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ICF CONSULTING

January 30, 2006

MEMORANDUM

TO: City Commissioners, Madame Mayor

FROM: Judah Rose, ICF Consulting
King Lin
David Pickles

SUBJECT: Options

The purpose of this letter is to respond to requests made during the Public Meeting last Thursday that one of the three options chosen by ICF to analyze be changed. Namely, it was suggested that ICF not analyze a 220 MW natural gas-fired combined cycle but instead replace it with a hybrid option with greater focus on renewables. ICF has interpreted that request to mean a 75 MW biomass oriented solid fuel power plant combined with "maximum"[1] demand side management (DSM). ICF is seeking additional input on this matter.

If this alternative approach is selected by the Commission, ICF would analyze biomass supply as an uncertain variable, achieving this greater treatment of biomass uncertainty by decreasing the number of electricity demand growth scenarios to four from six.[2]

Current Options

ICF proposed analysis of four options: (1) a 220 MW Circulating Fluidized Bed Combustion (CFBC) plant fueled by solid fuel (the GRU option), (2) a 220 MW Integrated Gasification Combined Cycle (IGCC) fueled by solid fuel, (3) a natural gas-fired plant using combined cycle technology, and (4) maximum DSM by short term purchase power or sales as appropriate. Since the first option is specified by contract, and the total is limited to four, ICF proposed actually only three options.

One aspect of ICF's approach is that by having distinct solid fuel, gas and DSM options, linear combinations can be created by the Commission. These combinations would provide approximations of a more detailed analysis option of mixed strategies, e.g., part gas, part solid fuel.

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[1] Maximum has the meaning used in the ICF Power Point document.
[2] Each demand scenario is a combination of demand growth before DSM and DSM.

Biomass and the Two Solid Fuel Options

ICF has concluded that a combination of petroleum coke and coal is likely the least cost solid fuel choice[3], but that the actual choice in the modeling and in reality will depend on fuel prices at the time, and environmental considerations. For example, high CO_2 emission allowance prices, or low biomass prices favor all else equal biomass over either coal or petroleum coke. Alternatively, a decision to support local biomass production or to favor biomass for reasons beyond the actual binding federal or state regulations could also favor biomass.

There is nothing about the decision to build CFB or IGCC solid fuel plants that irreversibly locks in one solid fuel over another. The solid fuel options are different technologies than the current solid fuel technology in use in most utility plants. Put another way, the difficulties in using biomass or pet coke or most U.S. coal options at the current Deerhaven 2 will not apply to the proposed plants. This is especially the case when one considers that the plant's lifetime is 30 years or more which gives a chance to retrofit fuel handling equipment. Conversely, the construction of a smaller solid fuel plant set up primarily for biomass does not preclude the eventual use of petroleum coke or coal at this plant since the required retrofits to use alternative fuels are not likely to be so substantial to rule out full or partial fuel change out. The only solid fuel power plant choice under consideration will be flexible – as a technical matter there is no such thing in the context of this study of a coal only or a biomass only plant.[4]

As a purely technical matter, ICF is currently of the view that it may be feasible for all of the solid fuel delivered to the CFBC or IGCC plants to be biomass. In other words, under two of the three current generation options, the two involving solid fuel, the CFBC, and the IGCC, the entire 220 MW of power could be generated from biomass. While this technical issue is still under study[5], it is worth emphasizing the extent to which the ICF proposed options could result in very high demand for biomass under favorable economic and regulatory circumstances. A 220 MW biomass only facility would need 15 trillion BTU per year. This requires approximately 5,000 square miles worth of biomass, drawing trucks from a 40 mile radius. If supply projections turn out to be overly optimistic, the area, distances, and costs could be higher.

Natural Gas Combined Cycle

The reasons ICF proposed the natural gas combined cycle have been articulated orally in four meetings with Commissioners, one in public, and supported by the

provided on the web site. Also, ICF anticipated additional description of its approach in its reports. Nonetheless, it is useful to further describe ICF's thinking in this regard.

ICF included the natural gas option because:

- **CO_2** – The four options allow for coverage of the full range of CO_2 emissions outcomes which many of the Commissioners indicated was an important issue. ICF concurs this is an important issue based in part on the potential for actual greenhouse emission control regulations in the future. The likely CO_2 emissions of the CFBC on fossil fuel is approximately 1.5 million tons per year, compared to 1.3 million tons for the IGCC, 0.9 million tons for the combined cycle, and zero for the DSM. The absence of the natural gas option leaves a gap in the range of CO_2 outcomes, though greater use of biomass (a zero CO_2 option) in the solid fuel plants can decrease CO_2 emission proportionately.

- **Health and Emissions** – The natural gas-fired combined cycle plant has the lowest emission and possible local health impacts of any option involving fossil fuel.

