THE BARBADOS ECONOMIC REPORT
ENERGY CHAPTER 2017

OIL AND GAS EXPLORATION AND PRODUCTION

ONSHORE

The total amount of product available for 2018 consists of 2.53 million barrels (bbls) of crude oil and 5,055,120 thousand cubic feet (mcf) of gas. These figures represent the reserves at December 31st, 2017 as reported by Barbados National Oil Company Limited (BNOCL). This represents an increase over 2016 reserves of thirty-two (32.0%) percent in the case of crude oil which stood at 1.91 million and thirty-five (35.0%) percent in the case of natural gas which stood at 3,292,000 mcf. The products extracted during the year came from existing wells including those drilled in 2005, commissioned in 2006 and brought on stream in 2009. Of the wells drilled in 2012, three (3) have been commercialized to help boost production as well as sand control operations. The drilling programme which commenced in December 2015 was completed in 2016 and five of these wells were also brought online.

PRODUCTION

During the Year 2017, the production of crude oil amounted to 233,489 barrels and this represented an increase of approximately 0.32% over 2016. In 2016, production stood at 232,741 barrels (bbls). This increase was as a result of sand control for some of the newly drilled wells in addition to some re-completions.

In 2017 natural gas production was 526,861 mcf a decreased of 13.13% when compared to 606,473 mcf produced in 2016. This overall reduction was as a result of a deduction in associated gas as well as conservation in the use of the swing gas wells.

OIL AND GAS SALES AND CONSUMPTION

Oil sales for the year decreased by 3.4%, from 241,202 bbls in 2016 to 232,896 bbls in 2017. By the same token, natural gas sales from BNOCL decreased by 37% from 467,868 mcf in 2016 as compared to 2017 which stood at 293,567 mcf.

During the period under review, gas sales to the public increased by 16.63% when compared to 2016. The value of the sales by NPC was $20,192,084 for 2017 when compared to $17,312,200 for 2016. The volume of natural gas sold in 2017 stood at 14,826,206 m^3 an increase of 3.92% above the amount sold in 2016 of 14,267,429 m^3. This increase in both volume and value was due solely to the imported liquefied natural gas.

The expansion programme of the NPC continued in 2017 through its addition of 0.77 miles to its distribution network and an additional three hundred and seventy-three (373) new customers for the year under review.

ELECTRICITY

The sales of electricity for the year 2017 were 944 million kWh, representing a marginal increase of 0.04% when compared to 2016. Of the total sales of electricity for 2017 it is estimated that 36.2 million kWh or 3.8% of electricity were sales from renewable energy sources. This represents 3.8% of total sales. The overall increase in electricity sales was largely due to a rise in customer demand with the largest category of users continuing to be the domestic sector. This sector accounted for 34 per cent of total sales or 324 million kWh.

The BL&P expanded its services by investing approximately $62 million to upgrade its capital infrastructure to accommodate forecasted demand for the year.

FUEL IMPORTS

For 2017, the fuel import bill was estimated at $353,338,000 (P) which represented a decrease of 4% when compared with the figure of $367,095,000 for 2016. The estimated decrease in the import bill can be attributed in large measure to decreases in petroleum prices in general.

With respect to the major fuels, gasoline imported during 2017 stood at 764,449 barrels, representing a decrease in imported volume of 3.7% when compared with gasoline imports for the 2016 which were 794,168 barrels.

Contrariwise, the imports of diesel for 2017 recorded 536,840 barrels registering an increase of 13.7% as compared with diesel imports of 472,078 barrels during 2016.

Imports of fuel oil showed a decrease of 19.6% over 2016 where 1,513,745 barrels were imported for 2016, as compared to 1,217,417 for 2017.

CONSUMPTION OF REFINED PETROLEUM PRODUCTS

The volume of gasoline consumed during 2017 was 772,265 barrels, representing a marginal increase of 0.66% when compared with gasoline consumed for 2016 of 767,206 barrels. The consumption of diesel for 2017 was 503,635 barrels as compared to 484,165 barrels for 2016. This was an increase of 4.0%. Fuel oil conversely showed a marginal decrease of 0.14% with consumed volumes of the commodity registered at 1,194,795 barrels for 2017, as compared to 1,196,470 for 2016. The consumption of Kerosene for 2017 was estimated at 546,068 bbls as compared to 572,219 bbls in 2016 representing a 4.6% decrease in kerosene consumption.

