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ORIGINAL

TECO
TAMPA ELECTRIC

BEFORE THE
FLORIDA PUBLIC SERVICE COMMISSION

DOCKET NO. 07_____-EI
IN RE: TAMPA ELECTRIC'S
PETITION TO DETERMINE NEED FOR
POLK POWER PLANT UNIT 6

TESTIMONY AND EXHIBIT
OF
MARK J. HORNICK

ORIGINAL

BEFORE THE FLORIDA PUBLIC SERVICE COMMISSION

PREPARED DIRECT TESTIMONY

OF

MARK J. HORNICK

Q. Please state your name, business address, occupation and employer.

A. My name is Mark J. Hornick. My business address is 702 North Franklin Street, Tampa, Florida 33602. I am employed by Tampa Electric Company ("Tampa Electric" or "company") in the position of General Manager - Polk and Phillips Power Stations.

Q. Please provide a brief outline of your educational background and business experience.

A. I received a Bachelor of Science Degree in Mechanical Engineering in 1981 from the University of South Florida. I am a registered professional engineer in the state of Florida. I began my career with Tampa Electric in 1981 as an Engineer Associate in the Production Department. I have held a number of engineering and management positions at Tampa Electric's power generating stations. From 1991 to 1998, I was a manager at Big Bend Station with various responsibilities including serving as Manager of Operations from 1995 to 1998. In July 1998, I was promoted to Director - Fuels where I was responsible for managing Tampa Electric's fuel procurement and transportation activities.

In March 2000, I transferred to my current role of General Manager - Polk and Phillips Power Stations. I am responsible for the overall operation of these two generating facilities. I have broad experience in the engineering and operation of power generation equipment including IGCC technology. I serve on the Electric Power Research Institute's "IGCC Experts Panel." I am currently the Chairman of the Gasifier Users Association, an international group of users and potential users of gasification technology.

Q. What is the purpose of your testimony?

A. My testimony provides a summary of Tampa Electric's successful experience with integrated gasification combined cycle ("IGCC") technology at Polk Station. I explain how IGCC technology functions and how it compares to conventional coal technology in terms of reliability, efficiency and emissions. My testimony discusses the commercial status and viability of IGCC technology. I describe how Tampa Electric's previous experience with Polk Unit 1 and the ability to expand on the existing Polk Station site will provide benefits to Polk Unit 6. Finally, my testimony discusses how IGCC technology is well suited to deal with potential renewable energy portfolio standards and carbon dioxide ("CO_2") emissions regulation.

Q. Have you prepared an exhibit to support your testimony?

A. Yes, Exhibit No. _____(MJH-1) was prepared under my direction and supervision. It consists of the following five documents:

Document No. 1	Water Loss Comparison
Document No. 2	Polk Unit 1 Availability
Document No. 3	CO_2 Mitigation Costs
Document No. 4	Potential CO_2 Removal Levels
Document No. 5	Water Use Comparison

OVERVIEW OF POLK UNIT 1 AND IGCC TECHNOLOGY

Q. Please provide an overview of Tampa Electric's experience with IGCC technology.

A. Tampa Electric is the world leader in power generation from coal-derived synthesis gas, or syngas. The company has 14 years of experience with IGCC technology, beginning with the design, construction and operation of the 255 MW Polk Unit 1. Polk Unit 1 has been in commercial operation for over 10 years, and it is one of the best known and highly acclaimed power generating units in the world. Polk Unit 1 was named Power Plant of the Year in 1997 by *Power Magazine*. In 2000, Polk Unit 1 was inducted into the Power Plant Hall of Fame. The unit has been the subject of dozens, if not hundreds, of articles in technical journals, magazines, newspapers, radio and television.

Conceptual design for this innovative power plant began in 1993. On-site construction began in 1994, and the unit entered commercial operation in September 1996. Polk Unit 1 was partially funded by the U.S. Department of Energy ("DOE") as part of the Clean Coal Technology, Round III demonstration program. The DOE views gasification and IGCC as a key technology for the future. The DOE's view is that "environmentally responsible coal production technologies will allow the United States to meet growing electricity demand and to lay the foundation for a sustainable hydrogen economy." Polk Unit 1 provides a demonstration of the commercial success of the technology to potential users of IGCC technology. Polk Station has hosted well over 4,000 visitors from industry and academia as well as governmental and elected officials from around the world. Recently, Polk Station has welcomed three U.S. Senators, Congressional staff, U.S. Administration officials, U.S. Environmental Protection Agency division heads, Energy Ministers from the United Kingdom and Poland, and high level delegates from China, Japan, Korea, India, Russia, South Africa, Venezuela, Mexico and Canada.

Polk Unit 1 uses IGCC technology to generate power from coal and other low cost solid fuels, while producing very low emissions. The unit has been rated as the cleanest coal-fired power plant in North America by the Energy Probe Research Foundation. The gasification technology at Polk Unit 1 allows flexibility in the use of various feedstocks to produce electricity, including the capability to burn large quantities of low volatile fuels, such as petroleum coke ("pet coke"). Polk Unit 1 has used over 20 different coals and blends of coals and pet coke. By using plentiful, low cost coal and pet coke, Polk Unit 1 provides Tampa Electric's customers with clean, reliable, low cost electricity. Polk Unit 1 currently has the lowest fuel cost of any unit on the Tampa Electric system. Polk Unit 1 has also successfully demonstrated the use of renewable fuels by co-gasifying biomass at up to five percent by weight of the feedstock.

