



ENERGY LECTURE SERIES

ENERGY TRENDS TO 2025

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Introduction or “The world is what it is...”

Energy is the basis of the modern world. Our ability to understand energy systems our mastery of laws of thermodynamics and electricity were distinguishing features of 19th century science. The harnessing of energy via sources such as coal, oil, natural gas and nuclear energy have marked the upward surge of mankind for the last 200 years. The world isn't running out of energy. Theories like “peak oil theory” are now relegated to the dustbin.

Running out of coal.....

“The fear of running out of energy has troubled people for a long time. One of the nineteenth century’s greatest scientists, William Thomson—better known as Lord Kelvin—warned in 1881, in his presidential address to the British Association for the Advancement of Science in Edinburgh, that Britain’s base was precarious and that disaster was impending. His fear was not about oil, but about coal, which had generated the “Age of Steam,” fueled Britain’s industrial preeminence, and made the words of “Rule, Britannia!” a reality in world power. Kelvin somberly warned that Britain’s days of greatness might be numbered because “the subterranean coal-stores of the world” were “becoming exhausted surely, and not slowly” and the day was drawing close when “so little of it is left.”

I am of the view that as a species we are at a critical moment in history as we seek to build a bridge from an unsustainable relationship with energy to a sustainable relationship. That bridge is being built through

emphasis on policies aimed at energy efficiency, energy conservation and renewable energy. These technologies are taking root in Trinidad and Tobago.

We will get there but it will take time. In the interim the world will continue to depend mainly on hydrocarbons for its energy needs in is not an “inconvenient truth” it is an “inescapable truth”. The industrial revolution that started in England in the 19th century was driven by coal; the 20th century was driven by oil; and natural gas will no doubt be the driver of the 21st century.

A Globalist Perspective

Global demand for energy will continue to grow. BP in their Energy Outlook to 2035 forecast that

“.....global energy consumption is expected to rise by 41 per cent from 2012 to 2035 – compared to 55 per cent over the last 23 years. Ninety five per cent of that growth in demand is expected to come from the emerging economies, while energy use in the advanced economies of North America, Europe and Asia as a group is expected to grow only very slowly.”

“Shares of the major fossil fuels are converging with oil, natural gas and coal each expected to make up around 27% of the total mix by 2035 and the remaining share coming from nuclear, hydroelectricity and renewables. Among fossil fuels, gas is growing fastest, increasingly being used as a

cleaner alternative to coal for power generation as well as in other sectors”

That growth is being driven by the Eastern world while growth in supply is coming from the western world. Forty years ago in 1974, Dr. Eric Williams gave three speeches on the state of the energy sector in the context of the Yom Kippur War and the Arab Oil Embargo. At that time the prevailing global energy equation was in reverse – growth in supply was coming from the East and growth in demand was coming from the West.

The world population eclipsed 7 billion in 2011. Earlier in that same year China became the second largest economy in the world. The United States however remains the largest economy in the world by some distance. In 2012, the World Bank reported that the USA’s GDP was \$US 16.2 trillion versus China’s GDP of \$US 8.3 trillion. It is my view that the shale revolution in the United States means that the autumn of the “American Empire” has been postponed. The term “American Empire” was borrowed from Oxford Historian Niall Ferguson.

In early 1974 the world was reeling from the Arab oil embargo of the Western world which sent oil prices spiraling upward and ushered into being the period we here call “the oil boom”. In response to the Arab oil embargo, President Richard Nixon launched an initiative called “project independence”. Its goal was to make America energy independent by 1980 through energy conservation and alternative energy sources. Of course naturally this failed.

Fast forward to 2014 and according to Daniel Yergin (writing in Politico) America is on the verge of achieving energy independence.

This is being achieved not through energy conservation (although very important) or wind, nuclear and solar (although very important) but through the commercial exploitation of shale oil and shale gas. To illustrate the point - in 2005 the United States was importing 60% of its crude oil by 2013 that number collapsed to 35%. America's lessening dependence on energy imports also has serious consequences for American foreign policy. That is part of the evolving world that we must understand.