LOCAL RETAIL PRICES

The policy of monthly price adjustment for the major fuels, gasoline, diesel, kerosene and LPG continued during 2017. This meant that the retail prices of the products were more reflective of their imported prices. In the case of gasoline, the average retail price for 2017 was $3.09 per litre or 11% above the average retail price for 2016, which was $2.79 per litre. With respect to diesel prices, the average retail price for 2017 was $2.31 per litre which was 18% above for the same period in 2016

of $1.96 per litre. The average retail price for kerosene during 2017 was $1.16 per litre or 25% above the average retail price for 2016 of $0.93 per litre.

The retail prices LPG, were adjusted in a similar fashion. During 2017, the average retail price of the 100lb cylinder was recorded at $151.85 which was 5% above the average retail price for the year 2016 of $144.08. With regard to the 25lb cylinder, the average retail price was $43.06 for 2017, an increase of 5% when compared with 2016, of $41.14. The average retail price for the 22lb cylinder for 2017 was $38.06, representing an increase of 5% when compared to that of 2016 which was $36.34. The average retail price for the 20lb cylinder during 2017 was $34.06 showing a decrease of 3% when compared to the average price for 2016 which was recorded at $33.04.

During 2017, the price structure of refined petroleum products experienced some changes such as, increases in thruput fees on gasoline and diesel, excise tax, marketers' margin, national social responsibility levy (NSRL) and the introduction of cross subsidies on gasoline and diesel to keep the thruput fees on fuel oil and aviation fuel unchanged. These changes to the structure of refined petroleum products have contributed to the increased prices seen.

PERFORMANCE OF THE GOVERNMENT OF BARBADOS RENEWABLE ENERGY AND ENERGY EFFICIENCY PROJECTS & PROGRAMMES

Electric Light and Power Act 2013

One Hundred and Thirty One (131) licences were offered since May 2015 to new applicants to supply electricity to the national grid and of these 53 were offered in 2017. The amount of licensed renewable energy totaled 30 MW however, 27 MW are connected to the grid at the end of 2017.

The Renewable Energy Rider (RER) has now made provision for RE systems up to 500kW and applicants are now submitting larger applications for licences. In addition the RER has removed the limit of which stated that the production must be no greater than 1.5 times the consumption.

Renewable Energy Feed in Tariffs

The demand for renewable energy was boosted through the delinking of the feed in tariff from being tied to global fuel costs. A fixed price was evolved at Barbados 41.6 cents for electricity purchased from PV systems, and 31.5 cents for electricity purchased from wind systems.

During the Year under the review the Division of Energy and Telecommunications (DET) is commenced an Electricity Market Study which seeks to determine the optimum tariff model for Barbados, advanced recommendations on tariffs and other electricity market structural requirements that may be considered by the FTC.

PV Systems at Schools

The DET completed work on outfitting four (4) schools with PV systems. These were Bayley's Primary School, St. Catherine's Primary School, Selah Primary School and Half Moon Fort Primary School. A total of 70kW of PV was installed and is projected to meet over 100% of the electrical energy needs of the schools.

The second phase of the 10 Schools PV system project completed in 2015 has commenced. The second phase involves the identification and interconnection of the emergency lighting circuits to the backup component of the PV system. The tender document was issued in December 2017.

Disaster Risk and Energy Access Management (DREAM)

The project started in 2016 with the hiring of a Programme Coordinator and has achieved the following thus far:

1. Installation of solar PV systems at the community centres has commenced and is expected to be completed within the first quarter of 2018.

2. The tender for the installation of PV systems at the nine (9) Polyclinics has been issued. The tendering process is expected to be completed within the first quarter of 2018.

3. Public Awareness Campaign: The first public awareness campaign titled 'Flip the Switch' was carried out. Participants learnt about renewable energy through an innovative gaming format.

4. Electric Utility Licence: The consultancy to prepare the license application form and conditions for an electric utility has been concluded. The DET is in the processing of having these documents peer reviewed. A peer review of the documents has also been completed.

