

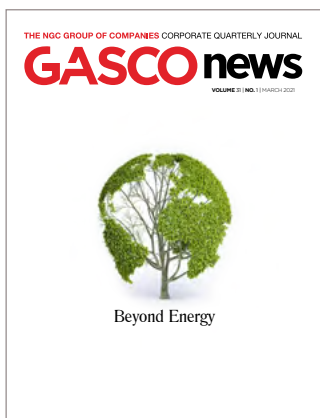
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Beyond Energy



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Together, we can do more

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**THE NATIONAL GAS COMPANY
OF TRINIDAD AND TOBAGO LIMITED**





PRESIDENT'S MESSAGE

Together, we can do more

Historically, the agendas of industry and big business have not often aligned with the concept of sustainable development. Energy companies in particular could be accused of operating for many years without being held accountable for future and broader-scale impact of their work. Indeed, it is universally acknowledged that the sector has contributed in large part to the environmental crises faced by the world today.

Addressing this misalignment requires a different kind of thinking - understanding that one's work has wider implications and externalities; consideration of impact beyond energy.

Today, fortunately, the necessary big-picture thinking is gaining ground. The historical misalignment between energy and sustainability is being corrected, as businesses, governments and academics across the world are collaborating to clean up energy production and consumption.

As the 17th UN Sustainable Development Goal (SDG) suggests, such partnership and collaboration are the only hope we have of meeting our climate goals and other SDG targets by the year 2030.

NGC and its subsidiaries have taken heed and is following suit, partnering to help achieve those global goals.

Taking on the SDGs

As an energy sector company, we are well-positioned to take on one of the most pressing issues facing our planet. Climate change has deep roots in the energy sector, which means we have a responsibility to help address it. We are doing just that, through several internal initiatives and strategic partnerships.

At the most basic level, we need to begin measuring and reporting on those metrics that impact our carbon footprint. We are strengthening our systems through smart reporting tools, and introducing dashboards to keep those metrics top of mind.

At the operational level, we are focusing heavily on methane mitigation. In addition to investing in specialist leak detection tools, we have entered into a partnership with an international provider to secure satellite data that will help us track emissions. We are on our way to membership in the Oil and Gas Methane Partnership, a global forum for exchange and innovation around methane mitigation.

At the systemic level, there needs to be investment in research and new technologies that can accelerate the drive toward sustainability in energy. This is the motivation behind our partnership in a new green hydrogen project, and in a research undertaking aimed at climate change mitigation.

Of course, climate change is not the only SDG that requires urgent action, and there are other unconventional yet impactful ways that energy companies can support sustainable development. For example, we have been exploring avenues to build food and water security, and enable sustainable community development, through strategic partnerships with government Ministries and other state entities.

In this issue of *Gasco News*, we take a look at some of the latest initiatives and partnerships of NGC and its subsidiary companies which are supporting sustainable development locally and contributing to the global SDG targets. We are looking beyond our business to the causes that matter and finding ways to collaborate and leverage our resources for the greater good.

Together, we can do more. ■



Mark Loquan, President



Mark Loquan, President, NGC

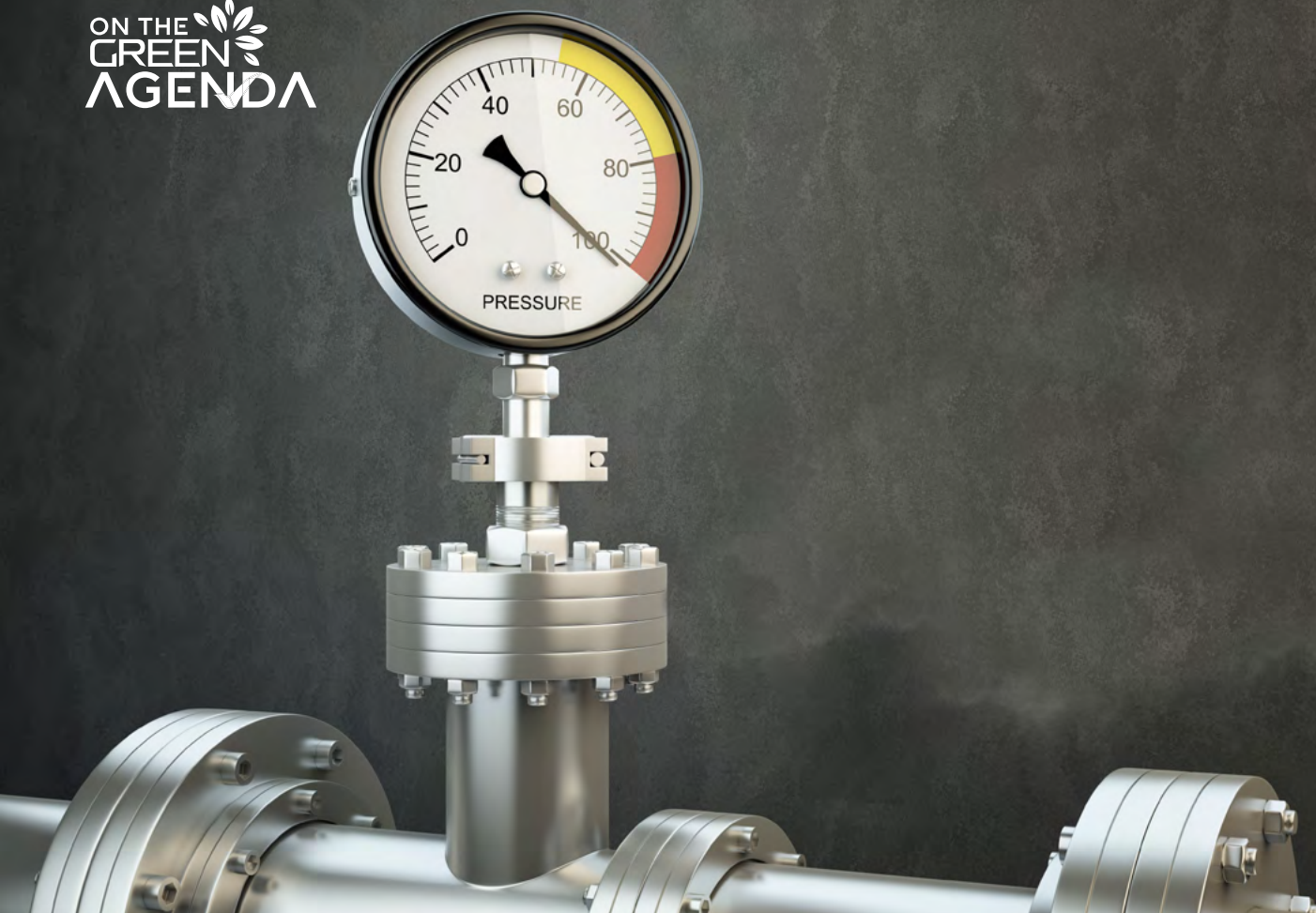
ON THE GREEN AGENDA



EYE ON METHANE

If you've ever had cause to submit for medical imaging, you would appreciate the value of being able to visualise with technology what your eyes cannot see. Locating that malignancy or malfunctioning system that is giving rise to disease is the first step towards treatment and cure.

By this same logic, if we are to save our planet from irreversible climate damage, it is imperative that we locate and address the sources of the problem - greenhouse gas (GHG) emissions. In some cases, we know exactly where to find these emissions - such as chimney smoke or exhaust fumes - but in others, and particularly in the case of one highly potent GHG, we need technology to help us visualise, measure and reduce these emissions.



VISUALISING FUGITIVE EMISSIONS IS KEY TO REDUCING METHANE OUTPUT.



While the world focused environmental policy attentions on CFCs and carbon dioxide, the volume of methane in the atmosphere has been steadily climbing, raising few alarms.

Methane rising

For a long time, while the world focused environmental policy attentions on CFCs and carbon dioxide, the volume of methane in the atmosphere has been steadily climbing, raising few alarms. It was not until fairly recently that it began to take the spotlight. In late 2013, the Intergovernmental Panel on Climate Change (IPCC) reported that methane is a far more potent greenhouse gas than had been previously assumed.¹ Although less abundant and more short-lived in the atmosphere than CO₂, methane has more than 80 times the warming potential on a 20-year timescale. With climate stability quickly deteriorating, reducing methane emissions is now the axis of many short-term remedial strategies.

Natural processes can be blamed for a significant percentage of methane emissions. The gas is released from

wetlands, thawing permafrost, volcanic craters, rice paddies and the guts of ruminant animals such as cows. However, methane is also the primary component in natural gas, and the global energy sector is estimated to account for a quarter of the annual methane budget.² Moreover, recent research has shown that the historical impact of fossil fuel extraction on methane levels has been underestimated by up to 40 percent.³ This means that the oil and gas sector has been releasing far more methane than previously thought. However, by extension, it also means these industries hold a key to bringing emissions down.

If energy companies can track and reduce methane emissions from their operations, the cumulative impact would be significant. In recent years, huge advances in satellite and other

¹ <https://www.greenpeace.org/usa/global-warming/issues/natural-gas/>

² <https://www.nationalgeographic.com/environment/article/methane>

³ <https://www.nationalgeographic.com/science/article/super-potent-methane-in-atmosphere-oil-gas-drilling-ice-cores>

Eye on Methane | CONTINUED

visualisation technologies have made it possible for companies to pinpoint leaks and vulnerabilities in infrastructure that are releasing methane into the atmosphere. Fortunately, locating the problem is the first step towards a cure.

Methane mission

As an energy company with over 45 years in the business, NGC accepts its share of responsibility in the methane matter and accepts its share of the burden of change. The Company has recognised the need for urgent action and has set an operational target of near-zero methane emissions.

Routine asset integrity management has always been a top priority from the perspective of safety, and systems are in place to detect leaks. For instance, NGC uses a Supervisory Control and Data Acquisition (SCADA) system to

monitor gas flow and pressure in the pipeline network for any variation that would indicate major leaks in addition to gas detectors at strategic locations.

SCADA information is however only reliable for detection of significant leaks and pipeline rupture. Therefore, routine Leak Detection and Repair (LDAR) programmes supported by specialised equipment for emissions detection play a critical role in the maintenance and safe operation of the gas transmission and distribution infrastructure. Complemented by staff training, certification and competency assurance initiatives, the Company's LDAR programme is very stringent and is continuously being improved to align with and exceed international best practices.


Notwithstanding its demonstrated performance in leak management,

NGC's focus on continuous improvement led to pursuit of the latest technologies and methodologies to complement existing practices for leak detection. Consequently, the Company has invested in two technology initiatives consistent with the corporate drive to achieve near-zero methane emissions.

MOU with Orbital Eye

In January 2021, NGC announced a pioneering partnership with Netherlands-based technology solutions provider, Orbital Eye.

Through satellite data and algorithms, this company is able to monitor infrastructure such as transmission pipelines, roads, railways and power lines, and more importantly, measure the GHG output associated with these assets.



**The global energy sector
is estimated to account
for a quarter of the
annual methane budget.**



DRAFTED INTO USE IN FEBRUARY 2021, THIS CAMERA IS CURRENTLY BEING USED TO EXECUTE AN ANNUAL LEAK SURVEY ACROSS NGC'S ABOVE-GROUND INSTALLATIONS.



Both the camera and satellite data will work together to enhance the Company's leak detection programme. The FLIR Camera will provide data through scheduled periodic assessments as required by international standards....

NGC signed an MOU with Orbital Eye which will allow the Company to access critical research and emissions information about Trinidad and Tobago's industrial on-shore and off-shore assets over the next three (3) years. The images and data provided by Orbital Eye will allow NGC and its subsidiaries to assess their methane footprint on a broad scale. It therefore can be used to develop mitigation and asset integrity management plans. Moreover, there is scope for growth as the intention is to extend this exercise across the Caribbean where feasible.

FLIR camera

To assist in the search for methane, NGC has also acquired a Forward-Looking Infrared (FLIR) optical imaging camera which is capable of detecting over 400 gas compounds. The camera is a small camcorder-type device, and the model procured by NGC is the most sensitive of its kind on the market. This means it is capable of visualising much smaller leaks in greater clarity and from a safer distance than other models.

Drafted into use in February 2021, this camera is currently being used to execute an annual leak survey across NGC's above-ground installations. Once that exercise is completed, the camera will be put into rotation for use during routine maintenance and inspections across member companies and as part of the collective LDAR programme.

Both the camera and satellite data will work together to enhance the Company's leak detection programme. The FLIR Camera will provide data through scheduled periodic assessments as required by international standards, whilst it is envisaged that the satellite technology will provide a more real-time approach to leak detection.

The next step would be to acquire an "add-on" device to enable users to quantify the methane output of a leak using the camera. This will facilitate

valuable measurement and tracking of progress toward operational targets.

