

August 16, 2018

NON-CONFIDENTIAL

Bermuda IRP Consultation Responses

Monique Lister
Regulatory Authority
1st Floor, Craig Appin House
8 Wesley Street
Hamilton, Bermuda

Subject: Response to Consultation Document: Comments on Integrated Resource Plan Proposal Consultation

Dear Ms. Lister,

Pursuant to discussions with the Department of Energy and the Regulatory Authority of Bermuda, Offshore Utilities, LLC (OU) proposes to develop a Floating, Storage, Regasification, Power-Generation (FSRP) unit producing up to 100 MW of clean power through Liquefied Natural Gas (LNG) onboard a converted tanker moored offshore to help meet the supply needs of Bermuda with the proposed terms and conditions described in this document to be used as a starting point for negotiations. In addition to producing wholesale power, OU is also capable to regasify LNG to natural gas and distributing it to the North Power Station along with producing fresh water for the local communities while taking up zero footprint onshore and offering a number of other environmental, and economical advantages. Our proposal is a direct path toward more efficient technologies, low cost of operation and sound environmental practices. Further our response shows irrefutable consistencies with the RA mandate and the Bermuda Government in the future direction of energy responsibility.

Our desalination and power plants are capable of adding a low cost, safe and reliable source of potable water and electricity for years to come. The offshore solution offers a number of benefits when compared to a traditional shore-based facility. Please see OU's presentation for further details on the benefits.

The Front End Engineering Design (FEED) study is complete for our FSRP and OU is ready to complete the balance. OU would need to complete the remaining FEED - which is specific to the topography, subsea construction, infrastructure and needs of Bermuda. Please see our responses as per the IRP consultation document listed on the following pages:

1. Are there any provisions in the IRP Proposal that should be modified? Please include any reasoning and evidence in your answers.

The IRP Proposal should allow all alternative proposals submitted prior the revised due date of August 17th to be explored before the Regulatory Authority grants any approval for future projects, such as the North Power Station. OU focuses on the effectiveness of Liquefied Natural Gas (LNG). This particular type of fuel is cost effective, abundant, safe and proven as a bulk power generating system. The IRP lists LNG as a competitive feedstock and OU would request for the Regulatory Authority to give alternative proposals a serious look to provide the Island of Bermuda a competitive, safe and reliable electricity rate for its citizens.

After careful review of Oxera's report of the IRP Proposals compliance with guidelines noted, we would like to mention items 4.9, 5.1-5.11. There are several concerns the Regulatory Authority have highlighted (Methodological Concerns, Replacement Generation and Qualitative Assessment). These sections highlight that the recent approval of the North Power Station was not one of the scenarios given to the Regulatory Authority and that accurate pricing detail still has to be provided. The IRP proposes that the conversion to LNG in Scenario 3 to be the most preferred. One of the largest questions remaining is the investment in a LNG terminal - which would greatly impact the cost of electricity. OU's solution has the advantage to offer commercial scale power generation without the need to build a LNG terminal, thus cutting the cost of infrastructure and reducing the footprint on shore.

There are several factors that allow for the island to take part of the LNG savings. Bermuda has an active maritime industry that will allow OU to fully develop, insure, finance and operate this power facility under the Bermudian flag. OU has explored these savings in capital and operational costs that allow for the island to create more jobs. The IRP should be able to co-explore other scenarios that strive to cut down on the CAPEX and OPEX for the greater good of the island.

2. Do you think that the procurement strategy outlined in the IRP Proposal is appropriate?

The procurement plan illustrated a number of broad steps within the resource basis using the levelized cost of energy condition. As an independent power producer, our fuel source for generating electricity is Liquefied Natural Gas (LNG). Our solution provides a seamless transition for the procurement process in several areas. First, the bidding process needed in section 2.7.2 is eliminated. Using our platform as a regasification facility, the entire process for storage, transport and regasification to be used for fuel is done entirely on the vessel. As the plans state, BELCO is undertaking a RFP process for third party contractors to engineer a regasification and distribution pipeline on the island. This requires not only valuable real estate but increases the scope of financing from the licensee's position.

A response is warranted for section 2.7.4. The IRP procurement plan identifies that no additional thermal resources are being pursued until 2031. OU is working with partners in the geothermal energy market along with new Solar PV technology onboard the vessel. Our focus is to incorporate clean and renewable technologies so that we remain environmentally relevant and maintain compliance with internationally set standards for emissions control and electricity output.

Section 2.7.7 references energy efficiency and demand side management of the bulk generation arm. OU is eager to work with the TD&R utility to maintain an operationally cohesive relationship, relying on a foundation of communication and teamwork. The method of power generation onboard the vessel is very simple as the TD&R utility and the bulk generator can measure consumption of electricity constantly, using a series of energy efficient generators to “load share” or “load shed” with respect to the local demand of electricity. In so doing, this limits the amount of generators to be used continuously to adequately power the island, greatly reducing operational costs while saving fuel. The generators on board the vessel are powerful enough to meet Bermuda’s entire electricity needs or contribute electricity in parallel with BELCO’s North Power Station. If requested, our vessel can be fitted to power the country during its peak demand periods for bulk electricity.

3. Which generation resources should the TD&R Licensee procure using competitive bidding, if any?

The OU team feels strongly that private companies should work with the TD&R Licensee in order to offer the most competitive bidding so that the consumers of the Island can enjoy a low fixed rate of electricity for years to come. Not only would a new bulk power producer offer unique and proven competitive methods of generating power, but they would bring in other means of financing that would avoid having the consumers pay for any new infrastructure. This would effectively save the ratepayers from being forced to pay out millions of dollars for the new bulk power station.

OU’s goal is to fully finance the infrastructure and to use Liquified Natural Gas (LNG) to power the bulk generation system. We are at a turning point in this world of oil and gas where the technology for producing LNG has never been cheaper and more accessible. Bermuda is easily accessible from the continental United States - which puts it in an excellent position to have LNG delivered at a fixed rate for 10, 20 or even 30 years.

Working with the TD&R is vital to protect the rate payers from overcharges, price hikes and constant fluctuations in the commodity markets. OU has no intention to compete with the TD&R but to only complement the delivery of electricity so that other funds within the Government and the Utilities sector can be repurposed for the Island’s other necessary improvements such as the new airport and other infrastructure projects.

4. Are there alternative proposals not considered in the IRP proposal, which may provide for an energy generation mix that is more consistent with the purposes of the EA (e.g. least-cost provision of reliable electricity)?

In a word; definitely. The incumbent proposal includes the laborious process of replacing its Heavy Fuel Oil (HFO) turbines with similar turbines one or two at a time. On the surface this is the most cost effective means to replace BELCO’s power generating infrastructure; all of which is beyond its useful lifetime. However, there is a bigger story to tell here. The fact remains that when the last of the HFO turbines are replaced, Bermuda is still acquiring the plurality of its energy needs from one of the two most environmentally damaging methods; coal being the other.

