FEATURE ADDRESS

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TECHNOLOGY: TRANSFORMING THE INDUSTRY

The Trinidad and Tobago experience

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Once again, it is my distinct honour and pleasure to deliver the feature address at this the opening of 2019 Energy Conference and Trade Show hosted by the Energy Chamber of Trinidad and Tobago. I want to thank the organizers for the sterling effort dedicated towards organizing this very important event and for being so kind to invite me to address you. It is an opportune moment, coming soon after my nationwide broadcasts and public conversations with the nation, on the state of affairs of the economy of Trinidad and Tobago (T&T) and particularly, the contribution of the energy sector.

The energy sector of T&T, notwithstanding its performance in the recent past, represents the industry best placed to achieve significant economic growth, not only within the sector but for the nation as a whole. However, as a small

producer, Trinidad and Tobago's energy sector is inextricably tied to the oscillating fortunes of the global oil and gas industry.

In its 2019 projections, the World Bank Group Global projected the slowdown in global economic growth to slow to 2.9 percent. This is set to have a negative impact on the global economy, including the oil and gas industry and by extension T&T's energy sector. There appears to be no respite in the volatility of energy prices. With a projected oversupply in oil production, prices are likely to be subdued unless there is a significant cutback in production by the major producers. In the meantime, however, Henry Hub natural gas prices have remained at the 2018 levels.

Notwithstanding, the volatility of energy prices, by and large, the oil and gas industry has remained resilient. The major companies practicing in the industry, in the face of lower prices, increased cost pressures, and tighter environmental standards, have been adopting powerful new technologies to ensure future relevance.

It has been well established that the petroleum industry has been in the forefront of changes in state-of-the-art exploration and development and production technology. Technological advances such as three-dimensional seismic techniques, polycrystalline diamond compact drill bits, horizontal drilling, and offshore platforms capable of operating in hostile, deep-water environments are widely acknowledged to have had significant impact on productivity in exploration and development.

In the context of the local oil and gas industry, the introduction of technology has been instrumental in its quantum leap as an industrial force in T&T. In an earlier time this country had the distinction of being the first producing country in which gas re-cycling and re-reinjection was applied in order to recover more oil. This was in the year 1916 in the Tabaquite Field. However, all was not plain sailing as in the early years drilling was dangerous business and blow-outs were the order

of the day. A solution was required. It took the form of a new development - drilling fluids- imported from the US in the 1930s to resolve the problem. Its introduction revolutionized the industry and allowed for much deeper wells to be drilled.

However, there were other challenges and the early operators realized as many do today, that T&T geological formations are exceedingly complex. This necessitated lengthy and costly coring operations to acquire the information required to delineate the lenticular reservoirs. It required a new technology-**Electrical Logging**-which helped to resolve formation complexity and eliminate the need to take expensive cores. During this period, the logging suite was increased by the introduction of the **Sidewall Coring Tool** which provided depth–accurate core samples. These technologies and other inventions enabled the industry to survive and flourish at a time when there was a global economic depression.

By the 1950s, the industry moved offshore and encountered a new level of technical and logistical challenges. However, the impending electronic age and the advent of computers brought about a positive change in oilfield technology and facilitated this new development.

The introduction of computers made possible the rapid processing of large amounts of data, transmission of data from remote locations to central offices and an enhanced ability to interpret data (for example, with computer graphics). Computerization occurred primarily in the areas of seismology and reservoir rock and fluid systems evaluation and, to a lesser extent, in drilling. The first computer-related application in seismology was the interpretation of exploration gravity measurements using mainframe computer systems.

During this period a suite of computer based applications such as exploration gravity measurement computer interpretation, reservoir and rock system and seismology digital processing were introduced. In drilling technology, the most significant advancement at that time was precise well placement within the

highest quality portions of the reservoir. This allowed operators to drill fewer but better wells at lower cost.

In drilling, computerization also provided another dimension as it allowed the integration of many variables such as bit speed, weight on the bit and angle to optimize different aspects of drilling operations. This technology resulted in significant improvements in productivity associated with more efficient use of equipment (that is, less need to replace bits and broken drill strings) and avoided downtime during drilling operations. The creation of computerized drilling databases also allowed operators to use historical experience to improve their operations in similar geographic areas and geologic formations.

Improvements in drilling technology occurred with regularity and encompassed several specific categories of technology, including-downhole motors, well pressure control, drilling techniques, drilling rigs, deep drilling feasibility and tubular goods. Notable advances included the development of more durable bit bearings and tungsten carbide inserts for rock bits, as well as the polycrystalline diamond compact drill bits, automated rigs and rig power systems. These developments had significant effects on productivity in the domestic oil and gas industry largely because they extended the life of equipment and reduced the time spent replacing damaged or worn-out equipment. Overall, they contributed to the lowering of costs, which was important to myriad of operators seeking to establish themselves in the industry at that time.