Let us examine two views that were recently presented on the McKinsey website. The first is that of Daniel Yergin the author of "the Prize" and "the Quest". This is what he says:

"The unconventional-oil and gas revolution—shale gas and what's become known as "tight oil"—is the most important energy innovation so far in the 21st century. I say so far, because we can be confident that there will be other innovations coming down the road. There's more emphasis on energy innovation than ever before. Unconventional oil and gas came as a pretty big surprise. It even took the oil and gas industry by surprise. "Peak oil" was such a fervent view five or six years ago, when oil prices were going up."

Yergin continues:

".....when you have a lot of bright people working on a problem in a sustained way, you will probably get to a solution. Will it be 5 years or 15 years? We don't know but, ultimately, need drives innovation. I see this as all part of the great revolution that began with the steam engine, and there's no reason to think it's going to

end. It's going to continue in the oil and gas industry, and it's also going to stimulate innovations of other kinds among renewables and alternatives."

The second view is that of Fred Krupp head of the Environmental Defense Fund:

"Ten years from now, what I see is an Internet-connected world where the behaviors of companies—including how products have been produced—are so transparent that those businesses who are truly good citizens will be rewarded in the marketplace."

These two thinkers have in a way framed the issues of energy and sustainable development. Writing in the online magazine Politico in November 2013 Yergin further crystalizes the US energy boom by adding that while it isn't likely that the United States would actually become energy independent in the foreseeable future, it will become a lot less dependent on importing energy.

But the United States isn't the only big story in the Americas. There have been big resource developments in Canada (Tar Sands) and Brazil (Pre Salt) and I will come to Mexico shortly.

East Africa

In East Africa, Anadarko, ENI, Statoil and BG have made huge gas discoveries in Tanzania and Mozambique. In an article in the Financial Times of March 18 2013 it was reported that:

The waters off [Mozambique](#) and Tanzania have turned into one of the hottest frontiers in the global [gas and oil](#) industry. By the end of the year 2013 Anadarko will have invested \$3 billion in its discoveries off

the coast of Mozambique, which have between 35 and 65 trillion cubic feet of estimated recoverable reserves in a block known as Area 1.....Eni said gas discoveries at its Mozambique fields contained around 80 trillion cubic feet. This would place the estimated gas reserves in Mozambique at about 150 Tcf. In Tanzania, the Minister for Energy and Minerals said the country is expected to exploit 60 trillion cubic feet of natural gas in the next five years. WoodMac says the two countries potentially have the same size gas resource as Australia, where some 200 tcf of gas has been found.

The energy consultancy Wood Mackenzie has said there is enough gas in the region for as many as 20 trains, each of which costs about \$7bn. That would give Mozambique and Tanzania a combined production capacity of about 100m tonnes of LNG per annum – much more than the 77 mtpa produced by the world’s biggest LNG exporter, Qatar. But Mr Dodson warned that it would take years for such facilities to be built. “We’re in an area with no infrastructure,” he said. “Everything will have to be done from scratch.”

Panama Canal expansion

The expanded locks of the Panama Canal will be able to handle ships as long as 1,200 feet and as wide as 160 feet, compared with the current 965 feet and 106 feet.

Only 4 percent of the 369 LNG ships can fit through the waterway now, and just six of the vessels have entered in the past five years, according to data from IHS Maritime. The new canal will accommodate 89 percent of the world’s LNG carriers.

The round-trip voyage to Fukuoka, Japan, from Sabine Pass, Louisiana, will cost \$8 million and take 43.4 days through the canal, instead of \$11.4 million and 63.6 days around Africa, Marucci said.

Nuclear Power

Nuclear energy is used to generate about 11% of the world's electricity with no greenhouse gas emissions. The 2011 Japanese Tsunami and the Fukushima disaster that followed dealt a blow to the image of nuclear power.