Adjunct benefits

The environmental payoff of these tools is undeniable, but there are other important benefits of being able to visualise fugitive methane emissions. Both camera and satellite data will help the Company increase the safety of its installations, as undetected leaks could result in process safety incidents, causing injury to personnel or endangering communities and property. Leak detection would also help reduce the number of gas molecules lost in transit through the network, which in times of tight supply, is an important win and aligns well with molecular optimisation goals.

Committing to the global cause

Despite its considerable efforts to bring methane emissions down to zero, NGC recognises that technology and research are constantly rewriting the rules of engagement, and there will always be room for growth and improvement. It is important, therefore, to keep abreast of the latest developments and trends in the area of methane mitigation. Accordingly, NGC and its subsidiaries applied for membership into the United Nations Environmental Programme Oil and Gas Methane Partnership (OGMP), which brings governments, international organisations, NGOs, and oil and gas industry stakeholders together to raise awareness around and responsibly address methane emissions.

It is expected that participation in this Partnership will strengthen NGC's capacity to treat decisively with methane. Furthermore, the Company intends to leverage knowledge-sharing platforms to spread the word, and help equip companies along the entire local energy value chain to tackle emissions in their own operations. After all, the sector shares a collective responsibility for the problem, and must therefore assume collective responsibility for its resolution. ■

GREEN HYDROGEN AND OPPORTUNITIES FOR T&T





OUR ENERGY FUTURE...

"We must now agree on a binding review mechanism under international law so that this century can credibly be called a century of decarbonisation."

— ANGELA MERKEL

Introduction

The energy transition is upon us! The decade to 2030 will be an exciting one as efforts intensify to tackle the global climate emergency. Updated Nationally Determined Contributions (NDCs) – to be presented in November 2021 at Conference of the Parties 26 (COP26) – are expected to define ambitious targets that reflect considerable political will and commitment.

For Small Island Developing States, there is much to lose should these efforts fail. Therefore, it is essential that collaborative and meaningful actions are taken to stay on the 1.5°C climate-safe pathway of the 2015 Paris Agreement. With natural gas identified as a critical transition fuel,

Trinidad and Tobago (T&T) is uniquely positioned to not only support the shift to natural gas from other fossils but also simultaneously accelerate its progress toward zero-carbon alternatives.

Carbon-cutting actions are bringing to the fore hydrogen's versatility as an energy carrier. The potential role of hydrogen technologies in a decarbonised world is well-recognised. However, the complexities and market challenges associated with hydrogen require careful understanding and management of risk. Wide-scale success in implementing suitable hydrogen technologies has been negatively impacted by cycles of high hopes followed by disappointments.

With unprecedented momentum, an alignment of techno-economic solutions, environmental urgency, and political influence may finally be taking place to break the cycle of disappointment. In 2020, hydrogen strategies emerged from Germany, Netherlands, Spain, Portugal, and the European Commission, and even China has set a 2060 net-zero goal that will feature green hydrogen. These measures can only augur well to accelerate technological innovations, lower emissions, and improve economies of scale for decarbonisation initiatives.

The prospects that lie in the hydrogen space offer NGC and its subsidiaries an opportunity to seek new markets and products aligned towards a nascent growth area – decarbonised petrochemicals – which can be a powerful platform upon which we build a sustainable future.

The Trinidad & Tobago Energy Context

With over 100 years of experience in the oil and gas industry, it may be hard to imagine a decarbonised future in T&T, but the transition is happening. Almost every international oil and gas major has announced strategies to decarbonise operations, and the same holds even for the downstream





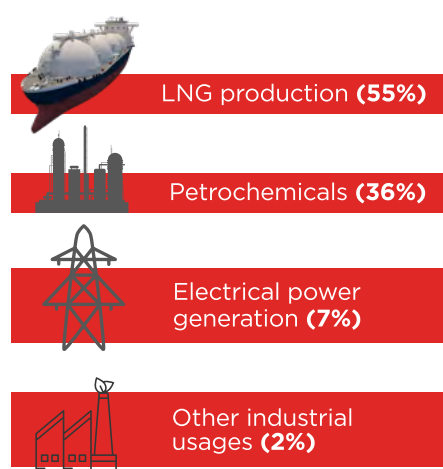
Today, solar and wind are among the cheapest sources to produce power in areas with high solar irradiation or wind speeds, with unsubsidised production costs for solar and wind being US 2 to 4 cents per kWh worldwide.

According to the International Energy Agency (IEA) (2019), hydrogen is gaining considerable momentum worldwide and could finally be on a path to fulfill its longstanding potential as a clean energy solution.

petrochemical players operating in Trinidad and Tobago.

Since the 1950s, T&T has been among the first countries to utilise natural gas for power generation. The proliferation of gas finds in the 1970s paved the way for a natural gas economy, and by the mid to late 1990s, T&T's economy shifted from an oil-based economy to one based on natural gas. Natural gas is also processed to recover Natural Gas Liquids (NGLs), a Liquefied Petroleum Gas (LPG) source – with both natural gas and NGLs being end-user fuels.

Based on the 2019 figures, usage of natural gas produced in T&T is apportioned as follows:



In the past, the local energy sector accounted for as much as 40% of the country's GDP, with the petrochemicals sector contributing over 20% of total export earnings. Further, approximately 99% of the power generated is fueled by natural

gas, making the country highly dependent on its hydrocarbon resources.

For T&T, there is an obvious opportunity to produce hydrogen and utilise it as feedstock in the country's well-established petrochemical sector, displacing hydrogen produced from natural gas. Beyond the industrial sector, hydrogen could also provide a possible avenue to transition towards clean mobility as the transportation sector shifts from gasoline and CNG towards electric driving, both with batteries and fuel cells powered by hydrogen.

Moreover, establishing a hydrogen production complex in T&T can kickstart a regional industrial cluster that will complement regional decarbonisation efforts.

The Case for Hydrogen in T&T

Trinidad and Tobago has a high per capita consumption of electricity and ranks among the world's most energy-intensive countries due to its extensive industrial sector and small population. Within the power generation sector, simple cycle gas turbines result in inefficient natural gas usage. Opportunities for improvement across the industry therefore abound.

In the 2019/2020 National Budget Presentation, the Minister of Finance indicated that the State was desirous of exploring different hydrogen applications within the local economy and encouraging collaborations with the private sector, academia, and international organisations. The private sector heeded the call and began work to study low carbon hydrogen applications in the first instance, using waste heat from the industrial processes to generate power to make hydrogen. The resulting economic disruption from the coronavirus has dramatically accelerated the need to advance efforts to help scale-up technologies such as hydrogen, setting the country on a post-COVID-19 path toward a sustainable energy sector.

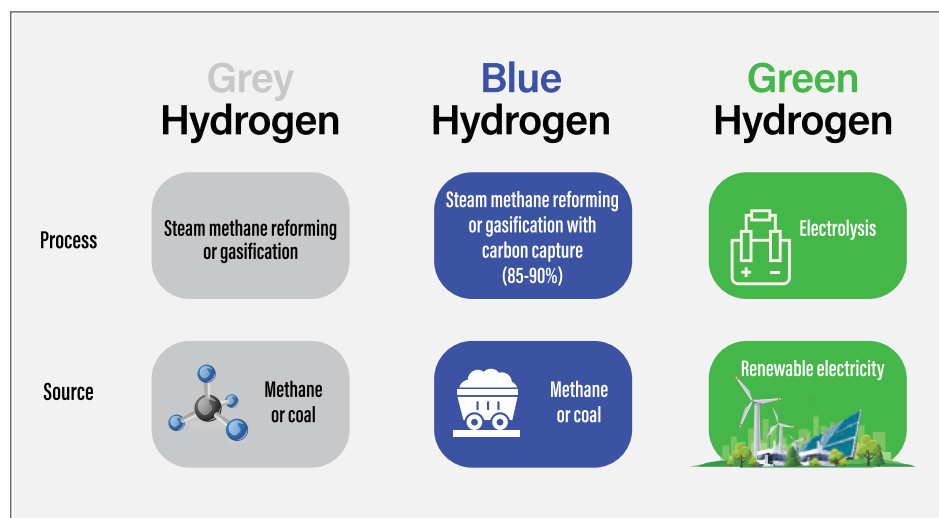


FIGURE 1: TYPES OF HYDROGEN AND SOURCES



FIGURE 3: PILOT GREEN HYDROGEN DEVELOPMENT HIGHLIGHTS

Figure 1 summarises the various types of hydrogen and sources.

Green hydrogen is another hydrogen technology that can decarbonise the sector and add significant economic sustainability to the local energy sector. With the country's first utility-scale solar farm under development and a revised target of 30% renewables by 2030, production of green hydrogen can become a reality in the medium to long term as electrolyser costs decline. Figure 2 captures the vision for T&T incorporating hydrogen into the energy landscape (See page 11).

In support of the Government of the Republic of Trinidad and Tobago's stated policy position, National Energy has initiated work to identify opportunities for applying renewables-based hydrogen locally. These efforts will be the basis for the decarbonisation of the existing petrochemical industry and hard to decarbonise sectors, like the cement and metals industries.

The overall benefits to the economy would include:

- An improved reserve to production ratio
- Storage of excess renewables as hydrogen for use as a secondary fuel;
- improved resilience;
- Job creation/ skills transfer;
- Reduced CO₂ emissions;
- Increased foreign exchange levels; and
- Energy diversification in T&T.

A Way Forward: Piloting for a Hydrogen Economy

A modular, purely green hydrogen facility can be a precursor to establishing a green hydrogen economy. A pilot would serve to advance a hydrogen economy along the most effective path and confirm proof of concept concerning the application of RE technology for hydrogen production in the local context. The pilot project would also:

- allow for the identification of the best RE technology for power generation to produce hydrogen
- lower the risks for entrepreneurial investments through the provision of relevant baseline data, specific to the T&T context
- encourage further technology development and private sector participation through access to data from a local pilot plant.

The pilot provides an avenue for NGC and group member companies to pivot T&T to lead industrial renewable energy applications.

As shown in Figure 3, establishing a pilot green hydrogen facility provides an avenue to link various stakeholders such as the State and private sector. Valuable data would then be available for reference to complement other sustainable energy programmes and inform policy development that facilitates the growth of a hydrogen economy in Trinidad and Tobago.

Green Hydrogen and Opportunities for T&T | CONTINUED

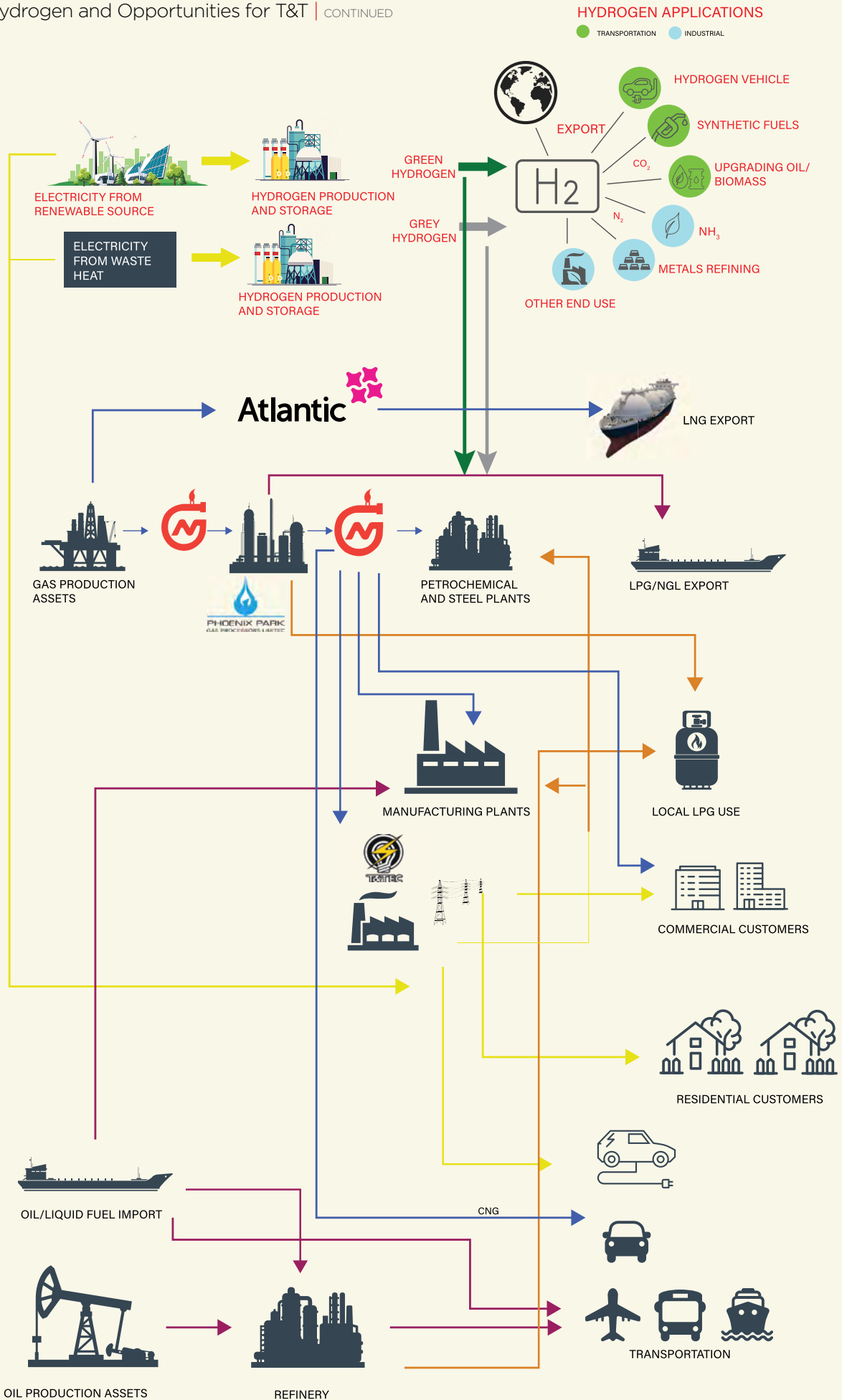


FIGURE 2: INCORPORATING HYDROGEN IN T&T'S CURRENT ENERGY VALUE CHAIN
Source: The National Gas Company of Trinidad and Tobago Limited, National Energy modified

