ON THE INTERSECTION OF ENERGY DEVELOPMENT AND THE ENVIRONMENT IN GUYANA.

ABSTRACT

In keeping with its obligations under the United Nations Framework Convention on Climate Change, Guyana developed a Low Carbon Development Strategy and a Climate Resilient Strategy and Action Plan that aim to achieve zero carbon status and climate resiliency in line with the Paris Agreement. However, the discovery of substantial oil and gas resources in Guyana now places the country in a seemingly contradictory position as both a current victim of climate change and an actor exacerbating the problem. How do we reconcile these two roles?

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Executive Summary

Before the discovery of significant oil and gas reserves in Guyana in 2015, the country, like other CARICOM countries in the Caribbean basin, had been on the forefront of efforts of vulnerable developing countries to raise international attention to their exposure to emerging climate risks and to galvanise international action for the institution of policies and provision of the necessary support for mitigation of and adaptation to climate change. Years of advocacy, mainly under the umbrella of the Association of Small Island States (AOSIS), led to global agreement under the Paris Agreement in 2015 to holding the increase in the global average temperature to well below 2°C above pre-industrial levels and pursuing efforts to limit the temperature increase to 1.5°C above pre-industrial levels, recognizing that this would significantly reduce the risks and impacts of climate change. The agreement also called for increasing the ability of countries to adapt to the adverse impacts of climate change, fostering climate resilience and lowering greenhouse gas emissions development, in a manner that does not threaten food production; and importantly to making finance flows consistent with a pathway towards low greenhouse gas emissions and climate-resilient development.

In keeping with meeting its obligations under the United Nations Framework Convention on Climate Change (UNFCCC), Guyana is committed to a zero carbon and climate resilient development pathway and had developed a Low Carbon Development Strategy (LCDS) and an accompanying Climate Resilient Strategy and Action Plan (CRSAP) which charts the course for Guyana to achieve zero carbon status and climate resiliency in the time frame prescribed by the Paris agreement. Underlying the thrust of the Paris agreement is a global aspiration to phase out the use of fossil fuels as an essential component of action to achieve the net zero target.

With the discovery of substantive oil and gas resources in Guyana in 2015, the country is now regarded as a new major producer of fossil fuels and has embarked on an accelerated effort to produce these resources for the local and global market. This new development does place Guyana as both a current victim of climate change, as well as an actor that exacerbates the problem. One must consider how these two seemingly contradictive roles can be reconciled.

In doing so, two factors need to be considered – the lack of resources to build climate resiliency to existential climate risks and to change the architecture of an unaffordable energy system, and the fact that, as globally we transition to the net zero status required by the Paris agreement, Guyana is now in a position to use its newfound wealth to implement both the mitigation and climate resilient (adaptation) aspects of the LCDS. Opportunities can be explored at the regional level under the umbrella of the CARICOM Heads of Government agreement to address regional energy and food security, by internalising the supply chains for the inputs to support these, and by utilising the resources from Guyana, Suriname and Trinidad and Tobago. This will also redound to the region's benefit in facilitating its progress in meeting their obligations under the Paris Agreement.

Given the low carbon intensity of Guyana's oil and gas resources and the feasibility of production compared with global producers, there is an opportunity for Guyana to emerge as a major supplier of fossil fuel during the global transition to net zero. Guyana needs to ensure that its production of oil and gas meets the highest available environmental standards and that the resources accruing are used to facilitate the transition of Guyana and the wider CARICOM to the required net zero status while at the same time building climate resilience to cope with the existential and future impacts of a changing climate.

Introduction

Guyana is now a major player in the oil and gas arena and has embarked on an accelerated production schedule to maximise the revenue that it can obtain taking advantage of the spike in global oil and gas prices. Rystad Energy recently forecast in a white paper "Guyana Upstream" that Guyana will be the fourth top global oil producer by 2035, with a specific focus on the current 33 discoveries and the 11 billion recoverable barrels in the Stabroek Block.

The projection is that only Saudi Arabia, Brazil, and the United Arab Emirates will produce more oil offshore on an annual basis. This places Guyana firmly in the camp of a major oil producer at a time when there is an urgent global need for the phasing out of fossil fuels, in keeping with the Paris agreement to restrict further warming of the earth's atmosphere to 1.5 degrees centigrade.

After decades of negotiating with vulnerable developing countries for Green House Gas abatement actions by developed and oil producing countries, Guyana now finds itself with the challenge of rationalising its new role as a major fossil fuel producer and its inherent vulnerability to existential climate change risks that pose serious threats to the country's developmental agenda and to the lives and livelihoods of its inhabitants. Locally, there have already been challenges from citizens to Guyana's decision to develop their oil and gas resources and to fast track its exploitation, given the limited time frame imposed by the global agreement to the phasing out fossil fuels.

How can Guyana as a "poor vulnerable developing country" – which for decades has been at the forefront of international climate change negotiations culminating in a global agreement to phase out the use of fossil fuels – now embark on a program of aggressively utilizing its own recently discovered fossil fuel resources? There are calls for keeping the resource in the ground but that is now unrealistic as the country is on a pathway to develop their newfound wealth. For all intents and purposes, continued production is a "fait accompli".

Background & International Context

In a discussion of energy development and the environment in Guyana, we are faced first and foremost with the environmental challenges engendered by Guyana's exposure and consequent vulnerability to climate change risks and a consideration of these provide a framework for such a discussion. . These are not intended to be a justification for the route Guyana has taken vis a vis the exploitation of its oil and gas resources but rather to provide a proper context as we consider how one might reconcile the apparent contradictions of Guyana's position as a victim of climate change on one hand and as a contributor to exacerbating the problem on the other. Any consideration of the intersection of energy development and the environment in Guyana must, to set a proper context, consider the following irrefutable facts.

A recent report regarding Guyana's status as an oil and gas producer by the energy intelligence group Rystad Energy indicated that Guyanese oil production was growing at such a rapid pace that it will surpass production levels in other big offshore basins, including the U.S., Norway and Mexico, by 2035 to become the world's 4th-largest offshore producer. Rystad reports that Guyana has been the global leader for new discoveries since 2015, with 11.2 billion barrels of oil equivalent, which amounts to 18% of total global discoveries and 32% of discovered oil. That growth has been driven by the prolific Stabroek block, where a consortium led by ExxonMobil has announced a series of major new discoveries since that time.

Rystad's report concludes Guyana's offshore production is in a prime position to weather the energy transition. Due to an estimated breakeven price of just $28 per barrel, Guyana is "well-positioned as an advantaged supply source in all Rystad Energy's energy transition oil demand scenarios." The report also points out that "the emissions intensity of Guyanese production is only half the global average," and that

those emissions are expected to decline further in the years to come, due in large part to the consortium's usage of state-of-the-art FPSOs (Floating Production Storage and Offloading vessels).

In terms of the financial benefits accruing to Guyana Rystad notes that the government receives 59% of the total value from the Stabroek asset, comparing that to the roughly 40% the U.S. government would receive from a typical offshore production area under current law. Government revenues are scheduled to surpass $1 billion this year, and Rystad says they will average $3.6 billion per year through 2030, rising to $12.4 billion annually through 2040.

Coincidentally, the year 2015 was also when the global oil industry started to suffer from a chronic under-investment in the finding of new reserves ample enough to replace annual consumption. It's an industry malady that still continues today and has led to the current under-supplied market conditions. Exxon announced its initial Liza-1 discovery well in May of that year, and the number of new Guyana discoveries has now grown to 32, with two more announced this week.

Guyana falls into the category of countries which are highly vulnerable to climate change and has taken major steps locally to develop an understanding to its exposure to risks arising therefrom to its coastal infrastructure, water, agriculture, health, and other productive sectors on the well-being and livelihoods of its citizens. Having ratified the United Nations Framework Convention on Climate Change, Guyana has been fulfilling its reporting obligations to the United Nations Framework Convention on Climate Change (UNFCCC) secretariat, by developing and submitting to the secretariat its National Communications, National Adaptation Plans (NAPs) and Nationally Appropriate Mitigation Actions (NAMAs). Latterly, in keeping with the requirements of the Convention, Guyana has submitted its first Intended Nationally Determined Contributions (INDCs) to the Secretariat.

The INDC provides information of Guyana's mitigation goals that would contribute to the global target of achieving a net zero status by 2050. It also provides information on national priorities under the Adaptation umbrella to build climate resilience across all the vulnerable socioeconomic sectors in the country.

As a signatory to the Convention, Guyana is committed to the global objective of the Paris Agreement, which sets out a global framework to avoid dangerous climate change by limiting global warming to well below 2°C and pursuing efforts to limit it to 1.5°C. To achieve this, the general consensus is that to stay below 1.5 °C of global warming, emissions need to be cut by roughly 50% by 2030. This is an aggregate of each country's nationally determined contributions.

