

July 23, 2013

Jeffrey Johnson, Chairman  
Guam Public Utilities Commission  
Suite 207, GCIC Building  
Hagatna, Guam 96932

## Docket 13-02: Review and Evaluation of GPA's 2013 Integrated Resource Plan

### Draft Letter Report

Dear Chairman Johnson,

Lummus Consultants International, Inc. (Lummus Consultants) is pleased to submit this letter report to the Guam Public Utilities Commission (PUC or Commission) in response to Mr. Horecky's request to evaluate and submit a report with respect to GPA's 2013 Integrated Resource Plan.

#### *Introduction*

GPA's previous Integrated Resource Plan (IRP) was submitted to the Commission in 2008. One of the key recommendations in that IRP review on behalf of the Commission was that GPA diversify its fuel supply<sup>1</sup>. That recommendation together with being faced with impending United States Environmental Protection Agency (USEPA) compliance deadlines resulted in transitioning to liquefied natural gas (LNG) as the main focus of GPA's current IRP. GPA's findings as submitted in the 2013 IRP are intended to provide a roadmap for generation system investment over the next five years.

Transitioning from residual fuel oil (RFO) to liquefied natural gas (LNG) is a significant and complex undertaking that involves investigation into many areas, some of which may not traditionally be considered as part of an integrated resource plan. In developing its IRP, GPA has relied on studies that were undertaken under its direction and which are included as appendices to the IRP.

Key assumptions that resulted from GPA's studies were utilized in the Ventyx Model, Strategist, in order to analyze alternative solutions and ultimately determine the optimal portfolio of least-cost options that eliminates annual capacity deficits in accordance with capacity reserve margin requirements. GPA modeled a base case and 17 alternate LNG cases in Strategist, which resulted in the selection of three top LNG cases by GPA.

The IRP documentation provided little in the way of transparency as to how Strategist processed the key inputs in order for the educated reader to understand and validate the output of Strategist, which we initially viewed as a black box output. However, throughout the review process, we were able to work closely with GPA staff via teleconference and emails in order to better understand how Strategist processed the inputs and to reasonably understand and confirm the output and results of the analysis.

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<sup>1</sup> In its review of GPA's 2008 IRP, Georgetown Consulting Group (GCG) emphasized the need for the Authority to identify a fuel diversification program that would mitigate the high costs and volatility resulting from its dependence on fuel oil. GCG's recommendations included conversion of the TEMES combustion turbine to natural gas as well as a number of renewable options including wind and sea water air-conditioning.

This letter report provides an overview of our findings and recommendations with more detailed findings and recommendations in the attached appendix which is organized as follows:

- Economic Analysis and Impact on Ratepayers;
- Environmental Considerations;
- Reliability; and
- Demand Side Management.

**Key Findings**

*I - Economic Analysis and Impact on Ratepayers*

Subsequent to the release of GPA’s 2013 IRP, the Base Case underwent a downside correction. The updated results, which are shown in Table 1 below, indicate that under the “test assumptions”, GPA can achieve approximately a 15%-16% reduction in net present value (NPV) as compared with the updated Base Case. It should be noted that the original Base Case PV Utility Costs is noted in the footnotes to Table 1. The updated Base Case is shown in Case 1 under Initial Screening Assumptions and the new values for Cases 2 through 4 are under Test Assumptions- which is the source of the savings quoted above. The reduction in savings under the LNG cases are primarily due to two factors: first is the ability to maintain a price advantage of LNG with respect to fuel oil; the second resulting from overall gains in system efficiency due to the addition of more efficient combined cycle plants that are added under the LNG conversion scenarios.

