

On another front, the Government of Guyana is duty bound to ensure that apart from the payment of royalties and other fees that there is high local content and that the sector utilizes goods and services from the local economy and does not function as an enclave. To this end, the Government of Guyana has passed a Local Content Policy (LCP) which is intended to maximize the level, quality, and benefits of participation in the petroleum sector value chain by Guyanese.⁶⁸ The overall analysis of the LCP has been positive.

The Agreements with international oil and gas companies should include provisions to encourage the hiring and training of local workers and the use of local goods and services. An example for the training of local workers is the National Energy Skills Centre (NESC) in Trinidad and Tobago, which was established to prepare “students to launch or advance their careers in well-paid, high-demand skilled trades in the energy and industrial sectors... or start a business and be your own boss”.⁶⁹ The Government of Guyana and enterprise has started some initial work in this area⁷⁰.

The government of Guyana should also draw upon the widespread Guyanese diaspora that possess skills, competencies, and experience located in the United States, Canada, Europe, and in neighbouring Trinidad and Tobago. It may also be prudent to devise mechanisms to encourage them to return to the country. For those who may not be interested in returning to the country, it may be helpful to formulate financial instruments to allow them to invest in the oil and gas sector.

The discovery of significant amounts of oil and gas in Guyana presents an opportunity to raise the standard of living of its population in a sustainable and inclusive manner. Progress on these fronts will only happen if concrete steps are taken to establish a governance model in which transparency, accountability, and sustainability are evident. A start would be the continued strengthening of the judicial, institutional, and legislative framework with clearly defined regulations and rules for stakeholders.

The global community, in large part, has become acutely focused on climate change, and most countries are making a concerted effort to enhance their reliance on renewable sources of energy. Guyana must decide the timeframe for maximizing value capture of its natural gas resources and how far downstream it would wish to go with this resource. Professor Ken Julien, former Chair of the Energy Co-ordinating Task Force and President of the University of Trinidad and Tobago, commenting on the attitude of the international oil and gas companies to exploration in Trinidad and Tobago stated the following:

“There have been attempts to persuade us that the simplest and easiest thing to do would be to sit back, export our oil, export our gas, do nothing else and just receive the revenues derived from such exports and as it were, lead a life of luxury – at least for some limited period. This, the government has completely rejected, for it amounts to putting the entire nation on the dole. Instead, we have taken what may be the more difficult road and that is, accepting the challenge of entering the world of steel, aluminium, methanol, fertilizer, petrochemicals. We have

⁶⁸ Guyana Ministry of Natural Resources, “Local Content Policy (LCP) for the Development of Guyana's Petroleum Economy”

⁶⁹ The National Energy Skills Centre. <https://nesc.edu.tt>

⁷⁰ <https://energyindustryreview.com/oil-gas/guyanas-first-oil-and-gas-training-centre/>

*accepted the challenge of using our hydrocarbon resources in a very definite industrialization process”.*⁷¹

The authorities in Guyana, are set a similar challenge to determine what path they will take with the vast hydrocarbon resources at their disposal.

⁷¹ Julien, “Eric Williams and the Emergence of the National Energy Sector”

CHAPTER 7: RECOMMENDATIONS AND CONCLUSION

The discovery of significant hydrocarbon resources off the coast of Guyana presents the country with an opportunity to improve the standard of living of its population and to increase GDP per capita to high-income status by 2030. However, when most countries exploit mineral deposits, the increased revenue associated with the exploitation of those minerals can lead to a resource curse or the Dutch Disease. The appreciation of the real exchange rate could reduce the competitiveness of other non-mineral sectors of the economy. This would mean double jeopardy for Guyana since the economy was already uncompetitive before exploiting the offshore hydrocarbon resources. The main drivers of this uncompetitiveness are the high cost of electricity, the unreliable electricity supply, and the time it takes to get an electricity connection.

Utilizing the associated gas from the offshore hydrocarbon discoveries for a gas to power project could enhance the competitiveness of the Guyanese economy by improving reliability and lowering the cost of electricity from more than US\$0.25 to US\$0.35 per kilowatt-hour to as low as US\$0.06 – 0.07 per kilowatt-hour. Guyana, however, has a low carbon development strategy that envisages the nation having a primarily renewable electricity mix because of the vast amount of potential renewable energy within its borders, such as hydropower, wind power, ocean power, and solar power. Natural gas is seen as a low carbon fossil fuel, and the gas-to-power project should therefore be a bridge to achieving the objectives set out in its (LCDS). The gas to power project, if managed well, could enhance the economy's value-added and lead to latent economic activity becoming a reality, thereby increasing jobs, wellbeing, and improved fiscal performance associated with additional economic activity.