By mid-century, CO_2 emissions would need to be cut to zero, and total Green House Gases (GHG) would net to be net-zero just after mid-century. One fact has become evident during the global net zero discussions is that as the world transitions to a net zero status by mid-century, fossil fuels will still be in use, so there will still be a global demand and hence a global market for fossil fuels. Thus, Guyana and all of its sister CARICOM countries will require access to supplies of fossil fuels during this transition.

Current experience underlines the fact that energy transition needs are to be grounded in energy security, described as the availability of adequate and reasonably priced supplies to ensure public support and to avoid severe economic dislocations. The present global energy crisis, regarded as the first of the global energy transition to its net zero status, can be attributed to a mismatch between supply and demand. We shall say a bit more about this issue of energy transition later but for now, let us keep in mind the fact that fossil fuels will still be in demand as we pursue the net zero goal.

In accordance with the UNFCCC requirements Guyana submitted their Revised Intended Nationally Determined Contributions before the Paris meeting. These documents were designed to inform the Convention on a country's intention to reduce their Carbon footprint and, especially for developing

countries, how they were going to adapt to climate change. This submission was made to the Convention in 2014 before Guyana was aware of their oil and gas bounty. We shall return to this early INDC later but would draw your attention to the assumptions made about the availability of financial resources for the implementation of Guyana's proposed actions, both in the mitigation of Green House Gases emissions and adaptation (building resilience to climate change impacts). Assumptions made were:

1. That Guyana and Norway will agree to renew and extend their bilateral agreement involving payment for carbon credits derived from forest conservation,
2. That the Green Climate Fund will be fully operationalized and begin disbursing from 2016,
3. That SIDS and in particular, coastal low-lying countries such as Guyana, will receive preferential access and special consideration in access to financing,
4. That REDD+ vulnerable developing and renewable energy programmes and projects will be resourced in a predictable, adequate and timely manner.

International Promises vs. Current Realities

These assumptions highlight one of the major stumbling blocks in the global climate change negotiations, the issue of climate change finance, which is required to allow developing countries timely and expeditious access to resources required for the urgent implementation of climate change adaptation and mitigation actions, which are articulated in their Nationally Determined Contributions, submitted to the United Nations Framework Convention on Climate Change (UNFCCC).

The promise of a $100 billion US per year capitalisation of the Green Climate Fund by 2020 made at the UNFCCC meeting in Copenhagen in 2009 has not been realised. Developing countries, including Guyana, have for the past three decades argued that developed countries need to establish a fund to finance Loss and Damage, which is the result of the ravages of the impacts ever increasing climate change triggered extreme events on their vulnerable countries and populations.

Agreement to establish such a fund was only reached at the recent Conference of Parties at their yearly meeting in Egypt. Logistics about how this will be funded and by whom, who will have access and on what terms, and the management and operationalisation of the fund are details to be worked out, so there is no certainty as to when it will be established. Already there are issues, such as to whether countries like China which falls into the negotiating Group of 7 and China, should be eligible for funding under this new umbrella or should be a contributor to the fund given its economic status and the level of its Green House Gas emissions. Recent indications are that the $ 100 billion US target is inadequate to address our needs for climate change mitigation and adaptation and the recent estimate is that there is a need for about $4 trillion US per year to effectively address these issues.

A New Green Roadmap for Guyana: The LCDS

With respect to Guyana's challenges from climate change they have developed, through an extensive series of expert studies and National consultations, a Low Carbon Development Strategy (LCDS) which defines in great detail Guyana's plans to build climate resilience through the implementation of Adaptation actions and at the same time, to pursue a climate mitigation pathway that is consonant with the aspirations of the Paris agreement with Guyana attaining net zero status by 2050. The LCDS describes actions to be taken to reduce Guyana's level of GHG emissions and to so manage its Natural resource base, that even after development, Guyana would be a net sink for global GHG emissions. Further, Guyana has developed a Climate Resilience Strategy and Adaptation Plan (CRSAP) which, essentially, is an implementation Plan for the climate resilience aspect of the LCDS. The CRSAP was prepared through a consultancy that included full consultation with expert groups and with different civil society stakeholders. It has prioritised and costed actions to be taken and provides a road map for the implementation of the identified actions. All

of these need to be considered against a background where, as a poor developing country, Guyana did not have access to the level of financial resources required for the transformation of the architecture of its energy sector and building the climate resilience of its coastal infrastructure, and its agriculture, health, water and other key socio-economic sectors in Guyana's economy.

Also of relevance, is the growing realisation that the global community is running out of time required to effectively adapt to climate change and to mitigate GHG emissions, so that we can achieve the objectives of the Paris Agreement.

The LCDS was first prepared and finalised during the tenure (2010-2015) of the People's Progressive Party led government. They commissioned the study to prepare the CRASP before demitting office in 2015 as a result of a change in government and the coming into office of a government led by the APNU coalition. The study to prepare the CRSAP was led by a British based risk assessment firm ACCLIMATISE and the study was completed in 2016 and submitted to the relevant authorities in the new government for their consideration.

With the change in government, there was a hiatus in the further development and implementation of the LCDS and the new government embarked on a new process of national studies and consultations, culminating in the development of an alternative document, the "Green State Development Strategy" which was finalised and endorsed in 2019. In essence the goals of the LCDS and the Green State Development Strategy aim to set Guyana on a Low Carbon climate resilient development pathway.
The Green State Development Strategy identified a number of key actions, which are oriented to the aspirations of the green economy modelling scenarios, emphasising, inter alia:

- Establishment of the Natural Resource Fund Act and adoption of a medium-term expenditure framework to more strategically, transparently and effectively manage oil revenues.
- Switching to lower-cost, renewable and reliable energy sources to support business operations and achieve energy access and security.
- Advancing in the use of more effective and coordinated management of natural resources.
- Diversifying Guyana's economic base and moving to higher value-add products with decent jobs for all.
- Investing in people, communities and health and education to ensure that the citizenry can have access to the best opportunities to prosper, prepare and participate in emerging economic opportunities.

It was expected that reinvesting part of the oil wealth into the adoption of sustainable policies in actions that impinge directly on livelihoods are cost-effective in the long run and will give effect to the Green State Development priorities for social inclusiveness and decent jobs. In order to fully reap the benefits, it posited that investments are also needed in the country's legal and regulatory frameworks.

Following the change in government in 2020, the LCDS was reintroduced into the national discussion, and revised. The revised version, LCDS 2030, was endorsed by the government as the strategy that would guide Guyana's action for low carbon climate resilient growth and the government has started to implement certain aspects of the programme.

Regional perspectives

The recent development of the oil and gas resources in the Guyana basin ought not to be considered in isolation from those in the Suriname basin and it can be argued that there are advantages to consider these in the context of the wider CARICOM region. We also need to keep in mind that the interconnectivity of

the Guyana marine space with that of the wider Caribbean has implications for the environmental integrity of the wider Caribbean marine space.

Since early 2020 there have been a number of oil discoveries in offshore Suriname. The first in offshore Suriname Block 58 in early January 2020 at the Maka Central-1 well. The optimism surrounding the first discovery in Block 58 saw investment bank Morgan Stanley announce that the block could contain 6.5 billion barrels of recoverable oil resources, with it believed to contain the same petroleum fairway running through the nearby Stabroek Block. Since then, there have been several commercial oil discoveries in offshore – Suriname being the latest in October 2022 – by Shell who announced the discovery of oil in another offshore block. This discovery is currently being evaluated to determine whether the working petroleum system found is commercially viable to exploit. The areas where these discoveries are made in offshore Suriname are close to the prolific Stabroek Block in offshore Guyana. This latest hydrocarbon discovery in offshore Suriname underscores the considerable potential oil wealth that exists in the former Dutch colony's territorial waters.

The appeal of offshore Suriname is amplified by the fact that the oil discovered to date has been light to medium with low sulfur content. That means that, like the Guyana deposit, it is cheaper and easier to refine into high-quality fuels, and there is a low carbon cost associated with its extraction compared to the heavier sourer oil grades produced in other countries e.g., Venezuela, Colombia, and Ecuador. Projects in Suriname have an estimated breakeven price of $40 per barrel Brent, which is expected to fall further as development ramps up, and vital infrastructure is put in place. For these reasons, offshore Suriname is an appealing investment jurisdiction for international energy companies, particularly when it is considered that many Latin American countries have far higher breakeven prices.

According to data from Staatsolie, the National Oil Company and industry regulator, offshore Suriname contains up to 30 billion barrels of recoverable oil equivalent resources. The government has recently decided to delay any production efforts until 2027 during which time they will concentrate on building the required national capacity to manage the industry e.g., through development of critical infrastructure and training of a local oil and gas cadre of technical personnel which they anticipate would result in an environment that would facilitate more investments in local content. more investments.