Table 1: Potential Savings of Diversifying to LNG<sup>2</sup>

CASE	Retirement Units	Initial Screening Assumptions		Test Assumptions	
		PV Utility Costs (\$000)	Present Value Variance (Savings) from Base Case (\$000)	PV Utility Costs (\$000)	Present Value Variance (Savings) from Base Case (\$000)
1	None	6,263,191	BASE CASE		
2	Marbo, Dededo Diesel, Cabras 1&2	5,258,080	(1,005,111)	5,246,848	(1,016,343)
3	Marbo, Dededo Diesel, Cabras 1&2, Tanguisson 1&2	5,241,317	(1,021,874)	5,250,353	(1,012,838)
4	Marbo, Dededo Diesel, Tanguisson 1&2	5,311,525	(951,666)	5,304,855	(958,336)

[1] In GPA's review after completion of the IRP, the present value of the base case was corrected from \$6,451,778 to \$6,263,191 (\$000).

Although GPA had low, mid and high fuel price forecasts, it only used the mid fuel price forecasts in Strategist. At our request, GPA ran a scenario for low fuel prices. This scenario resulted in a decrease in PV of the Base Case from \$6.263B as shown in the table above, to \$5.126B, and a decrease in the PV of the average of the three

<sup>2</sup> Descriptions for Retirement Units in Tables E-2, E-3 and E-4 were reversed in the filed IRP for Cases 3 and 4. The corrected descriptions for the top three case numbers are shown in Table 1, above. The source of this Table is GPA whose staff updated the table during discussions with Lummus Consultants during our review.

top LNG cases to \$4.854B, resulting in a NPV variance for the average of the three LNG cases of approximately \$0.272B. Such a significant difference underscores the importance of performing sensitivity analyses related to RFO and LNG price forecasts.

Lummus Consultants asked whether GPA had considered in its analysis an “As-Is” Base Case in which GPA did no environmental compliance, no fuel conversion, no life extension, IPP contracts would continue as-is, and would incorporate renewable contracts that were already awarded. Although GPA had not previously considered this case, GPA did model it at our request. The present value result for this case was \$5.573B, which is comparable to the present value for the three top LNG cases of \$5.258B (Case 2); \$5.312B (Case 3) and \$5.241B (Case 4). Thus, even though GPA would need to spend in the neighborhood of \$750M-\$850M to transition to LNG, if they did nothing and continued as-is, on a present value basis, the effect on ratepayers would be approximately the same. The As-Is Base Case, while informative, is not reflective of the future for the GPA generating system, as it does not include environmental compliance requirements.

The Lummus team worked closely with GPA to understand the effect of transitioning to LNG on ratepayers. Figure 1 and Table 2, below, provide a forecast of base rates, the LEAC and the variance through 2040 using the Base Case and the best LNG case scenario from Table 1.

Figure 1: Projected Rate Impact of Conversion to Best LNG Case versus Updated Base Case