Japan imports about 84% of its energy requirements. The country's 50+ main reactors have provided some 30% of the country's electricity and this was expected to increase to at least 40% by 2017. The prospect now is for at least half of this, from a depleted fleet of no more than 48 reactors. Only yesterday the Japanese Cabinet approved an energy policy reversing the previous Government's plans to gradually mothball nuclear power plants but there remains serious opposition in Japan to nuclear power.

Germany in 2011 has signaled that it will phase out its nuclear power plants. So it seems that to the year 2025 the expansion of nuclear power will be limited and there may actually be a decline in its use. There is therefore a big question over nuclear energy in the future.

Mexico

Finally, Mexico in the context of this hemisphere deserves special attention. Only a few months ago that country's Government voted to open up the country's oil industry to Foreign Investment. This means that Mexico will now become a serious competitor for Foreign Direct Investment and another competitor to Trinidad and Tobago. Trinidad and Tobago already competes with Colombia for FDI.

UPSTREAM

The petroleum resources of Trinidad and Tobago have been generated in rocks which are of similar type to those of Venezuela and Columbia, these source rocks are overlain by thick successions of deepwater sediments which form the basis for reservoir traps and seals that are necessary for the oil and gas accumulations in our country – the source of which are rocks from the Cretaceous period.

There are five major producing regions from which exploration and production has been occurring since 1857 they are the Southern basin, Central Range and its extension offshore the Darien Ridge, the Northern /Caroni Basin and its offshore extension into the Gulf of Paria as well as the Carupano Basin and in the eastern offshore, the Columbus Basin.

The prognosis for the marine frontier area offshore eastern Trinidad is favourable, several prospects have been identified by DGA in their analysis of the deep marine basin with potential in the order of thousands of square kilometres in areal extent. This area has been the subject of several of the more recent competitive bid rounds.

Additionally there continues to be exploration activity in already developed basins, the recently acquired survey in the Columbus Basin by BPTT, is being analysed and prospects are good for future finds as the data processed so far is of high quality and has yielded information which gives greater definition and higher reliability to the interpretation – the application of new technology to an old area.

As these areas receive renewed attention, other regions are not forgotten, the BHP Angostura oil discovery in 1999 has caused attention to be targeted on other similar play concepts along that trend.

While future exploration effort is focused in the deep water region to the extreme eastern offshore, there is as well potential for new oil discoveries on land and in the Gulf of Paria. Despite the presence of mature fields on land there is still the possibility of undiscovered petroleum resources in deeper horizons below 5000 feet in the Central and Southern Basins. In fact the Ministry's records show that most exploration on land in southern Trinidad has not gone beyond 6000 feet in depth. It is for that reason the Ministry of Energy has incentivized deep horizon drilling on land.

On-going seismic data acquisition and planned gravity and magnetic surveying are important. Substantial heavy oil resources under the operatorship of the state oil company, Petrotrin, have been identified both onshore and off the south western coast of Trinidad. These resources are in several different stages of development.

In a 2010 paper by Professor Richard Dawe, Raffie Hosein and Wayne Bertrand entitled "*Trinidad and Tobago Heavy Oil Recovery*", it was estimated that this country has eight billion barrels of heavy oil defined as "Oil Initially in place". If 10% of this resource is recoverable that is 800 million barrels of oil – a tremendous resource.

Fiscal Regime reform and FDI

The upstream sector is the main pillar of the energy sector and accounts for about 60% of the value generated from the overall energy sector in Trinidad and Tobago. It is the “engine of the engine of the economy”.

In 2010 petroleum sector FDI according to the Central Bank was \$US 501 million. In 2012 that surged to \$US 2.3 billion. The figures for 2013 are not available but the Ministry of Energy has collected its own in house data from companies for 2013.

