Draft

GUYANA GAS MONETIZATION STRATEGY

October 2023

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1. Introduction and Context

The Government of Guyana (GoG) has made the strategic choice of developing its Oil & Gas (O&G) natural resources in a timely manner to maximize the economic benefit associated with such developments, ensuring the further development of Guyana and prosperity for all the Guyanese people.

As a newly emerging O&G producer, the GoG is committed to promoting sustainable developments, reducing carbon emissions, and supporting the energy transition, as stated in the Low Carbon Development Strategy (LCDS). Incentivizing a mix of natural gas and renewable energy to substitute oil derived fuels, such as diesel and fuel oil, is an approach to accelerate the transition to a lower carbon energy system.

Since the first oil discovery in 2015, Guyana has successfully increased the number of discoveries and recoverable resources as shown in Figure 1 below. To date, Guyana has discovered more than 11 billion barrels of oil equivalent (BOE). It is also estimated that there are ~17 trillion cubic feet (Tcf) of recoverable gas resources, primarily of associated gas and condensates.

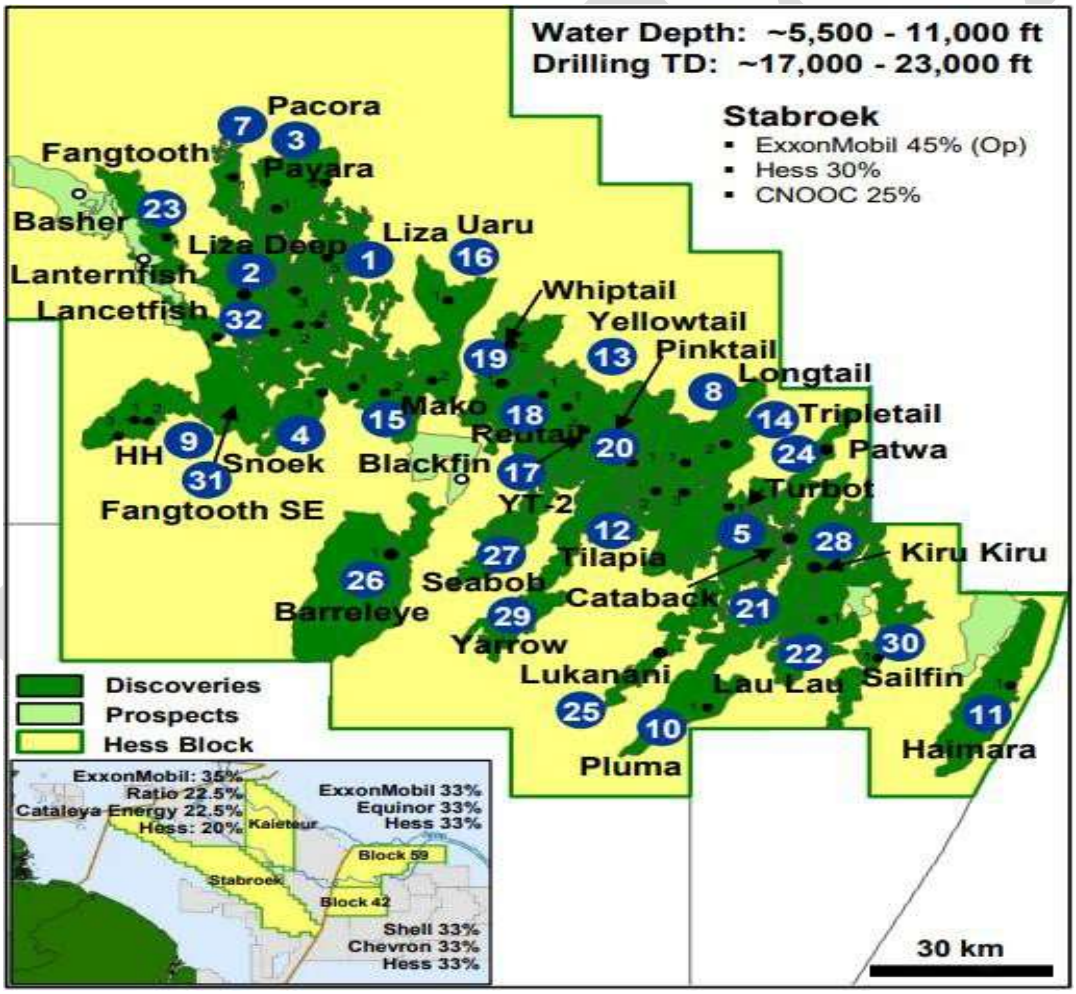

Figure 1: Map of current discoveries in Guyana

Source: Hess

Based on the appraisal work to date, it is possible to distinguish between two very distinct areas within the existing discoveries in the Stabroek Block: 1) northern part of the block where current developments and production are located, characterized mainly by oil developments together with rich associated gas, with such gas used at the moment for pressure maintenance and enhanced oil recovery; and 2) the southern part of the block, extending to the border with Suriname displaying similar technical characteristics and complexities, with very compartmentalized structures of condensate fields and a mix of low and high liquids yield/gas oil ratios, making the development of this deepwater gas more complex and expensive than traditional non-associated gas fields or those with large gas accumulations. It is important to note that this gas condensate/low liquid yield resources are trapping a **large proportion of the discovered oil, that will not be able to be developed and monetized unless infrastructure solutions for the evacuation of gas are put in place** in tandem with the associated gas that is being recycled today in the current production operations. Much scope remains for further exploration in the Guyana-Suriname Basin. Guyana plans to conclude its first offshore licensing round in September 2023, which offers 14 blocks for tender in shallow water and deepwater areas. Additionally, the US Geological Survey has estimated the p50 gas resource in the Guyana- Suriname Basin at ~37 Tcf. Providing infrastructure solutions for future gas developments will significantly enhance the attractiveness of the licensing round and will continue to make Guyana one of the best basins in the world to invest.

Currently, there is no gas infrastructure or gas market in Guyana to support existing or future gas developments. LCDS and Gas-to-Energy studies estimate that the 2030 natural gas requirements for power generation in Guyana will be 30-50 MMscf/d. The full 36.8 Tcf of gas resource reported by the USGS is thus equivalent to between 2,000 and 3,400 years of supply. Even 10% of the USGS estimate still represents 200-340 years of supply.

To timely monetize and maximize the value of <u>all</u> of Guyana's O&G resources, new gas monetization options and solutions need to be developed, including the participation of additional players in the O&G value chain besides the upstream project developers. Unlike oil developments, which by the nature of the oil's physical condition makes it easy to transport and store and benefit from access to a global, highly liquid, and tradeable market, gas developments are very complex technically and commercially, and require specialized, dedicated infrastructure and complex value chains and commercial structures for monetization. As an example, and to account for this complexity, Guyana's PSC allows for an additional 10-year period to develop and monetize gas resources compared to oil developments. Due to this complexity, and the minimum conditions required for gas resources to be commercialized, there are vast known global natural gas resources that are considered 'stranded' because resource holders and companies are not able to economically produce and deliver resources to markets.[1]

There are many benefits associated with natural gas and derived products, but time is of the essence due to market forces and uncertainties associated with the pace of the energy transition and ensuring that new O&G producers have a fair and just opportunity to develop their natural resources (Just Transition).[2] Natural gas plays a role in satisfying the energy needs of the world while helping to mitigate the risks of climate change. Choosing natural gas as a lower-carbon alternative to coal and other oil products like Heavy Fuel Oil

[1] Global Gas Fundamentals – US Department of Energy under Award Number DE-FE0024160

[2] Valérie Marcel, Deborah Gordon, Naadira Ogeer & Ekpen Omonbude (2023): Left behind: emerging oil and gas producers in a warming world, Climate Policy, DOI: 10.1080/14693062.2023.223139

(HFO) and diesel improves air quality and significantly reduces carbon intensity. Guyana's current power generation fuel is primarily HFO and Diesel. Replacing existing power generation capacity with natural gas could reduce CO2 emissions by ~50% and has the potential to reduce the cost of fuel significantly, as is expected by the GoG Gas-to-Energy project. Natural gas is also abundant and versatile. Natural gas is a reliable and flexible fuel for electricity generation and a lower-carbon industrial fuel. According to the 2022 version of the BP Statistical Review of World Energy, in 2021, natural gas accounted for 23% of global electricity generation and was second only to coal at 36%.

Decarbonization in Latin America and the Caribbean is not only a matter of energy. The region contributes approximately 8% of the world's total GHG emissions annually; however, less than half of these emissions are derived from energy use. Energy use accounts for 43% of Latin American and Caribbean GHG emissions, a distinctive emissions profile (compared to 73% globally). The limited energy contribution of GHG emissions is due to the large share of electricity generation related to hydropower in the Caribbean and Latin America. Other sectors such as agriculture, and land use changes, mainly because of the deforestation of the Amazon rainforest, have a greater impact than energy use, accounting for some 45% of total GHG emissions. These facts greatly impact energy policy, climate action, and decarbonization priorities. Latin American and Caribbean countries must therefore craft their own climate agendas related to their own set of circumstances while balancing economic development and decarbonization at the global scale[3].

While Latin America and the Caribbean lag the developed countries in terms of economic development, the monetization of natural gas resources can aid economic development in the region by lowering the cost of electricity. For this purpose, the role of public and private companies — local and international — is crucial, as are the contributions of policymakers and regulators, in creating a stable framework to attract energy related investment to the region. Energy transitions should not be neutral to their impacts in poverty and inequality and therefore **just transitions** need to be deployed.[4] An energy transition that exacerbates poverty and energy poverty could lead to unwanted social consequences.

However, **there is an immediate window of opportunity to monetize natural gas resources if Guyana seeks to monetize and maximize the value of its O&G resources.** This is due to global gas demand uncertainty and pace of decarbonization as part of the energy transition. Depending on the outcome of different scenarios, demand for natural gas, and thus available capital and potential investors, could be quite uncertain beyond the 2030's as seen in the following forecasts.

[3] Natural Gas in the Transition to Low Carbon Economies - International Gas Union, ARPEL, and OLADE
[4] Natural Gas in the Transition to Low Carbon Economies - International Gas Union, ARPEL, and OLADE

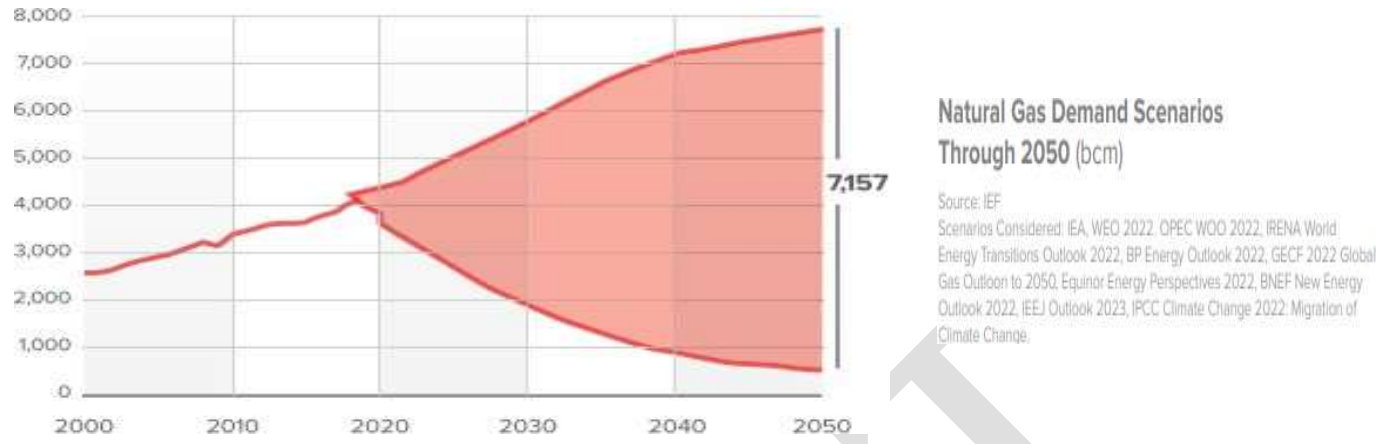

Figure 2: Natural Gas Demand Scenarios Through 2050
Source: IEF

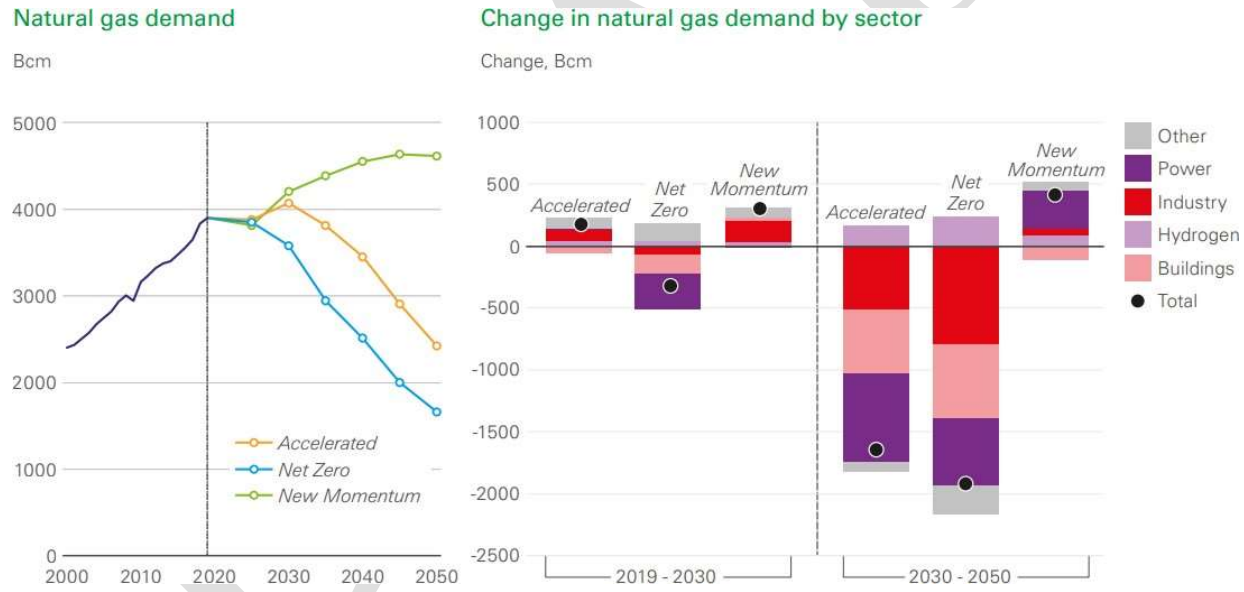

Figure 3: Natural gas demand forecast to 2050
Source: bp Energy Outlook 2023

An important factor to consider when evaluating the role of natural gas meeting potential future demand is the need for continuous investment to counter the effect of natural depletion associated with O&G developments (Figure 4).