All CARICOM member countries like Guyana are designated to be highly vulnerable to climate change risks, are signatories to the Paris convention, have all submitted National Determined Contributions that disclose their paths to zero carbon emissions status and suffer from the unaffordability of their fossil fuel dependent energy sector.

At the recently concluded Heads of Government meeting in Suriname, CARICOM countries agreed to prioritise energy and food security and climate change. This decision provides the region with a platform to address more effectively the environmental issue related to climate change mitigation and adaptation as well as finding a more sustainable way in which to ensure energy security as the region transitions to a net zero status.

Energy security has been regarded as an essential element for successful energy transition and is defined as having adequate and reasonably priced supplies to ensure public support and to avoid severe economic dislocations. Indeed, globally, with the Ukraine war we are facing, we are experiencing the first disruption in transition pathways with the present mismatch between supply and demand, and culminating with the UK for instance, despite its commitment to the net zero target, approving the opening of a new coal mine after the recent COP meeting in Egypt.

As we proceed to discuss the issue of the intersection of environment and oil production in Guyana, let us keep in mind the need for Guyana to implement the LCDS in order to pursue a low carbon and climate

resilient pathway given the global community has failed to provide resources for poor, vulnerable developing countries to effectively address their inherent vulnerability to climate shocks that are derailing their developmental efforts. At the present rate, we are way behind what is required to keep global warming within the limits needed to meet the targets of the Paris Agreement with the result being that there is greater urgency for expediting implementation of mitigation and adaptation actions. Finally, we reiterate that as the world transitions to a zero-carbon status, there will be a need for fossil fuels.

Environmental risks of oil production and development in Guyana.

The present trajectory of Guyana's Oil & Gas production schedule does immediately pose a problem in relation to one of the fundamental requirements of the Paris agreement, which relates to the phasing out of fossil fuels and for countries to transition to net zero status by 2050. There has been a call in some circles for Guyana to keep the oil in the ground but for a poor developing country like Guyana, without access to resources for the implementation of actions to mitigate and adapt to climate change, exploitation of this resource provides an avenue for addressing this need.

Guyana must also face the reality that in transforming its energy sector through investment in renewable energy and employment of energy efficiency measures across the entire energy utilisation landscape, fossil fuels will continue to play an important role as part of the energy mix as the country transitions to a net zero status, in the prescribed time as is necessary for the realisation of the objectives of the Paris agreement.

Note that countries like **Norway, have recently announced plans to carry out further exploration for oil reserves in their offshore area and the UK has recently** lifted restrictions on fracking to exploit new resources as a result o the energy crisis brought on by the Ukrainian war. With the changes in the leadership of the ruling party in the UK, they reversed the decision on fracking but agreed to grant a licence for the opening of a new coal mine – an action inspired by concerns on their energy security which is being jeopardised as a result of the Ukrainian war and disruption of the global energy market.

Note that Norway also uses resources from its sovereign fund derived from its oil and gas industry to pay Guyana to retain its forest cover and thus contribute to global Green House Gas sequestration. There is no indication from traditional producers, notably OPEC, that they are considering a reduction of their investment in fossil fuel resource development and extraction. It is anticipated that a massive investment in clean energy – inclusive of energy efficiency, renewables, and clean fuels – would be the best guarantee of energy security in the future and that about $1.4 trillion will be spent in 2022 on energy transition initiatives.

In order to get the world on track to meet the 1.5-degree target of the Paris agreement, it is estimated that expenditure will have to rise to over $4 trillion US dollars by 2030 while at the same time that there is adequate energy supply for existing needs. It is further estimated that a lot more than just renewables (solar, wind, hydro etc.) will be needed to achieve the pace and scale of the required energy transition to switch from fossil fuels to low carbon energy in time to avoid climate catastrophe. The present global energy highlights the need for a massive surge in clean energy investment. Recently wind and solar share of low carbon energy investment in the total global primary energy needs increased to 17% whereas fossil fuels still make up 77% of those needs.

Prioritising Guyana's Local Environment

To assuage local concerns about the possible adverse impact of the industry on Guyana's marine and terrestrial environment, it behoves the government to leave no stone unturned in ensuring that oil & gas production activities meet the highest environmental standards possible. In addition, considering the possible development of a global standard that may form the basis of a quota system for production,

distribution and the institution of a "production non-proliferation" cap, is further reason for Guyana to put in place the necessary systems and institutional arrangements to ensure that its oil and gas sector conforms to the highest environmental standards attainable in its operations.

For a start, the production process must meet the highest available standards in the industry, utilising state of the art technology in every phase of the production process, with no flaring or venting and with minimal leakage of gas and the employment of adequate measures to ensure that there is strict adherence to best practice for the mitigation of risks to the surrounding marine environment and to the shore-based facilities of the latter. Of major importance is the management and disposal of the naturally occurring radioactive waste generated in the offshore drilling process. Already there has been concern expressed by communities on plans to manage these wastes at onshore locations. This is an issue that should receive close scrutiny by the Guyana authorities, to ensure that the integrity of the surrounding environment is in no way compromised by radioactive contaminants. Of great concern is the risk from an oil spill which could not only impact the Guyana Exclusive Economic Zone but that of the wider Caribbean.

A recent forecast by Rystad Energy projected that Guyana's deposits were composed of light sweet crude which will be in demand for decades to come, despite the global move towards renewables. Combined with this, Guyana has both the necessary and sufficient conditions to be a preferred producer. This is due to the comparatively low cost per barrel of production in order to be profitable and the low amounts of carbon emissions, in an era of energy transition to cleaner energy and renewables. This could be to Guyana's advantage as a supplier of the resource on the global market.

In terms of future production, there is a school of thought that envisages the need for a global effort that brings together all oil producing countries to negotiate a global mechanism that uses well defined and consensual criteria as a basis of allotting production quotas to the different producers. Such a transparent scheme should allay the fears of new producers, like Suriname and Guyana, that they will be excluded from access to the residual global market as countries transition to the net zero status.

Criteria that can be utilised can contain issues related to the quality of the resource ("sweet oil"), the carbon intensity of its production process, the eventual transportation to markets for consumption ("near shoring of the supply chains"), and the environmental impact (on the marine and terrestrial environment) of the entire production process inclusive of the construction of onshore supporting facilities.

The new wealth derived from Guyana's rapidly developing offshore oil and gas sector presents a challenge to managing the natural wealth of Guyana that defines our green identity. Guyana's Environmental Protection Agency (EPA) has the mandate and responsibility to safeguard the natural environment and preserve the collective inheritance of all Guyanese. The EPA has broad responsibility under Guyana's Environmental Protection Act to oversee the environmental activities of persons and companies involved in the extraction of Guyana's natural resources in the mining sector, forestry, and oil and gas development. Before any project that might impact the environment can proceed, the EPA should determine the necessity of an Environmental Social Impact Assessment (ESIA) to ensure the effects can be mitigated and managed in a way that limits unavoidable impacts. A robust and competent EPA is a key safeguard to protect the natural environment and facilitate the successful implementation of the LCDS which in part depends on the integrity of key ecosystems for its successful implementation.

The EPA is boosting its capacity to regulate the oil and gas industry and adhere to international standards. The 2022 budget for the EPA included some G$100 million in allocation for capital expenditure, with G$74.1 million of that money to be spent on digital environmental monitoring, and reporting and verification of the framework for offshore, petroleum, mining, and forestry activities. This allocation is pivotal to providing remote monitoring sensors, instruments, and dashboards as well as scientific and laboratory equipment that will be useful in oil and the non-oil industries. However, concerns have been

expressed that the institution has not taken full advantage of the grant from the World Bank to strengthen its monitoring and enforcement capacity and that there was a hiatus in the implementation of this effort. The grant was aimed at establishing a corps of personnel including 34 highly specialized and experienced petroleum, geological and environmental engineers. But because of the hiatus, the intended outcome has not been achieved leaving the EPA lacking in these essential skills and capacities. By now the agency must be fully aware of the skill discrepancy that exists in the organisation in terms of its responsibilities to closely monitor developments under the oil and gas umbrella and every attempt should be made to address these discrepancies as a matter of urgency.

Opportunities for regional cooperation?

Guyana's production (and those from Surinam and Trinidad & Tobago) should be able to satisfy its own needs during the transition period and the needs of the entire CARICOM (CARIFORUM?) region. At the recent Heads of Government meeting, a decision was taken to resuscitate the Petrocaribe agreement with Venezuela, as a means of addressing the energy needs and energy security of CARICOM countries. Now, with the combined resources of Guyana, Suriname and Trinidad and Tobago, CARICOM should explore the feasibility of replacing the Petrocaribe arrangement with one where regional fossil fuel needs are satisfied from its own pool of fossil fuel resources as the region transitions to net zero status.