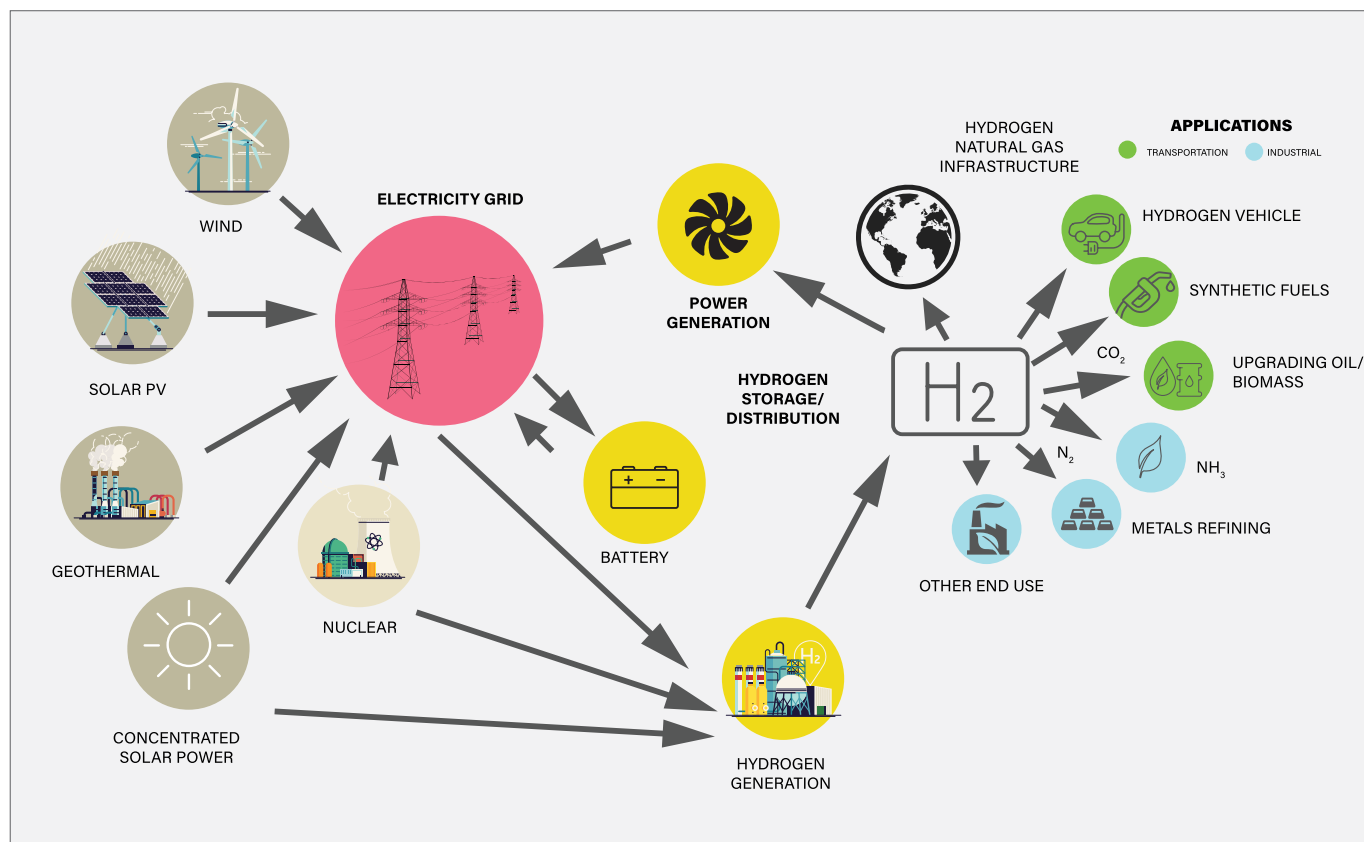


FIGURE 4: POTENTIAL SUBSECTORS FOR REGIONAL INVESTORS IN A HYDROGEN ECONOMY

Source: Sandia (2018)



The expansion of a Trinidad facility could also support regional cluster formations to showcase the advancement of hydrogen clusters among small islands or communities within large countries. Hubs and clusters are an emerging solution to overcome transport issues associated with hydrogen.

With support from the Ministry of Energy and Energy Industries (MEEI) and the Ministry of Planning and Development (MPD), National Energy secured funding from the Inter-American Development Bank (IDB) under an IDB-executed non-reimbursable Technical Cooperation Promotion of the Green Hydrogen Market in Latin America and Caribbean (LAC) Countries. This cooperation will facilitate feasibility studies in 2021 that contribute to understanding the economical parameters of producing green hydrogen locally. The results will add to the work of National Energy and the MEEI to provide insight into hydrogen growth for the country.

Beyond the Pilot: Caribbean Clusters

The expansion of a Trinidad facility could also support regional cluster formations to showcase the advancement of hydrogen clusters

among small islands or communities within large countries. Hubs and clusters are an emerging solution to overcome transport issues associated with hydrogen. They can link production, industrial demand, consumer demand storage, usage, and trading workforce in a small, centralised, focused area. In the future, Caribbean islands can serve as research centres to exemplify various renewable energy technologies and integration approaches. Such centres will foster evidence-based solutions, tailored to the region.

The Caribbean is predominantly dependent on relatively expensive and environmentally damaging fossil fuels for power generation and transportation. Thus, a major feature of Caribbean energy economies is the high and volatile energy prices, which have contributed significantly to the build-up of unsustainable debt and fragile economies.

TABLE 1: SUMMARY OF DOWNSTREAM SUBSECTORS HYDROGEN CAN SUCCESSFULLY DECARBONISE

DOWNSTREAM SUBSECTOR	COUNTRY
AMMONIA PRODUCTION	TRINIDAD AND TOBAGO
METHANOL PRODUCTION	TRINIDAD AND TOBAGO
METALS & REFINING	TRINIDAD, JAMAICA, DOM REPUBLIC
CEMENT AND OTHER MANUFACTURERS	TRINIDAD, JAMAICA, DOM REPUBLIC
SYNTHETIC FUELS FOR POWER PLANTS	REGION-WIDE
VEHICULAR TRANSPORT FUEL	REGION-WIDE
SHIPPING FUELS	VARIOUS
COOLING & HEATING FOR BUILDINGS	REGION-WIDE
ENERGY STORAGE	VARIOUS
HYDROGEN INTER-REGIONAL EXPORTS	TRINIDAD AND TOBAGO



Rethinking the use of energy in all sectors of the economy can boost economic growth, create jobs, enhance prosperity, support social development and advance environmental sustainability.

A decarbonised world does not equate to desolation, instead it brings benefits of healthy environments and strong economies when adequately managed.

According to the World Bank, despite the region's ideal conditions for leveraging green energy, the current renewable capacity in the Caribbean still leaves the area with a 90% dependency on fossil fuels for power generation. Sun and wind are abundant and geothermal energy and hydropower could theoretically free the islands almost entirely from dependence on fossil fuels.

There is, therefore, substantial room for expansion across the renewables supply chain to contribute to a transitioned Caribbean economy. Like the African Hydrogen Partnership, which aims to promote green hydrogen to stimulate sustainable economic development across the African continent, a Caribbean hydrogen cluster can contribute to an energy ecosystem to strengthen economic growth, improve regional transportation, and boost economic integration. Figure 4 illustrates the broad scope of opportunities that can be the catalyst for creating a resilient, integrated Caribbean energy system.

Three investment segments can be examined – upstream, midstream, and downstream as follows below:

Upstream Investments

As new power generation capacity is needed, investors will seek to develop wind, solar, geothermal, biomass, and

other forms of renewable and clean energy sources to satisfy demands.

Midstream Investments

Transportation of power from the power generation sites to the hydrogen production facilities throughout the islands will require infrastructural investments.

According to the EIA (2019), some pilot projects show that pipeline systems can be converted from natural gas to hydrogen gas with the limited investment required, but this is case-specific. A recent study for the Netherlands concluded that its transmission pipelines can be converted to facilitate hydrogen gas by replacing compressors and gaskets (DNV GL, 2017). Therefore, Trinidad's existing gas infrastructure and any new infrastructure to enable gas-fired power generation throughout the region could represent considerable infrastructure-in-place for integrating green hydrogen. Modifications and the build-out of new hydrogen/ gas-fired infrastructure will, however, be quite capital intensive.

From a storage perspective, hydrogen can go where batteries cannot facilitate long-term energy storage of clean energy. Energy storage can be attractive business cases for Caribbean grids, improving grid reliability and resilience against power shortages and outages. Additionally, as prices decline, a hybrid solution (batteries and hydrogen) coupled with solar generation can yield an attractive business case for Caribbean grid operators to integrate hydrogen into the energy mix with storage options in Trinidad and Tobago and elsewhere.

Downstream Investments

A suite of sub-sectors can potentially be built with renewable or green hydrogen as the feedstock on the downstream end. These are outlined in Table 1. The Caribbean is also a large hotel and cruise tourism region. A hydrogen cluster in the area can generate innovative solutions within the global tourism industry, with the Caribbean as the first-mover.

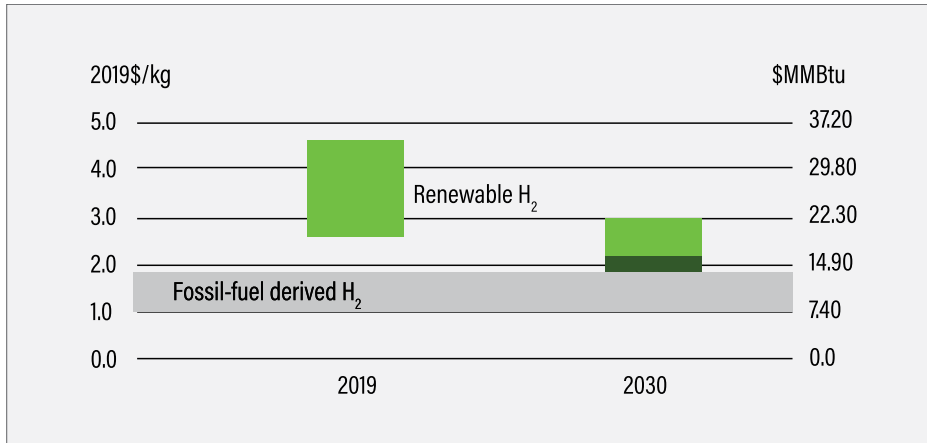


FIGURE 5: GREEN HYDROGEN CAN COMPETE WITH FOSSIL-DERIVED HYDROGEN

Source: BNEF (2020)

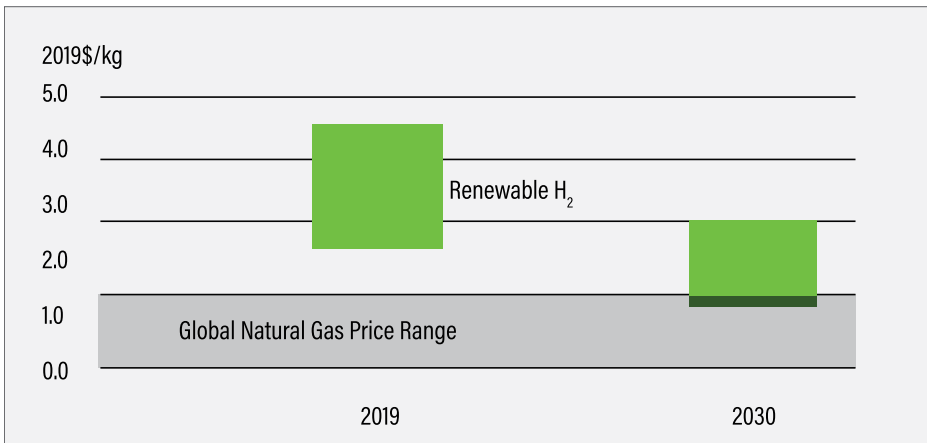


FIGURE 6: GREEN HYDROGEN CAN EVEN COMPETE WITH THE COST OF NATURAL GAS

Source: BNEF (2020)

Today, most governments within the region have set aggressive renewable energy targets, coupled with public policies and incentives that enable solar photovoltaic systems, wind turbines, geothermal and marine energy to become competitive with fossil fuel-based generation. Another impetus for regional collaboration has arisen from the 2020 pandemic.