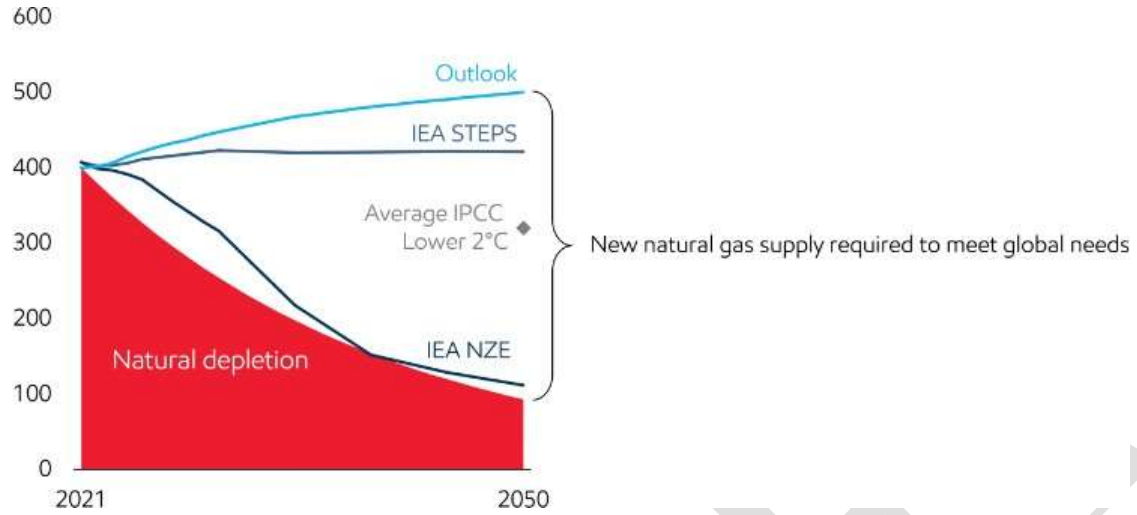

Figure 4: Global natural gas demand forecast to 2050 (Bcfd)

Source: 2022 IEA World Energy Outlook; IPCC: AR6 Scenarios Database hosted by IIASA release 1.0 average IPCC C3" "Likely below 2^{0}C" scenarios; ExxonMobil analysis

Although the previous demand scenarios use different terminology and analysis, all of them are fundamentally based on the International Energy Agency (IEA) scenarios (Figure 5) describing the role of natural gas in the energy transition described below[5].

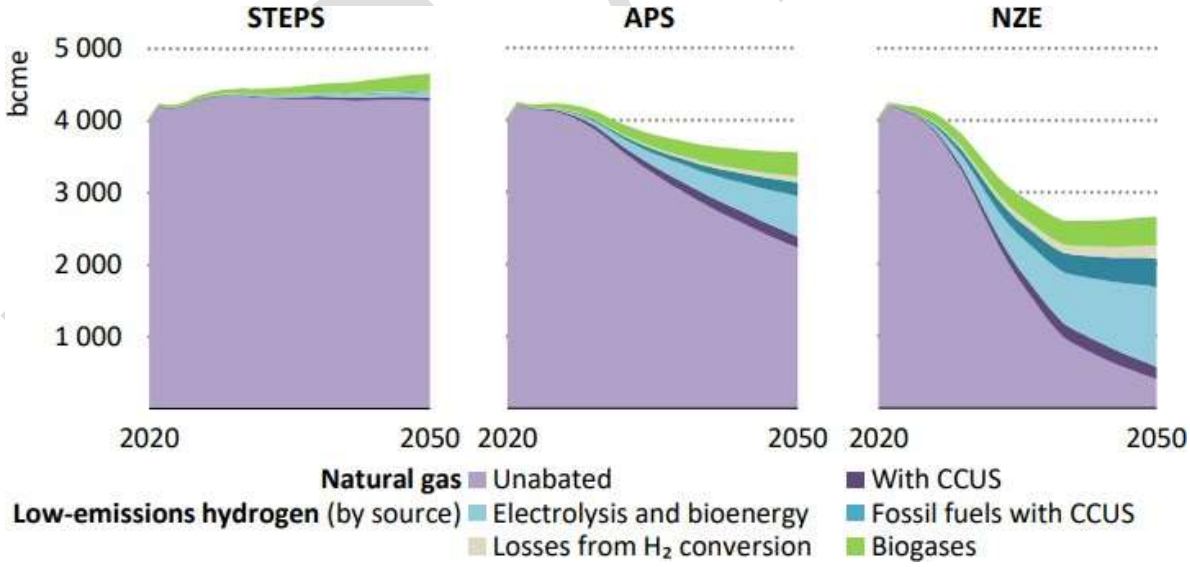

Figure 5: STEPS, APS, and NZE demand scenarios

Source: IEA

[5] Poten & Partners analysis

Since 1993, the IEA has developed medium and long-term energy estimates. The IEA had two main models, The World Energy Model ("WEM"), a simulation that can replicate energy markets' operations; and The Energy Technological Perspectives ("ETP") model, a model based on technology. Both models can be applied simultaneously.

Moreover, in 2021, the IEA created the Global Energy and Climate Model ("GEC") 2021, which combines the two models (WEM and ETP). This new model shows how to transition to an energy system with net zero CO2 emissions by 2050. This model has been the primary tool for creating long-term scenarios by industry and region.

There are mainly three different scenarios defined by the IEA's GEC. The Zero Net Emissions Scenario for 2050 ("NZE") is the normative scenario and has as its primary goal to achieve results under the following three assumptions: 1) an emissions track record consistent with keeping the temperature increase in 2100 <1.5 °C (with a 50% probability); 2) universal access to modern energy services; and 3) notable improvements in air quality. On the other hand, The Stated Policy Scenario ("STEPS") and the Announced Commitments Scenario ("APS") are exploratory scenarios that define a set of starting conditions, including policies announced by nations.[5]

Stated Policies Scenario (STEPS)

STEPS considers the current policies that have been issued by governments worldwide. This scenario also assesses whether objectives have been met and whether there are any restrictions on current energy and climate policy. STEPS does not assume that governments would achieve all set goals, as it offers a more cautious baseline for the future.

STEPS encompasses the measures and milestones established to meet energy-related goals, considering both existing policies and forthcoming actions. The scenario includes relevant policy proposals and policies that had been implemented by the end of September 2022 that had an impact on the energy markets, even if the implementation methods have not yet been completely defined. STEPS demonstrates that, overall, the promises made by the various nations are adequate to make a significant impact.

Additionally, STEPS and APS data indicate that during the following ten years, air pollution-related premature mortality will rise. Less than 2 billion people will be breathing highly polluted air by 2050. This improvement in air quality is estimated to result in 1.3 million fewer premature deaths from ambient air pollution in 2050 compared to the figures recorded in 2021.

Announced Pledges Scenarios (APS)

APS is based on all country-level international commitments on climate change, including Nationally Determined Contributions ("NDCs"), and long-term net-zero reduction goals.[6] It also assumes that everyone has access to power and clean cooking, under the belief that all these obligations will be fulfilled completely and on time. This scenario highlights the "ambition gap" that must be closed to meet the targets set in Paris 2015 and illustrates how far current pledges are moving the globe toward the goal of keeping global warming to 1.5°C. APS demonstrates the distance between attaining current goals and achieving universal access to energy.

[5] IEA, Global Energy and Climate Model Documentation, 2023.
[6] UNFCC, NDC Registry.

Whether and how these commitments are implemented has important implications for global energy. A commitment to net zero GHG emissions does not necessarily mean that CO_2 emissions from the power sector must go to zero.

Net Zero Emissions Scenario (NZE)

The NZE's goal is to reach net zero CO_2 emissions by the world's energy system by 2050. It is important to note that this scenario does not account for actions of other economic sectors besides energy (such as agricultural). NZE is based on the overly optimistic notion that everyone will have universal access to electricity, and everyone will have access to clean cooking energy means by 2030. While progress is being made towards these goals, they will be challenging to realize by 2030.

NZE sees electricity as the leading driver to reducing emissions – as it presumes that the world will be fully electrified. The primary source of electricity in turn, will be renewable energy. But to meet the required electricity demand from renewable sources, it is crucial to enhance the current battery storage technology and ultimately utility scale capacity, which would ensure the effective utilization and reliable delivery of renewable energy, even though current technology today is not able to economically deliver on such goal, and at a massive global scale.

The NZE scenario also believes that the world population will consume in aggregate less energy, not more. This assumption is predicated primarily on the electrification system improvement and energy efficiency of new technologies. However, on top of the requirement of developing new battery storage capacity, it is also necessary to develop the Carbon Capture and Storage ("CCS") technology for fossil fuels to scale, far from where we stand with the early application today.

Lastly, NZE does not consider a backup energy source, such as natural gas, which can provide a stable and reliable supply during demand fluctuations to balance renewables' intermittency. The second most-consumed energy source in 2050 by NZE will be nuclear, which is not the best one to model in case of demand fluctuation, given that nuclear energy production cannot be easily stopped and restarted, and therefore is not a good candidate to operate at peak and mid-load.

The IEA scenarios show how important government actions are in shaping the future of the world's energy system. In fact, governmental choices account for most of the differences in the outcomes of the scenarios.

Nevertheless, it is crucial to remain realistic. These scenarios act more as recommendations for facilitating the implementation of energy policies and envisioning an ideal world where electricity access is universal and renewable resources are the primary source of power. In reality, the world cannot rely on an energy source based on technology that is not proven, cost- effective nor scalable, and we must acknowledge that a substantial portion of the global population still lacks access to essential resources like water, electricity and/or food.

Additionally, these scenarios advocate for a world electrified by renewable resources, it is worth noting that each scenario includes a specific mention of gas in its discussion.

Natural gas **is essential to the sustainable development of Guyana**. Moreover, **it could have a transformative effect on Guyana, Latin America and the Caribbean region, thereby consolidating Guyana's role as a regional energy hub and reliable global supplier.**

According to the IGU, ARPEL and OLADE, natural gas-based energy systems constitute a mature technology, ready to contribute and provide quick wins that are consistent with long-term decarbonization objectives.[7]

As seen in the 3 different gas demand scenarios, the potential future for gas is wildly uncertain, thus, **the best time to secure the development of Guyana's O&G natural resources is <u>now</u>** and the GoG will need to utilize the right incentives to accelerate the development of upstream gas resources in the Stabroek block and future discoveries while attracting private investors to provide infrastructure solutions to enable the upstream gas developments in a timely, safe, and sustainable manner.

[7] International Gas Union, ARPEL, and OLADE, Natural Gas in the transition to low carbon economies, the case for Latin America and the Caribbean, 2023.

2. Resource Assessment and Development

In 2015 with ExxonMobil's Liza discovery, a new petroleum province emerged in the Guyana-Suriname Basin. This success was hitherto anticipated by the USGS in 2000 with the publication of their assessment of the Guyana – Suriname basin. The early discoveries confirmed working petroleum systems, world class reservoirs and pointed the direction for future exploration. With the substantial de- risking of the basin from an exploration perspective, exploration and production will continue to deliver additional discoveries that will augment the current substantial resource base.

The Natural Hydrocarbon Resource of Guyana

The Guyana-Suriname Basin is a half-graben basin on the passive continental margin basin on the northeast coast of South America[8], (figure 6).

Figure 6: The Guyana-Suriname Basin geologic province
Source: US Geological Survey World Petroleum Assessment 2000

[8] Seeking Alpha, The Guyana- Suriname Basin: An emerging petroleum province, 2019.

According to a 2019 article in Seeking Alpha,

"The history of the basin can be traced back to the Jurassic time when the North Atlantic rift system progressed southward to the Central Atlantic region as ancient continent Laurasia parted ways with Gondwanaland. A rift graben formed along the coast of Suriname and Guyana during that time".