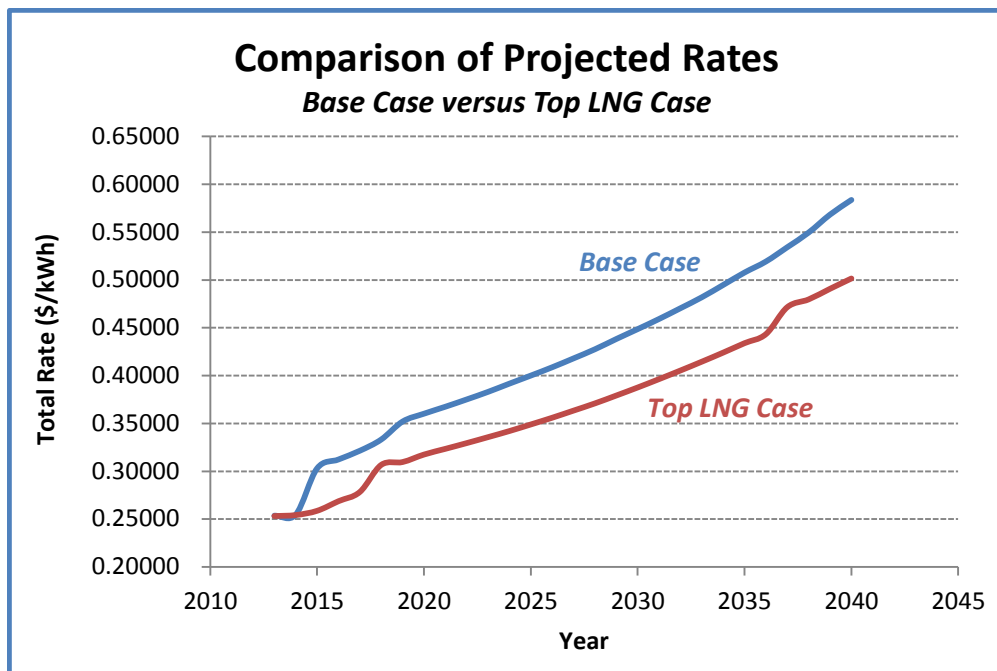


Table 2: Projected Rate Impact of Conversion to Best LNG Case versus Updated Base Case

	Base Case			LNG Best Case			Variance (F) - (C)
	Base Rate (A)	LEAC (B)	Total Rate (C)	Base Rate (D)	LEAC (E)	Total Rate (F)	
----- (Current Year \$/kWh) -----							
2013	0.09356	0.16005	0.25361	0.09302	0.16017	0.25320	(0.00042)
2014	0.09702	0.15768	0.25470	0.09647	0.15777	0.25425	(0.00046)
2015	0.14880	0.15425	0.30305	0.10432	0.15438	0.25870	(0.04435)
2016	0.15235	0.16000	0.31235	0.10863	0.16011	0.26873	(0.04362)
2017	0.15685	0.16464	0.32149	0.11361	0.16477	0.27839	(0.04310)
2018	0.16264	0.17059	0.33323	0.14349	0.16321	0.30669	(0.02654)
2019	0.17488	0.17713	0.35202	0.16532	0.14435	0.30967	(0.04234)
2020	0.17669	0.18352	0.36021	0.16849	0.14900	0.31749	(0.04272)
2021	0.17837	0.18912	0.36749	0.17002	0.15345	0.32346	(0.04403)
2022	0.18007	0.19506	0.37513	0.17154	0.15793	0.32947	(0.04565)
2023	0.18185	0.20119	0.38303	0.17315	0.16256	0.33571	(0.04732)
2024	0.18372	0.20793	0.39165	0.17483	0.16726	0.34209	(0.04957)
2025	0.18564	0.21443	0.40006	0.17659	0.17238	0.34897	(0.05110)
2026	0.18775	0.22100	0.40875	0.17855	0.17744	0.35599	(0.05276)
2027	0.19001	0.22803	0.41804	0.18064	0.18281	0.36345	(0.05458)
2028	0.19238	0.23519	0.42757	0.18284	0.18815	0.37099	(0.05658)
2029	0.19490	0.24339	0.43829	0.18517	0.19404	0.37922	(0.05908)
2030	0.19753	0.25111	0.44863	0.18763	0.19998	0.38761	(0.06102)
2031	0.20028	0.25895	0.45923	0.19022	0.20613	0.39636	(0.06287)
2032	0.20318	0.26727	0.47045	0.19293	0.21242	0.40535	(0.06510)
2033	0.20564	0.27626	0.48190	0.19525	0.21932	0.41457	(0.06733)
2034	0.20832	0.28645	0.49477	0.19775	0.22632	0.42407	(0.07070)
2035	0.21118	0.29660	0.50778	0.20045	0.23349	0.43394	(0.07384)
2036	0.21406	0.30522	0.51928	0.20318	0.24019	0.44337	(0.07591)
2037	0.21716	0.31706	0.53423	0.22408	0.24748	0.47156	(0.06267)
2038	0.22049	0.32908	0.54958	0.23301	0.24667	0.47969	(0.06989)
2039	0.22415	0.34417	0.56832	0.23568	0.25510	0.49078	(0.07754)
2040	0.22771	0.35597	0.58367	0.23833	0.26322	0.50155	(0.08212)

Insofar as the results of the net present value analysis is highly dependent on reliability of the study assumptions and sensitivity of the fuel price forecasts, we make the following recommendations.

- In its next IRP, GPA should include in its primary document more description about its reference case and alternative case assumptions to make it simpler for outsiders to understand the decision process and an appendix that provides more detail and transparency in support of the Strategist output.