Offshore Utilities proposes a complete swap of the base and peak-load power generating capacity on the same time frame that BELCO plans to complete its North Power Station – replacing only 56MW in the

process whereas OU can provide upwards of 100MW of cleaner energy within the same time window. Offshore Utilities will revolutionize the energy infrastructure in Bermuda; eschewing the piecemeal approach favored by the incumbent. Further, OU will be using LNG as its power source for the 100 MW of electricity it produces. This means a step change in terms of the carbon footprint for the island nation in 2020 – thrusting it onto the world stage as, arguably, one of the most energy-advanced nations on earth.

On top of converting 100% of the core energy production from HFO to LNG in one motion, Bermuda achieves its vision as laid out in the Electricity Act of 2016 of committing to an energy source which not only ensures the long-term health of its business and tourism industries but also achieves its stated goal of moving towards a cleaner source(s) of energy.

5. Do you have any additional views on the assumptions, assessment methodology, and conclusions set out in the IRP?

The assessment methodology within the PROMOD® software is credible based on its implementation from the client. However, the tools used and the agreements on what should be reported are solely based on the four scenarios addressed by the incumbent TD&R licensee. Once the factors of reduced project costs and use of 100% natural gas are implemented, we are confident that the results using our scenario would prove to be the most feasible for Bermudians environmentally by drastically reducing greenhouse gas emissions and financially by greatly reducing the cost of living.

While we find the assumptions, assessment methodology and conclusions set out in the IRP and its appendices fair and accurate they omit more advanced technologies such as ours. The net effect is that opportunities to realize the vision set out in the Electricity Act of 2016 may not be realized in the near-term due the continuing dependence on high-polluting hydrocarbons such as Heavy Fuel Oil.

Offshore Utilities' approach - using LNG to generate cleaner energy which can, in turn, be shipped ashore as electricity, water and/or natural gas solves multiple energy and utility issues. Our solution provides cleaner base energy for Bermudians, it enables the development of demand-side renewable energy installations, it eliminates the dependency on rain water and the island's fresh water lenses as the primary sources of potable water and supports the further development of natural gas as a primary source of energy on the island. Our water even enables the condensers on the existing equipment to be converted to water-cooling - improving their efficiency.

In short, our solution is beyond the scope of the assumptions set out in the IRP and its appendices. It represents a significant step forward in terms of Bermuda's energy infrastructure and can be implemented in as little time as it will take to design, engineer and build the North Power Station. We strongly encourage the Regulatory Authority of Bermuda to consider revisiting its four potential scenarios in favor of a fifth which will shift the base load to LNG and use the existing HFO generators as peak load capacity, instead, and better enable the adoption of renewable energy; exceeding the targets set out in the Electricity Act of 2016.

6. Do you have any alternative proposals for bulk generation or demand side resources that should be considered in the IRP?

What follows is not an alternative to what is outlined in question 4 (above) but an addendum to the same. On top of the ability to produce 100 MW of cleaner base and peak-load power for the citizens of Bermuda the Offshore Utilities approach accomplishes yet another means of achieving the Electricity Act of 2016's goal of a cleaner mix of energy for the island nation. Offshore Utilities Floating Storage Regasification Power vessel (FSRP) has a variant known as the FRSWP – where the 'W' stands for water. Offshore Utilities can produce millions of gallons of potable water using excess energy not sent ashore as electricity.

Potable water production onboard Offshore Utilities' FSRWP accomplishes two goals simultaneously for Bermuda. First, it affords the country a safe, secure and consistent source of potable water for the life of the vessel. Water can be sent ashore to provide drinking water and enough water to promote the growth of tourism and business on the island. Further, any water which is not sent directly to the citizens, business and hotels on the island can be stored onboard the ship or in water reservoirs on land for emergency purposes. This water supply ensures that Bermuda never has to envision turning away tourists or businesses looking to come to Bermuda for fear of exhausting its water supply.

The other way Offshore Utilities' water production can satisfy the needs of Bermuda is through renewable power. Without that consistent source of water homeowners and businesses, alike, must dedicate 100% of their roof space to rainwater catchment. Demand-side resources such as rooftop solar PV units come at the risk of eliminating significant percentages of that individual household catchment. With millions of gallons of water available south-facing roof tops can be repurposed to catch energy instead of water – greatly enhancing Bermuda's ability to meet – and possibly exceed – its stated goal of 38% share of renewable energy by 2035 as per the Bermuda Electricity Policy 2016.

Finally, OU is fully capable of installing larger LNG tanks onboard to accommodate the North Power Station once it converts to natural gas. The vessel will store, regasify and transmit the natural gas through a buried subsea pipeline to BELCO's station. This solution has been proven around the world, is one of the safest solutions and saves the island from having to dispose valuable land for LNG infrastructure with storage tanks and regasification terminals.

OU is ready to fully finance the subsea FEED in order to place a highly competitive bid for the future of Bermuda's electricity. Based upon our feasibility study, we believe that we can deliver power to Bermuda's shore for a lower cost than what Bermudians currently pay today all the while modernizing the country's energy generation fleet. Over the past few months, OU has worked with the Department of Energy to obtain a license from the Department of Planning and Building to conduct a FEED study of the seabed. The study will comply with all environmental regulations and so far we have not received any negative opposition from the DOE, Department of Planning and Building and the Department of Environmental and Natural Resources. We anticipate the license to be approved by the end of this month and would greatly appreciate your support to conduct this FEED to provide a very thorough proposal for the island of Bermuda.

After completing the FEED study, we will be able to offer a firm and attractive price agreed between all parties. That price would be adjusted for inflation annually on January 1st of each year with the adjustment being three percent per year or the previous year's change in the CPI, whichever is greater. Deliveries of electricity would begin on a mutually-agreed date or upon successful testing of the FSRP once it is

on-site. OU takes full financial responsibility for the cost of construction of the vessel and subsea cable, thus not relying on federal funding that can be used for other needed infrastructure projects.

Finally, OU has been tentatively approved for a multi-billion dollar bond to construct a number of these vessels. To facilitate this work, OU would fund the Authority's costs for consultants to complete the environmental analysis of the offshore alternative. OU's environmental consultants and engineers would coordinate data and information-transfer with your consultants and are happy to share with you all the details.

Bermuda is in a position to take control of the energy sector by modernizing the infrastructure and secure it's rightful place as an energy leader for the world to follow.

Thank you for your consideration.