"The basal sequence includes the continental Barremian Stabroek Formation, the Aptian Potoco Carbonate, and the Canje Formation, a regionally deposited source rock. Above the Berbice Unconformity, which shows rugged topography, is a sequence of sediments, i.e., the New Amsterdam Formation, which was deposited in the North Coroni basin-floor fan, shelf-margin deltas, and Berbice Canyon, and the carbonate- containing Georgetown and Pomeroon formations". T

"The Corentyne Formation of the mid–Miocene age overstepped the shelf edge as the clastic-dominated surge from the Andean uplift was deposited and continues into recent times" (Figure 7)".[9]

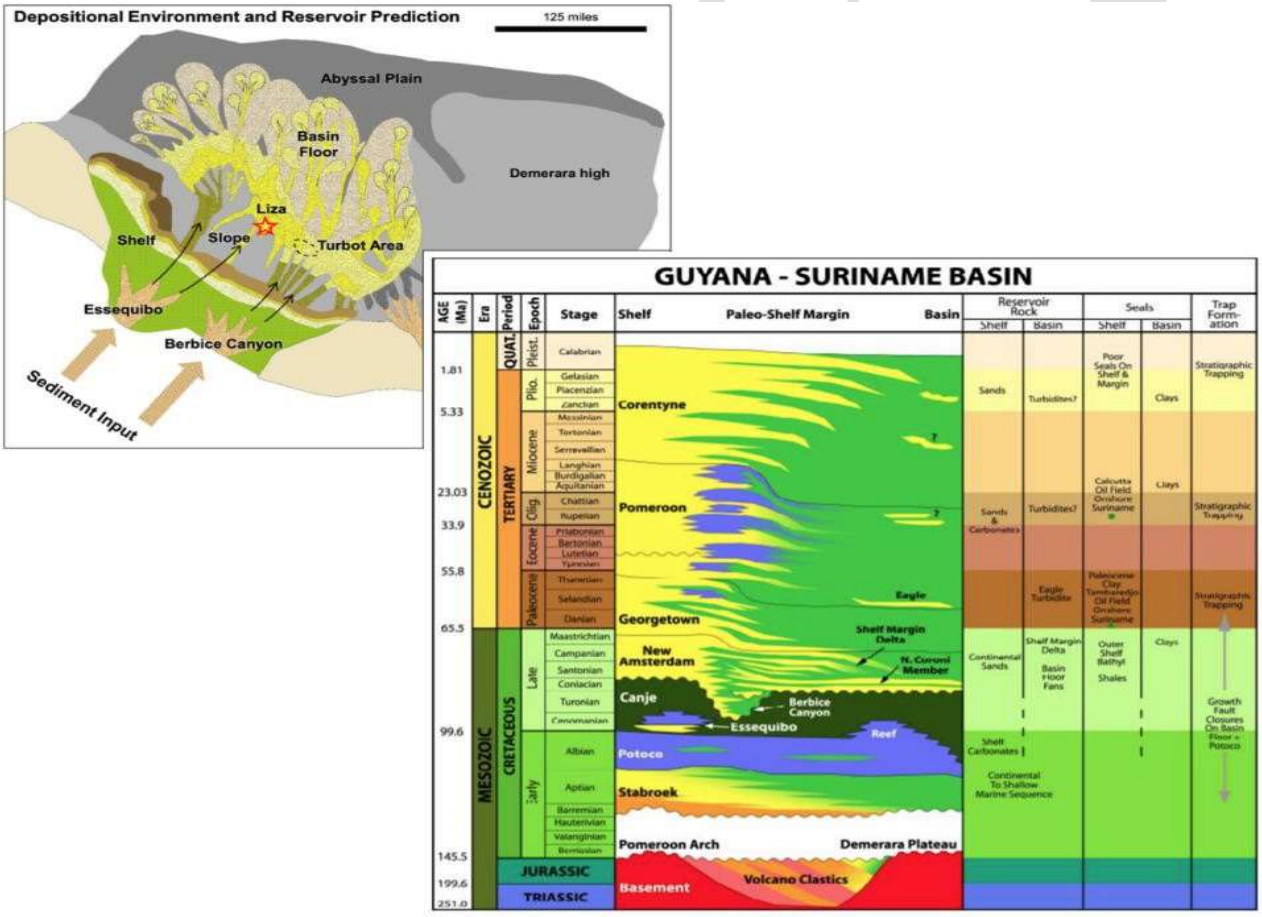

Figure 7: Guyana-Suriname basin stratigraphy schematic (right) and depositional environments (left)
Source: https://seekingalpha.com/article/4240592-guyana-suriname-basin-emerging-petroleum-province

[9] Ibid.

Over 150m thick Canje source beds had been brought to depths in excess of 6.5km to allow the source kitchen to reach maturity. A huge basin-floor fan complex, canyon feeder systems and carbonates in the New Amsterdam, Stabroek, and Georgetown formations are potential reservoir rocks. Stratigraphic and structural closures with multiple-stacked reservoirs can trap hydrocarbons at different levels. The Pomeroon seasonal carbonates and deep marine shales act as the seal. The Stabroek block shows that there are at least three main types of reservoirs, namely, Upper Cretaceous sandstones, Upper Cretaceous carbonates, and Tertiary sandstones, all having excellent reservoir quality.

According to a USGS study, the Guyana-Suriname Basin is estimated, on a P50 basis, to contain 13,937 MMbbl of undiscovered oil, 36,802 Bcf of undiscovered natural gas, and 1,981 MMbbl of undiscovered NGLs[10]. The basin may have up to approximately 147 undiscovered fields, (Figure 8).

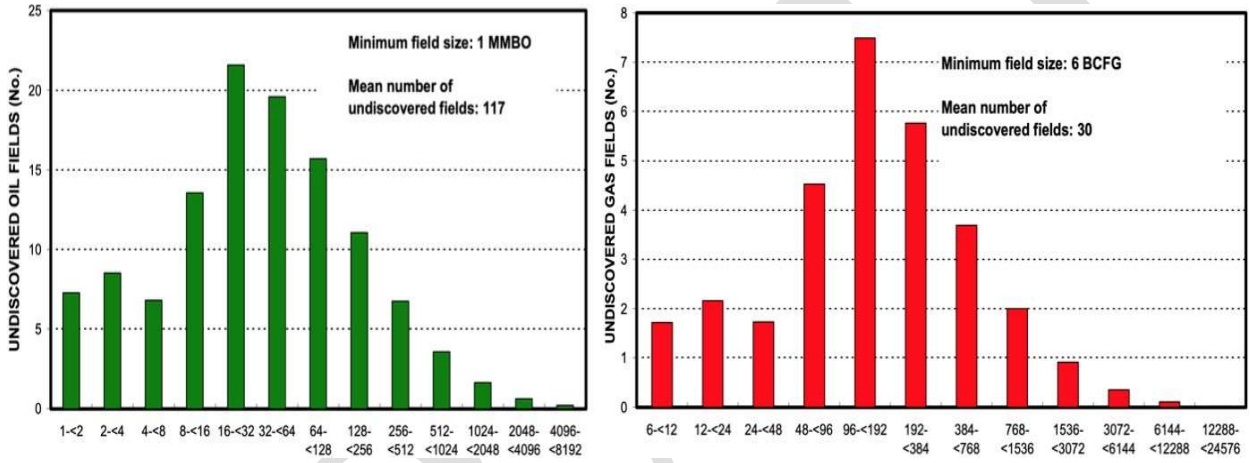

Figure 8: Guyana-Suriname Basin, undiscovered oil (green) and gas (red) field-size distribution
Source: US Geological Survey World Petroleum Assessment 2000

Discoveries

ExxonMobil initiated oil and gas exploration activities in Guyana in 2008. Later on the acquisition of substantial 3-D seismic data led to the company drilling its first exploration well in 2015, Liza-1 in the Stabroek block. Since then, there have been more than thirty discoveries reported by Exxon in Stabroek delivering recoverable reserves estimated to be in excess of 11 billion barrels of oil equivalent[11].

ExxonMobil's stated project development strategy has focused exclusively on Floating Production Storage and Offloading (FPSO) vessels. This is due to the distance from the shoreline. The five projects currently sanctioned as follows:

[10] USGS, World Petroleum Assessment 2000
[11] Rystad Energy, Guyana enters the big league as O&G revenues grow (rystadenergy.com), 2022.

Field	FPSO	Production Capacity (BOPD)	First Production
Liza Phase 1	Liza Destiny	120,000	2019
Liza Phase 2	Liza Unity	220,000	2022
Payara	Prosperity	220,000	2023
Yellowtail	OneGuyana	250,000	2025
Uaru	Errea Wittu	250,000	2026

ExxonMobil has announced a sixth FPSO that will deliver hydrocarbons from the Whiptail discovery with production commencing in 2027 bringing Guyana's production levels around 1.2 million barrels per day.[12] A further four FPSOs are envisaged for deployment by the end of the decade.

In addition to the discoveries announced in the Stabroek block, Guyana continues to experience new oil discoveries, with the latest reported by joint venture partners Frontera Energy and CGX Energy at the Wei-1 exploration well in the Corentyne Block9[13]. The well and subsequent bypass reported sweet medium crude oil in the Maastrichtian and light oil in the Campanian formations. That followed the 2022 Kawa-1 discovery in the same block (Figure 9)[14]. A total of 69 meters of net pay was found distributed in the Kawa-1 well throughout the Maastrichtian and Campanian formations where light oil was discovered and the Santonian and Coniacian horizons where gas condensate was discovered. Individual pay zones were up to 11 meters thick.

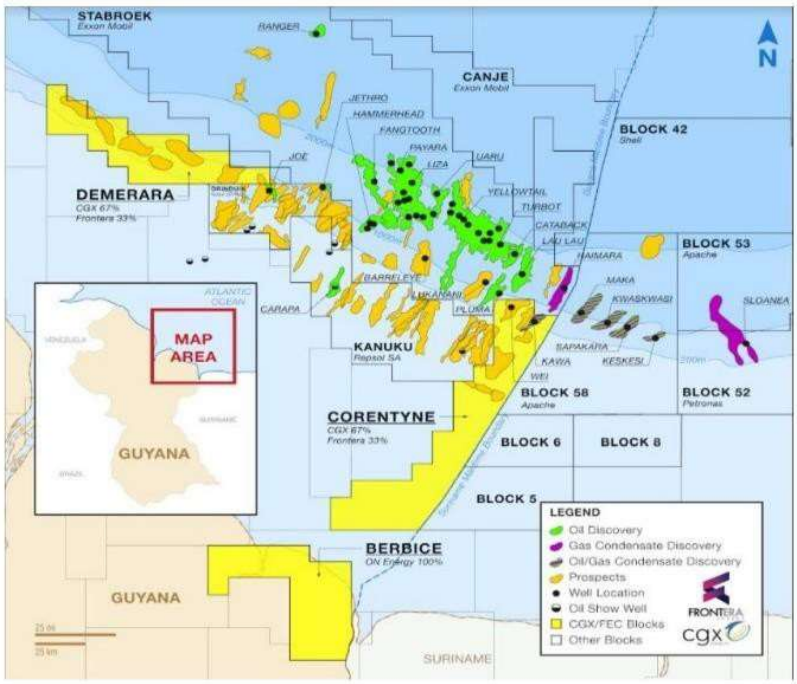

Figure 9: Guyana acreage map province
Source: Frontera Energy

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[12] Upstreamonline, https://www.upstreamonline.com/field-development/exxonmobil-targets-whiptail-as-sixth-development-offshore-guyana/2-1-1388691

[13] Oil and Gas Journal, https://www.ogj.com/exploration-development/discoveries/article/14295712/frontera-cgx-discover-hydrocarbons-at-wei1-corentyne-block, 2023

[14] Oilprice.com, https://preprod.oilprice.com/Energy/Crude-Oil/Guyanas-Oil-Revolution-Boosted-By-More-New-Discoveries.amp.html, 2023.

These intervals are similar in age and can be correlated using regional seismic data to recent successes in Block 58, Suriname and Stabroek block and support the assumption that the Corentyne block contains considerable hydrocarbon resources[15]. These resources, in an earlier independent 2021 resource evaluation by McDaniel & Associates Consultants Ltd.[16], were determined to be 1.5 billion to 7.3 billion barrels for the northern section of the Corentyne block. The entire block is estimated, in the same report, to contain prospective resources of 1.7 billion to 10.7 billion barrels of oil equivalent.

Much scope remains for further exploration in the Guyana-Suriname Basin with the Government of Guyana poised to conclude the Guyana 2022 Licensing Round before the end of the year.[17] This round offers 14 blocks for tender in shallow water and deepwater areas (Figure 10). The blocks South of Kanuku and West of Corentyne will be interesting prospects for the potential presence of light oil and condensate given the recent discoveries there.