- Although not required for inclusion in an IRP, due to the very significant change in direction and cost implications associated with conversion of generating resources to LNG, GPA's next IRP should include a section that addresses the impact of LNG conversion on its ratepayers.
- As the fuel price forecast is the most significant variable in the economics and the least predictable, GPA should update R. W. Beck's fuel price forecast and conduct an LNG Fuel Procurement Study that addresses sourcing and pricing of LNG delivered to Guam. This Study should identify specific LNG suppliers that would be interested in establishing long-term contracts for LNG volumes required by GPA. Preliminary indicative pricing should also be solicited from potential suppliers of LNG perhaps through a competitive bidding sourcing process.
- In its next IRP, and as GPA moves ahead with investment decisions relative to this IRP, GPA should include explicit risk assessments associated with variability in the price projections underlying the fuel choices included in the resource plan to understand the implications on costs if the fuel projections vary as widely as natural gas have in recent history.
- GPA should not fully commit to LNG based solely on the weight of its 2013 IRP.

## *II – Environmental Considerations*

There are a number of environmental regulations that will have an impact on the capital expenditures required by GPA to ensure future compliance of its existing generating assets. Three environmental regulations, which are expected to have a significant impact on the GPA assets, are summarized below. Additional details on how these regulations can impact the GPA are provided in Appendix B.

### *Reciprocating Internal Combustion Engines (“RICE”) Maximum Achievable Control Technology (MACT) Standards*

The United States Environmental Protection Agency (USEPA) recently promulgated the RICE MACT Standards, which will affect GPA's peaking diesel units as well as the slow speed diesels at Cabras Units 3&4 and Piti Units 8&9. The rule requires that carbon monoxide (CO) emissions be controlled by 70% at each generating unit, which is typically accomplished by retrofitting an oxidation catalyst on the exhaust of the engine. Guam was exempted from the RICE MACT requirement to use ultra-low sulfur diesel (ULSD) for these engines, but was not exempted from the meeting the CO emission limits, with a compliance date of May 2013. GPA obtained a one-year compliance extension from the USEPA until May 3, 2014 for the peaking diesel units and is in discussions with the USEPA on a potential extension of the compliance date for the slow speed diesels.

### *Mercury and Air Toxics Standards (MATS)*

On December 16, 2011, the EPA signed a rule to reduce emissions of hazardous air pollutants (HAPs) from existing and new coal-fired and oil-fired electric generating units (EGUs). These mercury and air toxics standards (MATS) apply to EGUs larger than 25 MW that burn coal or oil for the purpose of generating electricity for sale and distribution through the national electric grid to the public. Compliance with the MATS is required by April 16, 2015. However, sources may be eligible for an extension of the compliance deadline by one to two years. Tanguisson Units 1&2 and Cabras Units 1&2 are affected units under the MATS.

The primary MATS emission limit affecting future compliance costs for Tanguisson Units 1&2 and Cabras Units 1&2 is filterable particulate matter (PM). Initial stack testing conducted at Cabras Unit 1 indicated that the filterable PM emissions exceeded the MATS limit of 0.03 lb/MMBtu. GPA reported that the test procedures used in this initial stack test were not conducted properly and that a re-test was performed. GPA's Environmental Consultant, prior to the re-test, indicated that it was expected the re-test would meet the MATS filterable PM limit.

### *1-hour Average SO<sub>2</sub> National Ambient Air Quality Standard (NAAQS)*

The USEPA recently promulgated a 1-hour average SO<sub>2</sub> NAAQS. The USEPA is currently developing guidelines for implementation of the new SO<sub>2</sub> NAAQS. These guidelines may include both the assessment of air quality monitoring data and air dispersion modeling analyses for states and territories in order to demonstrate compliance with the NAAQS. If the USEPA eventually declares Guam, or portions of Guam, as not attaining the 1-hour average NAAQS, the Guam EPA will need to submit a State Implementation Plan (SIP) for attaining compliance with this NAAQS. If a SIP is required to attain the new standard it is likely SO<sub>2</sub> reductions from GPA generating assets will be part of that plan. When GPA was preparing the IRP, it was expected that the Guam EPA would submit a SIP by mid-2013 and reductions in SO<sub>2</sub> emissions would be required by June 2017. EPA recently published guidance on timelines for establishing attainment status for states and territories with the 1-hour SO<sub>2</sub> NAAQS. This schedule is likely to delay actions to lower SO<sub>2</sub> emissions at affected sources until the 2022 timeframe.