However, along this development path, there are pitfalls, which Guyana should be urged to avoid through competent policy management. The following recommendations are therefore applicable for Guyana's gas to power project.

Recommendations

1. Adequate grid infrastructure, policy, and legislative changes are required to ensure that all Guyanese benefit entirely from the gas to power project.
2. The purchase agreements for gas and power purchase agreements should be carefully crafted and backed by detailed analysis of demand and supply, so government liabilities are minimised.
3. Given the government's commitments under the Paris Climate Change accord and the desire to follow a low carbon development path, gas to power should be considered as a bridge to a low carbon future, allowing the country to develop while the country's significant renewable energy potential is refined and commissioned. A clear timeline should be defined for this transition which indicates how long gas to power will be the bridge to a low carbon future.

4. Populations living in the hinterlands and rural communities are the most deprived and the least likely to have access to reliable electricity. A strategy for gas to power must be cognisant of this to ensure that the benefits of gas to power are spread beyond coastal communities, whether through an expanded grid or how the additional economic activity associated with gas to power helps finance more reliable electricity for rural communities.
5. The Ministry of Natural Resources should have clear responsibility for both oil and gas to power regulation
6. Local benefit: Gas to power, including ancillary services and latent economic activity, should be compatible with the government's local content legislation.
7. Any adverse environmental and social implications from the project should be mitigated as far as possible.

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APPENDIX

Guyana Background

Guyana is located in Northern South America, bordered by Venezuela, Suriname, and Brazil. Despite its geographic location, Guyana is considered a Caribbean country due to its political and cultural history. It covers an area of approximately 220,000 square kilometres, with a total population of 786,559 (World Development Indicators (WDI), 2020)⁷². About 70% of Guyana's population is dispersed mainly outside the capital city in small rural communities along the coastline and the interior.

As of 2017, the national poverty rate was estimated at 41.2%⁷³, based on a poverty line of US \$5.50 /day. This exceeds the Latin America and Caribbean (LAC) regional estimates of 26.54% and 25.23%, respectively, and this rate is projected to have increased due to the COVID-19 pandemic.

The majority of the Guyanese working population is employed in agriculture, forestry and fishing, wholesale & retail trade, and public administration. In 2018, the unemployment rate in Guyana was estimated at 12% (10% male vs. 16% female), and youth unemployment was estimated at 23% (WDI, 2019)⁷⁴. During the pandemic, women have been particularly vulnerable to job losses compared to male counterparts. According to the 2021 Guyana labour force survey⁷⁵, the unemployment rate increased much more for women than for men from 2020 to 2021. In addition, poverty and unemployment rates are typically higher in more remote and rural communities in this vast country.

According to the United Nations Human Development Indicators, Guyana had a Human Development Index⁷⁶ (HDI) of 0.682 in 2019, putting the country in the medium human development category, positioning it at 122 out of 189 countries. Between 1990 and 2019, Guyana's HDI value increased from 0.548 to 0.682, an increase of 24.5%, reflecting improvements in the country's overall development. For example, during this period, Guyana's life expectancy at birth increased by 6.6 years, the mean years of schooling increased by 1.7 years, and expected years of schooling increased by 1.3 years. However, Guyana's 2019 HDI of 0.682 still falls below the average of 0.766 for Latin American Countries (LAC), indicating that the country remains less developed in many aspects compared to its LAC counterparts.

Guyana is highly rich in natural resources, and its economy has traditionally been highly concentrated in mining and agriculture. In 2019, the value of output from the mining sector was approximately G\$211.1 bn, with exploration focusing mainly on gold, diamond, bauxite, loam, manganese, oil, and sand⁷⁷. This equates to 16% of Guyana's Gross Domestic Product (GDP) and 56.4% (US\$1,017.1 mn) of Guyana's export earnings.

⁷² The World Bank, "World Development Indicators (WDI) 2020"

⁷³ Inter-American Development Bank, "LAC Post Covid-19 Challenges and Opportunities for CCB"

⁷⁴ The World Bank, "World Development Indicators (WDI) 2020"

⁷⁵ Guyana Bureau of Statistics, "Guyana Labour Force Survey"

⁷⁶ The HDI is a summary composite measure of a country's average achievements in three basic aspects of human development: health, knowledge, and standard of living.

⁷⁷ Guyana Office for Investment, "Mining Sector"

Agriculture is also a major export earner for Guyana and on average employs 17% of the labor force. In 2020, the industry contributed approximately 16.8% of the country’s GDP. While sugar and rice have been the main crops, the non-traditional agriculture sector is beginning to show high growth potential⁷⁸. For example, in recent years, there has been a rise in agro-processing exports, including prepared food and molasses, and exports in the prepared foods market, such as jams and jellies, coconut milk, and spices.