This would be an added advantage when looking at the carbon intensity of regional production and supply, in that the regional market is close and does not involve long carbon intensive hauls to deliver the goods to other markets. Altogether, such an arrangement would redound to the benefit of the region, in providing a more secure and affordable energy supply, as it transitions to net zero and ultimately, to the region's energy security.

With respect to localisation of the supply chain for the region's energy needs, it would be useful to assess the rehabilitation of the refining capacity in Trinidad and Tobago and Suriname with a view of determining the feasibility of utilising this capacity, instead of investing in new facilities for refining.

It was recently reported in the local press that as part of their concern on future energy security the Government will commission the construction of a small refinery. Studies have shown that the costs associated with the supporting infrastructure for a small refinery are not much different from those required for the construction of a large refinery and the need for care when making such a decision. Consideration also needs to be given to avoid investments in infrastructure that would lock in heavy emissions for years to come and end up as stranded assets at the end of the transition period.

It would also be useful to explore the feasibility of utilising the Trinidad and Tobago chemical complex and natural gas for the manufacture of fertilisers, an especially critical input for the region's food security thrust. Note the recent agreement of Trinidad and Tobago to take its Point Lisas facility out of moth balls and to develop its own natural gas resources in the Cypre offshore gas project. Trinidad and Tobago is also exploring supplementing supply, through an arrangement with Venezuela. One may consider whether the latter could feasibly be replaced with a line of supply from the Guyana/Suriname basin**.**

Guyana's Low Carbon and Development Strategy (LCDS)

Guyana's LCDS provides a useful platform on which Guyana can exploit its Oil and Gas resources in such a way, as to avoid any undesirable compromise of the environmental integrity of the country's natural resources. Environmental issues to be considered relate to those associated with our obligations under the Paris agreement to attain net zero status by 2050 and others addressed under the Climate resilience programme of the LCDS the implementation of which have implications for Guyana's obligations under other Multilateral Environmental Agreements (Biodiversity Convention, Convention on Land Degradation

& Desertification which are relevant for the successful implementation of the climate resilience aspect of Strategy.

With respect to the net zero objective the LCDS states:

"Guyana will act strategically and responsibly as the sector develops, supporting global energy security while diversifying and decarbonising Guyana's domestic economy and investing in development priorities for all Guyanese, including health, education and low-carbon opportunities. At the same time, the Government will advocate internationally for a strong global carbon price and the removal of subsidies on fossil fuel – to incentivise the lowest carbon, most cost-effective oil and gas in the global marketplace in line with the goals of the Paris Climate Agreement under which there will be demand for decades to come. In parallel, Guyana will advance a "no flaring" policy, and mandate the use of best technology in the Oil and Gas sector to limit its environmental impact."

As alluded to earlier, collective actions addressing regional energy security, like decarbonising Guyana's energy & transportation economic sectors, deriving revenue from forest conservation and ecosystem services, and investments in low carbon economic activities under the umbrella of Guyana's LCDS, should allow for the attainment of the country's goal for zero carbon status by 2050 if properly implemented. Espousing the concept of endogenizing of the region's energy supply during the transition period, should redound to both the financial and environmental (energy intensity) benefit of Guyana, CARICOM and ultimately the global community.

However, for Guyana to benefit from monetizing ecosystem services, it would be of paramount importance that oil production and distribution from the local industry adhere to the highest environmental standards, both in its offshore and onshore operations. In this respect, priority should be given to building the technical capacity of the local Environmental Protection Agency (EPA), so that they have the ability to closely monitor all of the activities of the industry to ensure that corners are not cut and environmental regulations are not flouted.

Guyana's Oil and Gas sector development poses many challenges to the country's aspirations "to create a new low-carbon economy in Guyana by establishing incentives which value the world's ecosystem services and promoting these as an essential component of a new model of global development with sustainability at its core." At the same time revenues recovered from the Oil and Gas sector provide Guyana with an opportunity to successfully meet these challenges and to accelerate the attainment of the objectives of the LCDS to:

- Stimulate future growth through clean energy and sustainable economic activities
- Protect against climate change
- Align with global climate goals
- Access market-based mechanisms for Forest Climate Services and other Ecosystem Services

Guyana's transition to net zero status

The LCDS provides a detailed roadmap for Guyana's thrust for clean energy involving early implementation of a generation facility utilising natural gas as a replacement for the present system and which will serve part of Guyana's energy needs during the transition to a zero-carbon status in the energy sector. The natural gas provides the needed firm capacity at a lower generation cost compared to other indigenous renewable energy options in Guyana. It is planned that this will be supplemented with hydropower through the development of a facility at Amaila Falls.

There is some uncertainty now on the fate of the Amaila project as discussions between the selected developer and the government have been suspended. There was also an agreement at the recent Latin America & Caribbean summit in the USA for the USA to provide an assessment of the hydropower capacity of Guyana. No doubt Hydropower will form a major part of the energy mix as Guyana transforms its energy sector and, with natural gas, supply the needed firm capacity during the transition. This will be supplemented with other renewable sources utilising solar and wind energy.

Globally, natural gas stands out as a transition fuel because of its economic viability and availability compared to emerging renewable technologies and its less-polluting effect compared to other fossil fuels. The availability issue makes it an attractive option for Guyana when considering the country's energy security in a volatile global market. Further, the country will not need to expend much foreign currency importing fuel during the transition period. natural gas produces less overall pollution than gasoline and diesel as it is the cleanest burning fossil fuel and less carbon intensive. It reduces carbon dioxide emissions by up to 60% compared to coal and by up to 30% compared to oil when used to generate electricity. As a result it has an overall smaller environmental impact.

It is characterised as a bridge fuel which will be used now to achieve short term Green House Gas reductions by replacing coal and other fossil fuel use, then reduce and end natural gas use over some time period to lock in long term GHG reduction. Guyana, like other countries, is committed to phasing out the use of all fossil fuel by 2050, to achieve the zero-carbon status as required under the Paris agreement. It is projected that under current decarbonisation policies, natural gas will continue to play an important role in the global energy mix over the coming decades. For Guyana, with its ready supply of natural gas, this route – using it as a bridging fuel during the transition period – has been assessed as the most desirable. It is argued that use of natural gas as a bridging fuel is a better alternative to the practice of venting and flaring during production of oil. In keeping with efforts to reduce methane emissions during production from drilling oil companies are now required to reinject the gas into the well from which it was extracted.

At the recent COP 27 meeting, some countries attempted to deter global acceptance of the concept of natural gas as an acceptable fuel to be used ad interim during the transition. Developing countries argued that this was the most feasible option, in terms of availability and affordability that was open to them, especially when the issue of their energy security is considered.

It is interesting to note that under the banner of energy security, the UK government approved the opening of a new coal mine just after COP 27. India is pursuing energy transition which involves a big commitment to renewable energy utilisation but is also building a $60 billion natural gas distribution system.

Several developing countries are seeking to initiate and expand the use of natural gas to reduce indoor pollution, promote economic development and job creation and eliminate emissions and pollution from burning coal and biomass. The USA for some time has been converting gas-based systems to those that use natural gas generated electricity to heat homes and provide energy for cooking. The LCDS observes that Guyana has some of the highest electricity rates in the Americas and is about 97% dependent on imported fossil fuels. It proposes that using natural gas as a bridge away from heavy fuel-oil, followed by the Amaila Falls Hydropower Project by 2027, Guyana will see a massive expansion of renewable energy across the country.

The LCDS observes that through it's proposed energy transformation plan energy use can increase five-fold with Green House Gas emissions staying approximately flat – one of the world's highest levels of decoupling of economic growth and fossil fuel use for energy. It is anticipated that if the electricity supply mix stays as it is today, consumer costs will not reduce significantly, while greenhouse gas emissions will triple by 2027, and increase steadily thereafter.

In the original LCDS, it was foreseen that the Amaila Falls Hydropower Project would have been complete by now, delivering cheaper, cleaner electricity. However, the Amaila Falls development was not progressed by the 2015-2020 Government.

Guyana's expenditure on imported Heavy Fuel Oil (HFO) and Diesel for electricity generation in the twelve public grids locally was approximately US $ 100 million in 2020. The Demerara Berbice Interconnected System (DBIS) is the largest grid accounting for 78% of the total cost. The power demand in Guyana's public electricity grids is forecasted to triple over the next five years. The DBIS peak power was 126 Megawatts (MW) in 2020. It is estimatedthe peak load by 2025 will be 415MW. The DBIS currently has 202MW of firm capacity. However, some of that capacity is from aged generators with low reliability. It has beenestimated that by 2025, new 300MW of firm capacity will be needed to cover the demand increase, the retirement of aged generators and to increase the grid reliability.