5. Under this project the DET will be developing its capacity to carry out grid modelling. This process was augmented through the DET hosting a research student from Martinique. The following has been achieved

a. Over 8 grid model software programmes were reviewed.
b. A grid modelling group consisting of persons from the Government Electrical Engineering Division and the Energy Conservation and Renewable Energy Unit as well as the Project (IABD) Unit within the ETD was established.
c. Proposals/quotations were requested from 4 short listed grid model suppliers.
d. The initial steps in modeling the Barbados Electricity grid have started.

Energy Efficient Lighting and Air Conditioning Retrofit Programme

The Energy Efficient retrofit programme which began in 2016 by the DET was completed in 2017. Under this programme a number of Government owned buildings which was facilitated through a technical assistance programme from the Peoples Republic of China. This retrofit entailed the distribution of 25,000 energy efficient

lights and 1000 air-conditioners. The 25,000 bulbs are expected to save the government 1,100,000 KWh per year or approximately $800,000 while the 1000 air conditioners are expected to save 1,800,000 kWh per year or $1,300,000 per year.

To date over 45 Government institutions have been retrofitted with LED lights and A/C units with the bulk of the inventory going to QEH, BDF, GEED and BCC.

United Arab Emirates (UAE) - Caribbean Renewable Energy Fund

In January 2017, the Government of the United Arab Emirates launched the US$50 million Caribbean Renewable Energy Fund. This fund was established for Caribbean developing states to promote the increased use of renewable energy. The Division of Energy and Telecommunications submitted five proposals to the funding agency with two projects from the Barbados Water Authority being approved. The fund is administered by a steering committee comprising the UAE Ministry of Foreign Affairs and the Abu Dhabi Future Energy Company (Masdar).

The goal of the two BWA projects is to improve water access by installing provision for backup power supplies and a reduction in operating costs through generation of electricity from photovoltaic sources.

The first project is the installation of a 500kW ground mount photovoltaic farm on 1.5 acres of land at the Bowmanston water pumping station. This PV farm is expected to generate 1.6GWh of electricity per annum or about 71% of the energy required by the pumping station, saving an estimated BDS$660,000 per year. The BWA spend on average $984,000 per annum on electricity at the Bowmanston pumping station. The second project is the installation of a 500kW solar carport covering approximately 35,000 sq. ft. of parking area at the Bridgetown sewage treatment plant. This solar carport is expected to produce 38% of the energy needs of the treatment plant.

Caribbean Center for Renewable Energy and Energy Efficiency (CCREEE)

During 2017, the Agreement to establish CCREEE was signed by 10 member countries at the heads of Government meeting in Grenada held in June. These countries were:

Barbados	St. Lucia
Belize	St. Vincent
Jamaica	Grenada
Trinidad	Suriname
Dominica	Guyana

To data however, only 2 of the 10 countries have ratified the agreement. Since the first meeting held in June, Antigua and Barbuda signed the Agreement in November.

Also during the 2017 period, four (4) sub-committees of the steering committee were established amongst which was a HR committee. This committee was charged with finalising the TORs for the recruitment of the 4 initial CCREEE posts.

These advertised posts were:

Executive Director
Sustainable Energy Expert
Senior Executive Secretary
Administrative and Finance Manager

It is anticipated that the CCREEE officers will be in place by April 2018.

SUSTAINABLE ENERGY FRAMEWORK (SEFB)

SUSTAINABLE ENERGY INVESTMENT PROGRAMME (ENERGY SMART FUND)

The Final Disbursement date for this project was May 7, 2017 and an end of project date of June 7, 2017. The Final Audit and Final Evaluation consultancies commenced in May and June 2017 respectively. The Final Evaluation Consultancy was completed in September and the Final Audit in October 2017.

During the year 2017, lone project activity was under the Energy Efficient Lighting Facility the Enterprise Growth Fund continued to partner with Caribbean LED Ltd. to implement a final phase of the facility by providing five (5) free light emitting diodes (LEDs) to a number of residential customers of BL&P through the issuance of vouchers. The Division received the Bank's non-objection to proceed with a third phase of this facility utilising uncommitted funds remaining under the Technical Assistance Facility as well as interest accrued to the Fund. This third phase distributed 11,575 lights at a cost of BBD 245,159.82. This facility was closed in April 2017. A total of BBD 1,219,887.60 was disbursed under this Facility.