Sincerely yours,



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Offshore Utilities, LLC

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Response to consultation document: Comments on the Integrated Resource Plan Proposal Consultation

Responder: Peter Everson

Interest: consumer

Contact details: email petereverson@northrock.bm; phone 292-2898

Date: 14th May 2018

Subject: paragraph 1.6 Financial and Other Planning Criteria (page 26 of 59)

Comment:

1. The IRP has used two rates for the cost of capital, being 8% and 10%. I cannot see any logic to substantiate this assumption. The cost of capital is a variable and not a fixed amount. It depends on many factors and is highly time-dependent e.g. it was lower three years ago than it is today, in part because interest rates have increased during that period. The actual cost of capital when new capacity is constructed and commissioned will vary depending on when, what and who.
2. Another factor is the credit standing of the borrower. This depends on both the capital strength of the borrower as well as the risk involved in the technology.
3. Other factors impacting the cost of capital may include: the regulatory environment; the strength of the Bermuda economy; the credibility of the Government of Bermuda to deliver on commitments etc.
4. I understand that an assumption must be made in order to undertake the comparative financial analysis.
5. I dispute the correctness of the assumption chosen. One single rate should have been chosen. In an ideal world this should have been arrived at after consultation with the Regulatory Authority ("RA") because the RA uses the cost of capital in setting tariff rates.
6. The two tier cost of capital described in the document is discriminatory in that it handicaps all projects assigned the higher capital weighting. A classic case of the outcome being determined by the assumptions.
7. A better approach is to use a single rate. If discussions between the RA and the TD&R Licensee conclude that 8% is an appropriate current rate then use it. In a scenario where a new entrant has a cost of capital of say 7%, then this should reduce the cost to the consumer, all other things being equal. Conversely, in a scenario where a new entrant has a cost of capital higher than 8%, then the RA will advise that the cost of capital is capped at 8% and they should plan accordingly.

Many thanks for your time in reading this.

Dear Regulatory Authority,

It is difficult to propose an alternative IRP scenario as a lay citizen.

given that it has taken a team of specialized consultants from Leidos to develop BELCO's current proposal, not to mention that I do not know all the details of BELCO's day-to-day operation requirements or nuances of our existing grid, which may lead to one technology being preferred over another (only what I have read).

However, I would like to echo some Oxera's criticisms and concerns. It seems to me far preferable that the IRP, start with mathematical modelling approach (considering many alternatives as possible) from the outset rather than an LCOE analysis. I would also strongly favour an IRP that does not treat replacement generation assets to be outside the IRP and does not rely on qualitative criteria (Oxera cites "job creation" as an example).

Furthermore, I believe the IRP does not adequately address the potential for stranded assets, in the favoured natural gas scenario. Though the expensive conversion to natural gas may result in short term job creation, it does not appear to be long-term solution to decarbonization, given the rapid development and cost decrease of renewables. See for example, the following article (written four years ago when the price for renewables was not as low as it is today):

https://rmi.org/news/blog_2014_10_23_four_reasons_why_natural_gas_is_wrong_for_electricity_in_the_caribbean/

While I do not have the background, to propose an alternative scenario, clearly, there are alternatives chosen by other islands with similar populations, power demands and cost constraints (i.e. high cost of importing fuel oil). For example, Kauai in Hawaii favoured solar and battery storage: https://www.greencarreports.com/news/1112800_teslas-solar-and-battery-project-in-hawaii-we-do-the-math

The fact that this technology was chosen by a utility "cooperative" rather than a utility company and its shareholders, lends added weight to Kauai's decision (see <https://www.electricamerica.org/blog-1/kauaibatterystorage>). Individual citizens of the island (each with a share in the cooperative), after weighing their options, believed this alternative to be beneficial to them from a cost and emissions perspective.

Should we lock ourselves into the incorrect energy technology and effectively build a bridge technology to nowhere, we will all continue to pay for a long time in the future, both economically and environmentally.

Thanks for considering my comments.

Tucker

LUF

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Response to Consultation Document: Comments on Integrated Resource Plan Proposal Consultation

Input for question 3:

Which generation resources should the TD&R Licensee procure using competitive bidding, if any?

In our understanding, the TD&R Licensee is looking for power generation resources, that best meet:

- reliable supply
- environmentally sustainable
- cost efficient on short- and long term
- ease of development and implementation
- economic development

Based on these criteria, the existing draft of the IRP as prepared by Leidos, concluded that “scenario 3” best meets these criteria. Scenario 3 assumes new power generation assets and some of the existing assets will consume LNG. Whereas the rationale for this is sound and could indeed prove to be preferred, we believe it may be in the interested of the TD&R Licensee to also consider the use of ethane.

Ethane has similarities with LNG, such as

- production from natural gas exploration
- significant reduction of emissions
- low fuel costs that are less subject to oil price fluctuation than diesel, HFO and LPG

Ethane potentially has a lower cost of supply than LNG. The price of ethane molecules has been similar or slightly higher than natural gas in the past 5 years. However, due to its higher temperature at fully cryogenic conditions (-89 °C instead of -162 °C), the logistic costs of ethane more than compensate this. The availability of ethane on a “small scale” level of consumption is better in today’s market thanks to ethane liquefaction terminals at the rights scale as well as a larger fleet of gas carriers in the right size. Therefore, from cost of supply point of view, ethane could present a significant advantage over LNG. It could be attractive to the TD&R licensee to allow potential suppliers to offer ethane in a future tender process to the TD&R licensee. Long term, it could provide the TD&R a more reliable and cost efficient and cost stable solution.

As fuel prices can vary, the TD&R licensee could consider to make the full chain capable for both LNG and ethane.

- This LNG/ethane flexibility can technically be achieved in supply and infrastructure (ships, storage, regasification and pipelines)
- OEM’s for both turbine- and engine-type power generation equipment have assessed the technical feasibility of flexible (ethane / natural gas) power generation (both for new equipment as well as conversions of existing). Two basic options could be considered:
 - direct combustion
 - modification of Wobbe Index prior to combustion

The optimal solution would largely depend on the size of new generation required, as well as the convertibility of existing power generation assets.

If the TD&R licensee and the RA wish to further understand and explore this possibility, we can offer our support in suggesting –and offering- potential feasible ways to accommodate this extra flexibility together with the government of Bermuda and the TD&R licensee.

Dear RA team,

17th May 2018

Comments on Leidos Integrated Resource Plan Proposal

Please refer to the comprehensive 12 page MWord doc 'IRP 2018three' sent with this invited IRP feedback response doc 'RAteam'.

It is much appreciated that you are initiating this rigorous IRP review process in accordance with EA 2016 requirements.

In our capacity as previous BELCO Senior Managers and current shareholders my former colleague and friend Ron Lucas and I have diligently endeavoured to communicate with Ascendant/BELCO and the previous Government over the last 6 years regarding the numerous articles that were appearing in the Royal Gazette stating a case being made for transition to LNG. Our concerns were based on fact that LNG is generally recognised as an unsuitable fuel choice for small and remote jurisdictions such as Bermuda. This is due to its extremely high capital cost and general recognition that Bermuda would represent a very small LNG bulk customer that could impact cost and also limit availability of tankers (The 2016 Castalia report stated need for Bermuda to purchase purpose-built tanker/s). This concern was compounded by total absence of any supporting justification for this LNG initiative. Despite many friendly and constructive approaches we made they consistently refused to discuss the subject with us.

I would mention that I found the voluminous IRP and associated appendices prepared by Leidos very difficult and time-consuming to fully comprehend, particularly since it only represents outline conceptual status, with virtually no plant design details or facts to justify such a major transition to LNG. In order to obtain a reasonable understanding of key input data and results it was also essential to refer to numerous other reports such as the Castalia 2016 LNG viability report prepared for the previous government, together with extensive internet research on associated key energy issues. In this situation the presentation of the IRP renders it extremely unlikely that more than a few percent of shareholders and members of the public will be minded to read past the Executive Summary. This would lead to misleading conclusions since the very subjective qualitative weighting scoring assessments and the text of the Executive Summary demonstrate a very strong bias towards making a case for LNG.