The present government intends to return to a strategy of decoupling economic growth from using fossil fuels for electricity by developing low-carbon energy resources (Solar, Hydro, Wind, Biomass, and Natural Gas)to meet rapidly rising demand and keep greenhouse gas emissions low. The LCDS projects that this will be accomplished in three phases:

- In the period 2022 to 2027, a near tripling of electricity demand will be met mainly through a combination of natural gas and the Amaila Falls Hydropower plant on the Demerara Berbice Integrated System grid, coupled with a major expansion of solar power, with batteries, on therural networks.
- From 2027 to 2032, further increases in electricity demand will be met by continued replacement of HFO, expansion of wind and solar power and the commission of Guyana's second hydro plant, the site of which will be identified before 2025.
- From 2032 onwards, expansion will be determined by prevailing market conditions,but it is likely that battery technology will be sufficiently advanced to enable solar and wind plants to provide most new capacity increases while contributing to further downward pressure on electricity prices.

The table and figures below illustrate how the percentage of the energy mix will shift in the years ahead from heavy fuel oil and diesel to mainly renewable energy while electricity prices fall.

Table 1. Predicted shift in the energy balance in the Demerara Berbice Integrated System (DBIS) and isolated grids to 2041. (Source Guyana LCDS)

Year	Peak Load	Backup HFO or Diesel	Natural Gas	Solar	Wind	Hydro	HFO	Natural Gas	Renewable Energy
	MW	MW	MW	MW	MW	MW	%	%	%
2021	161	203	0	5	0	0	99	0	1
2022	211	203	0	5	0	0	99	0	1
2023	283	192	250	15	0	0	47	52	1
2024	341	182	250	20	25	0	4	94	2
2025	414	182	250	25	25	0	11	86	4
2026	459	157	250	30	25	0	20	76	4
2027	506	132	250	35	35	165	7	62	31
2028	561	107	250	40	45	165	13	57	30
2029	620	82	250	45	55	165	20	52	29
2030	685	57	250	50	65	165	26	47	27

2035	989	47	250	300	315	585	1	32	67
2040	1,326	47	250	550	565	785	2	24	74

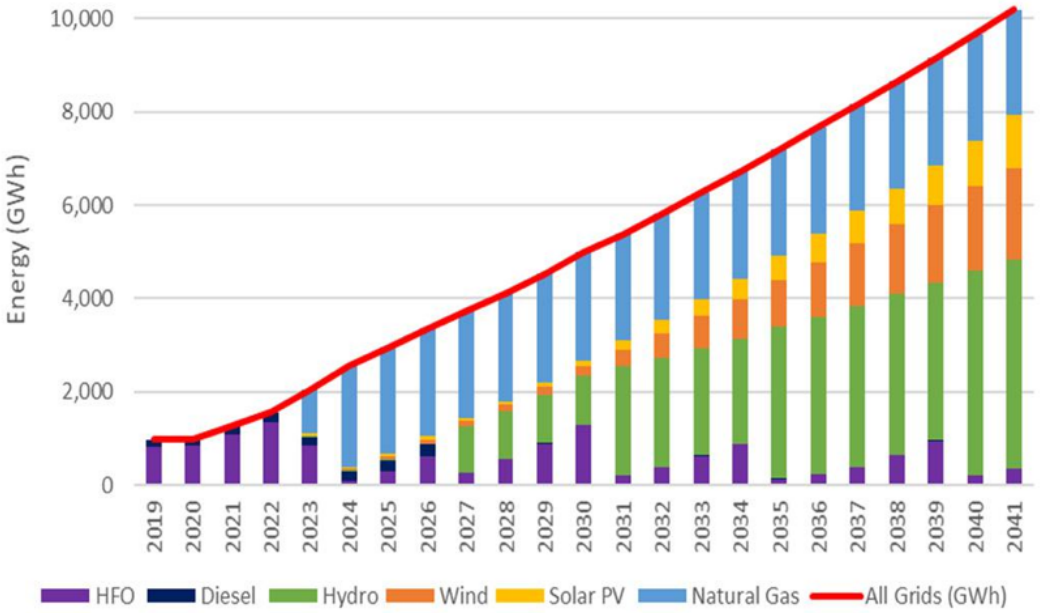

Figure 1. Energy balance in the Demerara Berbice Integrated System (DBIS) and isolated grids to 2041 (Source Guyana LCDS).

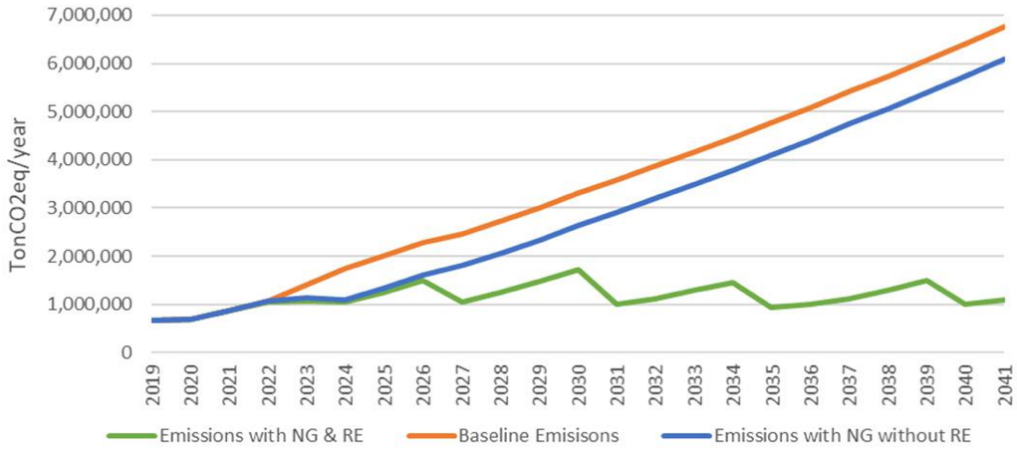

Figure 2. Annual GHG emissions in the Demerara Berbice Integrated System (DBIS) + isolated grids to 2041 ((Source Guyana LCDS).

The LCDS states that to use natural gas for power generation, the following investments are needed: a pipeline to bring the natural gas to shore, a processing plant to separate the Liquefied Petroleum Gas (LPG) and the natural gas, and a gas-fired power plant. Several studies have confirmed that the natural gas option would reduce the cost of generation.

The Government is currently undertaking the detailed studies and the financing structuring of the project. It is anticipated that a 250MWgas-fired power plant will be constructed and in operation in 2024. Besides the

natural gas-firedpower plant, and in order to provide the necessary firm capacity, new reciprocating 46MW dualfuel (HFO/NG) engines were added to the DBIS grid in 2021. Additional capacity will be installed as part of the Natural Gas Programme. GPL plans to convert 106MW of their existing HFO capacity to dual fuel engines (HFO/NG) by 2026.

By 2025, an additional 296MW of firm capacity will provide power to DBIS and the total capacityto generate electricity with natural gas will be 403MW. This will reduce the Green House Gas (GHG) emissions associated with the electricity generation in the DBIS by half.

As part of the natural gas Programme, the LPG consumed in the country would be provided by the new separation plant and LPG production facility, avoiding the current importation. The planned offshore pipeline is designed to provide larger amounts of gas. In case new discoveries are made, the natural gas could be used for other industrial activities.

In the short term, the natural gas will provide the needed firm capacity at a lower generation cost compared to the other indigenous renewable energy options in Guyana. But its availability is limited in time (20 years) and to the DBIS area. The development of the solar, wind, hydropowerand biomass technologies is a key priority for the future.

Renewable Energy in DBIS

The LCDS considers that solar and wind are intermittent energy resources, which cannot provide firm capacity unless battery storage is added. Hydropower and biomass resources are variable throughout the year,but in both cases the resource can be stored; with good planning, batteries are not needed to consider the output as firm. In Guyana, solar energy, wind and hydropower are good complementary resources. Solar energy is available during daylight hours, peaking at noon, while wind is stronger during evening hoursand at night. Wind is lower during the wet seasons, while hydropower is fully available. Because of their suitability for both the DBIS and the isolated grids, they are discussed under the section on the latter below.

Utility-Scale Hydropower in DBIS

The LCDS observes that Hydropower has the potential to provide Guyana with both utility-scale and small-scale capacity and that while natural gas provides a short to medium-term solution, over the medium and long term the most sustainable and resilient energy mix in Guyana would be formed by solar, wind, hydro and biomass power plants. Within the renewable energy resources available in Guyana, hydro will be important to provide firm capacity and short-term energy storage to compensate daily and weekly fluctuations from solar and wind. Hydro will provide, in the long-term, a cheaper solution than any other technology, due to its long lifespan.