The remaining three (3) of the five main facilities under Component one, the Technical Assistance Facility, the Pilot Consumer Finance (PCF) Facility and the loan Energy Efficient Lighting Distribution Facility were completed. The Air Conditioning Trade-In Facility was cancelled due to challenges in disposal of the air conditioning gas. The Technical Assistance Facility was closed on May 31, 2016. Cumulatively, thirty-six (36) applications were submitted to the DET of which twenty-eight (28) were totaling BBD $449,674.50 for firms to undertake energy audits and/or renewable energy designs. BBD $440,191.10 was distributed under this facility.

The Enterprise Growth Fund Limited (EGFL) partnered with Massy Stores (formerly DaCosta Mannings Retail Ltd) and Unicomer Barbados Ltd., Courts for the implementation of the Pilot Consumer Finance Facility. Cumulatively, BBD $498,839.83 was disbursed to Massy Stores and BBD 499,618.57 was disbursed to Unicomer. Approximately 2,600 customers benefitted from rebates of 20% or up to $500 for purchasing renewable energy and energy efficient equipment including energy efficient refrigerators, washing machines and solar water heaters.

Under the Energy Efficiency Retrofit and Renewable Energy Finance Facility, a total of twenty (20) loans totalling BBD $16.54 million were approved. A total of BBD 16.3

million were disbursed to loan applicants where BBD 15.5 was disbursed from IADB resources and BBD 810,116 from project reflows and interest to the fund. These loans enabled businesses to implement photovoltaic (PV) systems and energy efficient retrofits.

These projects totaled 1.727 Mega Watts of photovoltaic systems, energy efficient refrigeration and cooling and energy efficient lighting are expected to save 3,782 Mega Watts of energy per year. The combined output of these energy efficiency and renewable energy measures are projected to save the equivalent of 2,225 barrels of oil.

PUBLIC SECTOR SMART ENERGY (PSSE) PROGRAM

In 2017, contract between the Government of Barbados and the Barbados Light & Power Co. Ltd for the procurement and installation of LED street lighting across Barbados was signed and the procurement of the LED Fixtures by the BL&P commenced in September 2017. In addition, the retrofit of public buildings, with renewable energy is now scheduled to be completed in 2018, and the procurement of the contractors for the retrofit of buildings with EE technologies should commence in 2018.

Under the Electric Vehicles component, procurement activities for the remaining (6) six electric cars was completed and the vehicles were allocated to the (6) six beneficiaries: the Ministry of Foreign Affairs and Foreign Trade; the Barbados Defense Force; the Ministry of Environment and Drainage; the Ministry of Transport and Works; Financial Intelligence Unit, Attorney General Office; and Ministry of Education, Science, Technology, and Innovation. The installation of the charging station will be completed during the following period. The total cost of these six (6) vehicles was BBD $636,315.00.

With regard to the Ocean Energy component, preparatory work was conducted to procure the consultant for the second consultancy under this component: the Marine Spatial Mapping and Ocean Energy Locational Guidance Services Consultancy. This consultancy is to produce a series of locational guidance maps and a final report identifying areas suitable for installation of four selected ocean energy technologies (i.e. Ocean Thermal Energy Conversion (OTEC), Fixed Offshore Wind, Floating Offshore Wind, and Offshore Wave Energy). The cost of this consultancy is BBD $61,000. This consultancy's output will inform the development and implementation of the larger feasibility studies.

Capacity Building Institutional Strengthening & Public Awareness

Under Component 3 of the Program, preparatory work continued for the implementation of the capacity building, public awareness and energy labelling activities as the Division is currently revising the Terms of Reference for the procurement of a Public Education and Awareness Consultant and a Operations Consultant – Capacity Building. This component aims to affect a broad increase in institutional capabilities throughout Barbados' energy sector, strengthen the professional skills in the energy market, and increase public awareness regarding sustainable energy with a view of equipping both public and private actors with the

skills necessary to enable Barbados to successfully implement its Sustainable Energy Framework.