Since it is anticipated that the feedback document I have submitted will be almost unique in its in-depth investigations it would be much appreciated if your team liaising with Oxaera could kindly examine the document at your earliest opportunity. This request is particularly pertinent since BELCO have recently been given approval to place an order for 56MW of new dual fuel oil/LNG-natural gas generators outside the IRP procedures, and this specification may need changing if LNG is not approved in the IRP review process.

Mr. Lucas fully supports my analysis and as a Bermudian resident is also very concerned about the potential for a major incident which is not present with other fuels that are not refrigerated or pressurised during shipping or subject to regassification given Bermuda's delicate reef system, the abundance of winter storms/summer hurricanes and population density.

Ron's qualification is Fellow Chartered Institute of Personnel and Development UK. He served 21 years at BELCO in capacity of Snr Mgr HR.

My qualification is C.Eng, FIET – my CV synopsis is 8 years Central Electricity Generating Board, 3 years Burmah Oil Company, 23 years International Consulting CO (diverse power generation and T&D studies and designs in numerous countries), 11 years Snr Mgr BELCO (9 years in charge of Engineering & Planning and 2 years developing renewable and new technology opportunities and new business).

Since retirement I have maintained interest in all Intl energy developments with potential to benefit Bermuda.

I have received no remuneration for any of this work in retirement, and am only driven by a strong desire to ensure that Bermuda's energy choices are based on best practices and sound engineering decisions.

I look forward to receiving confirmation of receipt of docs 'RAteam' and 'IRP 2018three'. Should the text spacing format of the latter doc have deteriorated in transmission I can send a locked pdf version if given an email address.

Yours sincerely,

Bill Jewell

22nd May 2018

Leidos/BELCO Integrated Resource Plan (IRP) Proposal Feb 2018
Consultation Assessment, Questions and Comments

Re: Qualitative Factor: Supply Quality

Further to my IRP feedback submission dated 17th May 2018 I wish to elaborate on the comments and scoring re-assessments I made in Section 7.2 and Appendix A.

Again the IRP defines this factor as follows:-

Supply Quality - Evaluate the degree to which the asset enhances or reinforces system reliability as a firm resource.

The reference is the status quo fuel oil system, which is the basis of IRP scenarios 1&2. For the LNG scenario 3 the Leidos study and comparisons are based on fuel oil operations phased out in year 2022 and replaced by LNG/natural gas operations. In the LPG (Propane) scenario 4 the Leidos study and comparisons are primarily based on continued fuel oil operations, with only partial LPG (Propane) fuel introduced much later in year 2030.

The existing fuel oil system is based on large fuel oil tanks at Ferry Reach with fuels pumped via a 9 inch pipeline to 3 large bunker tanks on the BELCO central Hamilton site. These bunker tanks ensure fuel oil supply reliability with capacity to maintain supplies for weeks, possibly months, in event of non-availability from the Ferry Reach source, for whatever reason. This comprehensive and secure fuel oil system has demonstrated a system reliability of around 100% over the last several decades, thus providing virtually no scope for enhancement or reinforcement.

After 2022 when the LNG scenario 3 is shown totally fuelled by LNG/natural gas, with no back-up on-site buffer storage of natural gas supplies, concerns are expressed at short or longer duration loss of fuel supply due to issues such as:

- ❖ Breach in the single new gas pipeline
- ❖ Failure of Regasification plant located somewhere in Ferry Reach or Marginal Wharf
- ❖ Non-availability of the extremely small LNG tankers required for Bermuda
- ❖ Issues with fuel supplies if dependent on a single source

In view of the foregoing it would appear necessary to maintain an on-site standby fuel oil back-up supply with capacity to maintain generation supplies for at least 3 weeks.

This requirement could raise several problems in maintaining such a supply of fuel oils that maintain good quality and are within their storage

life. This life issue is dependent on several factors, and in recent years has become more of a problem as lower sulphur fuels have lower storage life because they are more prone to microbial problems, and also market forces have influenced introduction of practice of literally scraping the bottom of supply barrels, resulting in less stable products. Another significant issue is the accumulation of water, particularly if oil is stored in part-filled tanks.

This subject would require more in-depth studies to determine the shelf-life of the different types of fuel oils in these circumstances, hence the frequency that the plant would need to revert to running on fuel oil to use fuel near the end of its shelf life prior to replenishment. Also standby fuel systems would require regular maintenance and testing.

In any event none of these aspects are mentioned in the Leidos IRP study, nor have any associated costs been allocated to the LNG case.

It is for the foregoing reasons that the IRP qualitative assessments of this factor have been changed from their top score of 20/20 for both the LNG and LPG scenarios 3 & 4 to only 0/20 for the LNG case (the system reliability may be diminished and not enhanced) and the LPG scenario 4 has been changed to 10/20 (to reflect continued proven reliable fuel oil system with further back-up on LPG (Propane) fuel source in 2030).

W.H.Jewell C.Eng, FIET

Leidos/BELCO Integrated Resource Plan (IRP) Proposal Feb 2018
Consultation Assessment, Questions and Comments

1.0 Executive Summary – It is concluded from a detailed assessment of the IRP that it does not meet the EA 2016 requirements, and is an inadequate document to adopt as a basis for determining Bermuda's energy future. This bold statement is based on inadequacy of study detail, failure to give due consideration to all energy candidates, errors and inconsistencies, and an unreasonable bias in the promotion of a case for recommending LNG.

Contrary to the statements in the IRP Executive Summary, an accurate and unbiased assessment demonstrates that the LNG scenario 3 should be ranked the lowest of the four options. Not only does the quantitative Table 2.1 levelized cost results show LNG as the most expensive option, this result becomes dramatically worse if the study is re-run using the corrected LNG infrastructure capital costs shown in Section 3.1 of this appraisal. Furthermore the subjective qualitative results are incorrect and misleading - Section 7 of this appraisal demonstrates that these results require amendment to show the LNG option by far the least favourable. Please refer to Appendix A to provide undisputable support of this statement.

In these circumstances the preferred course of action may be to continue with existing fuel oils for the time being whilst increasing the focus on renewables, EE and DSM initiatives, together with the introduction of targets.

It would appear that BELCO and their consultant Leidos have been afforded more than enough time and funding to produce a suitable IRP, but have failed in this task. In view of the importance of developing a suitable IRP it would seem preferable to re-assign the task to a major international engineering consultant with profound knowledge in all relevant subject matters. Such a consultant would adopt a totally unbiased approach and could draw on their company's extensive data bank developed over long exposure to worldwide studies. This approach would facilitate the preparation of a suitable IRP in an expedient and cost-effective manner.

2.0 IRP Requirements and Submissions

2.1 Requirements – This Integrated Resource Plan (IRP) has been under preparation by BELCO for over five years, and is required to provide a sound basis for determining how Bermuda’s electricity supply needs should be met over the next 20 years. It is recognised that urgent and far-reaching decisions need to be made to both replace ageing generation plant and to embrace new technologies and energy policies that ensure future supplies are reliable and sustainable, with significantly reduced greenhouse gas emissions. This complex balance must also address economic factors and a need to achieve lowest possible electricity rates as per EA 2016.