In 2014 the forecasted capital expenditure for the energy sector is \$US 3.3 billion. In 2015 that figure is \$US3.2 billion and in 2016 it is \$US 3.0 billion. The main actors in these numbers are BP, BG and Petrotrin. Most of that money is being spent to bring oil and gas to the surface and to market in a safe and efficient manner.

In the past four years there has been no increase in taxes on companies in the energy sector. This has allowed them to, for the first time in many years; operate in an environment of certainty. Companies like certainty and don't like having the rug pulled from under them.

In the last four years we have simplified the competitive bidding process. The result is that we have signed:

- Seven deepwater Production Sharing Contracts
- Five shallow/ average depth water Production Sharing Contracts
- Granted a license to Petrotrin for its Trinmar acreage in 2012

This year we expect to sign two more Deepwater PSC's and three onshore licenses with Range Resources, Territorial and Lease Operators

Limited. There are currently 28 active PSC's dating back as far as 1974. Of these 28 active PSC's 12 were signed in the last four years. The role of the PSC's as a mechanism to capture value in this country is something that has to be explored.

Marketing of petroleum under new PSC's

Under a previous version of the model PSC, the Companies was given primary responsibility for developing markets for available natural gas and negotiating, on a joint dedicated basis, for the sale of the natural gas at prices agreed between the Minister and the Companies. This is no longer the case with the new PSC's. Under the new PSCs recently signed, the Minister has various options available to him/ her for the marketing of the Government's share of the natural gas, including marketing the natural gas as a joint participant with the companies, receiving a cash payment from the companies in respect of the Government's share of the natural gas, selling Government's share to the companies at an agreed price or taking the natural gas in kind.

The changes in the fiscal regime have been progressive and have recognized that we have to compete internationally for capital. Capital is not obliged to come to your doorstep. As a consequence the Government has made a number of progressive changes to the fiscal regime governing the oil and gas industry. These include:

1. Changes in the rates of cost recovery to better reflect risk and international best practice
2. Reduction in the rate of Petroleum Profits Tax for deepwater exploration and development

3. Simplification of the Supplemental Petroleum Tax regime
4. Harmonization of the SPT regime for the marine province
5. Incentives for small marine and mature marine fields
6. Investment tax credits for Enhanced Oil Recovery
7. Allowance for sub-licensing in marine areas
8. Introduction of a special SPT rate for new field development (25%)
9. Exploration incentives for deeper horizons on land and marine
10. Allowance for unclaimed tax credits to be carried forward for one year
11. Restructuring of capital allowances for exploration, development projects, workovers and compression.

Drilling Activity

These incentives introduced in the last four years set the stage for the future. The impact of these incentives has already begun to be realized in the increase in drilling. The main metric to gauge drilling activity is “Rig Days”.

Year	Rig Days
2004	2,501
2005	2,214
2006	3,274
2007	3,409
2008	2,690
2009	744
2010	1,132
2011	2,189
2012	2,788
2013	2485

In 2009 there was a significant decline in drilling activity and that continued into 2010. This situation has now rebounded and we expect the 2014 number to surpass that of 2013. Looking forward, there is going to be an unprecedented period of activity from 2014 to the end of the decade. This is not based on guess work but on the work programmes under the production sharing contracts and licenses. There are currently 28 active Production Sharing Contracts.

Exploration drilling to 2022

At the recently concluded Energy Conference, I announced the award of three land blocks to Range Resources, Lease Operators Limited and Touchstone. These three blocks, together with the Trinmar license and the seven existing deepwater PSC's will lead to the drilling of at least 31 exploration wells (these are based on contractual obligations) in the next eight years and at most 53 exploration wells. The additional 22 will be based on the optional second and third exploration phases under signed PSC's. The most exciting area of drilling must be TTDA Block 5 which is where BHP is the operator. At the Energy Conference, BHP gave some insight into this block. The structure they are seeing there with the limitations of 2D seismic is three times the footprint of one of their producing fields in the Gulf of Mexico. BHP is seeing something big in Block 5.