Institutional strengthening continued in the Division of Energy and Telecommunications and the Fair Trading Commission with a number of persons attending training workshops. During, the month of June 2017, 3 persons attended the Public Utility Research Center (PURC) 42nd International Training Program on Utility Regulation and Strategy in Gainesville, Florida. This was further enhanced as an additional 4 persons, 2 each from the Divisions were trained in PURC Advanced International Practices Program – Energy Pricing.

The PURC programs are in collaboration with the World Bank and are specifically tailored to the professional requirements of utility regulators, regulatory staff and infrastructure managers. The programs are designed to enhance the economic, technical and policy skills required for implementing policies and managing sustainable regulatory systems for infrastructure sectors.

In September 2017, the Division of Energy and Telecommunications received capacity building/training as a representative of the Division attended the Transport and Climate Change Week in Berlin, Germany. This afforded the opportunity for an exchange and in-depth discussions with national and sub-national government officials and internationally renowned experts on sustainable urban mobility solutions.

The year 2018, has started with continued PURC training as an officer from the Division of Energy and Telecommunication is currently attending the 43rd PURC International training Program on Utility Regulation and Strategy. This training would enhance the Division's legal section as it relates to the regulatory framework for the energy sector.

NATURAL RESOURCES

Barbados Offshore Petroleum Programme

In 2017, the Government of Barbados earned approximately $105,000 USD n the sale of seismic data to Cobalt International Energy Inc.

Moreover, geological services companies involved in multiclient seismic acquisition campaigns continued to approach the Division of Energy on a consistent basis. In 2017, the Division received formal proposals and requests from ION GeoVentures, and MultiClient Geophysical (MCG). It is notable that interest has been retained despite the difficulties faced by the industry in 2016/2017.

Barbados National Oil Company Ltd. (BNOCL)

The Natural Resources Department (NRD) compiles and analyses monthly oil and gas production figures provided by BNOCL, in an effort to study reservoir behavior and devise suitable strategies for improving hydrocarbon recovery. This work includes the review and assessment of applications to perform workovers and perforation operations. Additionally, the NRD's officers are responsible for performing well site activities, evaluating well logs and approving completion applications. Out of

these efforts, the NRD provided technical recommendations to BNOCL on suitable techniques to improve efficiency.

The officers of the Department reviewed and evaluated eight (8) applications to perforate new reservoir intervals. This work resulted in an increase in the average daily oil and gas production of the oil company. The logs for eight (8) oil and gas wells were also updated with the most recent perforation details.

Quarrying and Mining

Having secured the necessary funds, the NRD completed the preparation of a Request for Proposals (RFP) package in respect of the island's Sand Reserve and Resource Estimation Project in 2017. This Project is expected to be completed in the second quarter of 2018.

OUTLOOK/FORECAST FOR THE YEAR 2018

International Perspective

During 2017, international petroleum prices continued to be influenced by US production rates and stock piles, Saudi Arabia's ability to influence production, Iran's embryonic ability to continue oil production, Chinese increase consumption, Russia's continued recession and OPEC's decision to reduce production for the first six months of 2017. Collectively these demands led oil prices to increase. In addition, over supply continued to be a challenge for the market as well as nations that refuse to abide by any measure that would facilitate a true re-balance.

In a monthly report, the Organization of the Petroleum Exporting Countries (OPEC) forecasted that demand for the group's oil will remain around 32.85 million barrels per day (bpd) in 2018, due to an OPEC production agreement aimed at reducing global oil inventories. The Organisation for Economic Cooperation and Development (OECD) forecasted demand for 2018 to increase by 500 000 b/d while non-OECD demand is expected to average 52.50 mn b/d. On the supply side the Energy Information Administration of the US Department of Energy expects world production to increase to 100.11 mn b/d during 2018 above the 98.03 mn b/d level for 2017.

With the world economy strengthening through monetary and fiscal stimulus a synchronized improvement in growth rate is seen across most countries. It is expected that the annual growth rate of the world economy is projected to improve slightly in 2018. Expansion in the major emerging market economies is improving on the back of renewed infrastructure investment in China and recovery from recession in major commodity-exporting economies though this recovery is softer than in the past. Growth in China is projected at 6.6% in 2018 partly reflecting the ongoing rebalancing in China's growth model. On the other hand, in India, growth is projected at 7% in 2018, thanks to reforms that are expected to boost investment, productivity and growth.