To undertake these challenging decisions it is vital that the IRP demonstrates that all aspects and potential candidate fuels and supply-side and demand-side resources have been thoroughly considered and researched in a totally professional and unbiased manner. This remit requires supporting detailed engineering and economic studies to provide a robust case for any significant system changes proposed. For instance any proposal for transition from bulk fuel oil to LNG or LPG(Propane) must provide comprehensive details of the proposed changes and plant, together with demonstration that all associated safety, regulatory and licensing issues have been fully researched and satisfied.

Furthermore its presentation must be suitable to undergo a Regulatory Authority (RA) review process, to include IPP challenges and public comments.

2.2 Submissions - This 2018 IRP is very similar to the May 30th 2016 Leidos/BELCO IRP, that was incorrectly entitled a final report.

The level of study detail can be broadly categorised as only outline conceptual and not preliminary, and certainly not detailed study status. Bearing in mind that as far back as 2013 Ascendant/BELCO’s Annual Report made statements that the IRP was well under preparation and that a case was being made for transition to LNG there is no justification for the paucity of supporting data in this IRP. Instead of being able to develop a robust engineering and economic justification for this controversial proposed transition to LNG Ascendant/BELCO have resorted to a publicity propaganda approach over the last five years, with particular reference to articles in the Royal Gazette and communications to shareholders and customers. Furthermore they have consistently avoided all attempts by interested parties to discuss this controversial topic,

Since the EA 2016 and the RA recognise the significance of following the IRP Part 8 procedures the opportunity is taken to submit this comprehensive critique in endeavours to revert Bermuda’s energy future to decisions based on appropriate unbiased professional international consultancy studies, as opposed to the present propaganda approach.

Challenging statements are made that this IRP:-

- ❖ Demonstrates a bias to LNG Scenario 3.

- ❖ Inadequate study detail to evaluate LNG case. Also safety and associated regulatory and licensing issues ignored. Also the impact of associated methane greenhouse emissions totally ignored.
- ❖ Significant errors and inconsistencies in study data.
- ❖ Immediate dismissal of offshore wind potential with inadequate justification.
- ❖ Failure to provide equal weighting to LPG(Propane) option, and even conceding no studies carried out on this viable option.
- ❖ Introducing a quantitative and qualitative assessment criteria that allows very subjective qualitative scoring to override the quantitative levelized cost results. Whereas the LCOE costs favoured the LPG and fuel oil scenarios over LNG, their Executive Summary capitalised on an overall slender ranking result that was very much influenced by a very subjective (and controversial) qualitative assessment. In any event both results require amendment to show LNG by far the least favourable option in all respects.
- ❖ Failure to study and recommend renewable, EE and DSM targets (as introduced in the 2011 Government White Paper).

All these challenges are identified and fully addressed.

The aforementioned LNG bias was recently demonstrated in the request for approval to install 56MW of new diesels at NPS. Whilst the urgent need to replace ageing plant is recognised there was no justification for specifying dual fuel oil/natural gas sets outside the IRP procedures. It is assumed that changes could still be made to the specification if deemed appropriate from the IRP review. Furthermore there is no justification for adopting different fuel conditions in the LNG and LPG scenarios 3 & 4 to reflect that only the LNG option introduces an alternative fuel for this new plant at NPS. This approach renders the scenario 3 and 4 comparison results meaningless. The associated 10MW BESS will be useful to support all scenarios, and would also assist any case for wind generation.

3.0 LNG Assessment Issues - Leidos have relied on the March 2016 Castalia report prepared for the Bda Government entitled: “Viability of Liquefied Natural Gas in Bermuda” for most of their information. They do not appear to have provided any additional expertise to develop the concepts further. Furthermore they have been somewhat selective in conveying some of the uncertainties highlighted in this report or the LNG shipping transport issues.

Examples of these reservations are the Castalia report statements:

- ❖ **Implications of Market Trends for Bermuda** – “Most small island countries have been unable to import natural gas and take advantage of the price difference compared to fuel oil, because their demand is too small to justify investing in the expensive

infrastructure needed to import natural gas, and because tight global supply has made it difficult to contract natural gas at a competitive rate”.....

- ❖ **Shipping** – “Commercial scale sea-borne LNG shipping has a history of more than 50 years. A range of ship sizes is currently in production, including ships of the size required for Bermuda, about 10,000 to 15,000 cubic metres.....However ships at the size required for Bermuda are not widely available for charter, so a ship would have to be built specifically to deliver LNG to the island – cost \$75 million and would take about 30 months”.

Since the IRP has only factored in an \$/mmBtu add on cost to cover the shipping it does not address what actual costs could be incurred.

3.1 LNG Infrastructure Capital Cost - As stated below far more LNG infrastructure detail is required, and demonstration of what plant would be required to achieve stated reliability statistics when other fuels phased out to impose total dependence on LNG supplies. In absence of this information query arises if additional \$150 million capital required for 2 such ships, plus all associated berthing and maintenance costs?

As referenced in Section 6.0 of this feedback capital cost statements are vague and inconsistent. In absence of any further information the 2016 Castalia cost estimates are considered:

Landing Site	\$20 million
Terminal	\$57million
Pipeline	\$12 million
Power Plant Conversions	\$31 million
Total	\$120 million

Plus cost escalation over 2 years and addition of a 30% contingency to cover CAPEX conceptual design level uncertainties to achieve a secure system to meet reliability and safety criteria:

Add say	\$48 million
Plus cost of 1 tanker	\$75 million
Possibly cost of 2 tankers	\$150 million

This results in a revised total of \$243 million or \$318 million, to replace the low and unjustified all-in capital cost of \$117.091 million used in IRP.

These high cost solution shipping issues are primary reason why small and remote jurisdictions such as Bermuda fail to justify the very high capital cost LNG transition option.

The study IRP LCOE cost calculations should be re-run based on these amended capital costs to determine how much the Table 2-1 LNG Scenario increases above \$174.87/MWh(already the highest quantitative cost scenario).

3.2 Plant Detail, Siting, Safety and Regulatory Requirements – To facilitate decisions on any such major issue information is required on LNG infrastructure import terminal, and regasification plant. To enable an assessment of operations and reliability information is required on plant designs and capacities (in say cubic meters LNG), together with any duplication to provide standby/reserve margins, together with the derived frequency of shipping deliveries. It is also necessary to demonstrate that accurate capital cost estimates have been obtained to reflect the identified plant and operating philosophy, together with contingencies added.

Siting and layout proposals are required, together with a demonstration that exclusion zone distances will be met for the regasification plant, particularly as Bermuda is somewhat densely populated and has had no exposure to the potential hazards of LNG.

Concern is also expressed at potential risk of LNG ships negotiating Bermuda's reefs.

Extracts of a paper entitled: "Challenges of Developing LNG Terminals" provides an example of "fast-track" project preparation, showing a timescale of **6 years** from feasibility design stage to operations.