### *Impact of RICE MACT on GPA Peaking Diesel Units*

GPA petitioned the Commission, pursuant to the Contract Review Protocol for the Guam Power Authority, to review and approve GPA's request to procure equipment for compliance with the RICE MACT and to approve GPA's Environmental Program for diesel peaking units. The cost of the equipment has an expected cost of approximately \$1.5 million. GPA also indicated that additional costs of approximately \$4 million would be required to modify existing structures and civil works in order to complete the Environmental Program for the diesel peaking units.

It is Lummus Consultants' opinion that GPA has limited options for meeting the RICE MACT standards for the diesel peaking units. In addition to the option of installing the necessary emission control equipment at the affected units, either unit retirement or long-term layup until the emission control equipment is installed at a later date could be considered. It is our understanding that the generating units included in the Petition are important assets for maintaining reliability of the electrical system and therefore eliminate the retirement or long-term layup options. Overall, the impact of the environmental compliance plans for the peaking diesel units do not have a material impact on the IRP results.

### *Impact of RICE MACT on Slow Speed Diesel Units*

Compliance with the RICE MACT requirements for the slow speed diesel units have a significant impact on the environmental compliance plans incorporated into the IRP. These base load units have limited options for complying with this regulation. GPA's Environmental Strategic Plan (ESP) Addenda (February 2013) included with the IRP lists three compliance options, other than an USEPA exemption, for the RICE MACT rule. These are:

- 1) Use low sulfur diesel and install an oxidation catalyst,
- 2) Use lower sulfur RFO plus install flue gas desulfurization (FGD) systems and an oxidation catalyst, and
- 3) Convert to LNG and install an oxidation catalyst.

The impact of switching from RFO to low sulfur diesel fuel in order to allow the installation of CO catalyst would have a substantial impact on system fuel costs and would also require some capital investment for modifications of the fuel storage and feed systems to these engines. The option of installing FGD equipment to lower flue gas

SO<sub>2</sub> concentrations to levels that are compatible with operation of the CO catalyst would require substantial capital investment, increased O&M costs, and derates of the generating capacities of these units.<sup>3</sup>

The IRP Base Case (without LNG) assumed the installation of FGD equipment at the slow speed diesel units as part of the compliance plan for the RICE MACT standards. GPA included \$60M in capital cost for each of the slow speed diesel units for the installation of an FGD system to lower SO<sub>2</sub> concentrations in the flue gas to levels compatible with the CO oxidation catalyst required by the RICE MACT standards. The Base Case also included incremental variable O&M costs for operation of the FGD systems of \$5.38/MWh and \$4.78/MWh at Cabras Units 3&4 and Piti Units 8&9, respectively.

Lummus Consultants requested GPA to model an Alternate Base Case based on the use of ULSD fuel rather than the retrofit of FGD systems at the slow speed diesels. The present value (PV) for the Alternate Base Case increased by approximately \$600M, primarily due to the incremental cost of using ULSD rather than RFO, which was used in the original Base Case with the FGD compliance option. In our opinion, compliance with the RICE MACT standards for the slow speed diesels is the most costly, near-term compliance issue for the GPA generating assets.

#### Impact of MATS and 1-hour SO<sub>2</sub> NAAQS on Steam Boilers

GPA's compliance plans for the steam boilers combined the requirements of the MATS, which are well defined, with potential outcomes of the implementation of the 1-hour SO<sub>2</sub> NAAQS, which are quite uncertain at this time. GPA assumed the installation of FGD systems to lower SO<sub>2</sub> emissions at Cabras Units 1&2 and Tanguisson Units 1&2 would be required by the 1-hour SO<sub>2</sub> NAAQS. It was also assumed the FGD systems would reduce PM emissions sufficiently such that the affected units would reliably meet the MATS PM limit of 0.03 lb/MMBtu. The IRP assumed that each of Cabras steam boilers would incur a capital cost of \$80M and each of the Tanguisson units would incur a capital cost of \$30M for the installation of FGD systems and assumes 40% of the capital expenditures occurs in 2014 and 60% occurs in 2015.