- **Capital Costs** – The size of the combined cycle capital investment is only approximately $150 million, versus approximately $450 to $550 million for the solid fuel options. This lower capital costs can be a huge advantage offsetting higher fuel costs, especially if the current phase of high oil and natural gas prices ends faster than expected. Thus, while the current high fuel costs may appear to make the natural gas option a "straw man", the lower capital costs combined with environmental and health considerations make the gas option a real option that the Commissions may choose.

- **Financial Advantage of Municipals** – In the event that no decision is made regarding solid fuel, and if DSM does not sufficiently slow the electricity demand growth of GRU (which historically has been strong and exceeding the US average growth), electric power including the capital component will have to be purchased at open market prices from entities without the financing advantages of municipals. Municipals are exempt from paying income tax and can issue tax free bonds.

- **Flexibility Options for Deferring Decisions** – Once the combined cycle comes on-line, it can be converted to an IGCC and provided a solid fuel option – e.g., biomass, coal, pet coke, etc. Thus, the decision on solid fuel can be deferred, e.g., until CO_2 regulations are imposed, demand growth uncertainty is resolved, etc.

- **Proven Technology** – There is little perceived technology risk and little fuel risk in terms of delivery.

- **Financial Community Receptivity** – The financial community is currently involved in financing new combined cycles today albeit at a much lower pace than in recent years. There will be no issues regarding lowered bond rating associated with technology risk. Florida is adding 7,000 MW of gas-fired combined cycles (i.e., under construction, permitted, under study, or on hold), and in the U.S., approximately 100,000 MW are planned, permitted, under construction, or under study.

- **Comparability and Clarity** – Our contract requires specific options be analyzed. The 220 MW option is comparable to the GRU option in size and clarifies the trade-offs.

- **Economic Size** – The smallest sized combined cycle using the current Frame F technology, the most prevalent advanced high efficiency combined cycle technology, is approximately 220 MW. Thus, a gas plant with a size similar to the CFBC is feasible and, in fact, optimal in terms of capital cost economies of scale.

- **Flexibility and Electricity Demand Growth** – Unless GRU's electricity demand growth slows, 220 MW represents 12 to 16 years of growth in peak demand. Thus, smaller sizes would require frequent decisions, while the 220 MW size is not so large as to preclude decisions in ten years or so for a new technology based plant.

These reasons are offset to some degree by the high expected price of natural gas and the expected high volatility of natural gas prices. Our initial judgment was that evaluation of this trade-off should be made by the City Commission. Nonetheless, it is not unreasonable to conclude that the Commission's focus should be elsewhere since current high gas prices make this choice less attractive.

Smaller Biomass Oriented Solid Fuel Plant

As noted, ICF believes the next best option is a biomass scale solid fuel power plant. Before reviewing why it was next best, it is worth describing why it came after natural gas. These reasons include:

- In the event GRU's electricity demand continues, a biomass scale (75 MW) plant would represent as little as five years of demand growth. If the DSM option does sufficiently decrease demand, the default becomes use of oil and gas power purchased off the grid.

- The capital costs of a smaller plant are higher per kilowatt and per kilowatt hour. Thus, the 75 MW plant would cost approximately $200 million to build versus $140 million for a gas combined cycle with close to three times the generation capacity (i.e., 220 MW).

- The fuel costs of non-biomass solid fuel today could be as low as $1.25/MMBtu and the last thirty MW of biomass could cost $2-3/MMbtu.

- The amount of biomass is limited and the supply situation uncertain. Biomass appears to be best suited to co-firing in a larger plant that can flexibly respond to future information about environmental regulations and actual biomass conditions.

Advantages of 75 MW Solid Fuel/Biomass with Maximum DSM

The advantages of replacing the combined cycle with a 75 MW solid fuel plant oriented to biomass combined with maximum DSM include:

- The capital investment in generation is less than for the larger solid fuel options – approximately $210 million versus $450 to $550 million.

- The combination of the options (biomass orientation plus DSM) makes clearer an approach which tries to defer large capital commitments as long as possible until there is greater clarity about major uncertainties.

- The combination of options, maximum DSM and biomass oriented solid fuel plant, could have the least CO_2 emissions depending on purchase power.

Sensitivities

It is useful for context to recognize that we plan to analyze over 2,000 years of conditions as described in the overview document. This reflects alternative demand, fuel, and regulatory scenarios over many years.

Conclusions

ICF wants to evaluate options that the City Commission and Mayor believe are the most appropriate and useful. Feedback from the City is valuable to us and greatly appreciated. The citizens have given great thought to these issues and we are benefiting from this. However, we have a tight schedule, and accordingly, feedback on this issue must be provided as soon as possible and before Friday, February 3 in all cases. In the absence of Commission feedback, ICF must choose the options as necessary to meet the schedule which involves analysis starting this week.