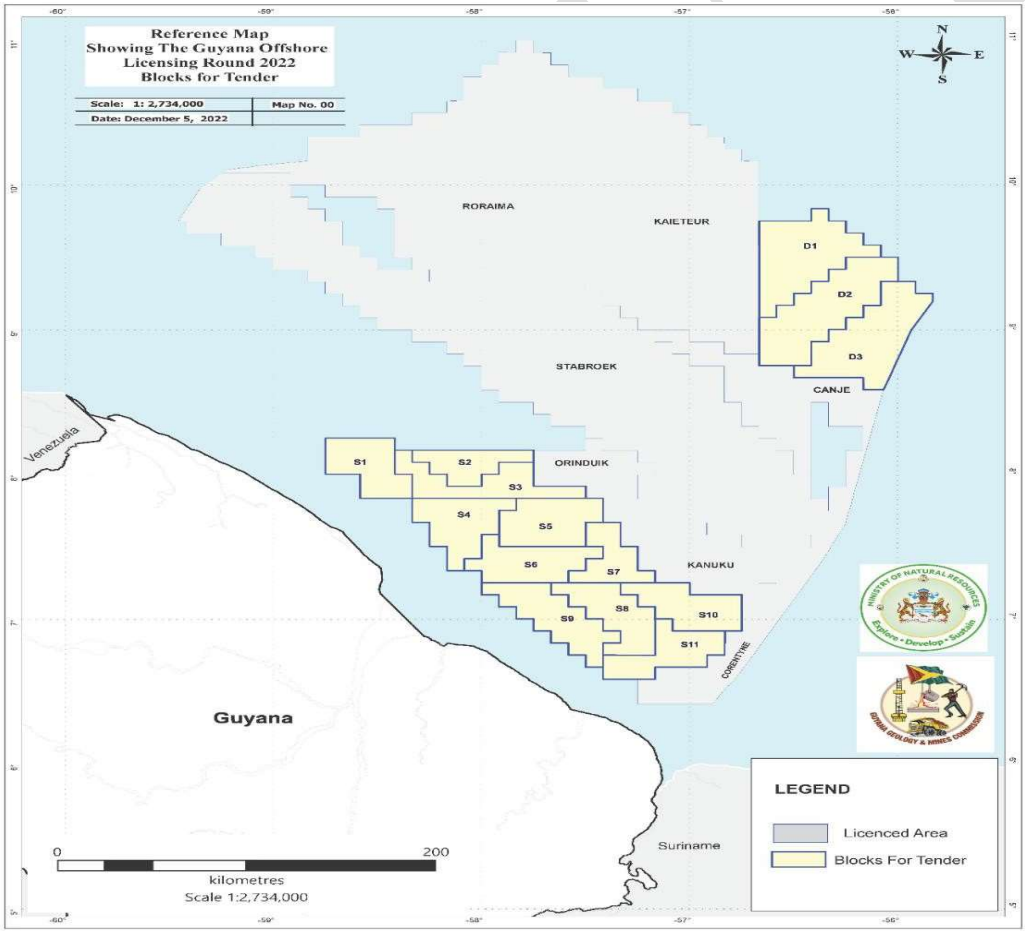


Figure 10: Guyana 2022 Licensing Round map

[15] https://finance.yahoo.com/news/guyanas-oil-revolution-boosted-more-220000850.html

[16] Frontera Energy, https://fronteraenergy.mediaroom.com/2021-02-16-Frontera-Releases-Independent-Resource-Evaluation-for-Guyana-Blocks, 2021

[17] https://petroleum-gov/guyana-offshore-licensing-round-2022

Development of Gas Resources

As described in the earlier sections of this report, Guyana maintains appreciable discovered gas reserves and resources. These may take the form of gas discoveries or, alternatively, gas that is associated with oil discoveries.

To date, it is estimated that there are ~17 trillion cubic feet (Tcf) of recoverable gas resources, mainly associated gas and condensates, in the Stabroek Block.[18]

All the gas produced is being used for reinjection to maintain reservoir pressure except ~50 MMCFD of gas produced from the Liza field, which will be transported to shore and used to generate 300MW of electrical power as part of the GtE project and other possible downstream initiatives.

Currently, no development plans have been submitted by any of the upstream resource developers for the condensate and gas fields discovered to date. Condensate is a mixture of light liquid hydrocarbons, similar to a very light (high API) crude oil. It is typically separated out of a natural gas stream.[19] Once separated from natural gas, condensate is generally treated like crude oil. It can be blended with other heavier crude streams or sent directly to market. Given the complex seafloor topography in Guyana with a very steep slope up from the deepwater to shallow waters, a requirement to conduct extensive flow assurance analysis to ensure continuance of hydrocarbon flow supply throughout the life of the fields will be required.

As previously mentioned, the development of these types of **resources in deepwater is costly and challenging**. Additionally, the **condensate/gas fields discovered to date in Guyana are compartmentalized and relatively small to support commercially viable production levels to make them economic**, making their development significantly more difficult unless there is clustering of fields/discoveries being developed and access to appropriate evacuation infrastructure to monetize them. Nevertheless, similar complex and challenging projects have been successfully deployed in much harsher environments than will be encountered offshore Guyana, such the Shell's Ormen Lange project in the Norwegian sector of the North Sea.

Attracting private sector investors to develop the necessary gas infrastructure, that are not part of the PSC regime, will incentivize upstream operators to pursue other upstream development options, such as **subsea developments** with subsea wellhead manifolds tied in as appropriate and with different options to transport and process the condensates/gas, which are **significantly more cost efficient and faster to deploy** that the current FPSO approach, which is necessary due to lack of available gas and condensates evacuation infrastructure. This **collaborative approach between the GoG, current and future upstream operators, and private infrastructure developers will provide the necessary alignment, incentives, and solutions to all the participants in the value chain and ensure the timely development of all of Guyana's O&G resources.**

Fundamentally, natural gas development is market driven. The market could be export (LNG) or domestic including small scale LNG to support manufacturing and mining, fertilizer manufacture such as ammonia/ urea or to support industries such as glass manufacturing .

[18] Lenton, C, Naturalgasintel.com, Guyana Plans to monetize natural gas output, 2023.
[19] McKinsey, McKinsey Energy Insights.

3. Guyana's Infrastructure Assessment

Guyana's gas infrastructure today is very limited. Guyana has modest importing LPG facilities that accommodate ~700 bbl/d of LPG. In order to monetize a small portion of the gas that is being produced and re-injected today, a new outlet to commercialize that gas had to be created, in the form of the Gas-to-Energy (GtE) project. The GoG is in the process of implementing the GtE project, which will bring ~50 MMscfd of gas to shore via a 12-inch offshore pipeline and will then continue onshore to the Natural Gas Liquids (NGL) and power plants being developed in the Wales Estate. The current pipeline has additional, but limited, capacity for future domestic gas utilization. The GtE project is a perfect example of the complexities of gas developments due to the significant infrastructure required to monetize even small quantities of natural gas. In this case, the GtE project benefits from already developed and available gas from the Liza field and existing FPSOs infrastructure. Future upstream developments will require costly and complex green-field development and dedicated infrastructure to support much larger developments in order to achieve a cost of supply that allows Guyana's gas to be competitive and affordable so a market can be created to monetize such gas.

This **limited existing infrastructure in Guyana today is not conducive to enable additional upstream gas development** and fulfill the GoG intentions to fully and timely develop Guyana's O&G resources. In order to enable and incentivize the development of upstream gas resources the swift development of gas infrastructure is of paramount importance. There are a number of infrastructure options that Guyana can choose depending on its objectives as described in the next section.

4. Natural Gas as a Transition Fuel and Utilization Options to Monetize Gas Resources

The Role of Natural Gas in the Energy Transition

Different fuels emit varying amounts of CO2 at combustion. **Natural gas is the cleanest and lowest greenhouse gas ("GHG") intensity hydrocarbon fuel**, emitting around half as much CO_2 as coal and around 25% less than gasoline or diesel (Figure 12). In addition, coal emits particulate matter and sulfur compounds into the atmosphere, creating health issues prevalent in a variety of large cities around the world where it is used as a primary energy source. Coal is also the highest GHG emitter when compared to all large-scale energy sources. Liquid fuels are expensive (particularly the cleaner burning low-sulfur fuel oil, and diesel, gasoil) and in the middle of the range of GHG emitters. These liquid fuels, primarily diesel and fuel oil, are a common fuel for small-scale power generators and are gradually being replaced by renewables and natural gas.

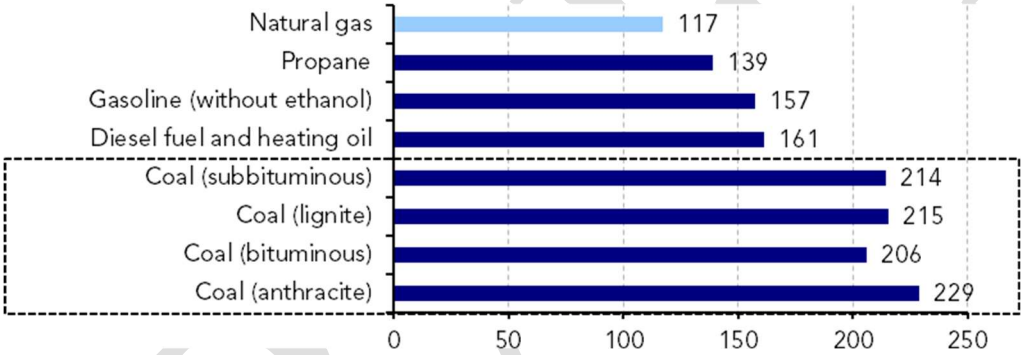


Figure 11: Pounds of CO_2 Emitted per British thermal units (Btu) of Energy for Various Fuels
Source: EIA, Poten & Partners

The IEA has developed a World Energy Emissions by 2050 Scenario to lay out a path for the world to achieve net zero emissions (compared to 2021). As previously described, the IEA suggests a massive renewable ramp-up between 2023 and 2050 is required to achieve this target, with wind and solar playing an increasingly dominant role in the continuously growing energy mix. In the IEA's various scenarios, natural gas is a critical short to medium-term solution to complement and balance renewables' intermittent load. Combined Cycle Gas Turbines (CCGTs) work very well in both stable and flexible operations, with a proven and efficient track record operating worldwide in baseload, mid-load and peak operations. Unlike coal- and nuclear- powered generation facilities, CCGTs can quickly shut down and restart and efficiently operate at partial capacity. Modern turbines can fully ramp up in 30 minutes to meet peaking and varying demand.

Technological advancements and production efficiencies have significantly driven down the cost of renewables, leading to aggressive growth worldwide. Costs for solar photovoltaic (PV) and wind power have plummeted in many areas of the world due to technology development and

economies of scale. Onshore and offshore wind farms in areas with high average wind speeds can be profitable even without government subsidies. Solar power has also capitalized aggressively on lower costs – and expanded market share globally. Yet, **due to the intermittency of renewable energy, natural gas for power generation remains very competitive even with the falling cost and growing market share of renewables.**

Natural gas is an abundant, reliable, and low-cost fuel when compared to most energy sources and is particularly well suited as a competitive and economical solution in power generation, complementing renewables' intermittency. Notably, CCGT represents the most efficient thermal power generation technology in terms of production and capital cost requirements, achieving thermal efficiency of over 60%, compared to around 45% to 50% for the most efficient coal power generation. CCGT can also be developed and constructed much faster than other thermal and nuclear plants. Whereas it typically would take two to three years to build a CCGT, nuclear plants can take up to seven years of construction, and coal plants up to five years. The total development time for coal and nuclear power plants would place them at a worse competitive position than CCGTs – as siting issues are typically more complex, and regulatory approval/permits could further delay development. Furthermore, renewables are mainly a non-dispatchable generating technology owing to their intermittency and lower capacity factor, unlike the dispatchable CCGTs. Gas-fired power is indeed often used to fill the dispatch deficit associated with intermittent renewable power.

As governments push for **cleaner environment policies, both natural gas and renewables would be called upon to balance the power generation requirement as coal and oil-based fuels contribution decline**. Given today's high cost and technological limitations, renewables are unable to provide an affordable and reliable grid availability/balance to meet growing power demands. As such, natural gas will play a key role during the energy transition to fill the gap.

Overview of Gas Monetization Routes

Monetizing indigenous **gas reserves to the best advantage is often very challenging**. There are multiple, often conflicting, financial, political, and economic forces at play and the interests of the host government, upstream companies, and other stakeholders are not always aligned in resolving key issues to facilitate those developments such as domestic market requirements (if a market exists), development cost and local market affordability, and if exporting is necessary, what export options are likely to generate the greatest value.

Many countries and resource developers have struggled with these problems and there are numerous examples of countries that have been left with sub-optimal gas utilization assets or gas resources that have been left undeveloped. Understanding the gas utilization options available and the relative value that each will generate for all parties is at the heart of solving this problem.[20]

There are a range of options available for utilization of natural gas as shown in Figure 12 below.

[20] Poten and Partners, Trinidad and Tobago Natural Gas Master Plan, 2015.