BP OBC seismic

Turning to BP and its role in the economic future of the country, it should be noted that BP is the country's largest tax payer. BP contributes to 20 to 25 cents on every dollar of government revenue. Their future in

Trinidad and Tobago is therefore of importance. In the last two years, BP has conducted its Ocean Bottom Cable seismic survey of its Columbus Basin acreage. Let us hear what David Renwick has to say about the OBC seismic and the future:

“OBCS employed integrated simultaneous source (ISS) technology, which uses multiple vessels to collect data and yields much improved imaging of the sub-surface. It was the first time the BP group had applied ISS technology outside of a test environment. The triumphant outcome: “To lengthen the life of the gas industry in Trinidad and Tobago,” in the words of Keith Bally, bpTT’s vice president for resources. Company president, Norman Christie, enthusiastically confirms this. “What the OBCS has told us,” he declares, “is that, not even looking deeper, there is probably much more in our existing shallower acreage than we would have realised before. When we fully interpret the seismic, we might even see something in the deeper horizons.” My 11 or 12 readers, who are all very smart people, will have immediately grasped the significance of this, which is, never mind the current fixation with deep water exploration with all the risk attendant upon it, the long-productive shallow water ECMA has a great deal still going for it that can be measured in decades, not years.”

EOR (Enhanced Oil Recovery)

Looking again to the future, Trinidad and Tobago is a mature oil province with some 1 billion barrels of oil already produced from onshore acreage and over two billion produced offshore. Most of Trinidad’s reservoirs produce via “solution gas drive” for which primary

recovery is approximately 15% of oil in place. This means that there are significant quantities of oil left in **known** reservoirs.

If EOR techniques can be systematically deployed to increase recovery by 5% this represents additional production volumes of approximately 600 million barrels of oil. Widescale EOR has been limited to steamflooding of shallow heavy oil reservoirs but there is potential for expanding existing steamfloods and application of water flooding and carbon dioxide flooding to deeper reservoirs. The NGC has been charged with the responsibility of developing a Carbon Dioxide flood project in collaboration with Petrotrin.

One of the main impediments to EOR implementation has been the uncertain geology of Trinidad. EOR design requires quality information on reservoir contiguity and boundaries. The recent acquisition of 3D seismic on land and offshore Trinmar will go a long way to provide better reservoir definition for EOR design and implementation. EOR will be a critical component in our future and by 2025 I expect it will be a large part of our production on land and Trinmar.

Future of Petrotrin

Petrotrin the State owned Oil Company is 21 years old. In summary the company has 408,781 acres under its direct control through its Land, Trinmar and North Marine Exploration & Production licences. In its Land and Trinmar operations, for fiscal 2012, a total of 2,216 wells were on production comprising 1,886 wells on Land and 330 wells in Trinmar. It is involved in 24 Joint Ventures with other companies. It is one of this country's major employers with 4,300 permanent employees and approximately 1,200 temporary workers on its payroll. The

company supports a pensioner base inclusive of spouses and beneficiaries of about 5400 persons. It is no doubt an important player in the economy of Trinidad and Tobago.

In 2013 Petrotrin made a loss. This loss was due to the economic performance of the Refinery at Pointe-a-Pierre. If we strip out the E&P performance from the Refinery performance the picture emerges. The E&P or Upstream is profitable and the R&M is not. In 2013 these two almost cancelled out each other and resulted in a net loss of \$TT 22 million.

All the analyses show that moving forward into the future, the return to profitability will be driven by increasing oil production. Increasing oil production is therefore the company's number one strategic goal. The company's forward capex profile is biased to the upstream. Its near term opportunities will come from the re-activation of the South West Soldado oilfield, the continued development of the Jubilee field and increasing drilling and EOR on land and in Trinmar.