These improvements in technology fueled the next phase of oil and gas exploration which took off in the marine areas. The first offshore well was drilled in 1954, in the Soldado Field by Trinidad Northern Area. This was followed by the first well which started on a platform 1.2 miles offshore from Brighton in 1958. The structure was designed to accommodate thirty-six (36) wells, a world record for that platform then. The next exploration well was the Galeota No. 1 on the East Coast which was un-economic. It was followed by the first commercial discovery on the East Coast, well QPR off Point Radix. The effect of the extended

exploration to the marine area resulted in oil production increasing from 21 million barrels in 1952 to 67 million barrels by 1967.

The next decade saw improvements in the techniques for identifying hydrocarbons and accurate assessment of reserves, when a discovery is made. This was abetted by advances in the application of microcomputers and interactive mainframe and terminal systems.

Current advances in technology that have impacted positively on T&T include conventional 3-D seismic - a technique that reveals more about subsurface geology and potential hydrocarbon reservoirs. This technology continues to evolve with the development of the ocean bottom cable system and ocean bottom nodes for the acquisition of seismic data. These improved technologies are currently widely used in the domestic oil and gas industry with great success. Their application has been instrumental in identifying many of the recent discoveries and the upward revision of reserves in existing fields. This application led to the situation in 2017, where the replacement of natural gas reserves exceeded production of natural gas in that year. The last occasion this happened was 2004.

In Trinidad and Tobago gas production is on the rise, increasing from 3.2 billion cubic feet per day in 2017, to 3.6 billion cubic feet in 2018 and is expected to increase to 3.9 billion cubic feet per day in 2019 as new production is brought on stream. We expect gas production to stabilize over the period 2020 to 2023 at approximately 4.0 billion cubic feet per day based on the level of investment to be undertaken by upstream companies and any cross-border initiatives with Venezuela.

In our country, gas curtailment has been contained due to the increase in gas supply, which in part is due to the stability brought to the upstream sector by the settlement of domestic gas contracts, in 2017, by NGC with EOG Resources and BPTT. The National Gas Company (NGC) is currently in negotiations with Shell

for a new domestic contract. A **Term Sheet** has been executed by the parties and a **Gas Sales Contract** is being worked on. The downstream industry can therefore expect a greater reliability of gas supply in the near term.

The current gas supply, however, does not include any contribution from our deep-water blocks at this time.

Initially, as in the case of T&T, exploration was confined to land and later shallow or moderately deep-water. As resources in these areas became depleted the global industry began to move further offshore and into deeper water. However, as the industry moved further offshore it has had to adapt to the new and often hostile environment in the exploring for and developing of petroleum resources. These adaptations included, improvements in fixed and non-fixed offshore structures and floating drilling systems such as semi-submersibles. The limitations of fixed structures were soon recognized. This led to the development, for deep water drilling, of compliant structures such as, tension leg platforms, buoyant towers and articulated columns, that allow for flexibility while remaining anchored to the bottom of the ocean floor.

These innovations enabled operations in much deeper water. Improvements in floating offshore drilling technology have also taken the form of greater depth capability. These were aided by the development of more effective and accurate station-keeping such as dynamic positioning systems, mooring systems and anti-roll devices for semi-submersibles and drill-ships. Improved techniques and equipment were also developed for working underwater and at increasing depths, particularly in carrying out repairs on wellheads or platform components.

The development of technology to facilitate the exploration and developing of hydrocarbon resources in deep-water has redounded to the benefit of the countries in the Caribbean Region.

The structure of the Caribbean region testifies to the extremely unstable condition of the terrestrial crust of this intercontinental and simultaneously

inter-oceanic area. In the recent geological epoch, the Caribbean region is represented by a series of structural elements, the main of which are the Venezuelan and Colombian deep-sea sub-oceanic depressions, the Nicaraguan Rise, and the Greater and Lesser Antilles bordering the Caribbean Sea in the North and East.

In a 2012 report, the US Geological Survey of thirty-one (31) priority geological provinces in South America and the Caribbean assessed the un-discovered conventional hydrocarbon potential at 126 billion barrels of crude oil and 679 trillion cubic feet of natural gas. In the Guyana-Suriname Province the crude oil potential was assessed at 13.6 billion barrels and natural gas at 21 trillion cubic feet. The study also assessed the potential of the Tobago Trough which is located north of Block 22 between Tobago and Grenada (the Grenada Trough) and the Barbados Accretionary Prism to the East. The geology suggests upper Miocene and lower Pliocene deltaic sandstones as well as deep-water turbiditic sandstones. Its potential was assessed at 15.7 trillion cubic feet for natural gas and the Barbados Accretionary Prism at 14.5 trillion cubic feet for natural gas and 154 million barrels for crude oil.