According to international consultancy firms, the world's risky dependence on vulnerable nodes in global supply chains has been exposed to supply chain disruptions.

As a result, production or sourcing could move closer to end-users, with companies localising or regionalising their supply chains.

Drivers

1. Sufficient Fossil-Based Capacity

The Bahamas, Barbados, Belize, Dominican Republic, Guyana, Haiti, Jamaica, Suriname, and Trinidad and Tobago represent the nine larger islands in the region. Among them, total primary energy supply (TPES) is 37,703 ktoe. Fossil fuels – oil, natural gas and coal – account for 89 percent of TPES in these countries. Natural gas accounts for 53 percent of all

energy use in the countries but this is primarily a Trinidad and Tobago story as over 90 percent of the gas used in the region is from T&T. Oil products account for 34 percent of TPES, followed by biomass as the third most important energy source, and the most important renewable resource, at 11 percent of TPES.

2. Growth Opportunities

Bloomberg New Energy Finance (BNEF) analysis concludes that by 2030 hydrogen will be competitive with fossil-derived hydrogen. Further, they conclude that green hydrogen will be competitive with the cost of natural gas. Figures 5 and 6 illustrate. According to Greentech Media, however, forecasts on when green hydrogen might be competitive with existing high-carbon production methods keep accelerating.

Given that Caribbean countries currently import natural gas at relatively high prices compared to the rest of the world, this can represent one of the first regions where green hydrogen will compete with natural gas in an unsubsidised market. Therefore, there is significant potential for both investors and the economies as each would maximise value by considering a hydrogen-based economy. A pilot facility at this time would therefore serve as preparation for fully capitalising upon this competitive cost position.

Roadblocks

The road toward a hydrogen economy will not be an easy one as future demand and the structure of the market remain uncertain. Most major projects are in the early phases of development, with few confirmed off-takers. Wood Mackenzie estimates that 80 percent of low-carbon hydrogen deployed this decade will be used to displace existing fossil-fuel-derived hydrogen (grey hydrogen). Hydrogen demand for heating, shipping and aviation are still considered longer term, and uptake by these sectors that have not previously utilised hydrogen, are crucial to further driving costs down.

Green Hydrogen and Opportunities for T&T | CONTINUED

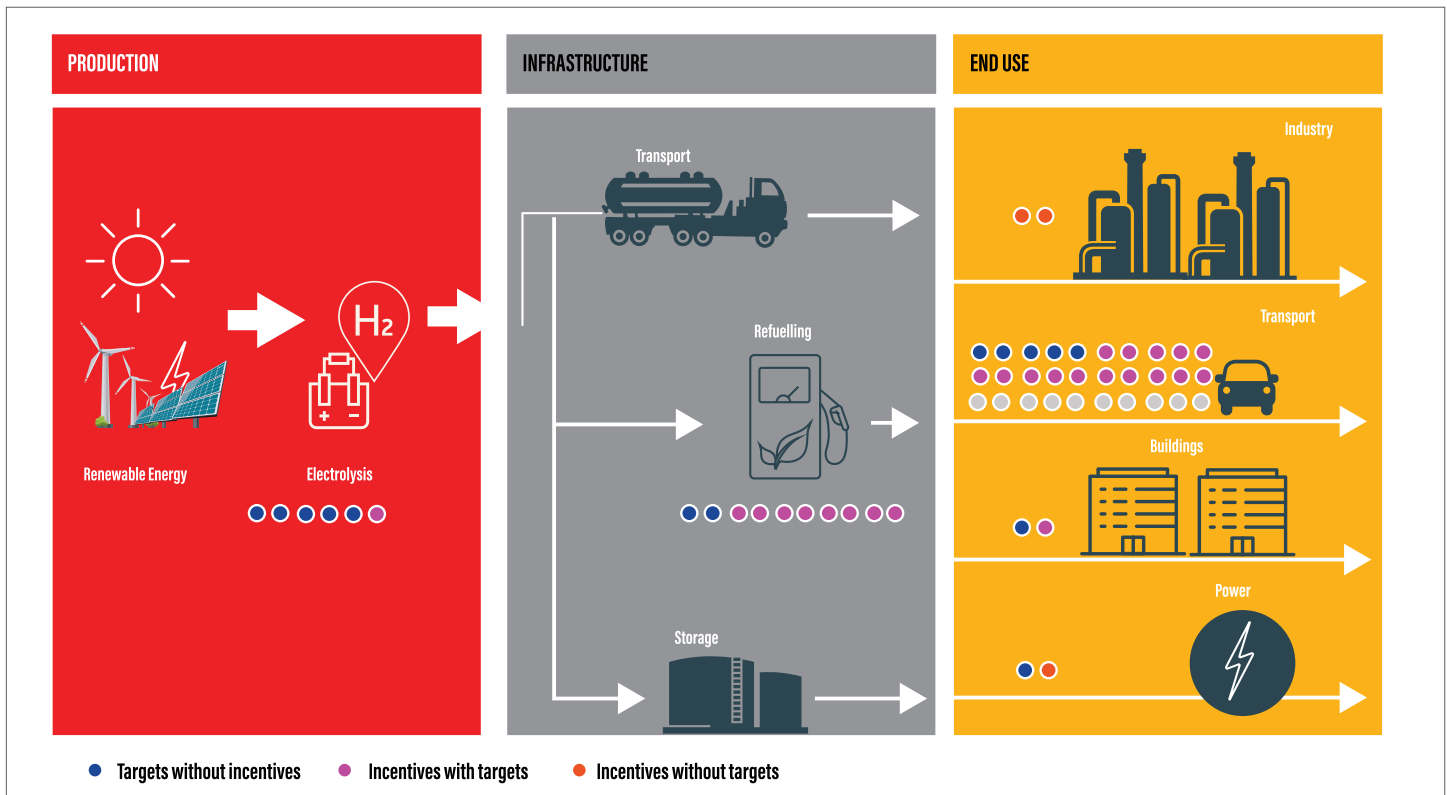


FIGURE 7: GLOBAL HYDROGEN POLICY SUPPORT SNAPSHOT

Source: IRENA analysis based on IEA (2019)

Role of Policy

To realise the true potential of hydrogen locally and to capture the benefits outlined earlier, policy support mechanisms are essential for the penetration of green hydrogen into multiple sectors and encourage sector coupling. The graphic on page 15, derived from IRENA, captures hydrogen policies at a global level by value chain segment.

Conclusion

As a state-owned enterprise, NGC and its subsidiaries are well-positioned to support the country's pursuit of a hydrogen economy, through the establishment of a pilot green hydrogen facility, with the expectation of scaling up over time, which will:

- Support long-term sustainability of the petrochemical sector by reducing exposure to non-renewable supply factors.

- Reduce fossil-based natural gas consumption and therefore decarbonise the petrochemical sector over time.
- Serve as a new source of revenue through the sale of hydrogen.
- Improve location competitiveness of Trinidad and Tobago.
- Allow the State to lead by example and mobilise private sector investments in advancing the hydrogen economy. ■

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ON THE
GREEN
AGENDA





NGC AND ITS SUBSIDIARIES PARTNER WITH UTT ON CLIMATE CHANGE MITIGATION PROJECT



Climate change is the single biggest thing that humans have ever done on this planet. The one thing that needs to be bigger is our movement to stop it.

– BILL MCKIBBEN

There is no doubt that we need to act with urgency on a global scale to address climate change. However, when it comes to mitigation strategies, one size does not fit all.

Variations in geographies, economic structures, and different development metrics from country to country, can mean that even tried-and-tested mitigation plans could falter if not tailored to local circumstances.

This also means that even though the fight against climate change is a global one, at the individual country level, a degree of independent effort is required. Countries must determine what unique opportunities exist to bring greenhouse gas (GHG) emissions down in their local contexts, and what strategies must be implemented to seize those opportunities. This can be most effectively achieved through collaboration among State, industry and academia.

Partnering in research

NGC and its subsidiaries have made climate change mitigation an axis of their business strategy, and there has been significant investment in several initiatives, focused on energy efficiency (EE), renewables (RE) and emissions reduction.

Some recent examples:

- In 2020, the Company launched the EnergySmarTT app to raise consumer awareness around more efficient energy use in the home. The team is currently working on extending the functionality of the app, to add more useful services and support greater uptake of energy efficient products and practices.
- Work is underway with partners along the energy value chain to advance RE projects such as solar and green hydrogen, reduce emissions from operations through reduced venting, and even produce carbon neutral LNG cargoes.

NGC Group partners UTT on Climate Change Mitigation Project | CONTINUED

In order to expand on this work, and recognising that the most impactful programmes are those that are grounded in research, NGC and its subsidiaries have decided to partner with the University of Trinidad and Tobago (UTT) on a special Climate Change Mitigation Project.

In December 2020, both state entities signed a Memorandum of Understanding (MOU) in relation to climate change research, with the overarching objective of helping Trinidad and Tobago meet its international emissions reduction commitments and play its part in the global fight.

The general objectives of the MOU for this Climate Change Mitigation Project are as follows:

- a) Promote further cooperation among NGC, its subsidiaries and UTT in renewable energy, energy efficiency and GHG emissions research
- b) Facilitate the exchange of knowledge, research and capabilities among all parties
- c) Produce data and reports for public awareness and education on RE, EE and GHG emission studies
- d) Provide, develop and exchange information on GHG reduction technologies and strategies which include industrial, power generation, and transportation sector applications
- e) Pursue relevant and related studies

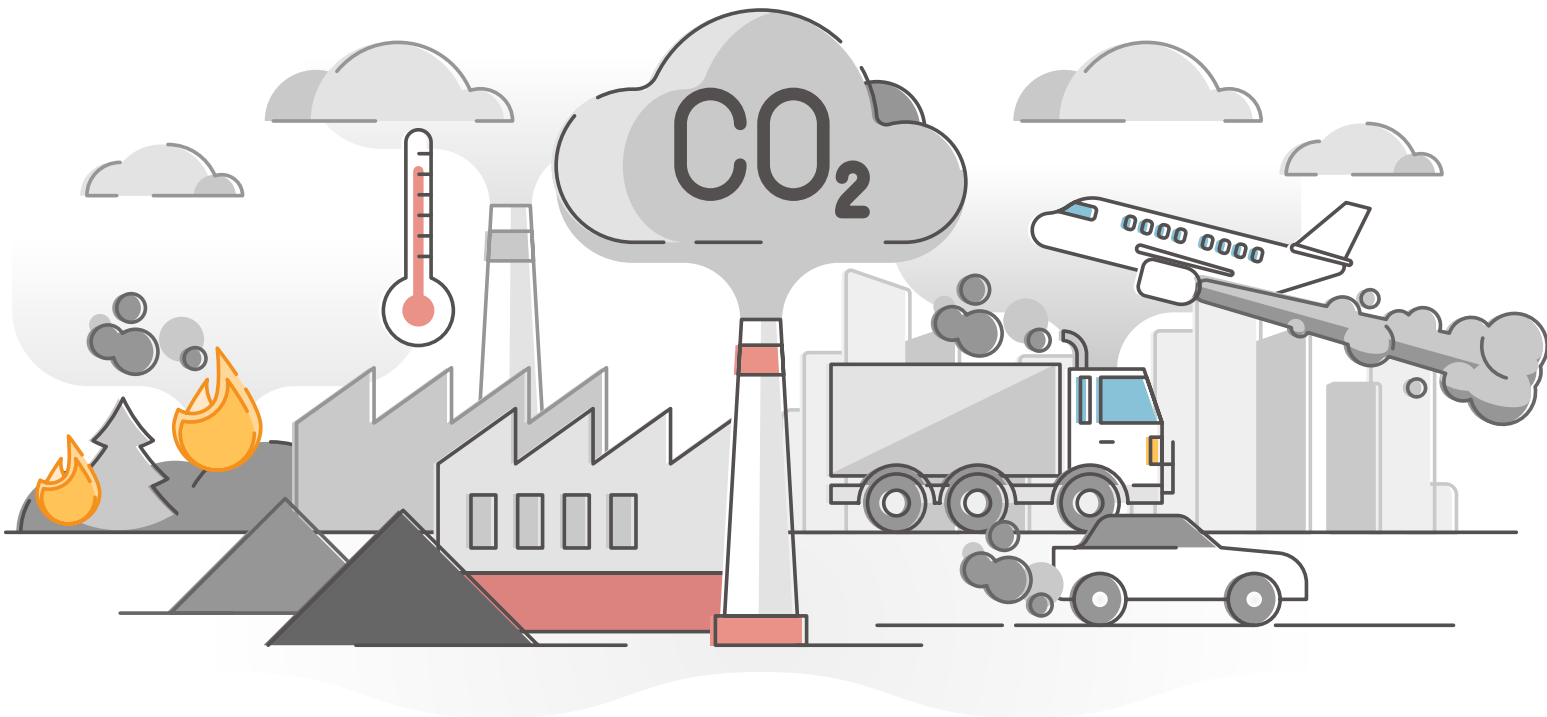
Several outcomes are expected from this collaboration over the three-year term of the MOU.