Moving into the future, the Refinery will continue to be impacted by low margins. This is a feature of external forces – a consequence of the shale oil revolution in the United States. By law the United States cannot export crude oil. This means that US refineries are being fed with cheaper crude oil than the rest of the world and are being supplied with cheap shale gas (natural gas is 30% of refinery opex in the USA vs 60% in Europe). The result is that America has become a net exporter of petroleum products (gasoline, diesel, jet fuel etc) and this is negatively impacting on refinery margins all around the world. Bloomberg on February 5th 2014 reported that French Refineries reported losses of 700 million euros in 2013.

Globally there is also excess refining capacity and this is projected to stay that way into the future. In recent years we have seen the closure of two refineries in the US Virgin Islands and in Aruba. Going forward

towards 2025, refining is going to be difficult businesses to be in if you are outside of the United States.

The critical success factor for improving the economics of refining in Trinidad and Tobago is access to equity crude. Currently about 27% of the crude oil diet of our Petrotrin refinery is sourced locally from land based oil fields and Trinmar. The remaining 73% is imported at world market prices. The other critical issue impacting the refinery is the gloomy future of residual fuel oil. The major demand for residual fuel oil arises from power generation. Demand is therefore projected to fall as more power generators switch to natural gas (as has already happened in Trinidad and Tobago). It can be argued that as global GDP increases the demand for fuel oil as a bunker fuel will increase. However changes in specifications for the Emissions Control Area in the United States and Europe will lead to a shift away from fuel oil and towards diesel.

Petrotrin's refinery will be challenged and its ability to survive will depend heavily on:

- Increasing the quantity of equity crude that it runs
- Leveraging on location to grow volumes in existing premium markets and capture new premium markets
- Aggressive cost management and increased operations efficiency
- Implementation of a bottom of the barrel solution to convert fuel oil into higher value products

It should be noted that Petrotrin still supplies half the demand for petroleum products in the Caribbean. The other major supplier is Venezuela under the Petrocaribe arrangement. In the period 2014 to 2018, Petrotrin will spend \$TT 16 billion of which \$TT 11.3 billion or 71% will be spent on the upstream as the company invests to increase its oil production. This will positively impact refinery margins.

MIDSTREAM

What is the future of the mid-stream sector? The mid-stream sector for our purposes includes the natural gas transmission system (pipeline) and the LNG industry. Some may argue that it also includes the refinery but I have chosen to keep the refinery in the section on Petrotrin for simplicity.

So we start with LNG. The industry is now 15 years old in Trinidad and Tobago. The first shipment was in April 1999. In that period some 2844 cargoes of LNG have been exported from these shores to some 21 countries. The justification for the LNG project of the 1990's was demand from the United States and to a less extent Spain. In the case of the United States this no longer applies.

The surge in US shale gas production over the past five years has transformed North America from an LNG importer into a new frontier for LNG exports. On a global scale, the US has the largest queue of projects. According to the International Gas Union as at 2014, twenty eight 28 liquefaction projects had been proposed, representing ~285 mtpa capacity. The US government is keen to control the project build-out for fear that a massive growth in LNG exports could impact domestic prices and supply and could result in an overbuild. There is also a powerful lobby in the United States led by Dow that is against the export of natural gas. The first export project, which is Cheniere Energy, in Sabine Pass Louisiana is scheduled to start in 2015. So we know that by the year 2025 the United States may be a major exporter of LNG.

What is the future of our own 15.3 mtpa business in Point Fortin? I want to postulate that once we can supply it with reasonably priced natural gas it will continue to exist. I believe the multi-nationals are of the same view. In 2013 Shell acquired Repsol's shares in Atlantic for the lion's share of the over \$US6 billion they spent on Repsol's assets. Why would Shell spend that kind of money if the LNG business in Trinidad and Tobago would be wiped out by American LNG? The other Atlantic partners have also signaled an interest to commence talks around a new Train One contract which expires in 2018. The strength of the LNG industry in Trinidad and Tobago rest on the fact that our four trains were constructed with the lowest capex per tonne in the history of the industry - \$US 250/ tonne. This figure will never again be realized whether in Trinidad and Tobago or in the United States or Australia.