At the time the IRP was prepared, it appeared that SO<sub>2</sub> reductions due to implementation of the 1-hour SO<sub>2</sub> NAAQS could be required by 2017. EPA has recently published guidance on timelines for establishing attainment status for states and territories with the 1-hour SO<sub>2</sub> NAAQS. This schedule is likely to delay implementation plans to lower SO<sub>2</sub> emissions at affected sources until the 2022 timeframe. GPA has submitted an Ambient Air Quality Monitoring Plan to the USEPA and is awaiting USEPA's approval of the proposed program.

We believe it is overly conservative to assume Cabras Units 1&2 and Tanguisson Units 1&2 will be required to install FGD systems in response to the 1-hour SO<sub>2</sub> NAAQS. This opinion is based on the uncertainty of whether Guam, or portions of Guam, will be deemed "non-attainment" with the 1-hour SO<sub>2</sub> NAAQS as well as the extended schedule for SIP submissions and SIP compliance dates. This opinion is further supported at Cabras since SO<sub>2</sub> reductions will occur at the Cabras/Piti complex in response to the RICE MACT, either through FGD installations as included in the current Base Case or switching to low sulfur fuels compatible with the installation of CO catalyst.

We believe the risk of needing future SO<sub>2</sub> reductions at Tanguisson in response to the 1-hour SO<sub>2</sub> NAAQS is higher than Cabras. This opinion is based on the preliminary dispersion modeling results submitted to Lummus

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<sup>3</sup> We note that FGD option would likely also require reheating the treated flue gas to higher temperatures required for efficient operation of the oxidation catalyst. The costs associated with reheating the treated flue gas do not appear to be included in the FGD option, which was included in the IRP.

Consultants by GPA and the fact there are no planned SO<sub>2</sub> reductions near this facility, as the case for the Cabras/Piti complex. However, it is our opinion that if confronted with a future decision to retrofit FGD at Tanguisson due to the 1-hour SO<sub>2</sub> NAAQS, it is likely that other options would be implemented (e.g. retirement or possibly conversion to peaking operation with diesel fuel) rather than make the substantial capital investment on units of this size, age, and low capacity factors.

It is Lummus Consultants opinion that the Base Case (no LNG) includes approximately \$185M to \$220M<sup>4</sup> in air quality control system expenditures that may not be required at Cabras 1&2 and Tanguisson 1&2. While adjusting for these cost reductions will reduce the PV of the Base Case, the reductions would not be sufficient to alter the conclusions relative to the merits of LNG conversion – for the Base Case fuel forecasts.

### ***Environmental Compliance Recommendations***

Although GPA considered the use of low sulfur diesel and LNG for the slow speed diesels, it appears that GPA has not performed an evaluation of other potentially low sulfur fuels that could be compatible with the use of CO catalyst on the slow speed diesels (e.g. methanol or dimethyl ether, or DME).<sup>5</sup> Such low sulfur fuel options would be expected to have lower infrastructure costs than delivering LNG to Guam and the primary feedstock used to create these fuels are non-petroleum based fuels (e.g., natural gas, coal, and biomass). Depending upon the projected delivered fuel costs and availability of these fuels to Guam, and required plant modifications, they could present a viable alternative to LNG or low sulfur diesel. It is recommended that GPA conduct upper level assessments of other low sulfur fuel alternatives prior to making final decisions to proceed with LNG development. It is Lummus Consultants opinion that GPA should consider derating Tanguisson Units 1&2 to 25MW to avoid being subject to the MATS standards and thus eliminate the compliance costs of installing electrostatic precipitators at these units. We believe GPA should carefully monitor the USEPAs implementation guidelines for the 1-hour SO<sub>2</sub> NAAQS. If in the future is determined that SO<sub>2</sub> emission reductions are required at Tanguisson Units 1&2, GPA should evaluate all compliance options at that time, including lower sulfur fuels (e.g. lower sulfur RFO, LNG if available), FGD retrofits, and retirements. It is our opinion that the retrofit of an FGD system for this size and age of plant would not be cost-effective.