The global economy is flying low and at risk of financial turbulence. An integrated policy approach strategy needs to be dogged that will balance actions to boost growth, mitigate risks in the financial sector and improve resilience. Complacency has to be avoided and the assumption that today's economy is as good as it gets should be the unthinkable as future generations deserve better.

It is anticipated that interest rates in the US will continue to increase in 2018 contributing to the downside of international oil prices. This view on interest rate movements is predicated on the DOT plot of the current members of Federal Open Market Committee. However, the international geopolitical environment seems to be entering a cycle of increased uncertainty that may be a higher contributing factor to oil price volatility in 2018. Moreover, alternative sources of energy are expected to continue at current pace representing a constraint on the upward movement of oil prices. In short, it is highly likely that international politics will be the key deciding factor on oil prices rather than economic fundamentals.

In light of the global international geopolitical economy events that are expected to pressure oil prices, it is projected that West Texas Intermediate (WTI) crude oil prices for 2018 will have monthly average prices that could range between US $38.00 and US $88.00 per barrel. The breaching of the upper band of the prices is likely to occur if there is a significant geopolitical event, as it is not anticipated that the economic fundamentals for oil will drive up oil prices. The width of this range is due to the upward trend development, and the expected volatility in oil prices estimated to be around 29% for 2017. The long-run average equilibrium price of the WTI crude oil price has been estimated at US $52.00 per barrel. It is likely that during 2018, oil will trade for the most part above the equilibrium level.

Local Perspective

The annualized volatility of the key fuels imported into Barbados is as follows:

Diesel	-	28.575%
Gasoline	-	30.858%
Fuel Oil	-	23.726%
Jet Fuel	-	29.015%
LPG	-	33.014%

The level of fluctuation indicated above suggests a very volatile year for oil and fuel prices over the remainder of the year.

The Fuel Clause Adjustment is expected to fall between 12.27 cents/kWh to 44.60 cents/kWh, as the annualized variation in the Fuel clause adjustment is estimated to be 38.64%. The long term equilibrium is estimated at 18.54 cents per kWh. It is anticipated that the Fuel Clause Adjustment is expected to register above long term equilibrium price for most of 2018.

Although, the price of electricity from renewable energy has been delinked from fossil fuel during 2017, the capacity of electricity from renewable sources stood at 27 MW

from mainly photovoltaic systems. This represented a 15% increase over 2016. Consequently, it is anticipated that the renewable energy will see an increase in production. The renewable energy sector has indicated that there are a number of policy and regulatory matters that must be address to give stakeholders confidence. For instance, stakeholders wish to see a significant reduction in the licence application fees and permanent tariff rates for the sales of electricity from renewable energy among other issues. If the main issues are addressed in a timely manner over 2018 it is projected that electricity sales from renewable will increase significantly.

During 2018, it is projected that the Barbadian consumers of gasoline, given the current price structure, will pay a retail price of between BDS $ 2.85 per litre and BDS $3.72 per litre. In the case of diesel it is projected that consumers will pay a retail price of between BDS $2.24 per litre and BDS $3.13 per litre. It is further projected that kerosene consumers will pay a retail price of BDS $0.90 per litre on the low end and an estimated maximum of $1.63 per litre. With respect to LPG, it is projected that wholesale and retail prices of between BDS $117.10, BDS $34.38, BDS $30.42, BDS $27.65 and BDS $176.34, BDS $49.18, BDS $43.45 and BDS $39.50 for the 100lb, 25lb, 22lb and 20lb respectively.

The table below summarises the preceding paragraph by showing the projected wholesale and retail prices for gasoline, diesel, kerosene and LPG for 2018.

Table showing projections for 2018

PRODUCT	HIGH	LOW
Gasoline	$3.72	$2.85
Diesel	$3.13	$2.25
Kerosene	$1.63	$0.90
LPG		
100 lb	$176.34	$117.10
25 lb	$49.18	$34.38
22 lb	$43.45	$30.42
20 lb	$39.50	$27.65