Associated activities include design, permitting, siting studies, engineering/procurement/construction and commissioning. Studies that must be carried out include assessments of siting requirements, facility process design, evaluations of the operational constraints and hazards associated with the facility, terminal facilities, shipping, assessment of potential risks to the public near prospective sites and assessment of potential effects of facility construction and operation on terrestrial and aquatic ecosystems.

For a US installation Federal Agencies involved comprise: The Department of Energy, Federal Energy Regulatory Commission, the US Coast Guard, the Department of Transportation, the US Environmental Protection Agency, the US Minerals Management Service, US Fish and Wildlife Service, US Department of Labour Occupational Safety & Health Administration.

State and Local Agencies include Departments of environmental protection, Fire departments and Police.

And Non-Governmental Regulators/Standards Organisations include the National Fire Protection Association, American Association of Mechanical Engineers, the American Society of Civil Engineers, The

American Petroleum Institute, The American Concrete Institute and the American Society for Testing and Materials. The foregoing reflects the extremely stringent regulatory requirements for LNG installations due to their dangerous potential.

The fact that the IRP makes no reference to these significant issues and shows LNG imported by 2022(4 years) concerns are expressed that insufficient work has been done to make any robust LNG viability claims.

3.3 Bulk LNG Fuel Cost Projections – Before any consideration could be given to transition to LNG it would be necessary to obtain details of long term fuel supply contracts that would be offered; it is understood the proposed supplier is Sabina Pass in Louisiana. Concern is expressed that bulk LNG is a commodity that can be sold on spot markets to the highest bidder, and unlike large importers such as Japan, Bermuda would have very little leverage with its abnormally small demands. LNG costs normally follow fuel oil prices and market opportunities. If Bermuda became committed to a single supplier there would be no scope for long term fuel cost negotiations. Conversely for an alternative fuel such as LPG there are major suppliers such as Vitol and BW LPG with vast shipping fleets and diverse sources of LPG supply and storage, so there should be very little risk of becoming a captive customer with no negotiating options.

An Immediate concern is that 11.C appears to show a 2017 cost of only \$3.16/mmBtu for the bulk LNG commodity before the usual adders for duty etc. This appears to cover only the Henry Hub gas source price. A US Dept of Energy paper schedules the actual 2017 LNG prices at the Sabina Pass export terminal for 17 shipments to countries including Japan and Mexico. The Japan cost was 3.72 \$/mmBtu and Mexico 7.52 \$/mmBtu. There is some discussion on whether these prices include the liquefaction fee, dependent on whether they are long term contracts. This demonstrates the significance of need for realistic long term contract rates.

3.4 Greenhouse Emissions – A major incentive to reduce dependence on fuel oil fossil fuels and migrate to a cleaner fuel was the wish to reduce CO₂ emissions. However the IRP fails to point out that LNG operations are associated with methane releases, particularly if the fuel source is fracked gas fields in locations such as USA. Environmentalists in USA are very vocal in objecting to the licensing of LNG export terminals and increasing fracking activities,

and also the public would prefer use natural gas for domestic consumption.

Environmental technical papers are readily available that point out that: “methane is initially far more devastating to the climate than carbon dioxide because of how it absorbs heat. In the first two decades after its release, methane is 84 times more potent than CO₂. Both types must be addressed if we want to effectively reduce the impact of climate change”. For this reason system developments based on ambitious targets to reduce fossil fuel dependency by renewable, EE and DSM expedients have much merit, and reflects the requirements of the Bda Government 2011 White Paper, that attracted positive feedback from the public.

3.5 Training Programmes and Costs – Since all aspects of LNG operations are far more hazardous and exacting than existing fuel oil activities there would be a need for a comprehensive training programme, with associated costs factored in.

4.0 LPG (Propane) – Propane has been used for many years in Bermuda, with Bermuda Gas the initial supplier, and now RUBIS. Whilst this fuel has generally been used for small domestic applications it can be readily scaled up for industrial power generation use. As it is a known resource and can be more readily transported than LNG(with its cryogenic and very high pressure storage requirements) it is a candidate fuel resource that should be allocated at least as much consideration as LNG within the IRP.

The US Virgin Islands are completing a contract for a propane fuelled 21 MW smart Power Generation power plant for their Water and Power Authority. The power generation plant is provided by Wartsilla and the propane infrastructure was provided within a contract with Vitol.

It is noteworthy that section 2.7.3 of the IRP states: “a detailed feasibility study of this option has not been undertaken to develop a conceptual plan along with project development cost estimates. Should the decision be made to give this option further consideration, the first order of business would be to perform such a study”. This statement totally reflects BELCO’s approach of only promoting LNG, and demonstrates a failure to comply with the IRP requirements.

5.0 Offshore Wind Generation – This is an energy resource option that was expected to receive serious consideration within the IRP for anticipated introduction within the 20 year study period.

In 2000 BELCO presented a paper entitled “The Challenge of Wind Power for Bermuda”. It was prepared in collaboration with the Bermuda Biological Station for Research” (BSSR). It incorporated the findings of

wind data collected over a one year period at Bermuda airport and weather balloon, Harbour radio site , BSSR offshore North Rock station and BELCO air quality stations. It reached a positive conclusion that the next step should be to install an offshore ambient monitoring station at the identified wind farm site.

The IRP Appendix refers to the 2014 report titled: “Offshore Wind Energy in the Context of Multiple Ocean Uses on the Bermuda Platform”. It was prepared by the Bren School of Environmental Science and Management at the University of California, Santa Barbara. Their Executive Summary included: “ our analysis shows that offshore wind energy on the Bermuda Platform is an economically viable option – the calculated LCOE of 261\$/MWh is significantly lower than the price of electricity paid by consumers. Even with the substantial mark-up on a project’s LCOE in a negotiated power purchase agreement, it is very likely that the actual cost of energy from offshore wind power will be less than the prevailing prices”. Whilst it was dismissed as a theoretical approach that required more research it received numerous feedback comments from the public supporting a follow-up.

In the UK offshore wind generation has gained momentum to benefit from the significant efficiency improvements and cost reductions over the last 5 years. This has resulted in the recent signing of a PPA for a 15 year contract to supply power from a 1,360 MW wind farm at the incredibly low rate of £64/MWh (\$87/MWh). Clearly this Hornsea North sea installation benefits from economy of scale.

Reference is made to a paper published in October 2017 entitled: “First Offshore Windfarm Awarded in the Caribbean”. It identifies that the Government of Jamaica has identified renewable energy as a major pillar of its strategy for energy security. The US Trade and Development Agency has awarded a grant to the Petroleum Corporation of Jamaica supporting the development of an offshore wind farm off Jamaica. The feasibility study for the project will evaluate the viability of installing an offshore wind farm. It would appear to be in Bermuda’s best interests to become associated with such studies and other similar renewable interests within the CARILEC group.

Whilst the IRP Table 1-2 shows the inclusion of a hypothetical 25MW offshore PPA in scenarios 2,3 &4 it was immediately screened out and formed no part of the studies. The IRP made a brief statement in Section 2.1 that: “ ..offshore wind resources were screened out from further consideration because of cost and logistical uncertainties that require addressing in a feasibility study”.