However, the discovery of offshore oil reservoirs in 2015, with the first oil production achieved in 2020, has brought a new set of economic opportunities to Guyana. Consequently, the nation's oil sector has taken the lead in boosting Guyana's export earnings. The current proven reserves and the recent new discoveries will lead to changes in the overall economic structure of the country and have the potential to increase the country’s GDP and promote structural economic transformation.

Macroeconomic Context

Table 5: Select macro-economic indicators

Indicator	2018	2019	2020	2021	2022	2023
Real GDP growth	4.441	5.353	43.48	19.9	47.5	32.1
GDP per capita (USD)	6,120.54	6,594.38	6,952.70	9,369.01	12,426.39	15,152.58
Current account balance (% of GDP)	-29.022	-54.439	-14.51	-16.783	13.781	20.523
Primary balance (% of GDP)	-2.005	-1.968	-7.292	-6.704	-1.618	-0.603
Debt (% of GDP)	47.37	43.87	51.37	47.03	36.20	30.14

Source: World Economic Outlook (WEO), IMF 2021

Despite the adverse economic implications of the COVID-19 pandemic, Guyana remained among the fastest-growing economies due mainly to the first year of full oil output in 2020 and a continuation in 2021. As shown above Guyana’s economy recorded real GDP growth of 19.9% in 2021, primarily due to its oil exports. Non-oil GDP also saw positive growth of 4.6%, as forward and backward linkages to the burgeoning oil and gas sector stimulated demand across the services sector.

GDP growth of 47.5% is projected for 2022, with the non-oil economy estimated to expand by 7.7%, as spill over from the oil and gas sector propel the growth of the services sector. Guyana’s public sector debt is also forecasted to decline to 36.2% of GDP, from 47.03% in 2021. Nonetheless, the country’s performance is highly dependent on potential threats such as the ongoing global supply chain crisis, inflation, flood risks to rural and urban areas, and the uncertainty around the persistence of COVID-19.⁷⁹

⁷⁸Privacy Shield Framework, “Guyana – Agricultural Sector”

⁷⁹ Ernst & Young Services Inc., “Focus on Guyana Budget 2022”

Environmental Context

Approximately 75% of the country's economic activities are located in the flat coastal area, where the major economic activities, such as agriculture, fisheries, and industries, are found. These sectors are susceptible to extreme weather events and sea-level rise and are thus highly vulnerable to changes in climate.⁸⁰ According to The Global Climate Risk Index 2021, Guyana has a climate index score⁸¹ of 130 (out of 190 countries), and Guyana is most at risk to flooding and droughts.

Over the years, high levels of flooding were observed in the country, especially along the coast and some inland areas. For example, there was catastrophic flooding in 2021. The social and economic damage is likely comparable to the flood in 2005, which affected close to 37% of the population and caused economic damage equivalent to 60% of GDP. Moreover, climate change is likely to increase the frequency and intensity of flooding events. Conversely, in the regions outside the coastal plains known as the hinterlands also experience drought conditions, including a severe episode in 2015. Against this backdrop of extreme environmental events, the Government of Guyana seeks to expand its efforts in combating global climate change by implementing mechanisms and programmes to mitigate greenhouse gas emissions and strengthen climate adaptation.

In spite of these challenges, Guyana represents a major carbon sink for the world as Guyana's forests absorb more carbon than the country's human activities generate⁸². Guyana has the world's second highest percentage of forest cover on the earth, with more than 99.5% of the forest's 18 million hectares remaining. Guyana also has one of the lowest deforestation rates globally. One of just four countries worldwide (and one of only two in the Amazon Basin) has been certified to have maintained a High Forest Low Deforestation (HFLD) state. The country is working with international partners to protect 99.5% of the forest while laying the groundwork for a new low-carbon, eco-system economy. Such an economy can enable the country to grow its economy while keeping energy emissions flat, invest in sustainable planning, protect the coast and hinterlands from climate change and foster economic growth in Guyana. The development of such an eco-system economy can also become a model eco-system economy for the world (Government of Guyana, 2021).⁸³

⁸⁰ Office of Climate Change, "The Consequences of Climate Change"

⁸¹ The Climate Risk Index (CRI) indicates a level of exposure and vulnerability to extreme events, developed by Germanwatch, analyses quantified impacts of extreme weather events both in terms of the fatalities as well as the economic losses that occurred. In the CRI 2021, data from 180 countries were analysed.

⁸² Government of Guyana, "Guyana's Revised NDC"

⁸³ Government of Guyana, "Brief for OTC 2021"