Guyana has a potential for 8.5 Gigawatt (GW) of hydropower on 33 hydropower plants (including storage capacity and run-of-river). It is anticipated that Guyana will build two hydro plants over the next 20 years: Amaila Falls and another which is still to be identified. Of the potential 33 sites, many were assessed in the 70s and 80s, when environmental and social standards were lower. Itis anticipated that the new site will be identified by 2025, with the goal of providing 370MW of capacity by 2035 and a further 150MW of capacity by 2040. In the meantime, Amaila Falls will be the focus of the hydropower programme.

Additional renewable energy sources for consideration

The LCDS mentions that the natural gas facility has a lifetime of 20 years but there is no indication that it will be retired at that stage (as it should if the energy generation is fossil fuel free). Also, there is no mention

of waste to energy generation as part of the energy mix. Guyana has opportunities to generate energy from wastes from its extensive rice and sawmilling industries.

Additionally, the Rice Husk Ash (RHA)obtained from the incineration of rice husks has value as an extender for cement and as the optimal raw material for the production of raw silica which is used to manufacture photovoltaic cells for the solar energy industry. There should also be some consideration of the conversion of municipal waste to energy facilities possibly utilising some of the available technology requiring incineration of the waste. The other alternative would be through biogas production from municipal landfill for energy production. Biogas production from animal wastes for the livestock (pigs, cattle) industries, from distillery wastes offers opportunities for in situ energy generation and for the use of the slurry obtained after fermentation as an organic fertiliser that can be used in the agriculture sector. This should be a required facility for the commercial dairy investment being pursued by Demerara Distilleries Limited (DDL). Utilising wastes in this manner also provides a solution to the environmental challenge it poses. Consideration of other energy resources would help to alleviate some of the waste management environmental problems.

Guyana has many small communities settled along our tidal rivers and consideration might be given to the feasibility of installing available and proven tidal systems to generate energy for these communities. Systems that can operate in either direction of the water flow are available and operational. Offshore wind is now a very mature and affordable technology and though the green light has been given to the Hope Wind Generating Facility Guyana may still visit the possibility of a much more substantive facility offshore. It has the possible advantage of being near to the population centres along the coast thus providing significant cost savings for the transmission systems.

The transportation system does offer an excellent opportunity for decarbonising. CARICOM now has a well-articulated road map for the implementation of electric vehicles across the sector. Barbados is leading the region in terms of implementation of a programme for the introduction of electric vehicles which can be instructive for Guyana. One major challenge for Guyana would be the reintroduction of a comprehensive public transportation system which would make for a more effective transportation system locally but given its present configuration could pose some serious challenges from the present private operators. The water taxi community should also be a part of this transformation with the introduction of electrically operated boats. Regrettably our railways have been defunct for some time but were they still operational they would have provided an excellent platform for such a transformation.

The Climate Resilience Strategy and Action Plan (CRSAP)

On completion of the LCDS the Guyana Government contracted UK-based risk management firm Acclimatise to work on the development of Guyana's Climate Resilience Strategy and Action Plan (CRSAP) in 2014. The CRSAP was intended to roll out the implementation plan for the climate resilience aspect of the LCDS. Work on the CRSAP proceeded in 2015 and included numerous expert sectoral workshops, a comprehensive consultation process with sectoral expert groups and other key stakeholders and several iterations with the climate office in the Office of the President. A draft of the CRSAP was submitted to the government and discussed with a stakeholder workshop before finalisation. The final draft was submitted for cabinet approval in February 2016 but by that time the government had changed. The change of Government and strategic direction and changes in the climate office in the Office of the President, resulted in substantial delays with the approval of the draft by Cabinet and subsequently this did not go through the approval process.

With the current revision and endorsement of the LCDS the climate resilience aspect has not changed and the analysis and recommendations made in the CRSAP are still relevant and can inform Guyana's programme for implementing climate resilience aspects of the revised and approved LCDS. To date

although there have been efforts to deal with issues related to sea defence, drainage and irrigation, and the perpetual episodes of flooding, such efforts have not received the focus or level of attention that the CRSAP recommended. Initiatives to adopt modalities for smart agriculture (shade houses, green houses), salt tolerant rice varieties to address estuarine saltwater intrusion in the rice industry, participation in the PAHO smart hospitals regional project and others are being implemented, but not at the scale or in the time frame required for effective climate change adaptation across all of the vulnerable socio-economic sectors in Guyana.

So far, especially since the discovery of oil in 2015, the focus has been on the implementation of the mitigation programme of the LCDS through taking action for the transformation of the energy sector and transitioning to the net zero status. However, it is necessary to accelerate the implementation of the climate resilience programme, to ensure that all the shore-based facilities, infrastructure and development taking place in the vulnerable coastal region are not compromised by the impacts from climate change. Guyana in the LCDS and CRSAP, has the roadmap for building a climate resilient and low carbon economy, but needs to place as much emphasis on the climate resilient aspect of the LCDS as it does on its mitigation programme.

With respect to the earlier LCDS document the CRSAP states that, despite steps being taken to address adaptation, "Guyana still requires an overarching framework for planning and implementing climate resilience actions so as to achieve the Government's 'Vision 2020' for a green economy. This Climate Resilience Strategy and Action Plan (CRSAP) addresses this gap and aims to provide a comprehensive and overarching framework for adapting and building resilience to climate change impacts. The CRSAP builds on the work that has been in Guyana over the years and identifies key climate risks and priority resilience building actions. The Strategy and Action Plan are underpinned by the five cross-cutting pillars of adaptation identified in the Second National Communication namely information, research and systematic observation; institutions and capacity building; policy and legal frameworks; infrastructure and technology; and finance. Specifically, the CRSAP provides:

- A roadmap for the next five years. (2016 -2020)
- Project Concept Notes for four priority climate resilience programmes which can now be developed into full proposals and submitted for funding.
- A summary of the most significant climate risks and required resilience actions across 15 key sectors. These actions are proposed as the basis for the design of new interventions and a pipeline of projects which can be presented for funding and implemented within five years and beyond.
- A set of capacity building actions that enhance Guyana's capacity for national adaptation planning and becoming climate resilient to be undertaken within the next five years.
- A strategy to finance the CRSAP inclusive of the PCNs.

The CRSAP Roadmap summarises the key strategic actions that need to be taken to deliver the CRSAP and increase Guyana's resilience to a variable and changing climate. It articulates a timeframe for action focussed on the next five years (2016-2020), as well as a proposal for a review and iteration process in 2020. This approach is largely synchronised with the newly commenced government term and national planning cycle (2015-2019). The roadmap recognises that building climate resilience is a journey that requires cycles of action, reflection and iteration as lessons are learnt about effective implementation and resource allocation. To deliver the Strategy, an Action Plan has been prepared which includes the draft Project Concept Notes (PCNs), detailed findings of the climate change vulnerability and risk assessment and identification of resilience actions in the form of 15 sectoral briefing notes. The summary of the most significant climate risks and required resilience actions across 15 key sectors provides an overview of the most serious risks (i.e. higher likelihood of occurring and severity of consequence). This is likely to provide crucial guidance to sectors on prioritising and implementing these actions through the application of an

'adaptive management' approach. Capacity building actions are presented according to the five pillars on adaptation defined in the Second National Communication. These actions have been defined based on feedback provided by stakeholders and by a review of the available literature. Both the PCNs and the 15 sectoral briefing notes can be used to further develop, finance and implement resilience actions.

A key component of the CRSAP has been to identify early-start, costed and evidence-based climate resilience programmes which can be moved quickly through funding, design and procurement stages and into implementation. These early-start priority Project Concept Notes (PCNs) are:

- **'Building Climate Resilient Agricultural Systems'**, by improving water management, developing climate proof sustainable farm systems and building the adaptive capacity of the sector to reduce the vulnerability of farmers (in particular small to medium scale).

- **'Guyana's Sea Defence Enhancement and Maintenance'**, through coordinated and complementary actions of mangrove development and restoration and rebuilding the most critical sea and river defences in low-lying coastal areas. This will help increase the coverage of and strengthen the existing sea defence against high tide, which in turn will reduce flood risk in coastal communities.

- **'Public Health Adaptation to Climate Change'**, through strengthened national disaster risk management (with specific reference to health) and early warning response systems, enhanced access by communities to clean water and sanitation facilities and food hygiene, reduced impacts of water-borne diseases, increased human and physical sectoral capacity and increased public awareness.

- **'Strengthening Drainage and Irrigation Systems'**, by improving the capacity of the network starting with the most critical areas, upgrading the existing drainage and irrigation system with a focus on the agriculture sector, institutional strengthening of the National Drainage and Irrigation Authority (NDIA) and development of a training curriculum on drainage and irrigation.