Firstly, the partnership will allow NGC and group members to feed empirical data from their operations and other GHG emissions projects¹ into research

¹ Read more about the Company's efforts to reduce methane emissions on page 4 of this issue.

undertakings at UTT. By making such data available to researchers, the companies will facilitate a better academic understanding of the local emissions profile. It will also build a clearer picture of how and where emissions are lost in operations, and allow for targeted innovation around industrial tools and processes.

Investment attention is both a prerequisite and a consequence of increased innovation. Research and development require funding, particularly when prototypes must be created and tested. Through this MOU, NGC and its subsidiaries will commit support to relevant research, ideation and prototyping in the areas of EE, RE and GHG reduction. Successful projects can then be marketed to attract other investors, creating a positive feedback loop and strengthening the capacity for innovation, entrepreneurship and real-world deployment.





There is no doubt that this partnership can have big impact in the years to come, and the fight ahead.

This MOU and the attendant research findings will enrich the body of literature around climate change mitigation. The more we know, the more we can teach. Raising public awareness and education can help drive climate action at the individual level, and ultimately strengthen the collective national effort to bring emissions down.

Project underway

The Climate Change Mitigation Project has kicked off with an important first task. In order to track its progress toward meeting emissions reduction commitments, Trinidad and Tobago must be able to measure and inventory its GHG output.

Even though this inventory process is underway, current emissions estimates may be inaccurate due to the absence of country-specific emissions factors.

An emissions factor (EF) is a value that helps quantify the amount of pollutant released during an activity - for example, the volume of carbon dioxide emitted per unit of fuel burned. The Intergovernmental Panel on Climate Change (IPCC) has established EFs for a range of fuels and emitters using averages of aggregated world data. Because these are global averages, the IPCC EFs do not allow for the most accurate calculations of emissions from local activities. Different grades of crude, for example, sourced from different wells, might emit marginally different amounts of CO₂. The actual emissions factor for Trinidad and Tobago crude might be higher or lower than the global average. Even marginal differences can add up to statistically significant numbers.

To start addressing this shortcoming, the UTT team is currently working on developing a country-specific EF for natural gas combustion. That is, they are seeking to determine exactly how many units of carbon dioxide equivalents are emitted when a unit of natural gas is burned in domestic industry. To do this, the team is analysing five years' worth of compositional data of both inlet and residue gas provided by Phoenix Park Gas Processors Limited (PPGPL). The team is aiming to submit an EF specific to natural gas combustion in Trinidad and Tobago for UNFCCC acceptance by the end of 2021.

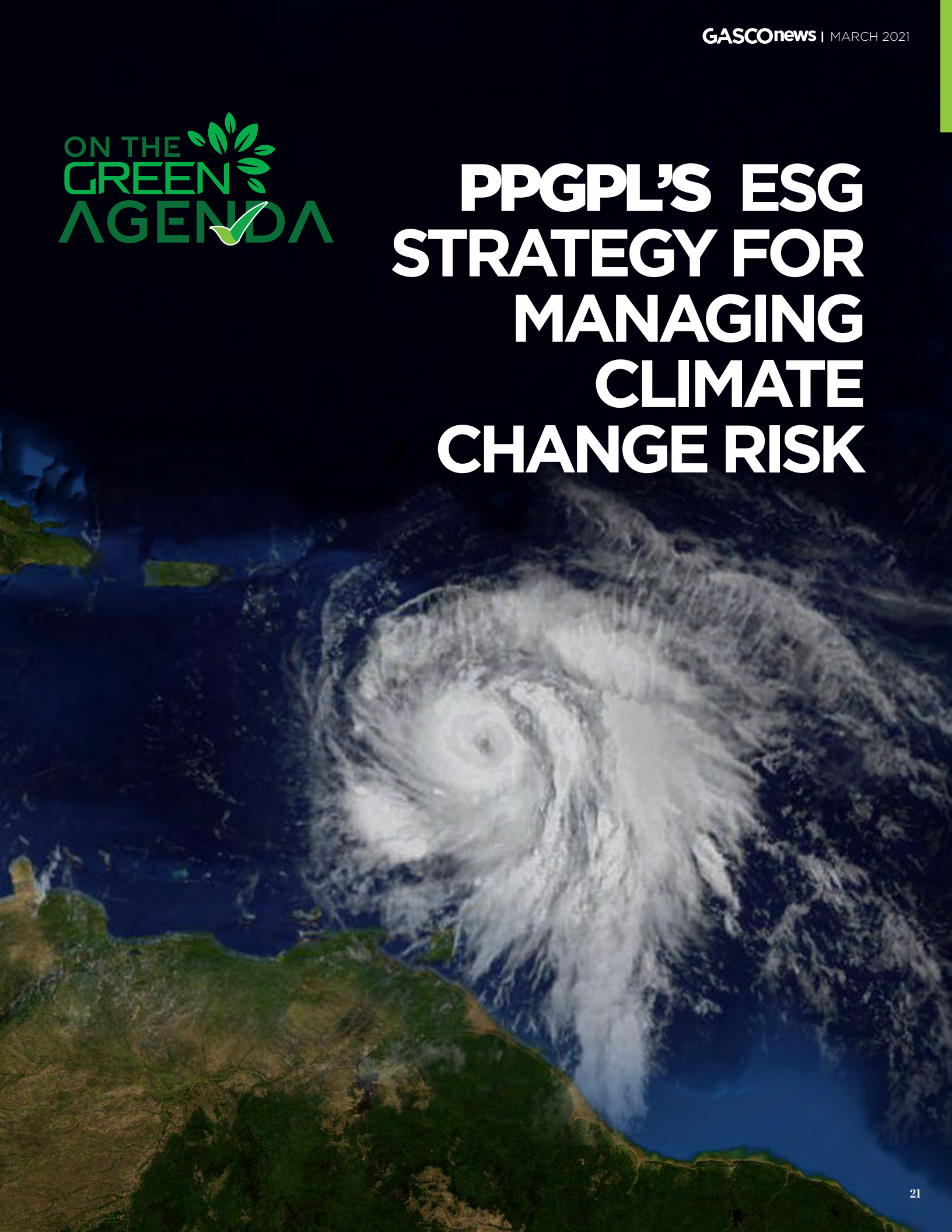
Given the significance of the current exercise being undertaken by UTT within the framework of the Climate Change Mitigation Project MOU, There is no doubt that this partnership can have big impact in the years to come, and the fight ahead. ■



L to R: Mr. Dominic Rampersad, President PPGPL; Mr. Curtis Mohammed, President NGC CNG; Prof. Prakash Persad, President (Ag.) UTT; Mr. Mark Loquan, President NGC; Dr. Vernon Paltoo, President National Energy; Ms. Wendy Seow, General Manager LABIDCO



PPGPL'S ESG STRATEGY FOR MANAGING CLIMATE CHANGE RISK





There are echoes that haunt the Caribbean region after each extreme weather-related event. Loss of life, damage to property and social displacement are painful remnants of the trail of destruction that remains. These are perils that plague the islands of the region up to today.

The echoes are a glaring reminder of the region's vulnerability. Threats of hurricanes, ocean acidification, and wildfires are representative of the long-term shifts in regional or global climate patterns. Coastal areas have come under threat. Sea level rise and warmer oceans are changing our biosphere. Plankton - the source of at least half the oxygen we breathe - is dying, with coral reefs that protect coastlines following suit. Events such as these cannot be ignored as they hinder socio-economic development and play a significant role in human displacement patterns. Consequently, economic progress is hampered, and future generations are deprived of their home and ecological heritage.

Without access to land and marine resources, the path to prosperity will become murky. Certain areas will become inaccessible to those economies that rely on it the most. Climate risk management (CRM) is therefore an important part of the conversation. It is imperative for preventing, mitigating, and adapting to extreme weather-related events.

Global warming is the long-term heating of the earth's climate system. The rise in heating has been observed since the pre-industrial period (between 1850 and 1900). It has been attributed to human activities such as fossil fuel usage, which increases heat-trapping greenhouse gas levels in the earth's atmosphere. Whilst climate can change over a period due to natural causes, the warming being linked to human activity has been identified as the main driver behind climate change.

When one considers the devastation from climate change, there appears to be a global fight for survival. In what has been termed a climate emergency, one thing becomes clear, GDP would no longer be the main measure of national prosperity. Instead, adaptation to climate change and strong resilience mechanisms would be the flagship measure of wealth. With 60% of humanity living in coastal areas, the global collective will either directly or indirectly share vulnerability to climate change.

This highlights the importance of climate risk management. Using information about present and future climate change can help with the development of practices, policies, and infrastructure to make governments, and by extension organisations more resilient to this risk.

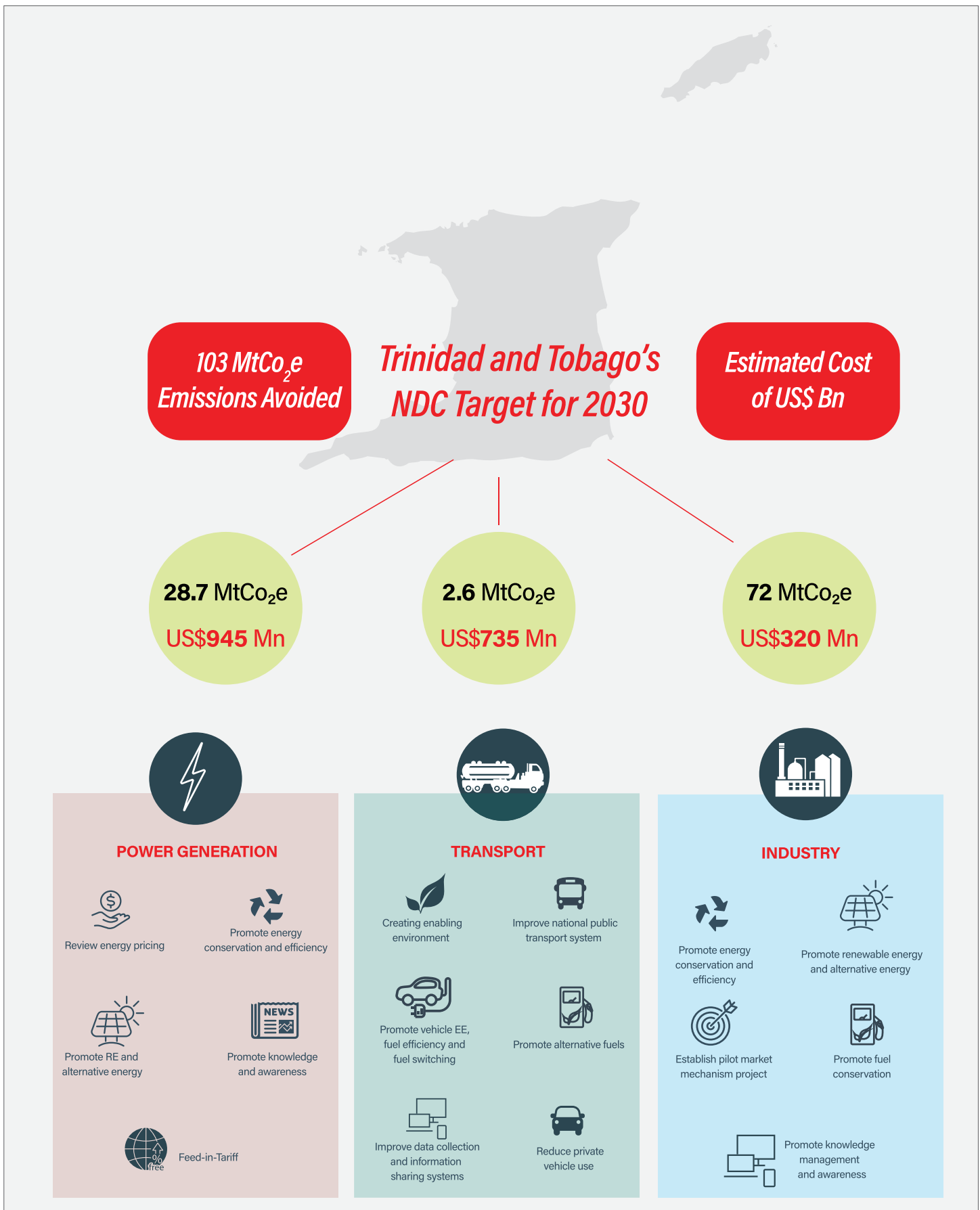
Building Resilience through Climate Risk Management

When PPGPL looks at its history and role in shaping the energy sector, it will see a common thread of safety leadership, capacity building and community development. These embody its vision of being recognised as a global leader in the development of sustainable energy-related businesses. However, as the company contemplates the impact of climate change on the region and its future, it must determine the right tactics to employ for business growth.