### ***III – LNG Study***

R.W. Beck characterizes its LNG study as a preliminary feasibility study and Lummus Consultants agrees with that open assessment. Before an updated LNG study is performed, additional costs incurred, and a commitment made, we recommend that GPA, with fiscal support from the Commission for its investment:

- Prepare a detailed timeline detailing tasks, benchmarks that indicate the order in which studies need to be completed, and costs to determine that point at which there can be a ‘go / no-go’ decision for LNG.
- Enter into commercial discussions with potential LNG suppliers to ascertain the LNG volumes required to entice suppliers into long-term contracts or whether GPA will need to purchase LNG at spot market prices.
- Identify specific ships, routes, transit times and shipping volumes including frequency of shipments with incorporation of potential delays with recognition of the Authority’s 60-day LNG storage criterion.

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<sup>4</sup> \$220M reduction if FGD costs are removed. Approximately \$186M reduction if electrostatic precipitators are required at Cabras 1&2.

<sup>5</sup> The R. W. Beck LNG report does provide a discussion of producing methanol or DME from a hypothetical coal-gasification system on Guam. Lummus Consultants recommends evaluation of methanol or DME and other new alternatives as a delivered product to Guam rather than construction of a coal gasification facility.



- Prepare an updated economic analysis including sensitivity runs for fuel costs, construction costs, delivery delays, and other risks.
- Prepare a detailed assessment of the risks that such a project encompasses, including, cost overruns, natural disasters, the risk of losing ships at sea, risks associated with handling of LNG, among others.

#### IV – Reliability

The list of supply-side options considered in the IRP is generally consistent with what would be expected in the development of an IRP for a utility of this size and location. However, project specific information regarding the capital expenditures associated with life extension or environmental upgrades are provided only in the aggregate making it difficult to interpret.

Capital expenditures included in the GPA IRP are focused on improving efficiency and/or extending operating life and/or the addition of air quality control systems (AQCS). However, there is no discussion related to improving unit reliability.

Also, the IRP does not focus on improvements to transmission and distribution (T&D) system reliability that may improve system performance. The IRP presents reliability only in the context of generation reliability and resource adequacy in the form of adequate levels of reserve margin.

Lummus Consultants has a related concern as to the process used in developing the IRP. While the list of options considered is reasonable the constraints relative to the volume of LNG required to justify LNG terminal facilities combined with what in our view is an optimistic forecast for LNG prices, given historical volatility, well into the future essentially have eliminated all but a very few alternatives as realistic option

We recommend that:

- Future IRP's should include annual forecasts of specific capital expenditures by project for each unit.
- Future IRP's should integrate the planning for the overall system so that the Commission is provided a holistic perspective relative to system investment and prioritization of investment across the generation, transmission, and distribution framework.

#### V – Demand-Side Management

Demand-side management (DSM) initiatives can be an important adjunct to supply-side options. In our review of R.W. Beck's DSM study, we found a lack of transparency with respect to important details such as how avoided costs and program costs were developed. We also observed that whereas R.W. Beck indicated that they considered a wide range of options, no identification of those options were evident in the study. The study reported on only a narrow range of options and one of the options that was considered, i.e., compact fluorescent lighting, which is now low cost and ubiquitous, could have been replaced with light emitting diode (LED\_ lighting that have recently undergone significant increases in efficiency and reductions in cost).

Lummus Consultants recommends that in GPA's future DSM studies additional information is provided with respect to:

- Analyses and reporting for a wider range of DSM options, including but not limited to air conditioning (AC) cycling; retrofit of existing T-12 lighting fixtures to the more energy efficient T-8 and T-5 fixtures, as well as advances in existing technologies such as LED lighting and higher efficiency air-conditioning units.
- Greater technical detail with regard to equipment evaluated.
- Explicit discussion on how avoided capacity and energy costs were developed.