The findings of the US Geological Survey have been validated by the hydrocarbon discoveries in Guyana's deep-water. As a consequence, there has been great interest by major upstream companies in conducting exploration for hydrocarbons in the territorial waters of Barbados, Jamaica, Suriname, Bahamas and Grenada.

T&T with its technical expertise, capacity and experience has offered to assist member CARICOM states in the development of their hydrocarbon resources. In this regard, the Government of the Republic of Trinidad and Tobago (GORTT) has executed Memoranda of Agreement for the provision of technical assistance in the energy sector with both the Government of Guyana and the Government of Grenada. It is my sincerest hope that in the clamour for the elusive "secret information" to which everyone is entitled, that these standard operational

procedures, some of which must of necessity carry confidentiality clauses, do not fall victim to the abandonment and withdrawal of enthusiasm on any of these very valuable initiatives. Preliminary discussions have been held with Government of Barbados with the view to the establishment of such agreement. Technical Teams from Trinidad and Tobago and Barbados are to be appointed to develop the necessary Memorandum of Agreement.

This country is well poised to service the industry requirements emanating from the development of emerging hydrocarbon economies in the Caribbean. The existing facilities in the Southwestern Peninsula which includes the Labidco Industrial Estate and port, and the Brighton port, will be supplemented by a maritime business anchored on a dry-docking facility at La Brea. The facilities, upon completion, are anticipated to comprise a large container and bulk transfer terminal for a trans-shipping business and an outfitting terminal for a ship building, dry-docking and repairing business. It will have a deep-water port with a capacity to to handle drill ships, Panamax vessels, rig supply vessels, offshore construction support vessels and other energy services.

Notwithstanding anything else that we might be engaged in, the energy sector remains pivotal in the economic development of Trinidad and Tobago. Gas production has eclipsed oil production and is the dominant hydrocarbon but we will keep on being aggressive in expanding our oil business. In the early years of the domestic industry oil was king and gas was considered as a by-product to be flared. All of that was changed with the development, particularly of the Point Lisas Industrial Estate and the Atlantic LNG Trains. While gas production flourished oil production stagnated and languished. At present oil production is at a low of approximately 66,000 barrels per day, with two-thirds of the production coming from state owned company Heritage Petroleum Company which acquired the petroleum production responsibilities of Petrotrin.

Petrotrin which held most of the country's oil reserves was mainly responsible for the drastic decline in oil production as much needed capital was diverted to other

parts of the business, which in several instances offered little or no financial returns. The Board of Directors of Heritage has projected by year end crude oil production could be restored to pre-2018 levels at approximately 40,000 barrels of oil per day, initially through an extensive workover program involving up to 18 work-over rigs on its land assets. Areas such as Forest Reserve, Catshill, Guayaguayare and Point Fortin will benefit from this increased activity.

Government cognizant of the impact of the restructuring of the former Petrotrin has accelerated and initiated several projects in the West, South and South-West Peninsula which will benefit the communities in these areas. They include The San Fernando to Point Fortin Highway and the rehabilitation of the Moruga Main Road which are already in train and for which construction is being accelerated in this year 2019. Others include the development of the Phoenix Park Industrial Estate, the San Fernando Waterfront re-development and re-generation project, the development of an Administrative Complex at Chancery Lane, San Fernando, the restoration and upgrading of Skinners' Park and a new fishing port in Moruga. It is estimated that 3,500 direct jobs and 5,700 indirect jobs will be created in the West, South and South West Peninsula.

The transition from Petrotrin to the new business model comprising a Holding Company, Trinidad Petroleum Holding Company Limited and subsidiaries, Heritage Petroleum Company Limited, Paria Fuels Limited, Guaracara Refining Limited and Petrotrin has been orderly, relatively uneventful and the haemorrhaging that characterized the operations of Petrotrin has been arrested.

To date Heritage Petroleum has sold several cargoes of crude oil and has received a price as high WTI plus US$2.00. Paria Fuels has been serving the local transportation with liquid petroleum fuels and continuously holds an inventory of 20 days' supply of the fuels. LPG is being provided by Phoenix Park Gas Processors with Government continuing to provide substantial subsidy on this product without increase to the citizenry. Bitumen is being supplied by Lake Asphalt Company Limited and the open market.