One thing is certain: It must remain resolute on the issue of sustainability and not pursue business growth at the expense of its community. For PPGPL, the sustainability agenda must not be at odds with profitability. In fact, the company understands that it cannot expand its asset base and support nation building, unless deliberate action is taken to preserve it. There should be no tradeoff between its vision and the stability of its natural environment.

PPGPL's external environment has been rumbling for some time. It has been portending the rapid transformation of the global energy sector. At the forefront, is the growing threat of abrupt and irreversible climate change and the influence abatement measures will have on energy usage. The Paris Climate Agreement has created a vehicle to prompt social and intergovernmental discourse on the critical actions required to address global emissions. Once at arm's length with commodity producers, consumers have become more empowered through social media. Some have even commenced litigation procedures against polluting companies. They are not only demanding social justice, but cleaner products in support of energy security. This is influencing the global energy mix.

New technologies are also changing energy production, delivery, and consumption patterns. The internet of things and digital twins are making plant operations safer and efficient. Electrified transportation, autonomous vehicles and ride sharing are also changing demand patterns through cost and fuel efficiency. Presently, the COVID-19 pandemic has not only affected societal behaviours like travelling, personal hygiene and personal space norms, but it has also caused the world to slow down and focus on tackling climate issues.





"Nothing happens until the pain of remaining the same outweighs the pain of change".

ARTHUR BURT.

These external rumblings have caused PPGPL to do some introspection. It has reinforced the company's commitment to be a leader on sustainable issues. While sustainability has always been the company's passion, we must reinforce environmental, social and governance (ESG) principles into our strategy if we want to mitigate risk, drive profitability, and ultimately create a compelling future for stakeholders. Issues of biodiversity protection, climate and preservation of natural assets are all things that we must consider in our pursuit of growth.

PPGPL's internal environment has also been making a statement. Its facilities are changing in a way that can no longer be viewed as a

series of random events. PPGPL has been observing environmental abnormalities at its facilities for some time. In 2016, the rate of shoreline erosion was noted to have increased to the extent that shoreline conditions had significantly worsened, and PPGPL's plant infrastructure was in critical danger of significant negative impact on structural integrity. This plant infrastructure included PPGPL's Dock 2 southern fence-line, its Dock 2 pipeline Right-of-Way (ROW) and ultimately, PPGPL's Dock 2 (East to West) pipeline (Lee Young & Partners Limited, 2017).

At the dock facility, localised waves and currents are driven by more generalised tides, currents, and waves in the wider Gulf of Paria.



CHANGES IN THE GULF OF PARIA ARE AFFECTING PPGPL FACILITIES

It is the belief that the waves effecting erosion at PPGPL are abnormal "extreme condition" storm waves that have to approach the shoreline perpendicularly, thereby effecting the observed onshore-offshore erosion and transport, resulting in the observed 2.2 metres per year shoreline erosion calculated by the subject matter experts. These seemingly unrelated observations have been reviewed and have caused the staff at PPGPL to ask these questions – are these occurrences genuinely random and unrelated or do these occurrences provide evidence of the impact of climate change on our small island nation? A story is being woven as PPGPL ponders its observations, connects the dots, and maps its future. The story's theme suggests that the way we invest, manage, and maintain our assets must be reflective of our environmental context. We must also consider our responsibility to our stakeholders. With this mindset, the opportunities become glaring. Embedding ESG into our investment and project decisions grants us social licence as it illustrates the values that the company espouses with respect to sustainable and ethical management. Under the ESG umbrella, issues such as environmental preservation, institutional strength, gender, and diversity have a key role in enabling sustainable management.

When grappling with the issue of climate risk, the business cannot only be viewed in short five-year horizons. PPGPL understands that it must create the right balance between short-term and long-term priorities. This would allow it to shape its future rather than reactively trying to fit a square-pegged strategy within an externally defined round boundary. As PPGPL looks at its risk profile, it will not only be focused on the physical manifestation of climate risk on its asset integrity, it will also contemplate transition risks that are likely to occur as the company tries

to decarbonise. These are risks that may occur due to policy, regulation, litigation, adoption of alternative energy sources, and shifting consumer preferences or behaviour.

In the past, PPGPL has supported environmental initiatives under the umbrella of our corporate social responsibility and our health safety, security and environmental initiatives. These activities included coastal community interventions, children's art competitions on biodiversity and staff involvement in home gardening. One of our flagship projects was our partnership with NIHERST in 2012, to provide rainwater harvesting systems (RWHS) in water-scarce schools combined with solar energy solutions.

Whilst we are proud of these achievements, for our next phase of growth, we will use a more transformative approach. We cannot afford to flatline when climate change has been declared the world's greatest threat to economic stability. This decade has been underscored as a critical period to win this fight.

PPGPL will be championing issues that create a platform for social leadership and stakeholder stewardship. Our project and investment management principles would be influenced by these values. How we select our partners, suppliers and customers will also be informed by our renewed agenda. We are committed to supporting Trinidad and Tobago's Nationally Determined Contributions (NDC) under the Paris Agreement, so we will dig deeper, elevate our outlook, and take bold action.

We have already championed energy management within the organisation by upgrading our heating, ventilation, air conditioning and cooling systems. Upgrades include:

- Replacement of lighting
- Timer-controlled lighting operating specific areas



"Facts do not cease to exist because they are ignored."

- ALDOUS HUXLEY

- Solar Technology:
 - Perimeter lighting – beta-testing in specific/remote areas
 - Entrance barrier controls operating specific/remote areas
- Motion sensor operated extractor fans in specific washroom areas
- Thermostat management-reduce energy consumption during low occupancy periods
- Gradual replacement of old/defunct air conditioning equipment with new 'energy star' equipment
- Utilising energy saving technology such as Multistage Air Volume
- Maintaining quarterly air conditioning servicing schedules.

Notwithstanding the above, we will be embarking on the formalisation of our energy management systems by aligning to ISO 50001. In this regard, some of our future initiatives will include:

- Monitoring and quantifying gas leaks to reduce energy consumption using a leak detection camera
- Implementing fired heater optimisation to reduce fuel consumption and emissions
- Evaluating the benefits of using inert gases instead of fuel gas in storage tanks
- Retrofitting and replacing existing lighting with more efficient lighting and LED lighting
- Determining the feasibility of small-scale utility solar PV projects on the plant.

Taking bold focused action creates explosive results (John Di Lemme). PPGPL intends to do what we must. ■





WHERE FUEL MEETS FOOD

**BRIDGING THE GAP BETWEEN
ENERGY AND AGRICULTURE**





As energy sector revenues decline due to a challenging global market, the expenditure of such a significant portion of foreign exchange on imported food has become an increasingly bitter pill to swallow. Concurrently, the need for alternative revenue streams has become more pronounced and urgent.

The COVID-19 pandemic also exposed the danger of dependence on international markets for food. At its current rate of food importation, Trinidad and Tobago could suffer tremendously if another extreme event were to force a complete border closure, cripple international trade, or disrupt global food production systems and supply chains.

It is with good reason that the United Nations has made food security a priority target under its Sustainable Development Goals (SDGs).

ENTER NGC

The industries of energy and agriculture seem an incongruous pairing - it is not immediately obvious where one can help the other, but NGC, together with its subsidiaries, believes it can add value to agriculture and food production. Why would this company take an interest in this sector, and how exactly could it contribute?

To the question of motivation, NGC and its group members have become vocal advocates for sustainability. To be a respected business in today's world, one must be attuned to the impact of operations on people and the planet. Sustainability means constantly focusing on current and future impact, and aligning business objectives with the targets of the UN SDGs. A focus on strengthening the domestic agricultural sector fits within the Company's sustainability agenda, by allowing the organisation to help move the country closer to several SDG targets (See next page).



There have been calls in recent years for the revival of local agriculture and greater investment in food security. Despite having the resources to support food production for both internal markets and an export-oriented industry, the country today spends around **\$5 Bn** annually to import over **80%** of its food.

A country's sovereignty and capacity for sustainable development are severely undercut if it cannot feed itself.

Agriculture has become a mere spectator in the development of Trinidad and Tobago with the advent and subsequent reliance on the oil and gas industry. Accordingly, there have been calls in recent years for the revival of local agriculture and greater investment in food security. Despite having the resources to support food production for both internal markets and an export-oriented industry, the country today spends around \$5 billion annually to import over 80% of its food.¹

¹ <https://publications.iadb.org/publications/english/document/Analysis-of-Agricultural-Policies-in-Trinidad-and-Tobago.pdf>
<https://oxfordbusinessgroup.com/analysis/aiming-revival-targeting-reduction-costly-food-imports-and-bolstering-development-agricultural>
https://sta.uwi.edu/uwitoday/archive/may_2020/article7.asp

Where fuel meets food | CONTINUED



Add to these all the adjunct socioeconomic benefits that come with increased earning potential and purchasing power, and there is no denying the gains to be derived from building out the agricultural sector.

On another level, NGC and its subsidiaries have embarked on several initiatives aimed at managing climate change, from emissions reduction programmes to renewable energy exploration to energy education. NGC, however, appreciates that this battle cannot be fought in isolation, as there are many sectors with a role to play. Agriculture is one of them.

Although agriculture might be perceived as a green enterprise, the sector does have a hand in climate change. According to the Organisation for Economic Co-operation and Development (OECD), agriculture contributes a major share of greenhouse gas (GHG) emissions – 17% directly through agricultural activities and an additional 7-14% through land use changes.²

Incidentally, the sector also accounts for 70% of all freshwater withdrawals globally³ – an unsustainable consumption rate given increasing demands on water resources from growing industry and populations. If agricultural expansion is to happen, whether organically or by government decree, it has to be done sustainably, to ensure a low carbon footprint and efficient use of resources. Existing farmers and agribusinesses should also be educated and encouraged to make their operations greener. By bringing its own emissions reduction strategies and other relevant research and technology out into the fields, NGC, together with its member companies, could help ensure local agriculture develops sustainably and produces efficiently.

In summary, then, the reasons for NGC's involvement with agriculture are twofold – to help effect positive socioeconomic change through the development of the sector, while helping to reduce the negative externalities and inefficiencies of the industry.

So how exactly does the Company propose to help?

RESOLVING THE CHALLENGES

In 2020, a team from across NGC and its subsidiary companies sat together to figure out what stands in the way of agricultural expansion, food and water security, and what internal resources could be leveraged to remove those obstacles and facilitate sustainable growth in the sector. The outcome of that internal process was a technical paper entitled 'Energy and agriculture - bridging the gap', which was presented to the Ministry of Agriculture, Land and Fisheries for consideration. In that paper, several possibilities for collaboration and support were explored.

Putting technology and data to work

There are many challenges facing farmers which could be overcome or at least alleviated using technology.

Changing weather patterns due to global warming are causing more unpredictable and severe dry and rainy spells. In flood-prone areas, farmers run higher risk of losing crops after heavy rainfall, and this

² https://www.oecd.org/agriculture/ministerial/background/notes/4_background_note.pdf

³ <https://www.worldbank.org/en/topic/water-in-agriculture>



is a deterrent to planting. Floods also bring pests and diseases, which can equally ravage crops. The giant African snail, which feeds on over 500 types of plants, is one destructive agricultural pest that is spread by floodwaters.⁴

On the opposite end of the spectrum, droughts also lead to crop failure, particularly in areas with little or no artificial irrigation. Even when there are irrigation systems in place connected to the national grid, water supply can be unpredictable due to rationing when reservoir levels are low. Leaks along water pipelines are also notoriously common and interfere with regular supply.

Technology and specialist skill sets that are already used in Group operations could be adapted to help address some of these concerns.

Although weather patterns are changing, data captured by satellites, drones and airborne sensors could potentially be used in computer modelling and predictive analysis to help mobilise action ahead of significant weather events. It is possible to send alerts to farmers through integration with telecommunications providers. With enough input data, major instances of flooding, drought and even pests or diseases can be mapped and tracked year-on-year to create vulnerability models and better guide planting. Software and partnerships managed by NGC's Geospatial Information Services (GIS) Department could help make such resources available to agricultural communities and stakeholders.