Project Concept Notes (PCNs) were prepared for these four priority actions and a preliminary cost estimated for the implementation of each. There was an indication that implementation of this aspect of the CRSAP would commence this year (2022). So far, focus on the LCDS has been on mitigation, with plans for the installation of renewable energy systems (solar, wind, hydropower) and the much-discussed gas to energy project but little has been done to address the climate resilience (adaptation) aspect of the programme. Accompanying the oil and gas production schedule, there has been several development initiatives on the coast – roads, bridges, housing, industrial estates, shore-based oil production facilities - most situated in the highly vulnerable coastal environment. Due to the political process that led to a change in government and the change of direction by the new administration the LCDS and accompanying CRSAP were shelved. With the return to office of the People's Progressive Party in 2020, the original LCDS was revised and updated. The CRSAP still provides the country with a roadmap for the implementation of the current LCDS. Under the circumstances it should be revisited as a matter of urgency and steps taken to commence with its implementation for the forthcoming period. There must be simultaneous focus on the implementation of actions to achieve the net zero status and to build climate resilience

It is critical that some urgency be given to the early start of the implementation of the CRSAP to ensure that all the new infrastructure is protected from climate risk impacts. There was an indication in the CRSAP, that the PCNs would be developed into full project proposals which would then be submitted to donors for support. Now that Guyana has access to its oil revenue and given the time factor consideration for countries to adapt to climate change, the country should make financing of the PCNs from its oil revenue fund a

national priority. Ad interim, they should ensure that all development in the terrestrial and marine space of Guyana should incorporate mitigative actions to deal with climate risk. Our mantra must be that climate risks should be fully integrated into national development plans – without exception.

Carbon Credits

One important feature of the LCDS is the plan to monetize forest conservation efforts and the associated ecosystem services derived from functional watersheds and biodiversity that intact forests support. It is estimated that the strategy speaks to developing a credible Monitoring Reporting Verification System (MRVS) to meet internationally acceptable standards for forest coverage as a basis for assessing the carbon credits that can be marketed on the international market. Through the program with Norway that rewards Guyana for sustaining deforestation at a level below an agreed baseline, Guyana has been able to establish a robust MRVS methodology that is internationally acceptable.

They have also been able to address other technical issues related to the integrity of carbon credits derived from forest sequestration that would allow for the marketing of those credits. In this respect, Guyana's carbon credits now satisfy the globally accepted Architecture for REDD+ Transactions (ART's) standard for the quantification, monitoring, reporting and verification of Greenhouse Gas (GHG) emission reductions and removals from REDD+ activities at a jurisdictional and national scale.

Progress with the Implementation of the LCDS

Energy sector transformation

The contract to build a US$759 million, 300 MW combined-cycle power plant and a natural gas liquids (NGL) facility at Wales, West Bank Demerara (WCD), has been signed between Guyana and US companies CH4/Lindsayca. At the core of the project, is a pledge by the government that power charges to householders and industry will be halved when energy is produced. The national DBIS grid and transmission network is expected to be upgraded as indicated in the LCDS. There has been concern expressed locally about the need for assurances that the necessary Environmental and Social Impact Assessment had been rigorous and addressed key issues that ensure that project does not have negative impacts on the environment or on the lives and livelihoods of citizens. It is anticipated that implementation and subsequent operation of this facility will be carried out under a regime that adheres to the highest international standards available and that our local authorities are armed with the technical capacity to provide the necessary oversight and monitoring required during the lifetime of the project.
Progress has already been made on the provision of renewable energy sources for several rural and hinterland communities. Guyana plans to improve the diversification of its energy matrix by promoting the use of climate resilient renewable energy sources for electricity generation, helping to avoid deforestation and confront climate change with non-reimbursable investment financing of US$83.3 million approved by the Inter-American Development Bank (IDB) with funds from the Norwegian Agency for Development Cooperation.

The IDB has been supporting the Government of Guyana to develop energy sector through financing of several renewable energy activities. Building on this, the country will now make a transformational leap towards decarbonisation by expediting climate resilient renewable energy in the electricity generation matrix. The Guyana Utility Scale Solar Photovoltaic Program (GUYSOL) will invest in eight utility – scale photovoltaic solar projects totalling 33 MWp with associated 34 MWh energy storage systems distributed across three areas in the country. Specifically, it will invest in 10 MWp in the Berbice area, 8 MWp in the Essequibo system with a minimum of 12 MWh battery storage and 15 MWp plant connected to the Linden system with a minimum of 22MWh battery storage.

The eight projects will contribute to avoiding carbon dioxide emissions, lowering electricity cost generation and supporting a substantial transition to generation based on renewable energy sources. It is anticipated that the program will also support a step-change with respect to digitalization of Essequibo and Linden electrical systems, moving them from manual systems towards real-time automated monitoring and control improving efficiency, reliability and stability. Alongside these investments in infrastructure the GUYSOL Program will encourage diversity and inclusion in the maintenance and management of renewable infrastructure, developing local skills and apprenticeships with a focus on opportunities for women. The Guyana Power and Light Inc. (GPL) and the Linden Electricity Company Inc. (LEC) will benefit from the use of solar photovoltaic technology that will displace significant amounts of fossil fuels and reduce generation costs.

Other opportunities for Energy Sector Transformation.

In addition to the steps being taken to transform the architecture of Guyana's energy sector, some consideration should be given to incorporating other opportunities that can contribute to the attainment of this objective. In this regard some attention should be paid to supporting programs for waste to energy generation utilising domestic waste, wood waste from the sawmilling industry and rice husk from the rice industry. Also, support should be considered a national biogas programme for domestic, institutional and industrial use (e.g. Demerara distilleries, Banks DIH, mega scale dairy farm). These are not new ideas as these activities were successfully implemented in Guyana in the Eighties. Two local rice mills had their energy system successfully adjusted to use rice husk as fuel, and one sawmilling enterprise at Kaow Island had theirs adjusted to utilise sawmilling wastes. At that time, too, Guyana had a vibrant local biogas programme based on the use of animal wastes and, after India and China, had the highest per capita ownership of biogas plants including for use at both the domestic and institutional levels.

Another opportunity for early action on energy use is the transportation sector. Transportation is the second highest GHG emitter in Guyana and efforts should be initiated to move to electrical transport to include both road and water transport. In this area there are opportunities for public sector/private sector partnership to initiate action through electrification of government private sector fleets (e.g. Banks DIH, Demerara Distilleries,). Regionally under the supervision of the Caribbean Centre for Renewable Energy and Energy Efficiency (CCREE), countries in the region have been provided with a roadmap for the transformation of their transportation sectors for use of electrical vehicles which Guyana can utilise to chart the course of such a transformation. In this respect, lessons can be drawn from the Barbados experience as they are the most advanced in this respect.

Considerations for a regional initiative

In keeping with the call of regional Heads of Government to address CARICOM food and energy security: Guyana should explore the feasibility of utilising the oil and gas resources available from Guyana, Suriname, and Trinidad and Tobago (including processing infrastructure) to satisfy the energy security needs of CARICOM countries as they transition to net zero status. In doing so, Guyana should assess the availability of installed refinery capacity to determine whether there is enough capacity to provide for the needs of CARICOM, in the region, determine the feasibility of rehabilitating the Point Lisas petrochemical facility in Trinidad and Tobago for fertiliser production to support the food security programme and other natural gas petrochemicals, and explore the possibility of supplying natural gas from the Guyana basin for use by the Point Lisas facility which would avert the need to negotiate access through a pipeline from Venezuela. These actions are designed to determine the feasibility to utilise regional oil and gas resources for the region's energy and food security while they transition to net zero status and to internalise the supply chain as required for the provision of fuel and fertiliser to support the region's thrust for energy and food security. In addressing these two issues CARICOM countries would have managed to satisfy their

obligations under their NDCs to transition to a zero-carbon economy and to address resilience issues related to their energy and food security.

The Rystad Energy report observed that the emissions intensity of Guyana's production is nine kgCO2/boe– half of the global average and able to outperform ~75% of global producing assets. This is due to several factors, including larger-scale developments with fewer wells with high rates of productivity, more specialized technical solutions to limit emissions, such as gas reinjection, and more stringent regulations. The report further observes that Guyana offshore is also one of the most resilient segments under carbon tax scenarios. With taxes of US$50 per tonne, US$100 per tonne, and US$200 per tonne, Guyana's average breakeven remains resilient due to lower relative carbon intensity compared to other sources. Endogenization of the supply of oil and gas resources for CARICOM energy and food security with its lower carbon intensity supply chain further enhances Guyana's competitiveness as a source of supply in the future global oil and gas market.

Mitigation activities required by the region, mainly investment in renewable energy and energy efficiency, require investments which show a favourable Internal Rate of Return and is an attractive emerging area for private sector investment. Can we consider a regional investment fund for mitigation to facilitate easier access by countries in the region to finance the necessary transformation in their energy sector and accelerate their transition to net zero status. Such a fund could be supported by investments from Guyana's sovereign fund (and Surinam's revenue from oil and gas), regional governments, regional private sector, indigenous banks and the regional credit unions. These can be managed on behalf of the region by the CDB which can use the regional capital in the fund to invite foreign capital to subscribe to a fund that will operate under conditions laid out by the region.