- Greater detail, including a breakdown of program costs for both the utility and the customer.
- Inclusion of the Participant Test
- Consideration of customer incentives.

#### *VI – Other Findings*

**Methodology** - Lummus Consultants understands the complexity of the IRP and recommends that GPA provide greater discussion and details of the decision process it follows using the base case and alternative cases so that the Commission and customers better understand the thought process and reason for its recommendations.

**Diversification Goal** – While shifting fuel sources to less expensive sources may be a good solution, the goal of diversification of fuel is largely unaddressed with GPA’s recommended solution. In parallel with its investigation of appropriate generation solutions, GPA should be required to invest in the transmission infrastructure to support increased reliance on native renewable resources such that Guam’s reliance on imported fuels is reduced and diversity is truly enhanced. As recommended in other areas of this report, additional investigation and due diligence should be undertaken prior to investing in and over-relying on a new fuel. Shifting from a high reliance on RFO to a high reliance on LNG does not sufficiently diminish GPA’s over-reliance on a single fuel for Guam’s energy future.

#### *Recommendations*

Lummus Consultants offers the following overall recommendations.

- GPA should proceed with the recommendations in the IRP; however the conversion to LNG requires a cautious approach, with multiple check-points along the project development path.
- R.W. Beck’s LNG study was a preliminary feasibility study. GPA should be required to submit a detailed LNG Project Implementation Plan. One of the components in the LNG Project Implementation Plan should include a detailed implementation schedule including durations and interfaces of key project activities (e.g. permitting, engineering to support permitting, Front End Engineering Design (FEED) studies, equipment procurement, project construction, start-up activities, etc.). The plan should also provide a projected cash flow projection consistent with the project schedule. The LNG Project Implementation Plan should also identify key decision-making milestones and expected expenditures to reach these milestones. One of the initial tasks may be to evaluate the feasibility and project economics of using a lower design volume of LNG, for example sufficient to replace the slow speed diesels and to supply a new NGCC plant. These results should be compared with the concept of complete conversion of the GPA system as currently planned.
- GPA should also provide a detailed LNG Fuel Procurement Study. As the whole LNG transition plan for Guam hinges on the availability and delivered pricing of LNG to the Island, the most important issue for justifying a “go forward” decision is the sourcing and pricing of LNG delivered to Guam. The study would need to identify specific potential suppliers of LNG to Guam and include discussions with such suppliers as well as preliminary indicative price offerings based on preliminary project specifications. The R. W. Beck report is approaching two years old and although it looked in general at the LNG market in that area, it doesn’t appear to include communication with specific LNG suppliers and discussions regarding preliminary indicative price offerings specific to Guam.
- GPA should consider performing an “Alternate Low Sulfur Fuel Study”. It appears little analytical work was performed on alternatives to LNG for the slow speed diesels (the most important near-term consideration of fuel switching). Lummus Consultants was not provided any reports, whether internally

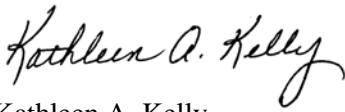
prepared by GPA or by outside consultants, which addressed the availability and price forecasts for alternative low sulfur fuels (e.g., methanol, dimethyl ether, or ultra-low sulfur RFO). As GPA obtains greater detail on capital expenditures for an LNG receiving infrastructure on Guam and the availability and pricing of LNG delivered to Guam, an Alternate Low Sulfur Fuel Study will provide an added benchmark to the attractiveness of LNG. d to consider other options other than LNG or ULSD.

- GPA should enhance the presentation of the IRP to include a full description of the base case and alternatives used in its modeling along with a rationale for why these are the appropriate choices for comparison for Guam's future energy supply.

We expect to have a discussion of these findings and are prepared to meet at your convenience.

Sincerely,

Lummus Consultants International, Inc.



Kathleen A. Kelly  
Vice President and Practice Lead