NGC uses drones to survey and monitor its pipeline corridors and associated infrastructure for encroachment, landslips and other terrestrial changes that could expose or damage its assets. In similar fashion, NGC could use its expertise



TECHNOLOGY CAN HELP ADDRESS FLOODING ISSUES, WHICH CAUSE SIGNIFICANT LOSSES FOR FARMERS.

and equipment to help farmers monitor large tracts of land for changes that could affect crop yield or soil stability. With the attachment of special sensors, drones could even monitor plant growth or assess irrigation needs. The latter function would be particularly important in helping ensure the country's limited water supply is used efficiently. Aerial surveillance could also be useful in curbing the threat of praedial larceny, which often accounts for a significant share of losses faced by many farmers and agribusinesses when crops reach maturity.

With regard to the challenge of water loss due to leaking pipelines, there is considerable opportunity for NGC to collaborate with the Water and Sewerage Authority (WASA) to manage its infrastructure, given that both NGC and WASA oversee extensive pipeline networks. WASA's network is reportedly in great need of repair – the Minister of Public Utilities shared that approximately 50% of water that enters the network does

not make it to consumers.⁵ NGC has a robust Asset Integrity Management (AIM) framework in place, as well as a world-class SCADA system to monitor pipelines in real time for integrity issues. Sharing technology and best practice with the state utility will allow for much-needed improvement in the national water grid. This will not only benefit agriculture but build water security for the wider public as well.

Of course, technology is only able to help prepare and protect the industry up to a certain point. However, if and when severe weather events do happen, the same technology is capable of expediting recovery. Drone and satellite resources can be deployed to take early stock of damages due to flooding – an exercise that would be dangerous if not impossible for farmers to physically conduct. Aerial imagery may also be used to help support and expedite insurance claims for agribusinesses.

⁴ https://agriculture.gov.tt/wp-content/uploads/2017/11/51_Giant-African-snail-factsheet-general-Flyer.pdf

⁵ <https://newsday.co.tt/2017/10/17/minister-50-per-centof-water-lost-via-leaks/>



Reducing environmental impact

Although the connection is not readily made, energy is an important input factor in agricultural production. Petroleum-based fuels and electricity are used to operate machinery and equipment for preparing fields, planting, harvesting and transportation. Natural gas, liquid propane and electricity have also been used to power crop dryers and irrigation equipment. In addition, natural gas is a key component in the manufacture of fertilisers and pesticides.

Given that fossil fuels contribute to GHG emissions, there is room for reducing the carbon impact of the agricultural sector by integrating cleaner fuels. Through its subsidiary, NGC currently markets Compressed Natural Gas (CNG) as a cleaner and cheaper alternative to diesel and gasoline. Farmers should make use of incentives offered by NGC CNG to convert their vehicles to run on CNG, thereby reducing their GHG output and saving on costs. The same gains would be accrued further down the

value chain, if vans and refrigerated trucks that are used to transport goods to market are also converted.

Subsidiary National Energy is also exploring applications for renewable sources of energy, including solar and wind, which could replace conventional fuel in powering certain farm equipment, generators, buildings or even irrigation systems.

Of course, power generation and transportation are not the only sources of GHGs in agriculture. The sector is a major contributor of methane, which has a much higher warming potential than carbon dioxide. The Company has embarked on a campaign to address methane emissions,⁶ which involves knowledge sharing across sectors to raise awareness about and action against this potent GHG. As part of its education drive, the NGC team will look to engage with agricultural stakeholders to bring attention to practices that help decrease methane output, such as better management of manure or the use of quality feeds.

Innovation

Trinidad and Tobago's agricultural productivity, or value-added per worker per hectare, is among the lowest in the Caribbean, according to the Inter-American Development Bank (IDB).⁷ Many factors contribute to this, such as small farm sizes that prevent economies of scale, a shrinking agricultural labour force and issues related to changing climate.

Growing agriculture as an industry today requires research and innovation to help address these issues and raise productivity and competitiveness.

Educational institutes such as The University of the West Indies (The UWI), University of Trinidad and Tobago (UTT) and The Caribbean Agricultural Research and

Development Institute (CARDI) are leading research in agronomy to help accelerate local food production by: developing high-yielding and climate- and pest-resistant crop varieties; building gene and tissue banks; and exploring technology options to make food production less labour and land intensive. NGC has been partnering with academia for many years and intends to work closely with these research institutions to uncover modern and sustainable ways to enrich the sector and boost its revenue potential.

The Company also proposes to establish a Research and Development work centre in collaboration with the Ministry of Agriculture, Land and Fisheries to focus on energy innovation within the agricultural sector, to improve on core capabilities and explore new, disruptive solutions for the advancement of the sector. The objective would be to facilitate idea generation and the realisation of concrete projects with measurable outcomes.

A third initiative being considered is creation of an ideation platform to bring students and young inventors into the conversation, where early stage ideas can be developed, pilot tested and brought to fruition. This initiative would be particularly important to stimulate interest in agriculture among youth.

Global statistics show an ageing crisis threatening the future of the agriculture industry, as the average age of farmers in many countries has climbed over 50.⁸ The occupation of farming is not seen as an attractive career choice for most young people today, due to associations with 'backward' living, low income and tedious manual labour. However, if more young people do not take up the mantle, food production in years to come would be at risk.

⁶ See p 4 for more information

⁷ <https://publications.iadb.org/publications/english/document/Analysis-of-Agricultural-Policies-in-Trinidad-and-Tobago.pdf>

⁸ <https://www.bbc.com/future/ bespoke/ follow-the-food/the-ageing-crisis-threatening-farming/>



Young people must be made to see agriculture as a lucrative business sector ripe with opportunities for modern technology. This sector will be tasked with solving one of the most pressing challenges of the decades ahead – feeding a rapidly growing population with healthful and sustainably farmed foods. Accordingly, bright and innovative minds will need to be engaged in the development of the industry.

The intent is that NGC's ideation platform, and other R&D initiatives, will show the potential to modernise local agriculture and attract a new generation to the sector.

Investment facilitation

One of the prerequisites for expansion of any industry is a downstream market. Local produce markets can only absorb so much, given the perishable nature of many fruits and vegetables. The existence of agro-processing industries in Trinidad and Tobago to serve as off-takers for produce would provide much needed incentive for investment in agricultural development, especially for farmers of highly perishable goods like peppers, and specialist goods like cocoa.

In July 2020, the Government of Trinidad and Tobago officially opened the country's first Agro-Processing and Light-Industrial Park at Moruga.

The park offers leasable factory shells and lots for processing of pepper, fish, cocoa, root crops and fruit.

Investors must be wooed to set up shop at the park, and other estates, but Trinidad and Tobago has a poor ease-of-doing-business rating, which often deters investment. In 2019, the country was ranked 105 out of 190 economies, down from 86 in 2015.⁹ Attracting investors to take up residence at the park is an undertaking that will be supported through National Energy's TTEngage platform. This platform brings all major regulatory agencies involved in the approval process for new investments into a single portal, making the end-to-end process faster and more efficient.

With this company's support, more agro-processors could launch new businesses, opening fresh market demand for local production.

⁹<https://publications.iadb.org/publications/english/document/Analysis-of-Agricultural-Policies-in-Trinidad-and-Tobago.pdf>
<https://tcpd.gov.tt/2020/01/30/trinidad-and-tobago-ready-to-raise-ease-of-doing-business-index-caribbean-news-global/#:~:text=Trinidad%20and%20Tobago%20has%20placed,2018%20and%-202019's%20annual%20ratings.>

Bringing stakeholders together

It is clear that NGC and its subsidiaries have a strong value proposition in terms of helping to develop the agriculture sector in Trinidad and Tobago.

However, there are other entities with just as much to contribute to the sector, which need to be brought into the conversation.

One of the Company's most important roles going forward may be to facilitate collaboration among key stakeholders, by leveraging its position in the energy value chain and its partnerships with state entities and academia.

NGC provides input for some of the foremost fertiliser companies in the world, including Nutrien, CF Industries and the Proman Group. These companies are themselves making waves in agriculture by pioneering technologies and products that can help ramp up the productivity, yield and profitability of farming enterprises. Bringing their insight and expertise to bear on discussions around expansion of local agriculture will be of tremendous value.

Also critical to the conversation are insights from both government and academia. Through its relationships with The UWI, UTT, CARDI, the Ministry of Energy and Energy Industries, the Ministry of Agriculture, Land and Fisheries and other key stakeholders within the energy and agriculture value chains, NGC sees itself as an axis around which collaboration can take shape.

The Company intends to push forward with this cross-sectoral and interdisciplinary collaboration, and has already proposed the formulation of a Steering Committee to oversee the process.

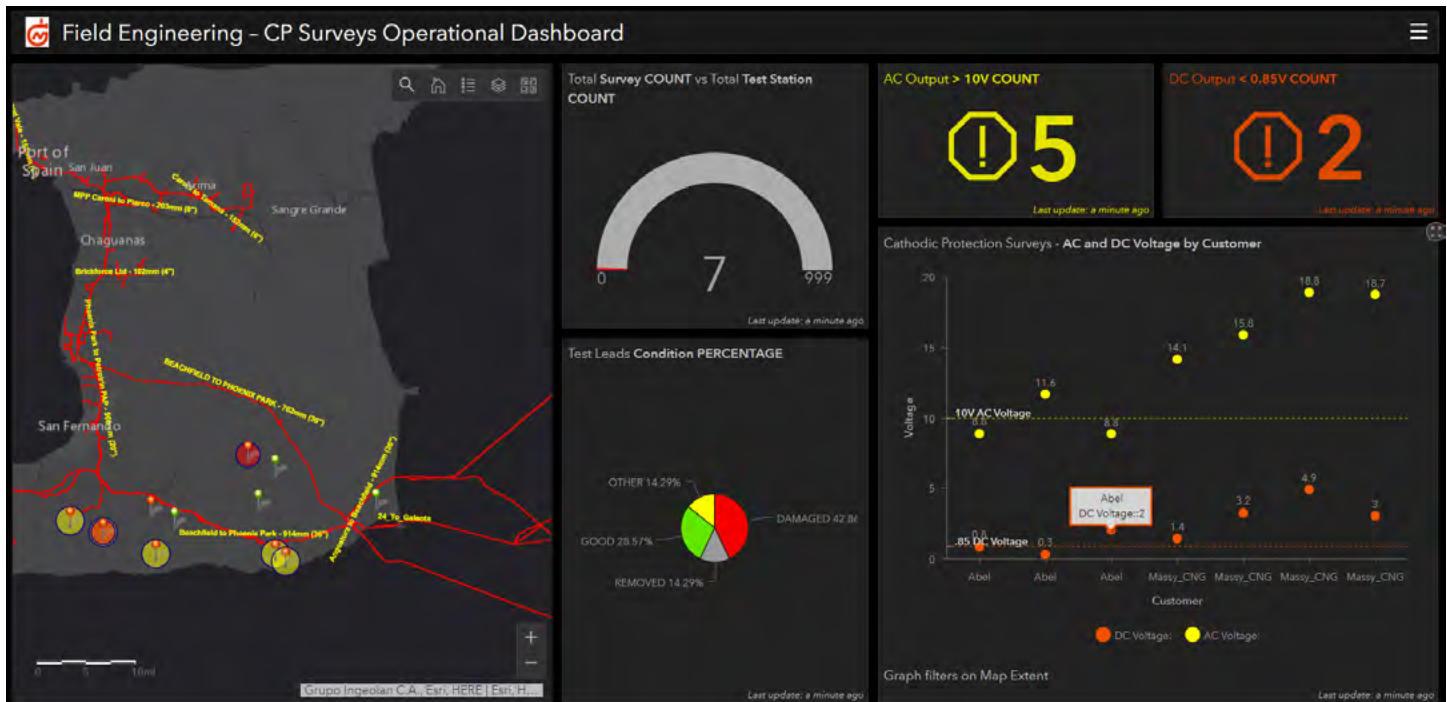
FUELLING THE FUTURE

The future of agriculture and food production in Trinidad and Tobago should be the concern of every citizen. This industry will not only fuel bodies but has the potential to fuel careers and the economy. Recognising this, and as an invested corporate citizen, NGC, together with its subsidiary companies, will continue to advocate and work closely with all players to help build the sector, and national food and water security. ■

DATA & DASHBOARDS

LEVERAGING GIS TECHNOLOGY FOR SMART REPORTING





EXAMPLE OF OPERATIONS DASHBOARD

In the year 2020, millions of people around the globe became familiar with this image - a stark black world map with splashes of red and a tally counter showing a deadly virus on the move. This was a dashboard developed by a Johns Hopkins PhD student to track the progress of the novel coronavirus.

It was a resource of universal interest during the pandemic, but the dashboard was particularly valuable to governments and their advisors, who were relying on its real-time data to guide decisions about border closures, internal shutdowns and public safety measures. Thanks to this dashboard and its data, many countries, including Trinidad and Tobago, had sufficient information to act quickly and avoid worst-case public health scenarios.