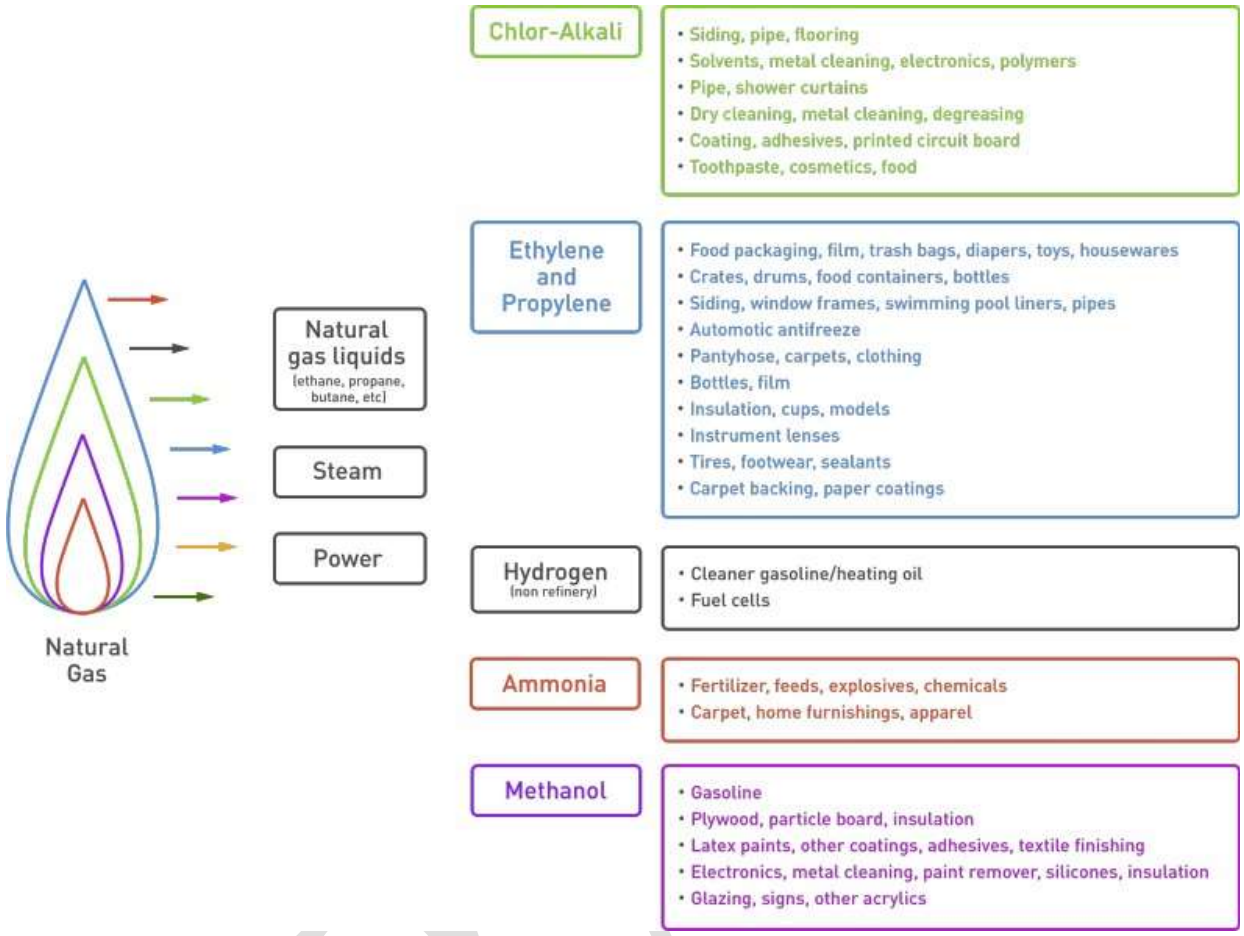


Figure 12: Gas utilization options

Source: US Department of Energy under Award Number DE-FE0024160

Analysis of Gas Monetization Options

Power Generation

Overview

Gas to power generation is a potential gas monetization route, as demonstrated by the Government's GtE project expected to start up at the end of 2024. Electricity demand in Guyana is expected to increase and a gas fired power plant has the potential to take advantage of an increasing downstream market as well as growth in commercial and residential demand for electricity.

Access to cheaper and more reliable power generation will continue to incentivize the development of new and more diversified industries with the associated benefits for the economy and the creation of new jobs.

The estimated additional firm capacity required by 2035 to cover peak capacity plus reserve margin in Guyana, as per the LCDS, is approximately 250 MW, making the current 50 MMscf/d feedstock level the most viable option. However, the potential electricity supply gap depends on the extent and timing of renewables deployment in the country.

Methanol

Overview

Methanol is a common natural gas monetization route, for sales into the global petrochemicals and fuels markets. Methanol is produced from natural gas (or other carbon source, e.g., coal) via a syngas (CO/CO2/H2) process.

Methanol is a globally important commodity chemical. The global methanol market was around 88 million tones (MMt) in 2022, with China the largest producer and consumer, accounting for around 60% of methanol use. Methanol is used in petrochemicals and for fuel use with the current split around 50:50.

Formaldehyde, acetic acid and methylamines are the main derivatives produced from methanol. These have a wide range of industrial and other applications and follow GDP and industrial growth. Other petrochemical uses include the fast-growing methanol-to-olefins (MTO) technology for production of ethylene and propylene derivatives. This is mainly in China from coal-based methanol production or "coal to olefins" (CTO).

Fuel use for methanol has the fastest growth due to its clean combustion characteristics. Many countries are promoting methanol blending into gasoline for automotive use. It is growing as a marine fuel due to its low emissions compared to heavy fuel oil. In addition, methanol has a wide range of other fuel-based applications including the gasoline additive methyl tert-butyl ether (MTBE), in the production of biodiesel and dimethyl ether (DME). It can also be used as a solvent in paints and resins and as an antifreeze agent.

Although growth in demand was slow in 2022, future growth rates of around 3-4% could be expected, driven by methanol-to-olefins and fuel demand.

Production

Methanol is produced by the catalytic reaction of synthesis gas:

$CO + 2H_2 \leftrightarrow CH_3OH$

Modern efficient methanol plants consume around 30 MMBtu of gas per ton of methanol.

Pricing

Methanol pricing has evolved as its end use has. With a large amount of methanol now used in the fuels sector, the price has become more correlated with petroleum prices.

Projected base case for realized methanol prices in the US Gulf Coast (USGC) market is $375/t (Real $2022).

Liquified Natural Gas (LNG)

Overview

Liquefied natural gas (LNG) is natural gas that has been cryogenically cooled to a liquid state so that it occupies a much smaller volume. It is cryogenically frozen to about -260° Fahrenheit (or ~162º Celsius), for shipping and storage. The volume of natural gas in its liquid state is about 600 times less than its volume in its gaseous state, making it easier for ocean transport in special LNG tankers to receiving facilities called regasification terminals around the world. There it is "warmed,", and returned to its gaseous state (called regasification) and transported by pipeline to distribution companies, industrial consumers, and power plants.

LNG value chains are very complex and ensuring that LNG projects create value for all participants requires that each link in the chain fully performs its contractual obligations. Unlike oil, and despite increases in spot trading, LNG remains a fairly illiquid, geographically segmented, market that relies heavily on long-term contracts to underpin the significant capital investment and risks associated across the value chain.

The vast majority of LNG projects throughout the world are predicated on large non-associated gas reserves. Guyana, on the other hand, has thus far purely been an oil-focused play. While there is a considerable amount of associated gas in the ground, relying on associated gas carries greater risk than a dedicated, non-associated source of natural gas. In the case of the Stabroek Block, all gas currently produced is either re-injected to support production or used as on-site fuel.

Production

From 2000 to 2022, the number of countries producing LNG almost doubled from 12 to 23, although Libya has halted production since 2013 and Yemen has not produced any LNG since 2015 due to the ongoing civil war. LNG exports almost quadrupled over this period – from around 100 MMt in 2000 to 400 MMt in 2022, driven in large part by export growth in Qatar, Australia, and most importantly over the last five years, the United States.

Market growth since 2000 derived mainly from three countries – almost sequentially: Qatar, then Australia and now the United States. As of early 2023, there were fifteen LNG supply projects under construction worldwide, with a total production capacity of around 160 Million Tons per Annum (MTPA). In continuation of the trends over the last decade, two countries lead the majority of this production under construction: US (with around 50 MTPA) and Qatar (around

32 MTPA). Australian projects could not match the level of FIDs of competing Qatar and the US, and only Pluto T2 is currently under construction (Figure 14).

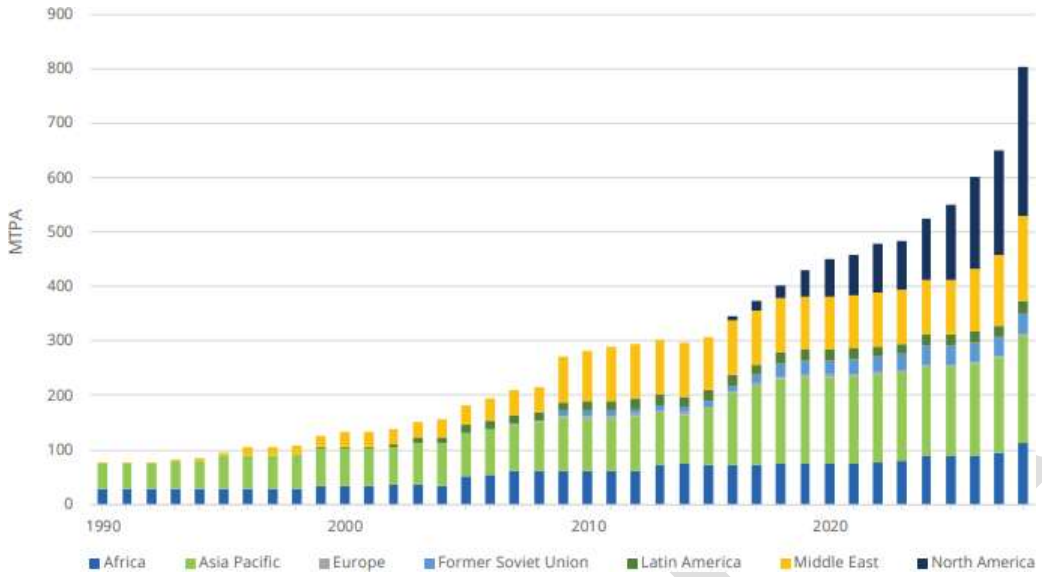


Figure 13: Global liquefaction capacity growth by region, 1990-2028
Source: Rystad Energy

Despite this large amount of LNG production capacity under construction worldwide, there is a need for additional LNG supply to sustain longer-term growth in demand post-2026. Global LNG demand is expected to outstrip production from currently operating and under-construction projects, as shown in Figure 14. As previously mentioned on the natural gas demand forecast, LNG suffers from a similar level of demand uncertainty due to different scenarios related to the energy transition.

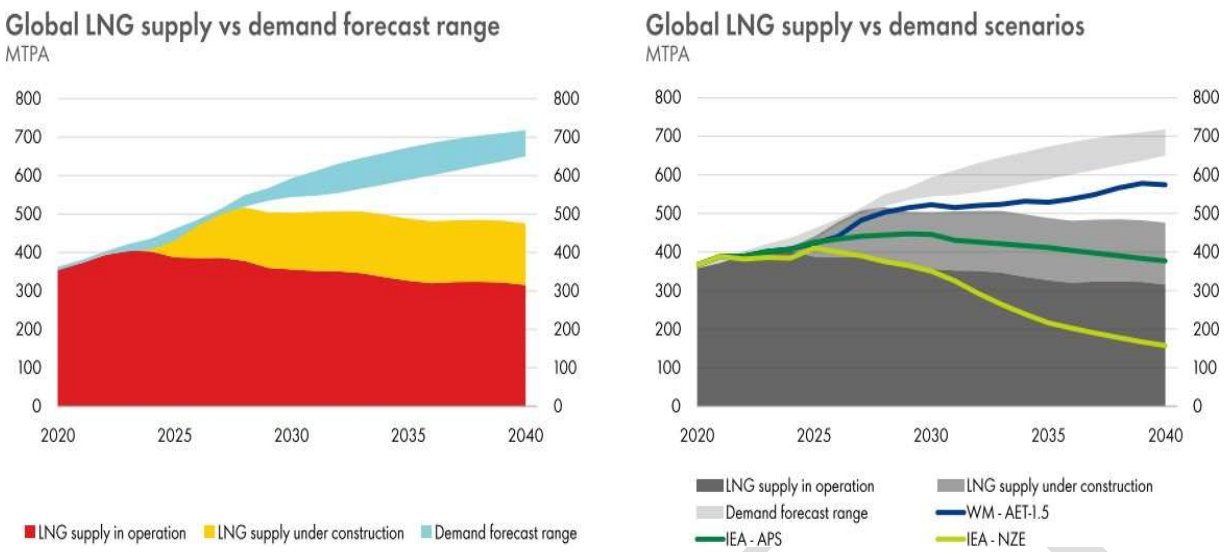


Figure 14: Global LNG supply vs demand forecast range (left) and demand scenarios (right)

Source: Shell interpretation of Wood Mackenzie, Poten & Partners, IEA, S&P Global Commodity Insights and FGE 2022&2023 data

AET1.5 = Accelerated Energy Transition 1.5 degrees

Pricing

Global gas and LNG prices have historically been somehow volatile but moving within a limited band as seen in Figure 15.