Climate Resilience Implementation

In the revised LCDS 2030, government targeted over US$300 million in carbon credits earnings. The LCDS 2030 sets out an updated vision for how government intends to drive the transformation of the country, highlighting the finances that can be accrued for its under 1% deforestation. The document outlines how Guyana can earn payments. "Earning payments as Guyana moves towards a market mechanism will involve: (i) integrating with the market standard; (ii) generating credits in accordance with that standard; (iii) marketing Guyana's credits to potential buyers,"

Appendices 1 and 2 of the document describe credit generation and the methodology for calculating those credits, but says "in sum, Guyana will receive credits for (i) any reductions in deforestation against the previous five-year average (starting with 2016-2020 as the reference period); (ii) restoration of deforested or degraded forest; (iii) the long-term storage of carbon in Guyana's standing forest, providing that Guyana's deforestation rate does not increase significantly above historic averages."

To generate the credits, "Guyana will submit an annual report, which will then be independently verified and certified to ART-TREES. At the same time, Guyana has submitted a Safeguards Information Report (SOI) highlighting continued adherence to agreed social and environmental safeguards. Reporting on progress/adherence to safeguards on an annual basis will be a part of ART Monitoring Reports. Once the credits are certified, the document states that the ART-TREES Secretariat will record them on the publicly accessible ART registry, from which point they will be available for purchase by governments or companies with high emissions which they want to offset. When the credits are available for sale, these can be sold on the market, either directly by Guyana or through brokers.

Using the Norway project, Guyana was able to satisfy all the necessary international standards and requirements for the sale of carbon credits derived from forest conservation. At the moment it is anticipated that two major markets would be the oil & gas and aviation industries as they both strive to reduce their

carbon footprint in response to the policy dictates in the jurisdictions in which they operate and the global call for industries to address the issue so that the Paris targets can be achieved.

Guyana's progress on this front has resulted in a situation where they were able to have a first set of carbon credits certified and listed for sale in the ART registry. The credits can now be bought by any interested party. The Government of Guyana recently announced an agreement with Hess Corporation to purchase high quality carbon credits for a minimum of $750 million between 2022 and 2032 directly from the Government of Guyana. The multi-year agreement is for 37.5 million REDD+ jurisdictional carbon credits (current and future issuances). These credits will be on the ART (Architecture for REDD+ Transactions) registry and will be independently verified to represent permanent and additional emissions reductions under ART's REDD+ Environmental Excellence Standard 2.0 (TREES). Under the Norway agreement, payment to Guyana for carbon credits from forest conservation was made through an intermediary – in this case the IDB.

Utilisation of payments on local development projects were then authorised after agreement by the donor. Under the arrangements for selling carbon credits to Hess Corporation, payments are made directly to the government and they decide on how they are to be utilized. In keeping with the LCDS, fifteen percent of the revenue derived from the sale of carbon credits were assigned for use by the indigenous population.

Building Climate Resilience – adaptation.

As mentioned earlier, Guyana has over the years engaged in addressing climate vulnerabilities in different sectors – water, health, agriculture. However, these activities have not been at the scale required to significantly impact the inherent vulnerability of the respective sectors mainly because of the lack of resources to implement the necessary actions. Given the rapid pace of development now taking place on the fragile vulnerable coast of Guyana, it behoves the country to address the critical vulnerabilities as identified in the CRASP which should as a matter of urgency be revisited and updated and used to guide the implementation of an effective climate resilience programme across all of the vulnerable segments of the Guyanese economy. With particular reference to sea defence and drainage and irrigation, Guyana needs to adopt a holistic and comprehensive study to design systems that would provide the necessary protection of the vulnerable low-lying coastline, taking into account scenarios of future climate (specific scenarios are available for planning in Guyana) and addressing projected changed rainfall patterns and sea level rise. Similarly, implementation of resilience building activities in the agriculture and health sectors should be vigorously pursued.

Guyana is now in the process of carrying out a comprehensive LiDAR survey over the entire country and should use the opportunity to develop flood risk maps for all areas along the coast and for inhabited areas in the hinterland. These flood risk maps can be used for land use planning to inform development activities in Guyana. As part of the development of land use plans, efforts should be made to look at possible resettlement zones for the movement of vulnerable communities to areas not susceptible to inundation. There was a comprehensive study done on the possible development of the Parika Township as a possible area for future development. This should be reappraised taking into account future climate change scenarios for the area. The Silica City initiative which speaks to relocation from Georgetown does not cover the entire population in the Georgetown area and does not seem to be addressing the needs of the most vulnerable populations in the city, so alternatives need to be identified as part of the national effort to build resilience and to have in place contingency plans for the relocation of exposed and vulnerable communities. Activities for Marine Spatial Planning have commenced, but from the reports so far it seems that the focus of these activities relate to facilitating transport, port development and activities that support the oil and gas industry. There is need to consider other aspects of Marine Spatial Planning that address issues related to demarcation of Marine Protected Areas (MPA) and management of the marine space so that livelihoods that depend on it are not compromised. Caribbean countries have undertaken to put at least thirty percent of their marine

space under the MPA umbrella, as part of their efforts to support the continued contribution of the ecosystem services that are critical for our exploitation of the opportunities under the blue economy.

Recommendations

- Operations for the development and production of oil and gas should adhere to the highest available standards for such activity with particular attention being paid to air emissions, waste water discharges, solid and liquid waste management with specific attention to shore based disposal of radioactive wastes, noise generation (including underwater), oil spills, energy efficiency and resource conservation. Adopt procedures that minimise leakage of natural gas.

- For shore-based facilities, the government must insist that the necessary safeguards are in place to address issues raised in the ESIAs for the construction of those facilities. Equally developers must be made to carry out climate risk assessments using available climate scenarios of future climate and to address those risks in their final design. The latter condition should also apply to the government's development related to new infrastructure by applying the CDB's requirements for climate risk assessments for consultancies related to the infrastructure work that they support in the region.

- Fast track the implementation of the four priority areas identified in the CRSAP of the LCDS – Sea defence, drainage and Irrigation, Agriculture and Health care, by use of some of the funds generated from sale of the Carbon Credits.

- In keeping with the call of regional Heads of Government to address CARICOM food and energy security: explore the feasibility of utilising the oil and gas resources and installed infrastructure available from Guyana and Suriname to satisfy the food and energy security needs of CARICOM countries as they transition to net zero status,

- Strengthen institutional capacity to monitor and regulate the oil and gas industry. In this respect focus must be placed on providing the EPA with the capacity to provide Guyana with the necessary oversight to ensure that oil and gas operations do not in any way compromise the integrity of Guyana's fragile ecosystems to the extent that it disrupts livelihoods and negatively impacts the lives and well-being of the citizens of Guyana.

- Build institutional and human capacity relevant to the needs of the LCDS and the provision of technical services for the oil and gas sector services at the e.g., University of Guyana, the National Agricultural Research and Extension Institute, Iwokrama International Centre for Rainforest Conservation, the Bina Institute, Technical & Vocational training institutions.

- Address governance issues as adumbrated in the LCDS - inclusivity, national consultation with relevant communities, adherence to the legal provisions for oil and gas regulation and operation, transparency and access to information, adherence to the requirement for Free Prior and Informed Consent (FPIC) as it applies to interfacing with the indigenous communities.

- Promote a sense of ownership with the Guyanese population for the actions in the LCDS. This will require a nationwide Public and Education and Outreach effort to inform communities throughout Guyana of the actions for implementation under the LCDS, status of implementation and plans for further implementation and encourage a culture of full disclosure to enhance trust and benefit from informed feedback from the public. Aim to make public consultations events that the public can

contribute to meaningfully and overtime gain confidence and provide their support for the successful rolling out of the key elements of the LCDS.

Conclusion

Revenue derived from Guyana's oil and gas resources can be utilised to accelerate the implementation of Guyana's Low Carbon Development Strategy in such a way that Guyana achieves its net zero status, as required by the Paris Convention, while at the same time undertaking development that is climate resilient and environmentally benign.

It is essential that all activities associated with oil and gas production in Guyana are conducted in a manner that meets the highest environmental standards and in such a way that it does not compromise the integrity of Guyana's environmentally sensitive ecosystems.

To ensure this, Guyana, as a matter of priority, needs to build the institutional capacity to oversee, monitor and regulate all activities carried out in the production and distribution of oil and gas and in the implementation of the development objectives of the LCDS. Guyana should explore the possibility of a regional effort to internalise the oil and gas inputs for regional energy and food security and enhance its eligibility as a supplier of low carbon intensity fuel during the global transition to a net zero status.