The value of real-time data

NGC is not managing a global health crisis, but having access to real-time data is no less important in the management of high-risk energy

assets. To avoid system failures that could put life and property in jeopardy, NGC needs to constantly monitor its network, and act on information regarding potential hazards or risks. The reporting mechanism between field crews and line management must allow for swift and accurate transmission of data, especially when timely decisions must be made to avert danger or mitigate risk. Information received from the field should also be easily visualised and readily compared against historical or other types of data to map trends, track progress of works and identify areas for attention. Paper-based reporting tools are woefully inefficient at meeting these criteria. For this reason, the digitisation of data collection processes and data repositories figures prominently in NGC's short-term technology strategy.

NGC's Geospatial Information Services (GIS) Department has been working with internal customers to help realise this strategic goal.

They are using best-in-class tools to enable smarter and richer data capture and reporting through georeferenced smart forms and associated dashboards. To do this, the team is making use of applications within its in-house Esri software - the most powerful mapping and spatial analytics technology available today. Incidentally, this is the same technology that was used to create the now-famed Johns Hopkins COVID-19 dashboard.

The capability and reliability of this software have been demonstrated at the highest global level, and now it is being leveraged to bring reporting and data analytics at NGC up to world-class standards.

In practice

So what exactly does smart reporting look like in practice?

The new GISD-generated smart forms are basically digital versions of traditional paper forms, with embedded functionalities that enable

users to capture much more data and report up the line much quicker than was possible before. In the past, a technician in the field would need to document data on paper, then transcribe it into a report or static digital form in office, before submitting it to his or her supervisor. On a routine basis, data from all inspections and surveys would need to be compiled into summary reports for tracking and measurement against key performance indicators (KPIs). With smart forms, data captured in the field can be input directly into an interface on a tablet or mobile device, tagged with geospatial coordinates, supported with photos, and submitted immediately to management for real-time reporting. In addition, data from these forms is automatically aggregated into a dashboard, built to display in graphic format the curated statistics and trends that management wishes to keep track of for KPI reporting. This automated process offers many notable advantages over previous practice.

Consider this example of a Right of Way (ROW) surveillance team inspecting a remote segment of the ROW corridor. They notice some tilled land in proximity to NGC's buried pipeline. Using the new smart form, the team lead writes up the details of the discovery on his portable device, attaches a few photos to give a clearer idea of scale and scope, and sends off at once to his supervisor. The supervisor, in her office, receives the notification and opens the incoming field report. Since the form is georeferenced, she can automatically pinpoint the location of the ground disturbance, based on where the form originated. She sends a note to the Legal department to determine whose property lies adjacent so the individual could be contacted for further investigation. She then toggles to her dashboard and notices that two similar ground disturbance events were reported in the past three months, both within a few miles of the new one. She realises there may be a need

to remind persons of safety concerns around digging and farming near NGC's ROW, and contacts the Corporate Communications Division to discuss the issuance of a public advertisement.

While the series of actions in the foregoing scenario could certainly have been completed using the old reporting process, the immediacy with which a supervisor can now receive and compare data to make connections and prompt decisions means that asset integrity and public safety can be more expeditiously managed. If properly leveraged, smart reporting can greatly reduce the time between risk identification and risk mitigation. It, therefore, adds an important safety barrier to the Company's arsenal.

Integrating platforms

Perhaps one of the most useful features of smart forms and similar technological tools that are being introduced at NGC and its member companies is the capability of integration across platforms. Datasets captured on one platform can be merged and overlaid with data from another to allow for richer analysis and more efficient workflows.

Imagine during a valve inspection a team discovers one fitting that needs to be replaced. The faulty valve is the source of a considerable methane leak, as determined by the Company's newly acquired infrared camera. The team shoots off the report to management via a smart form. Using the form's georeferenced coordinates, the manager can pull up the facility's 3D as-built – recently rendered by the GISD – locate the faulty valve and its technical specifications, and activate a request with Procurement to source a replacement. In the background, the methane emissions data logged on the form is now live

EXAMPLE OF SMART FORM

on all the company dashboards that are tracking this information.

This kind of workflow integration is already possible based on the tools and services made available by the GISD. Already, quantifiable benefits have been derived in the form of man-hours saved on tasks, outsourcing costs eliminated and less human error. As the forms and dashboards are rolled out to more areas of the Company, greater efficiencies are expected.

In pursuit of excellence

The GISD is working hard to deploy these and other process-improving technologies across the organisation. In time, it may be possible to create a national GIS Centre of Excellence using NGC expertise, to offer similar services to companies across the country (think: state utilities or public-serving offices with notoriously inefficient processes).

With a driven team and constantly evolving technology, the GISD is quite capable of moving such a vision off paper. ■



A large, diverse crowd of people of various ages and ethnicities is arranged on a white background to form the shape of a large, upward-pointing arrow. The arrow points towards the top right corner of the image. The people are densely packed within the arrow's shape, with some individuals standing outside the main body of the arrow, particularly at the bottom and left edges. The overall composition is dynamic and emphasizes community and growth.

EMPOWERING COMMUNITIES TO LEAD DEVELOPMENT



The National Policy on Sustainable Community Development (NPSCD) was formulated to respond to issues that continue to plague communities across Trinidad and Tobago despite public and private sector attempts to remediate them.

In the 1970s, the Norwegian government decided it wanted to help Kenya raise the standard of living in one of its poorest regions. The Norwegian development agency determined that abundant fish stocks in Kenya's Lake Turkana could hold the key to economic success for the region, so they set about building a fish-freezing plant and teaching the surrounding communities how to generate export income from fishing.

Though it was a good idea in principle, the Lake Turkana project was a massive failure. Millions were spent to complete the plant, which was shut down after a short period. Operational costs were too high, and more importantly, the community residents were nomadic pastoralists with no history of catching or eating fish.

Although it has always been a well-intentioned enterprise, the history of global development is littered with examples like this one, of unsuccessful interventions - from

food aid that created dependency, to long-gestating projects that outlived their usefulness, to projects that caused irreversible environmental damage and destroyed livelihoods. Connecting many of these failures were questions not asked - how will these interventions fare over the long term? What will their impact be down the road? And most importantly, as in the case of the Lake Turkana project, is this project a good fit for this community?

The answers to some of these critical questions lie within the communities themselves. For this reason, a participatory, bottom-up approach to development - which not only takes community needs into account, but actively involves the community in project design and execution - can be most effective.

This is the philosophy underpinning the National Policy on Sustainable Community Development which was launched in 2020, and falls within the remit of the Ministry of Sport and Community Development (MSCD).



Desirous of strengthening the community interventions within its own Corporate Social Responsibility (CSR) portfolio, NGC has decided to partner with the MSCD in the implementation of this Policy.

Overview of the Policy

The National Policy on Sustainable Community Development (NPSCD) was formulated to respond to issues that continue to plague communities across Trinidad and Tobago despite public and private sector attempts to remediate them. These include, but are not limited to, crime, poverty, dependency, juvenile delinquency, cultural erosion, and environmental degradation.

The government saw the need for a more structured approach to community development, which coordinated and focused the efforts of all investors and government agencies. Fragmented programmes all seeking to achieve similar ends can sometimes overlap or trip over one another and are consequently less impactful than one consolidated effort.

“Corporate Trinidad and Tobago was invited to lend support either through direct partnership with or adoption of communities, partnership on specific thematic areas...

The government also saw the importance of leveraging the strengths or assets of each community - finding the competitive advantages that could give entrepreneurs a market edge or developing those local skills and resources that could directly address community problems.

Thirdly, and critically, government recognised the importance of giving community organisations and leaders a seat at the table, and direct input into the programmes being introduced into their communities. This would ensure stakeholder buy-in and improve the chances of success relative to top-down programmes.

The NPSCD takes all these needs into account and outlines a strategy for programme design and execution that responds to these needs. It is based on the premise of participatory, needs-based development. The Policy proposes the establishment of Community Development Committees (CDCs) in each area, for the residents to lead the process of transformation. Community-Based Assessments (CBAs) are to be carried out to establish the baseline context for action, and these will then help

inform area-specific Community Sustainability Frameworks (CSFs). The CSFs will serve as customised blueprints for growth and progress, and encompass both quick-win, short-term goals for early implementation and longer-term development strategies. The NPSCD also outlines a framework for monitoring and evaluation of interventions.

When this Policy was launched in 2020, corporate Trinidad and Tobago was invited to lend support either through direct partnership with or adoption of communities, partnership on specific thematic areas such as youth or culture (inter alia), and/or forging business partnerships within communities. The objective would be for companies to make resources available to support development projects and get involved in the dialogue to understand community issues and goals.

In 2020, NGC committed its support for the rollout of the NPSCD. Pilot activities in the community of La Brea were interrupted due to the COVID-19 pandemic, but the process has since resumed, and NGC is working closely with stakeholders towards implementation.

Deepening impact through data and partnerships

NGC has an extensive CSR portfolio, which has enabled it to contribute to hundreds of causes over the years, in core areas of sport, culture and the arts, education, youth empowerment, environmental preservation and community development.

That said, all CSR contributions, regardless of thematic concern, ultimately aim to strengthen communities. Sponsored groups and programme participants – be they pan sides, Police Youth Clubs, athletes, reforestation workers or NGOs – constitute building blocks of their respective communities. An investment in a steelband should not just benefit the members of that one band, but should positively impact the wider community in which that band operates.



While metrics associated with individual interventions help the Company assess impact at a granular level, having community-level data will allow the Company to see where its programmes fit into the bigger community picture, and if they are indeed helping to address community-level needs. This can, in turn, help NGC develop programmes that have wider reach, and which are more effective and sustainable over the long term.

The NPSCD pilot in La Brea will facilitate just that. La Brea was selected as one of the first communities for the rollout of the NPSCD based on its ranking on the Basic Needs Index (BNI) – a tool used to gauge living standards. Instead of using income as the primary indicator, the BNI assesses the degree to which a household satisfies its basic needs using indicators such as housing quality, household assets, source of lighting, education level of household head, occupancy, type of toilet, and employment.¹ Based on these criteria, La Brea was ranked among the poorest communities in the country, in clear need of developmental support.

La Brea has a close historical relationship with the energy sector, and NGC subsidiary LABIDCO is based in the community. Accordingly, La Brea is considered one of the Company's fenceline communities, in which it has invested heavily over the years. The opportunity to work closely with people on the ground through NPSCD activities, to arrive at best-fit solutions to endemic problems, will allow NGC and its subsidiaries to focus their investments for greater impact.

NGC is making preparations to conduct the Community-Based Assessment (CBA) for this area, to gather vital demographic, socioeconomic, infrastructural, and institutional data that will help paint a true-to-form picture of the community and its needs.

The Company will work closely with the established Community

¹ NPSCD: https://mscd.gov.tt/wp-content/uploads/2020/03/NPSCD_Ministry-Policy-Book-FAW-March-10-compressed.pdf



NGC GROUP SUBSIDIARY LABIDCO IS BASED IN LA BREA.

Development Committee (CDC) – a body comprising representatives of organisations and interest groups functioning at the community level, who will ensure an informed, coordinated and participatory process of community development.²

Together, the team will map not only the needs but the assets of the community and help identify quick wins which can be implemented with corporate and government support.

The CBA exercise is expected to be completed by the end of 2021. At that time, the community will be apprised of the data and involved in the creation of a Community Sustainability Framework (CSF) or Strategic Development Plan. The CSF is the vision and strategy document for the community which will guide the process of development over a five-year-period, using identified assets and leveraging local strengths to achieve human, social, economic, cultural, and environmental goals.

Per the intent of the NPSCD, NGC's role in this process is to be a strategic partner of the community, lending assistance where necessary so that

² Ibid

residents and community-based organisations can attain their goals. Support will go beyond infusions of capital, to include on-the-ground engagement with residents, guidance, and mentoring. Following the CBA, NGC will also be better informed about specific community needs and can adjust existing programmes and sponsorships to respond to those needs.

The road ahead

While the La Brea CBA is being undertaken in 2021, the groundwork will be done for the rollout of the NPSCD framework in fenceline communities near the Cove Industrial Estate in Tobago. NGC will also be partnering in that process, to help facilitate sustainable development on the sister isle.

As the Ministry of Sport and Community Development continues to implement the NPSCD across the country, NGC intends to use collected data to further streamline its CSR interventions. The ultimate goal is to build a portfolio of investments that does not simply have superficial impact but makes deep and meaningful contributions toward sustainable development for all citizens of T&T. ■

One Moment Please



**TO REFLECT ON THE BEAUTY
THAT SURROUNDS US HERE IN
TRINIDAD AND TOBAGO**

*In 2020, NGC partnered with Logging Tape Media to bring
breathtaking images of our islands to homebound citizens.
Captured here is the stunning beauty of Charlotteville, Tobago.*