Another brief statement appears in Appendix 11.F of the IRP, and dismisses wind generation because offshore ambient wind data is not

available at the identified Murray anchorage site. BELCO have had 18 years to arrange for this data to be collected as recommended in the conclusions of their 2000 study and paper. The Leidos recommendation to update an Elsam report and collect the site data does nothing to advance the prospects of this technology in Bermuda, and again it demonstrates that BELCO have not acted on any of the earlier 2011 White Paper requirements and the IRP has failed to pursue all potential energy candidates in sufficient depth.

6.0 Errors and inconsistencies in Study Data –

Examples of these shortcomings include :

- ❖ Scenarios 3 and 4 (LNG and LPG comparisons) not based on equal conditions, as stated earlier.
- ❖ Statement in Section 1 that LPG would be sourced in the USA is not valid or relevant.
- ❖ The LCOE results in Section 2.1 and Appendix 11.D1 show randomly different values.
- ❖ Figure 2-4 shows Summary of Levelized Costs by Scenario and Sensitivity. Bearing in mind that Section 1 correctly states that the main uncertainties are project capital and O&M costs there is no justification for these results showing a higher \$/MWh upswing for the LPG case than that of the LNG case. As stated in various parts of this appraisal it is the LNG capital costs that are vague, require revision and will undoubtedly significantly increase. Similarly O&M costs are uncertain for a new LNG technology. Conversely the LPG case modelled is based to the well established and proven fuel oil practices until 2030 when partial Propane is introduced.
- ❖ Figure 2.3 indicates best result for natural gas carbon dioxide emissions but fails to identify its far more damaging methane emissions.
- ❖ The LNG infrastructure costs and NG conversion costs appear vague and the IRP \$104 million capital cost estimate is impossible to correlate with the Castalia cost estimates (loading terminal \$20m, regas/storage \$57m, pipe to Hamilton \$12m, fuel conversions \$31m totalling \$120m, plus purchase of tanker/s \$75m or \$150m). Furthermore the Appendix 11.C shows another value of \$117.091million all-in capital cost.
- ❖ The presentation of the Appendix 11.C fuel price projections is very difficult to interpret and compare LNG and LPG values, mainly because different headings have been adopted for the Adders.
- ❖ Also an explanation is required why the add-on duty for the LNG and LPG cases change from around 2.5 to 3.0\$/mmBtu to a constant 5.37\$/mmBtu in the “bulk duty normalised” cases. Does this infer the Government have agreed a reduction of duty of around 50% for these alternative fuels and which values have been used in the study

calculations? If a lower duty is being assumed for LNG could this change if it not recognised as a “clean fuel” due to methane release implications? If a lower duty is assumed in the studies this clearly favours the LNG Scenario 3 that uses far less fuel oils than LPG Scenario 4. Again the low LNG commodity cost of around 3 \$/mmBtu is queried, and appears to be only the base Henry Hub gas cost. Also an explanation is required why the LNG cases show a “commodity adder” of around 0.4\$/mmBtu whereas the LPG cases show a higher “supplier commodity charge” of around 5.2\$/mmBtu.

7.0 Qualitative Scoring of Candidate Resource Types (Appendix 11.E1

– For simplicity and expediency a review is made of only:

Scenario 3 – Ref Appendix 11.D4 LNG Case with fuel oils phased out by 2022 to become predominantly LNG dependent thereon

Scenario 4 – Ref Appendix 11.D4 LPG Case modelled in IRP as predominantly fuel oils until small mix of LPG introduced in 2030

The IRP definitions of the five factors are as follows:

- 1 Supply Quality** - Evaluate the degree to which the asset enhances or reinforces system reliability as a firm resource.
- 2 Environmental Sustainability** - Evaluate the degree to which the asset will cause a reduction in the emission of Green House Gases (GHG) from electricity generation.
- 3 Security and Cost Resilience** - Evaluate the degree to which the asset contributes to resource/fuel diversity to make Bermuda resilient to shocks caused by dramatic changes to the cost and availability of fuel.
- 4 Logistics** - Evaluate the degree to which the asset provides for ease of logistics and implementation.
- 5 Economic Development** - Evaluate the degree to which the asset contributes To the economic development of Bermuda with focus on job creation.

There is a maximum score of 20 for each qualitative factor

7.1 IRP Scoring and Comments

Qualitative Factor	Scenario 3 (LNG)	Scenario 4 (LPG)
1 Supply Quality	20	20
Comments	Units are based on mature technology for operation in firm, dispatchable resources providing high quality reliable power	Same comments
2 Environmental Sustainability	10	10
Comments	Operation on natural gas as a primary fuel cause a reduction in GHG emissions relative to business as usual	Similar comments for LPG

3 Security and Cost Resilience	10	5
Comments	Dual fuel resource will increase fuel diversity and cost resiliency	Operation on LPG will increase fuel diversity and cost resiliency
4 Logistics	10	5
Comments	Significant gas fuel and handling transportation infrastructure is required, creating permitting and siting challenges	Significant gas fuel handling infrastructure is required, creating permitting and siting challenges. Transportation risks are higher than natural gas. Resource to be located at gas storage facility site.
5 Economic Development	17.5	15
Comments	Construction as well as long term O&M jobs would be created. Would create potential for piped gas distribution	Construction as well as long term O&M jobs would be created
Total Score	67.5	55

7.2 Re-assessed Scoring and Comments Challenge

Qualitative Factor	Scenario 3 (LNG)	Scenario 4 (LPG)
1 Supply Quality	0	10
Comments	With fuel oils phased out by 2022 maintaining adequate supplies of standby fuel oil problematical. NG system less reliable than existing fuel oil system due to dependence on regasification supplies via a single pipeline compared with proven fuel oil storage systems at site. Also tanker deliveries a concern due to very low LNG capacities for Bda.	Existing secure fuel oil systems, introduction of partial Propane additional fuel source in 2030.
2 Environmental Sustainability	10	10
Comments	Impact of methane GHG to be assessed by environmental authorities	For modelling used by IRP fuel oils remain the dominant fuel. (Another reason why scenarios 3 & 4 should have been modelled on the same criteria for comparison purposes)
3 Security and Cost Resilience	5	10
Comments	After 2022 fuel oil is phased out and merits of dual fuel operation no longer apply. Concerns of long term LNG supplies and transport due to Bermuda being a very low volume customer.	Operation on partial LPG 2030 onwards will increase fuel diversity and cost resiliency
4 Logistics	5	15
Comments	As indicated in Section 3.2 of this appraisal the introduction of LNG infrastructure into Bermuda and refuelling would be major and time-consuming activities. The timescale for LNG/NG operations by 2022	Expansion of existing Propane activities in Bermuda to introduce partial Propane fuelled generation by 2030 should not present any significant issues. There should be a choice of siting for this

	does not appear to be realistic.	generation plant at either Marginal Wharf or Hamilton central.
5 Economic Development	15	15
Comments	Construction as well as long term O&M jobs would be created. Would create potential for piped gas distribution	Construction as well as long term O&M jobs would be created. The significantly lower capital cost provides scope for future funding of alternative generation technologies such as offshore wind generation. Bulk LPG imports should reduce Propane costs and benefit existing domestic customers
Total Score	35	60

Note: These 7.2 revised scoring assessments are based strictly on the IRP factor 1-5 definitions, and show the LNG Scenario3 scores far lower (35/100) than the LPG Scenario 4 case (60/100).