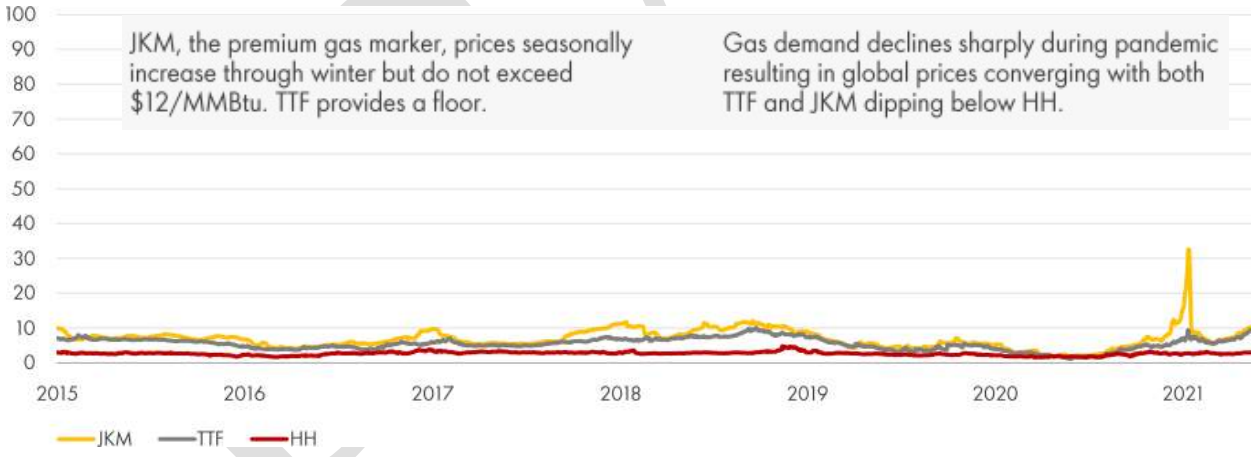


Figure 15: Global gas prices

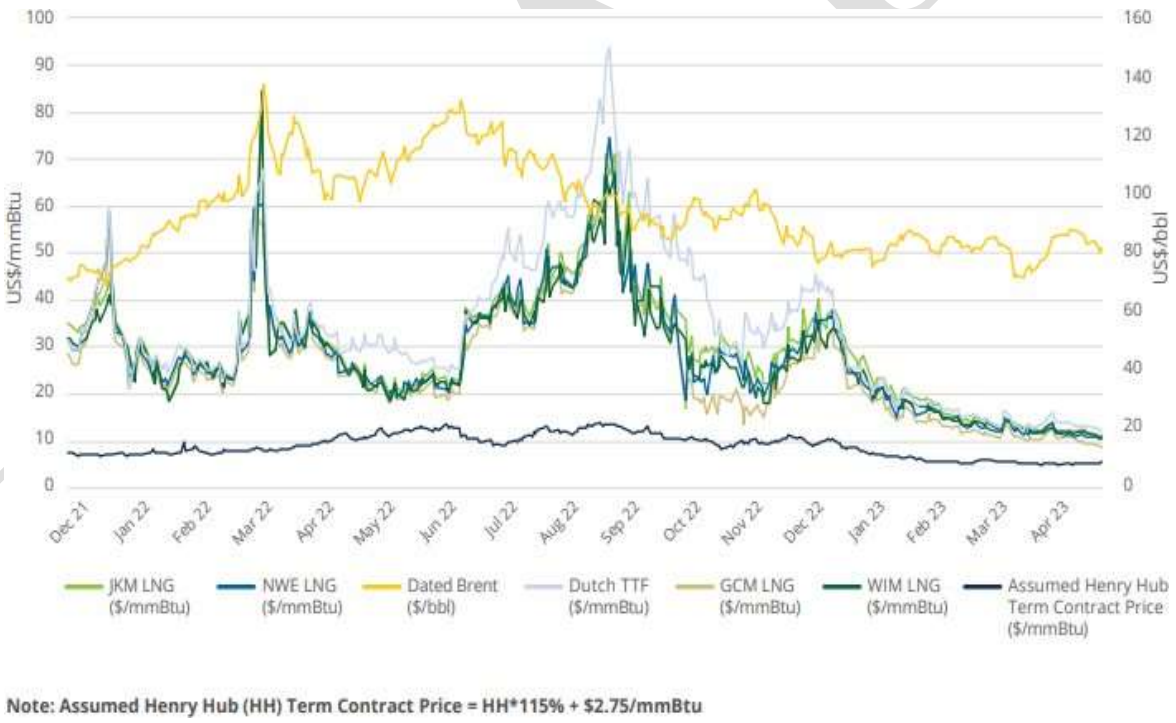
Source: Shell interpretation of ICE, CME, S&P Global Commodity Insights 2022&2023 data

TTF = Transfer Title Facility HH: Henry Hub NBP: National Balancing Point

However, benchmarks for gas and LNG prices have been subjected to extreme – in some cases, unprecedented – volatility in recent years (Figure 16). The market has whipsawed from a severe and sudden demand shock due to the economic collapse triggered by the COVID pandemic to a severe and sudden supply shock from curtailment of Russian gas supplies to Europe.

According to the IGU's 2023 World LNG Report, 2022 was a tumultuous year for the global LNG business. The market tightness that emerged in 2021 continued and was exacerbated by the Russia-Ukraine conflict. Europe's sudden and pressing need to offset Russian piped gas volumes with short-term LNG deliveries, coupled with government-induced energy saving and gas demand destruction driven by high gas prices and stock-filling, contributed to imbalances and volatility in the global market. The market conditions contributed to a reversal in the Asian demand trend, as it reduced significantly in most locations throughout the region, with the two fastest-growing major LNG markets in recent years, China, and India, both taking a major step back in procurement.

One of the adverse effects of this has been a slowdown in coal to gas switching. While prices modulated closer to more historically average levels at the start of 2023, they remain elevated with the risk of a return to 2022 conditions still present as long as Europe remains strongly reliant on short-term LNG (which accounts for around 70% of the continent's imports) and LNG supply additions continue to be scant.[21] If anything the European energy crisis of 2022 demonstrated the importance of LNG in the diversification of the European energy mix.



Note: Assumed Henry Hub (HH) Term Contract Price = HH*115% + $2.75/mmBtu

Figure 16: Comparison of major LNG, pipeline gas and oil benchmarks, December 2021 to April 2023

Source: S&P Global Commodity Insights

[21] International Gas Union, World LNG report, 2023.

Ammonia / Urea

Overview

Ammonia / Urea is a typical natural gas monetization route, for sales into global fertilizer markets. Urea is an ammonia-based solid product fertilizer that is produced from natural gas (or other carbon source, e.g., coal) via a syngas process: Ammonia (NH_3) is synthesized from the syngas. Ammonia and CO_2 are then synthesized to form urea.

Urea's main use is as a fertilizer (it is the most commonly used nitrogen fertilizer), with annual demand around 180 MTPA. Urea consumption has increased by an average of 1.9% yearly over the last decade, with Asian markets dominating. China and India, the two largest fertilizer consumers globally consumed ~50 MMt and ~33 MMt of Urea in 2021, respectively.

Although fertilizer consumption fell in 2022, the International Fertilizer Association (IFA) forecasts consumption of nitrogen fertilizers increasing by around 0.8% p.a. to 2026, with a higher growth rate forecast for urea as most new nitrogen capacity additions are of urea rather than other nitrogen fertilizers.

Production

Modern ammonia production consumes around 30 MMBtu of gas per ton of ammonia. The most modern ammonia plants have benefitted from years of process optimization and increasing efficiencies, with modern plants much more energy efficient than older, less efficient plants which may consume up to 38 MMBtu per ton of ammonia production.

One ton of urea requires 0.57 tons of ammonia, which is reacted with carbon dioxide (CO2) recycled from the ammonia production process. In addition to ammonia, around 3 MMBtu of natural gas is consumed in the urea processing plant, giving an overall gas consumption of around 20 MMBtu/ton of urea.

A new world-scale plant producing 1.3 MTPA of urea would require gas feedstock of ~70 MMscf/d. This volume of feedstock gas would produce ~0.7 MTPA of ammonia.

Pricing

Historically, prices were steady for a number of years, averaging ~$225/t FOB Black Sea from 2016-20 before extremely steep rises in 2021 and into 2022, which saw prices peaking at $720/t in Q1 2022. In April 2022, cargoes from Pont Lisas in Trinidad were fetching as much as $1500 to $1600 per tonne FOB.[22] The war in Ukraine has created export constraints and extremely high gas feedstock prices in Europe, driving prices to record levels. The Base Case assumes long-term FOB Egypt urea prices of $350/t, with the high case at $425/t and low case at $275/t (Real $2022). The high-level assumption is that urea produced by a world-scale plant in Guyana would be able to capture similar prices to FOB Egypt. Local domestic sales from a new urea plant in Guyana would probably capture an import-substitution price premium of around $40/t, but volumes would be extremely limited.

Blue Ammonia / Hydrogen

Overview

Developing a hydrogen economy has been heralded in recent years as a key to fighting climate change. Green and blue hydrogen can be utilized in sectors that are difficult to decarbonize, such

[22] S&P Global, Fertecon Ammonia Report, April 28 2022.

as steelmaking, and as a long-distance transport fuel. Green hydrogen requires access to significant renewable energy sources, whereas blue hydrogen requires access to Carbon Capture and Storage technology and CO2 transportation networks that have yet to be proven and developed in Guyana. Given this potential, governments and industry leaders around the world are increasingly focusing their efforts on building out the infrastructure necessary to support a hydrogen economy.

However, a major barrier to implementation is the high cost and questionable technical feasibility of transporting bulk volumes of hydrogen over long distances by ship (hydrogen embrittles steel). Ammonia offers some significant logistical advantages over pure hydrogen as a means to transport hydrogen:

- Ammonia liquefies at -33ºC compared to hydrogen at -253ºC and contains 1.7 times more hydrogen and 1.5 times greater heating value per cubic meter than liquid hydrogen.
- The technology of synthesis, handling, and transportation of ammonia is very mature. Ammonia has a well-established international trade, transmission and distribution network compared to pure hydrogen, which remains at the conceptual stage.
- Liquid hydrogen is difficult to handle due to its tendency to induce corrosion in steel.

Ammonia can then be cracked at the import location to produce hydrogen for end use or used directly as a fuel, and it is currently seen as a far more prospective means of transporting hydrogen than pure hydrogen. Commercial operation of high-capacity liquid hydrogen ships is not targeted until the 2030s and may never happen at scale.

Green / blue ammonia also has significant potential as a marine fuel that does not produce any CO2 when burned. [Note: Green/blue label for ammonia are the same as for hydrogen].

Cracking Ammonia

Using ammonia as a hydrogen carrier will require the cracking of ammonia back into hydrogen and nitrogen at the ammonia delivery destination.

The ammonia cracking process is endothermic and to avoid CO2 emissions from burning with a hydrocarbon fuel (which would defeat the whole point), it is generally assumed that some of the hydrogen produced would be used as fuel for the process (i.e., no CO2 emissions). In future this could potentially switch to ammonia fired (cheaper to burn the feedstock than the product) but licensors have yet to develop a guaranteed offer to include this. The overall energy efficiency of the large-scale process offered by KBR is around 85% (i.e., this includes the energy required to heat the reactor).

Burning Ammonia as a Fuel

Significant focus is being put on potential direct ammonia consumption for power generation as a means to reduce CO2 emissions. JERA has successfully run trials in Japan to test using ammonia as a fuel in its power station boilers (20% NH3:80% coal) and it is believed that it is fully satisfied that this is feasible as Japan is now proceeding to source large volumes of clean ammonia to meet this need. No detailed technical information about these trials has been made public.

6. Investment Climate for Gas Infrastructure Projects[23]

In general, the **Government's role to promote the investment in gas infrastructure is to set policies that define development objectives for the gas sector, establish institutions that set priorities, establish legal and fiscal frameworks governing gas, and monitor governmental entities and private sector partners to ensure the rules and priorities are followed by all parties during development and operation of gas infrastructure projects**. Moreover the ultimate use of natural gas should be married to national economic development goals, for example, the need for more and cheaper electricity.

In some countries, projects are developed and operated by state oil companies, but, typically, gas projects, whether they are developed by national or foreign investors, require access to specialized knowledge. **Rules, regulations, and procedures should be clear, consistent, and transparent so that all stakeholders know what to expect from each other.**

The government will provide an enabling environment to promote integrity of the gas supply and connecting infrastructure both to meet domestic demand and facilitate export. Some of the key elements are:

a) **gas deliverability**, by ensuring that key gas infrastructure across the value chain is properly planned and built in concert with planned power and industrial consumers. This can be achieved via non-discriminatory regulations to enable investment by domestic as well as foreign investors in gas infrastructure.
b) **appropriate costing of upstream gas (cost of supply)** to ensure affordability for domestic consumers and competitive price levels to incentivize the development of gas infrastructure at acceptable rates of return for all stakeholders.
c) **market driven commercialization of supply** by allowing and protecting commercial structures which enable alignment along the value chain, and which facilitate secure offtake with long-term back-to-back bilateral contracts with creditworthy parties that share obligations and liabilities and/or use of integrated business models throughout the value chain.
d) **availability of gas**, by balancing available gas resources in line with demand in domestic, regional, and international markets and in line with contractual obligations of the parties.
e) **access to market**, by supporting the right, but not the obligation, to directly access or invest in all parts of the value chain.
f) **regulations**, by clearly defining and agreeing among all parties with regard to issues such as third-party access, ownership, tariff structures, etc.

In order to attract private investors, both domestic and international, Governments need to provide transparency, clarity of roles/responsibilities and ease of doing business. Business investment and foreign direct investment (FDI) inflows for gas developments are supported by Government's legislation. The ease of doing business will continue to be a key factor for private investment decisions in emerging O&G producing countries. Additionally, clear and consistent monetary policy (exchange rate/ repatriation of profits, etc.) is required and Governments must provide the necessary assurance that movement of profit from invested capital for gas projects are not subjected to restrictions. Repatriation of profits must be allowed if countries want to attract FDI or investors for their gas resource development.