As for the refinery, an RFP is currently being finalised for issue to the industry. Expressions of interest have been received from about fifty (50) interested parties from all sectors of the industry, including the Oilfield Workers Trade Union. The Union has been given an opportunity to be the first to have access to data for the preparation of its proposal. On finalization of the RFP, a public notice will be issued inviting bids. It is projected that entire process of receiving, evaluating and selection of the successful bidder will be completed by the end of June 2019. This process could see the new holding company making a recommendation to Government by mid-year with this resulting in reopening of refining operations sometime later on, without taxpayer exposure. This all depends entirely on what the interested parties propose to the Government in the months ahead.

Given, the importance of the domestic energy sector, this Administration has focused on creating stability and where necessary reforms within the sector in order to optimize its contribution to the national economy. However, on assumption to office, we realized that there was an imbalance in the financial returns accruing to stakeholders, particularly as it relates to LNG. The upstream companies and their marketing affiliates were enjoying the lion's share of the revenue accruing from this business and the Government and by extension the people of this country were receiving minimal returns. We highlighted this concern in the Spotlight on Energy which was held at this very venue in March of 2018. This, to our surprise evoked the ire of some local energy commentators who were of the view that we were sending the wrong signals to the upstream companies. Notwithstanding this not so surprising reaction, we persevered.

In April 2018, we met with senior executives of both Shell and BP in London to discuss a more equitable arrangement for the sharing of revenue accruing from LNG. Arising from the discussions we established Empowered Negotiating teams to review the LNG marketing arrangements. We have completed Phase 1 of negotiations with BP and executed a Memorandum of Agreement which provided

for the payment of US$73M for royalty gas claimed by the Government and terms for a new ALNG Train 1 marketing arrangement.

Gas for ALNG Train 1 will be sourced from the Cassia Development. The construction of the jacket for the Cassia Platform will be undertaken by TOFCO. The enhanced incremental GORTT revenue under the new LNG marketing arrangements versus a continuation of the current LNG marketing arrangements is estimated at US$118M (TT$800M) per year. Negotiations with both BP and Shell are continuing and are projected to be finalized by the end of first quarter 2019. In this regard, I wish to complement both companies on the professional manner in which negotiations are conducted and look forward to a mutually satisfying outcome.

As we move forward, we would wish to deepen our relationships with the upstream companies many of whom are involved in research and development on their own or indirectly through academic institutions. While T&T has benefited from the application of technology there has not been any serious investment in research and development for the oil and gas industry in this country. In today's globalized world, a country's prosperity depends on its ability to generate new ideas and convert knowledge into socio-economic benefits.

Technology enhances these capabilities and provides a platform on which a country can build its economic development. However, T&T has lagged behind in research and development. As a consequence, there has been limited production and export of high technology products. In a 2015 World Bank Report on high technology exports from developing countries T&T occupied the cellar position of the study group with its high technology exports representing 0.1% of total manufacturing exports. Costa Rica attained 16.83% and Singapore achieved the highest with 49.28 %.

Therefore in our 2030 Vision we have identified this as one of the priority areas that needs to be addressed. Accordingly, we will be promoting among our

citizenry a culture of innovation, and an increased level of investment in research and development by both public and private sectors.

In this regard, we intend to engage the major oil and gas companies and domestic educational institutions the University of the West Indies and the University of Trinidad and Tobago in effecting a strategy to promote and finance research in technology relative to the oil and gas industry.

We are at critical juncture of our development. The platform on which our economic development has been based has been subject to a volatility that is to be unrelenting and threatens our stability. In the circumstances we need to be a cohesive group working together for our mutual benefit.

The oil and gas industry is a close knit community in T&T. We are operating in a challenging environment and therefore we need to be more collaborative, by sharing risks, establishing joint ventures and adopting technology which allow for increased productivity, real time information dissemination and decision making.

I acknowledge that there has been collaboration but in a too limited number of instances. We need to expand the level of collaboration to maximize the level of hydrocarbon output. Given the changing global energy landscape we cannot afford to have hydrocarbon resources that remain un-exploited due to scheduling issues. The legal and regulatory systems provide for such collaboration. There is no reason why we cannot work together for a better outcome.

Time is of the essence. Let's have more considered action and less talk. Moving forward, the key challenges for the industry will be to reduce costs, adhere to environmental standards and to continue to discover new methods, while achieving high levels of efficiency. A steep challenge, but achievable.

In closing, I wish to remind you that the oil and gas industry of T&T is inextricably linked to the global industry and so too are our fortunes. It is our goal that it continues as a globally competitive and viable business and with all stakeholders benefitting equitably from its returns. Technology, as it has done in

the domestic oil and gas sector's formative years will play a major role in achieving this objective. This is the 21st Century, let's all rise to the occasion and realise our true potential, if not for our own selves but for the children's future.

I thank you.