APPENDIX A

Examples to Clarify Why the Controversial IRP Qualitative Scoring Assessments Challenged

A.1 Need to Adhere to IRP imposed Factor Definitions

Refer to 7 above, the IRP's assessment of Supply Quality Factor 1. Its definition is: **"Evaluate the degree to which the asset enhances or reinforces system reliability as a firm resource,"**

It is not valid to assign a maximum 20/20 score for this factor with comments: "Units are based on mature technology for operation as firm, despatchable resources providing high quality, reliable power."

In the context of this study evaluation it is the alternative fuel systems that are under consideration. BELCO's good practice of obtaining high levels of system reliability by maintaining high specification generation plant with adequate spinning and standby reserve margins is not the issue being addressed.

Since the asset in this case is either the LNG based Scenario 3 or the partial LPG based Scenario 4 the revised assessment has been to assign scores of only 0 and 10 respectively, since the existing fuel oil system is very reliable and proven over the last several decades. There are many indications that the proposed LNG Scenario 3 could detract from rather than enhance system reliability. Certainly it remains somewhat an unknown entity until far more information is provided.

A.2 Example of Misleading Scoring Challenge that Favoured LNG Case

Refer to 7 above, and Factor 4:"Logistics", defined in IRP as – **"Evaluate**

the degree to which the asset provides for ease of logistics and implementation.”

In the context of this study and evaluation of the relative merits of the Scenario 3 LNG based case and the Scenario 4 partial LPG based case it is comparing the following activities:

LNG Based Case: In present situation of only outline conceptual info available undertake all the onerous studies and regulatory and licensing etc tasks as outlined in Section 3,2 of this appraisal and install and commission a complete new LNG infrastructure in Bermuda and achieve nearly 100% LG fuelled operations by 2022. This also requires committing to a long term fuel contract and building BELCO LNG tanker/s.

LPG Based Case: Continue existing fuel oil operations until 2030. Design and install a partial Propane system and plant by 2030, scaling up existing Propane practices in Bermuda. This task would include optimisation study to determine whether generation plant installed at Hamilton or Marginal Wharf.

The IRP allowed this subjective qualitative assessment to score a higher 10/20 for the LNG Scenario 3 and a lesser 5/20 for the LPG based Scenario 4, for reasons that appear impossible to justify.

Such scoring has been allowed to present their Executive Summary declaring case proven to recommend LNG. This situation was then recently followed up with another Royal Gazette article aimed at convincing the public that IRP proved case for transition to LNG.

13th August 2018

Dear RA Team,

Response to Consultation Document: Comments on Integrated Resource Plan Proposal Consultation

Serious Concerns Arising From Recent Approval of The National Fuels Policy

1.0 Procedures

Further to the IRP feedback comments I submitted in May 2018 an urgent and transparent explanation is requested regarding procedures and publications within the Department of Energy.

In 2011 the Government White Paper met with widespread approval, and reflected the requirements of a remote island such as Bermuda to fully embrace renewables and energy conservation measures and targets, and thereby significantly reduce dependence on imported fossil fuels.

Incentives included environmental, security and economic aspects,

The Electricity Act 2016 recognised that it was imperative to ensure the future long term energy policy for Bermuda was based on a comprehensive Integrated Resource Plan(IRP), to be prepared in a totally professional and unbiased manner with equal measure given to all potential energy options. Of even greater significance were the associated rigorous procedures to ensure the fully researched IRP was subjected to feedback and discussion with the public and all interested parties in a fully transparent manner before acceptance, thereby ensuring the adopted energy plan met with the general approval of the public.

It is beyond dispute that the direction of energy policy promotions and publications dramatically changed immediately following the arrival of the former Ascendant/BELCO President and CEO (Walt Higgins) with his major financial interests and positions in the major US natural gas company South Jersey Industries. BELCO adopted a relentless sales campaign including via RG articles for BELCO to import LNG from the US. Since no other remote small island has been able to justify the LNG option due to its extremely high capital costs, incompatibility with tanker volumes and safety aspects, there was understandably a major challenge to the LNG option. The CEO provided no justification and refused to discuss the subject with anyone seeking explanations. The current CEO has also pushed for LNG, albeit less vigorously.

Ascendant/BELCO spent 5 years and several \$million dollars preparing the legislated IRP using their choice of consultant: “Leidos”. During the protracted period of its preparation BELCO entertained no discussions. As stated earlier the IRP that was officially submitted to the Government in February 2018 is considered unsatisfactory, very strongly biased towards stating a case for LNG and dishonest in its analysis. Since this IRP contains the only available data sources it was considered pertinent to adopt most of the basic data and carry out a totally unbiased analysis of the results, which clearly demonstrate that the LNG fuel option ranks the lowest, and not highest of all energy options.

For reasons not explained the previous Government commissioned Castalia to produce the 2016 report entitled: “Viability of Liquefied Natural Gas (LNG) in Bermuda.” This report makes no claim that a case is made to favour of LNG over other viable energy options, and also contains numerous reservations to include future pricing and transport issues.

The 2017 National Fuels Policy discussion paper appears to be a continuation of the ill advised efforts of the previous administration to embrace LNG, and with minimal emphasis on renewables and energy efficiency compared to the 2011 White Paper. I submitted a joint feedback to this paper, and note that the public responses published on 22nd August 2017 regarding concerns cited for LNG covered:

- ❖ **Cost** – Importing LNG would be too expensive, capital intensive, and would make the country dependent on LNG for several decades, even if changes in technologies and costs make cleaner alternatives more viable
- ❖ **Environment and Climate Change** – Emissions over the whole lifecycle are not significantly lower than from conventional fossil fuels
- ❖ **Safety** – LNG storage and transport raise huge safety and planning problems

The stated Department of Energy responses to these significant and complex issues are limited to general comments that do not address the specific issues raised.

2.0 Queries

I therefore query the justification for the recent statement that the National Fuels Policy of Bermuda has been approved, and provides guidelines the Bermuda Government would like to see to direct the island’s fuel sector towards “affordable and sustainable” energy in the

future. In the RG article “Roban welcomes national fuel policy” it states biofuel and natural gas should account for 57% of the fuel mix.

Concerns arise that the National Fuel Policy is approved when its major feedback comments regarding LNG have not been fully answered AND the IRP feedback procedure stipulated in the Electricity Act 2016 is still in progress with a revised closing date of 17th August 2018? It begs the question if the Electricity Act IRP procedure requirements are being totally compromised?

3.0 Recommendations

In view of the foregoing any premature and inadequate justification for making a transition to LNG would not be in the Bermuda’s national interest and would always be deemed controversial.

I suggest the only satisfactory resolution would be to refer both the IRP and the National Fuels policy to a totally independent international consultant with a profound knowledge of all energy options suitable for small and remote island situations. This would entail a comprehensive review of ALL energy options together with recommendations,

Bill Jewell, C.Eng,FIET