[23] Global Gas Fundamentals – US Department of Energy under Award Number DE-FE0024160

Guyana has a comprehensive Petroleum Act and PSC regime that defines the directives for upstream gas developments and certain related infrastructure as part of production operations. GoG should incentivize the participation of other players along the gas value chain to ensure timely development and different **investment criteria for private investors outside of the PSC regime – so GoG can better manage the PSC Cost Bank and expected revenues – by promoting and categorizing infrastructure projects similar to industrial developments.**

Regardless of the approach (via a combination of legislation and agreements), **the objective is to create a stable and viable investment climate to underpin substantive and continued investments, usually spanning decades, in the country's hydrocarbon sector, providing a framework for an equitable sharing of revenues between the investors and the host government**. A summary of principles applied in successful jurisdictions with gas developments can be found, for reference, in Appendix A, which forms the foundation of future investment policies.

Finally, it is worth noting that the overall legal framework of the host country, including bilateral investment treaties, regional and other multilateral treaties and free trade agreements, are all part of the framework within which an agreement between a host country, its broader constituencies, and an investor resides. The legal standing of a contract in relation to a country's laws is an important consideration. Contract and revenues stability are paramount in establishing a viable investment in gas infrastructure and monetization projects, which is generally the case for large-scale, long-term investments.

Another crucial consideration to incentivize the development of gas resources and associated infrastructure is to have Government support and alignment. Strategic Government support in many countries is critical to gaining access to land and proper approvals. Government support in a gas project may be of significant assistance in all phases of the project, improving project credibility and alignment along the value chain. Supporting the development of this key infrastructure will allow the Governments to create additional revenues streams to support their domestic fiscal budgets from the projects through percentages of sales, taxes and/or fees as outlined in the agreements without the expense of standing up or supporting a state company, as is the case in many countries, such as the United States.

For domestic gas and power projects, government investment may also be required to provide an initial platform for subsequent growth. Infrastructure investments such as gas transmission pipelines and gas distribution systems typically require initial government investment, particularly in countries with minimal existing infrastructure. Generally, power generation and electric distribution systems are initiated by government entities. However, some power generation projects, such as IPPs, are done with private participation. When the sector and regulations are more developed, private companies can build and operate whole integrated systems, at which point the government participation may be reduced to regulation and the collection of taxes and fees. As projects for which government has provided the initial investment near the point of becoming economically self-sustaining, there is then the opportunity for the government to divest the project through privatization.

Finally, GoG will **seek to attract private funding for the timely and cost-effective development of its gas infrastructure** to avoid the large upfront capital required to develop such projects and eliminate the risk associated with the debt infrastructure given uncertainty related to the revenue streams required for repayment. Additionally, **by diversifying the**

participants in the gas value chain and securing private investment, the GoG will avoid significant capital charges into the cost bank through the current PSC structure, which will significantly accelerate revenues to the GoG given the current upstream plans and FPSO deployment by the Stabroek Consortium.

7. Environmental Considerations[24]

Natural gas is viewed as part of a **balanced approach to addressing environmental concerns that supports lower GHG gas emissions, grows our economies, and strengthens energy security**. Natural gas has contributed to lower emissions in many countries, in particular it has allowed the United States to be a leader in emissions reduction. Natural gas can be used for cooking, power generation, or heating and cooling. As economies develop, the need for energy will continue to grow not only for natural gas for export and power generation but also as an input to natural gas derived products, such as fertilizers, petrochemicals, and olefins.

Throughout the value chain, **natural gas infrastructure developments should seek to minimize and reduce emissions**, including flaring. Methane emissions must be measured and mitigated throughout the value chain, including processing equipment, pipelines, storage tanks, valves, compressors, and other fugitive sources.

The global gas industry has a good safety record, mainly as a result of diligence and planning to ensure that very high standards are maintained in project planning, design, procurement, construction, and operating phases of the projects.

International trade bodies also publish safety standards, some of which are used internationally. The HSE requirements for gas infrastructure projects should cover all the stages of the development of the project including drilling and completion, construction, installation, commission, start-up, production, maintenance, and decommissioning operations.

[24] Global Gas Fundamentals – US Department of Energy under Award Number DE-FE0024160.

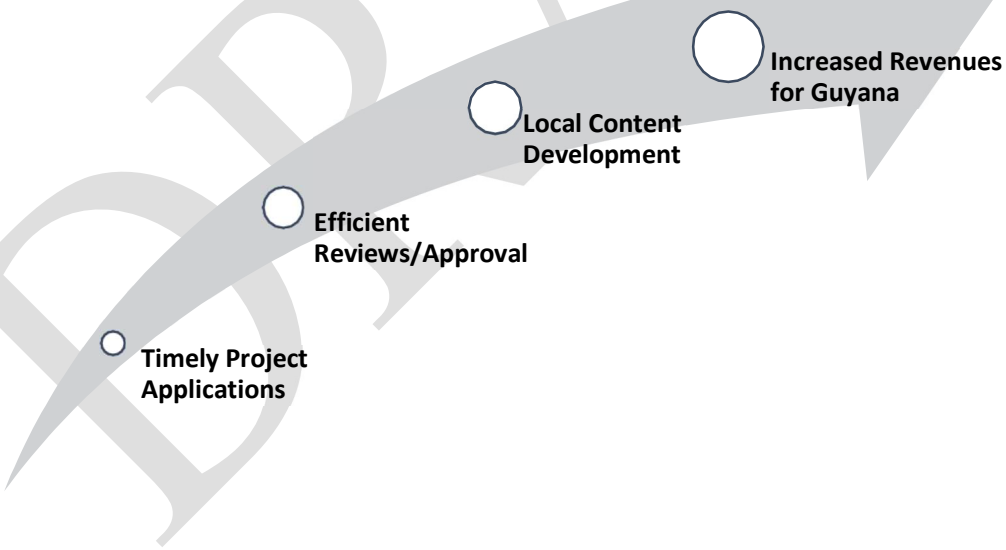
8. Benefits for Guyana

Overview

The GoG remains firm on its position that the oil and gas sector must bring benefits to all Guyanese and must also provide for future generations of Guyanese. In fulfilling this obligation, the Government has established new legislation to create the necessary institutional mechanism for overseeing the revenues generated directly from the sector. The key legislation in this regard is the Natural Resource Fund Act, 2021. Equally important, the GoG implemented the Local Content Act 2021 which has already enabled Guyanese to benefit tremendously from employment and supply chain activities in the oil and gas sector. To this end a robust energy services sector is emerging in Guyana to support the activities of the upstream operators.

With the sector expanding rapidly due to massive oil and gas discoveries offshore Guyana, the Government is cognizant of the nature of the project lifecycle especially the development and production phases which are impactful to local content development and revenue generation, respectively.

Guyana encourages and welcomes timely project applications and proposals for its natural resources and is steadfast in utilizing a similar approach regarding natural gas development. The government's objective is to maximize revenues to the nation from oil and gas developments with minimum impact to the environment, and crucially, ensure that opportunities for all Guyanese are realized through maintaining momentum within the sector via a continuous project pipeline.



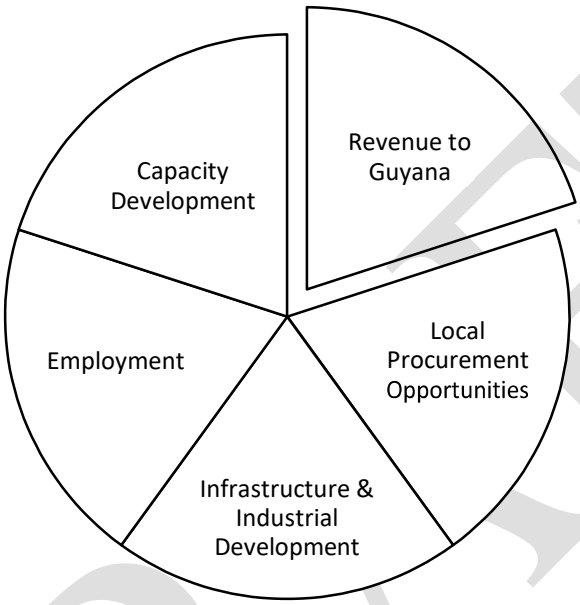
Benefits

Guyana is focused on realizing the opportunities that natural gas development can provide under the condition that all Guyanese benefit from the industry. The Government has established and implemented Guyana's Local Content Act 2021 which seeks to prioritize Guyanese nationals and companies when procuring goods and services for the enhancement of the value chain of the oil and gas sector. The act also focuses on local capacity development and promotes

competitiveness while encouraging the creation of related industries that will sustain the social and economic development of the nation.

It is expected that any path decided on to develop and monetize Guyana's natural gas reserves must be aligned with this legislative framework.

The ongoing GtE in Region 3 of Guyana provides a reference case to all stakeholders, although the GtE project will be consuming only a fraction of the natural gas being envisioned for development under this strategy. Nonetheless, there are several streams of benefits to the people of Guyana that the government has outline that must be contemplated; these include:



Revenue to Guyana

Guyana will increase its revenue from the oil and gas sector with the development and processing of its natural gas resources offshore. The revenue stream is one that is price sensitive and must be considered closely with the global market as it relates to commercialization/utilization which was discussed in section 4 of the strategy. Timing of development and production will be crucial to ensure that Guyana receives the maximum benefits from its dormant resource endowment. Revenue streams that will be active for Guyana will include profits and royalties from crude oil production and export, sale of electricity, natural gas liquids and other petrochemicals from the GtE project, and with the comprehensive development of the gas reserves offshore, increased inflows to the nation from sales after larger gas processing and offtake.

Infrastructure and Industrial Development

Since independence, **Guyana has strived to develop an economy that not only focuses on primary production but also value addition and manufacturing for export markets**. Guyana has been unable to realize its full potential in manufacturing due to issues surrounding the cost of energy

which makes local production less competitive to those globally and within the Caribbean Community. The nation has long depended on primary production for exports, specifically in the natural resources sector which has seen precious commodities such as bauxite and gold being exported in its raw forms. **The development of natural gas can facilitate the transition and transformation of traditional industries to make their produce more attractive and competitive on the regional and global markets.** Natural gas may be converted into electricity on a larger scale for the electrification of all of Guyana including the Hinterland regions and possible exportation to other surrounding nations.

Alternatively, the gas can be used as a direct feedstock to industries, especially those demanding large smelting operations for instance bauxite processing into aluminum and a gold refinery; both of which can attract premium prices globally in their value-added forms. Additionally, with the complementary infrastructure developed at an onshore facility and cooperation with industry leaders, there are numerous uses and lucrative end products that can be manufactured with natural gas as the catalyst; these include feedstock for waste recycling, manufacturing of glass, ammonia, hydrogen, carbon fiber, natural gas liquids amongst other petrochemicals. We will continue to encourage the private sector, both local and international investors, to engage with the government on realizing these opportunities for which natural gas will be an important enabler in the near future.

Local Procurement Opportunities

The oil and gas supply chain has been crucial to Guyana's economy over the last few years with procurement activities especially support services stimulating business within the private sector. The local private sector is expanding rapidly with the influx of investors and investments in Guyana particularly in the oil and gas sector. Guyanese businesses are continually developing, new companies are being created and the establishment of joint ventures are on the increase with the formation of majority owned Guyanese partnerships with companies from the USA, Canada, UK, Trinidad, Ghana, etc. The Government of Guyana is fully supportive of the local private sector in their quest to fast-track their development through mutually beneficial partnership that will enable these companies to be technically eligible to participate in the oil and gas value chain, engage in subcontracting arrangements with other local companies and retain earnings within the nation for our country's development.

Guyana's Local Content Act 2021 provides a clear framework for doing business in the oil and gas sector and includes specific obligations where compliance is expected. In consultation with the private sector, industry and other stakeholders, the law was developed and enacted with the addition of the first scheduled that outlines forty (40) supply chains and targets for which companies engaged in petroleum operations must adhere to. The spirit and intent of the law is to ensure that Guyanese companies that are capable to execute various services are given first preference within the sector. This allows Guyanese companies, once technically equipped and commercially competitive, to reap the rewards from their investments within Guyana whereby others local companies can benefit from spin off activities and increases the likelihood of in-country value maximization.

The Guyana Gas Monetization Strategy provides a pathway to maintain the momentum within the sector with the demand for services slated to increase as the government contemplates activities in the upstream, midstream, and downstream industries of the natural gas value chain.