Moving into the future, I have signaled that the Government would like to get a stronger position in the LNG business. Currently we own 10% of Train I and 11.11% of Train IV through the NGC. The Government acting through the NGC or another agency would also like to have a greater presence in the marketing of LNG. That is our broad position towards the renewal of any LNG contracts. New trains in Australia could cost as much as \$3000 per tonne. This will mean that our LNG industry will have a competitive advantage over new Trains in America and Australia. It should also be noted that Atlantic is considering a "boil off gas" project which would see natural gas that is lost when loading vessels. This is a good future project and the Ministry supports it as it lends to energy conservation and makes more gas available for export as LNG.

DOWNSTREAM

The future of the downstream sector can be defined along the lines of the following initiatives:

1. Protect the base
2. Energy Efficiency interventions at Point Lisas
3. Further downstream of Methanol and Ammonia
4. Development of Union Industrial Estate

Trinidad and Tobago's downstream sector (the base) is constituted into:

1. Ten (11) ammonia plants
2. Seven (7) methanol plants
3. One (1) urea plant
4. Four (4) Direct Reduced Iron modules
5. One Ammonia – Urea – Melamine plant

Trinidad and Tobago remains the world's largest exporter of ammonia and methanol. In the face of the shale gas revolution, we have to think very carefully about the future of Point Lisas. One policy of the Government is to facilitate going further downstream of ammonia and methanol. We have succeeded in going further downstream of ammonia – having already gone to Urea and Melamine.

The proposed Mitsubishi to Di-Methyl Ether plant to be located at Union Industrial Estate in La Brea proposes to produce methanol from natural gas and then go further downstream to di-methyl ether by combining two molecules of methanol and removing a molecule of water. DME is a replacement for both propane and diesel. The Government has also received a proposal for Methanol to gasoline. The Holy Grail has

however been going from natural gas to plastics and that has eluded us for the past 40 years.

Energy Efficiency is important to the future. By 2025, we expect that a number of investments would have been made to upgrade existing plants at Point Lisas towards making them more efficient. In some cases such as Tringen and PCS this work has already started. Efficiency speaks to mmbtu/ metric tonne. That is a unit of energy per unit of production. The older plants at Point Lisas are less efficient than the newer plants. The levels of efficiency at Point Lisas range from 50.5 mmbtu/ tonne for the older plants to 33.4 mmbtu / tonne for the newer plants.

CONCLUSION

Upstream

1. BP Juniper project
2. BP Angelin project
3. BG Starfish development
4. BG 5C and 5D development
5. BHP – Angostura phase 3
6. BHP/ BP – deepwater campaign
7. Centrica development of its reserves
8. Trinity development of its TGAL November 2013 discovery
9. Petrotrin – SWS, Jubilee, EOR, Trinmar 3D, Land 3D
10. Range / LOL/ Territorial – exploration on land
11. Compression investment
12. Galeota Port Phase 1 and 2 completed (seeds development in the SE of Trinidad)
13. Cross Border Gas commercialised / monetized
14. Oil production commences from deepwater in 2019

15. Production at 1,000,000 boe up from 780,000 boe today

Midstream

1. Small scale LNG a reality
2. Caribbean natural gas market emerges
3. Renewal of Train 1 contract
4. Renewal of Train 2& 3 contract
5. Renewal of NGC domestic contracts with BP/ BG/ BHP and EOG
6. Bottom of the Barrel upgrade of Point –a- Pierre Refinery
7. Boil off Gas project at Atlantic
8. Train 5?

Downstream / Power Generation

1. Mitsubishi / Neal and Massy
2. Energy Efficiency projects at Point Lisas implemented
3. Further downstream of Ammonia and Methanol
4. Development of Point Lisas North
5. Development of Union Industrial Estate
6. Two new combined cycle power plants built in Trinidad and power generation in Tobago expanded.