It is likely that with the simultaneous developments of oil projects, the GtE, and a comprehensive approach to monetizing natural gas resources there will be a massive ramp of activities in Guyana that will require technical and profession services. While the first schedule of the local content act may be limited to the forty (40) supply chains currently, the following are some of the core areas that development and participation by Guyanese companies are required:

- Fabrication and Welding: fabrication and welding activities in a natural gas project create business opportunities for local welding and fabrication companies. These companies can secure contracts for constructing pipelines, storage tanks, and other infrastructure components, leading to increased revenue and employment opportunities. Local businesses can seize the opportunity to supply raw materials, equipment, and consumables required for fabrication and welding. This includes providing steel, welding electrodes, safety equipment, and other related products, fostering the growth of local suppliers.
- Engineering Services: local engineering firms can provide a range of services, including feasibility studies, engineering design, project management, and construction supervision. They can secure contracts to support the planning and execution of the natural gas project, leading to business growth and the creation of high-value jobs. In addition, collaboration with international engineering firms can facilitate technology transfer, enabling local companies to acquire new knowledge and expertise. This positions them to provide cutting-edge engineering solutions in future projects, both domestically and internationally.
- Operations and Maintenance Support Services: Guyanese companies can provide maintenance and support services for the natural gas infrastructure, including equipment inspection, repair, and calibration. This creates sustainable business opportunities and employment for technicians in the long term.
- Security Services: security companies can secure contracts to provide personnel for the protection of natural gas facilities, including access control, perimeter surveillance, and emergency response. This leads to the growth of local security firms, job creation, and the development of specialized security services tailored to the energy sector.
- Medical/Healthcare Facilities: the influx of project personnel necessitates healthcare facilities, including clinics, hospitals, and emergency response services. Local healthcare providers can establish or expand their facilities to cater to the increased demand, creating new business opportunities and employment in the healthcare sector.
- Waste Management: waste collection and disposal companies can secure opportunities to collect, treat, and dispose of waste generated by the natural gas project. This includes managing construction debris, hazardous materials, and wastewater. It creates a stable revenue stream for waste management companies and promotes the development of waste treatment and recycling facilities.
- Environmental Consulting: consulting firms can provide services such as environmental impact assessments, monitoring, and compliance reporting. They can assist the project in

navigating environmental regulations and ensuring sustainable practices, leading to business growth and employment opportunities.

- Transport and Logistics: Guyanese companies will be encouraged to apply for opportunities in this area to support the development of this project. These include customs brokerage services, inbound and outbound logistics, transportation via roads, air and sea, warehousing and storage of materials and products.

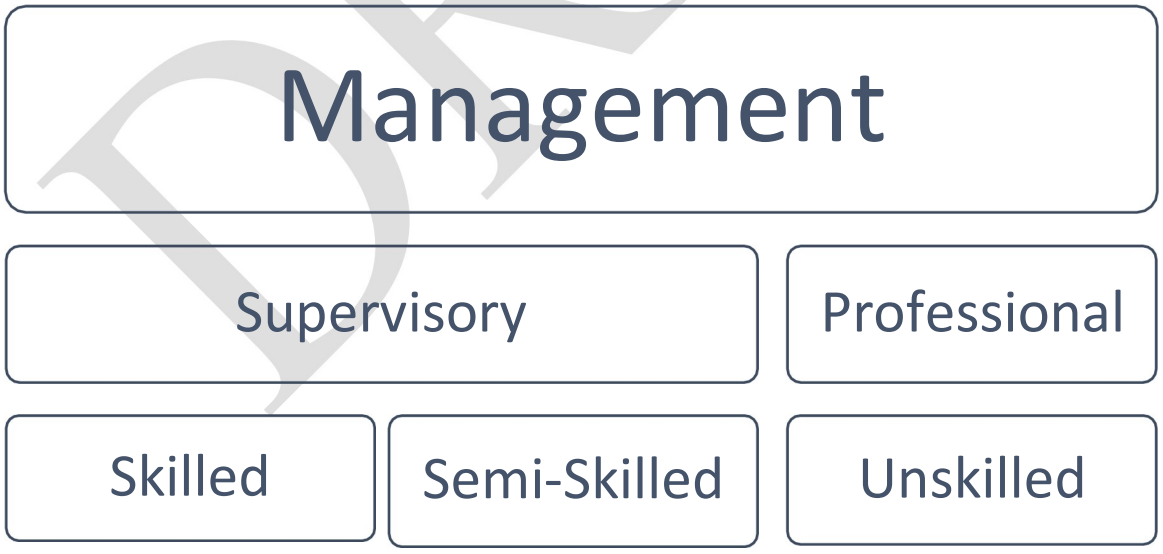
Employment

Over the last few years, the oil and gas sector has attracted more than 3,300 Guyanese employees to support activities in country. The Government of Guyana is projecting that the GtE project and build out of the Wales Development Zone will see an additional 3,000 Guyanese being employed within the sector.

Currently, there are numerous skilled workers in Guyana without full time employment, semi-skilled and basic skilled individuals upgrading their trainings with certification programs through technical institutes and centers, professionals graduating from universities and colleges that are looking to be gainfully employed especially within the oil and gas sector. The Local Content Act 2021 provides that all companies engaged in petroleum activities shall ensure that first consideration must be accorded to Guyanese national having the relevant qualifications and experience.

Based on the skill set being demanded by the GtE Project, there are several high value skills in Guyana that the government will encourage companies to consider when seeking talent.

It is likely that over the project life cycle, from development to operations, there will be thousands of jobs created for Guyanese across job categories, whether unskilled, skilled, technical, professional and management positions.



The fabrication and welding sector can create several direct and indirect job opportunities. In a Guyana, a natural gas project could potentially generate hundreds of jobs in this category, including welders, fabricators, supervisors, quality control personnel, and support staff.

Engineering offers diverse job opportunities. In the case of a natural gas project, there could be employment prospects for engineers and technical professionals in various disciplines such as civil, mechanical, electrical, and chemical engineering. The number of jobs in this category can range from several dozen to a few hundred, depending on the scale and complexity of the project.

The number of jobs for technicians in a natural gas project depends on the size and scope of the project. It could include roles such as technicians specializing in equipment installation, maintenance, instrumentation, and control systems. In Guyana, a natural gas project could potentially create several dozen to a few hundred technician jobs.

Security service professionals can see an increase in job opportunities due to a natural gas project. This includes security personnel for the protection of infrastructure and assets. The number of security jobs created can vary based on the size and security requirements of the project, ranging from several dozen to a few hundred jobs.

A natural gas project may require medical facilities and services for the project workforce. This includes doctors, nurses, paramedics, and support staff. The number of jobs in the medical sector can range from several dozen to a few hundred, depending on the project size and the level of medical support required.

The waste management sector can benefit from a natural gas project, creating jobs in waste collection, treatment, recycling, and disposal. The number of jobs in waste management can range from several dozen to a few hundred, depending on the project's waste generation and management needs.

Likewise, environmental services can provide employment opportunities related to environmental monitoring, impact assessments, compliance reporting, and consulting services. The number of jobs in this category can range from several dozen to a few hundred, depending on the project's environmental requirements and the need for ongoing monitoring and reporting.

Additionally, there a numerous related skillsets that will be demanded during the difference stages of the project life cycle, these include:

- Heavy equipment operators
- General managers
- Professional staff (accountants, finance, administrative, etc.)
- Project managers
- Commercial experts
- Medical professionals
- Mechanics

Capacity Building

The overarching objective of local content development in Guyana includes Guyanese participation in the oil and gas sector and equally important capacity building initiatives to build the skillset, competencies and technical capacity of local companies and individuals. As Guyanese continue to invest in their development, the Government of Guyana is also supporting through programmes and offerings such as scholarships, support to technical institutes and centers and the University of Guyana.

The Government also views the support from foreign companies doing business in Guyana who possess a wealth of knowledge and experience in working and developing employees and supply chains so that Guyanese can be easily integrated and provide their skills and services. Notably, companies in the oil and gas sector have been proactive in funding and providing technical support to institutes, centers and the university to build their capacity through strengthening their curriculum, upskilling lecturers, upgrading facilities and providing other resources necessary for learning. Companies are also supporting initiatives jointly and directly to develop businesses by hosting seminars, workshops, feedback sessions and funding projects and conferences that contribute to Guyanese business development. The community also plays a great role in the overall development of human resources and can be the center to drive the growth in entrepreneurship. As such, the Government encourages developmental initiatives at the community level especially outside of the urban centers which can have a significant impact on the level of business sophistication and services provided as well as the skillset in demand by industries.

Guyana welcomes additional capacity building initiatives that will enhance the services and skillset offered by Guyanese that will enable participant to be technically qualified for the job or business in their field. We encourage training programs, internships and apprenticeship programs

to build local workforce capabilities and promote knowledge transfer in natural gas-related and new energies industries.

A gap that has been identified in Guyana is the skill level of Guyanese technicians and their ability to do complex work within the oil and gas sector. Local technical institutes and training centers can offer specialized courses and certifications tailored to the needs of the natural gas industry. This creates a skilled workforce capable of filling technician roles in the project and beyond, opening employment opportunities and supporting the growth of training institutions.

9. Summary of Key Insights

- The Government of Guyana (GoG) has made the strategic choice to develop its Oil & Gas (O&G) resources in a timely manner to maximize the economic benefit associated with such developments, ensuring the further development of Guyana and prosperity for all the Guyanese people.
- How Guyana chooses to monetize its natural gas should be married with its wider economic objectives.
- Guyana has material natural gas resources. It is estimated that there are ~17 trillion cubic feet (Tcf) of recoverable gas resources, primarily of associated gas and condensates.
- Limited existing infrastructure in Guyana today is not conducive to enable additional upstream gas development. A sizable proportion of the discovered oil will not be able to be developed and monetized unless gas infrastructure solutions are developed.
- To timely monetize and maximize the value of all of Guyana's O&G resources, new gas monetization options and solutions need to be implemented.
- Natural gas is the cleanest and lowest greenhouse gas ("GHG") intensity hydrocarbon fuel and is particularly well suited as a competitive and economical solution in power generation, complementing renewables' intermittency.
- Natural gas is viewed as part of a balanced approach to addressing environmental concerns that supports innovation, lowers GHG gas emissions, grows our economies, and strengthens energy security.
- Energy transition and market forces creates significant uncertainty for gas demand beyond 2040, therefore there is an immediate window of opportunity to monetize natural gas resources if Guyana seeks to maximize the value of its O&G resources.
- Gas is essential to the sustainable economic and social development of Guyana, and it could have a transformational effect in Guyana, Latin America and the Caribbean region, consolidating Guyana's role as a regional energy hub and reliable global supplier.
- Condensate/gas fields discovered to date in Guyana are compartmentalized and relatively small to support commercially viable production making the development of these types of resources in deepwater is costly and challenging.
- Attracting private sector investors to develop the necessary gas infrastructure, that are not part of the PSC regime, will incentivize upstream operators to pursue other upstream development options, which are significantly more cost efficient and significantly faster to deploy that the current FPSO approach.
- The development of gas infrastructure will enable alternative options available for utilization of natural gas such as Gas-to-Power, Methanol, LNG, Ammonia/Urea, and Blue/Green Ammonia/Hydrogen.

- Governments play a critical role setting the right Investment Climate for gas infrastructure projects by providing transparency, clarity of roles/responsibilities and ease of doing business. Guyana gas needs to be competitive on a global basis.
- Diversifying the participants in the gas value chain and securing private investment will avoid significant capital charges into the cost bank through the current PSC structure, which will significantly accelerate revenues to the GoG.
- The GoG remains firm on its position that the oil and gas sector must bring benefits to all Guyanese.
- Guyana has strived to develop an economy that not only focuses on primary production but also value addition and manufacturing for export markets. The development of natural gas can facilitate the transition and transformation of traditional industries to make their produce more attractive and competitive on the regional and global markets.
- The oil and gas supply chain has been crucial to Guyana's economy over the last few years with procurement activities especially support services stimulating business within the private sector.
- It is likely that with the simultaneous developments of oil projects, the GtE, and a comprehensive approach to monetizing natural gas resources there will be a massive ramp of activities in Guyana that will require technical and profession services.
- It is likely that over the project life cycle, from development to operations, there will be thousands of jobs created for Guyanese across job categories, whether unskilled, skilled, technical, professional and management positions.
- The overarching objective of local content development in Guyana includes Guyanese participation in the oil and gas sector and equally important capacity building initiatives to build the skillset, competencies and technical capacity of local companies and individuals.

Appendix A - Principles for Developing Country Hydrocarbon Investment Policies[25]

Create the greatest overall value from the country's resources by generating:

- Value through the maximum life-cycle economic recovery of resources consistent with the most efficient, safe and environmentally sound development and decommissioning/restoration practices.
- Growth in local economies as part of value creation via development of local infrastructure, industries, jobs, and training.
- Revenues for the country (including all governmental stakeholders) to reinvest, including in other parts of the economy to avoid the "resource curse"

Be equitable both to government and investors:

- Ensure the government, as ultimate steward of the resources, receives for the country an equitable share of the benefit from those resources.
- Provide that investors receive a share reflecting all of their contributions and is commensurate with the overall risks they bear.

Align government and investing companies through project life:

- The regime should be responsive such that equitable sharing of value is realized through all stages of a project life cycle and across ranges of outcomes and market conditions.
- Recognize that projects and relationships are long-term and thus seek ways to promote partnership and mutual trust.

Promote a stable and sustainable business environment:

- Country and investors should be able to plan ahead and rely on terms agreed upon.
- Investors should be willing to manage and accept business risks (e.g., exploration, technical, project execution, operation, market, price, and costs) and the country should seek to provide maximum possible certainty on rights and economic terms (e.g., rule of law, contract terms, legal framework, land access or ownership, and fiscal terms).
- Country and investors should operate in good faith to solve potential disputes quickly and efficiently and adopt mutually agreed dispute resolution procedures, such as mediation and/or arbitration practices, which lead to principles-based, timely resolved and satisfied outcomes.

Be administratively simple:

- Provide a clear, practical, enforceable, and non-discriminatory framework for the administration of laws, regulations, and agreements.
- Adopt programs promoting cooperation and trust between tax administrators and taxpayers.

Be competitive:

- Should be competitive with other countries, given the relative attractiveness and risks of resource development.
- Should attract the widest range of potential investors to ensure a country maximizes competition for its resources.

[25] International Tax and Investment Center, Principles for Developing Country Hydrocarbon Investment Policies.