Q. How does IGCC generating technology work?

A. IGCC technology uses the gasification process to convert solid fuels, such as coal, pet coke and biomass, into a syngas that is used to fuel a combustion turbine generator to create electricity. The syngas is cleaned of impurities such as particulate matter ("PM"), sulfur and mercury prior to being used as a fuel. Waste heat from the combustion turbine is recovered in the form of steam, which is used in a steam turbine to generate additional power. Using a combustion turbine along with a steam turbine for power generation is known as a combined cycle process. By integrating the gasification process, along with the highly efficient combined cycle power generating equipment, IGGC technology allows the use of low cost solid fuels to produce power efficiently and with extremely low emissions.

COMMERCIAL AVAILABILITY OF IGCC TECHNOLOGY

Q. Are IGCC units commercially available and viable for power generation?

A. Yes, IGCC generating units are commercially available and are a viable option for baseload power generation. The technology expected to be used for Polk Unit 6 is being commercially offered by an alliance of General Electric ("GE") and Bechtel, two of the largest and most respected equipment and architectural/engineering providers in the electric power industry. The GE technology was originally developed by Texaco Corporation and is widely used for not only power generation, but also for the production of chemicals, ammonia based fertilizers, and hydrogen. The GE gasification system has the largest market share and greatest installed base of entrained flow gasification technology.

IGCC technology is also being commercially offered by the Shell group as well as by an alliance between ConocoPhillips, the Fluor Corporation and Siemens Power Generation. These systems, while viable, are not the optimum choice for Polk Unit 6. The GE IGCC system is the same technology currently in use at Polk Unit 1, where technical challenges have already been resolved. By using the same IGCC system as Polk Unit 1, there will be substantial savings in personnel training, maintenance practices, spare parts and support services.

There are numerous second generation IGCC plants being planned around the country, using either the GE technology or the other IGCC technologies. The argument that IGCC technology is not commercially ready until some number of units, 10, 50, or 100, are operating is difficult to support. Following that logic, no technology could ever be considered commercially ready if all potential users waited for others to "go first".

Q. Is IGCC technology used successfully at Tampa Electric's Polk Station?

A. Yes, by a number of measures, IGCC technology has been successfully implemented by Tampa Electric. The company has used IGCC technology to generate more than 13 million MWH of electricity. Polk Unit 1 operates reliably, with an availability rate equal to or greater than that of typical existing conventional coal units. Polk Unit 1 has demonstrated that combustion turbines can operate well using syngas as a fuel and has not experienced reliability problems associated with IGCC operation.

Polk Unit 1 has very low emissions and, as I stated previously, the unit has operated well on a broad range of solid feedstocks.

OTHER "LESSONS LEARNED" FROM POLK UNIT 1

Q. Is IGCC technology safe?

A. Yes, the plant has been successful in using IGCC technology in a safe manner with recordable injury rates averaging approximately 50 percent less than the general industry average. Like all industrial technologies, IGCC has specific hazards that must be appropriately controlled and addressed. These facilities are governed by the Occupational Safety and Health Administration's Process Safety Management regulations which provide specific requirements for safe operation.

Tampa Electric considers safety its highest priority. Specific operations and maintenance ("O&M") procedures and practices have been developed to ensure the safe operation of the IGCC technology at Polk Unit 1. In addition to equipment specific safety procedures, Tampa

Electric has multiple safety programs that address hazardous energy control, safe work practices and employee safety awareness. These programs are all applicable to the operation of an IGCC unit and provide an excellent safety environment for Tampa Electric team members.

Q. Are IGCC units large enough to meet today's generation needs?

A. Yes. First generation IGCC units, such as Polk Unit 1, were typically in the 250 MW size range. This next generation of IGCC units are in the 630 MW size range. As discussed in the testimony of witness Michael R. Rivers, Polk Unit 6 will be configured with two gasifiers, feeding two combustion turbines each with a heat recovery steam generator that will supply steam to a single, common steam turbine. The total net output of the unit is expected to be 647 MW and 610 MW for winter and summer, respectively. Units of this size have good economies of scale and are not so large as to upset the stability of the generating system upon the loss of one generating unit.

Q. Please describe the key advantages of an IGCC generating unit compared to a conventional coal unit.

A. Since IGCC units process fuels differently and use a more advanced power cycle to produce electricity, they provide a number of advantages compared to conventional coal units. IGCC units can be designed to use a wide range of fuels and since the gasification process is conducted at very high pressures and uses pure oxygen instead of air, it is capable of using up to 100 percent pet coke as a fuel. Conventional pulverized coal units are generally limited to a maximum of 20 percent pet coke, blended with coal as a fuel. The ability to use such a high percentage of pet coke, which is lower in cost than coal, is an important factor in reducing the cost of electricity from IGCC units.

Biomass contains carbon and hydrogen which can be co-gasified along with coal and pet coke in an IGCC unit. The cost of biomass for use as a fuel has generally been higher than other solid fuel alternatives. If these economics change, or if renewable energy portfolio standards are enacted, IGCC units will be able to include biomass in the feedstock mix.

The power block of IGCC units can also operate on a backup fuel, which will be natural gas for Polk Unit 6. This capability, in combination with the wide range of solid fuels that can be utilized, gives IGCC units greater fuel flexibility than any other technology.

In the IGCC process, impurities are removed from the fuel gas prior to use in the combustion turbine. In conventional coal units, pollutants are removed from the flue gases leaving the boiler after combustion. The volume of high pressure syngas in the IGCC process is over 100 times less than the flue gas in conventional units. This reduces the size and increases the effectiveness of pollution control equipment used in IGCC versus conventional coal technology. IGCC units such as Polk Unit 6 will have lower emissions of sulfur dioxide ("SO_2"), nitrogen oxides ("NO_x") and PM than even the cleanest of the new, proposed conventional coal units. A comparison of the typical emissions is provided in the testimony of witness Paul L. Carpinone.

IGCC units can control the emissions of mercury that result from burning coal to a very high degree, with over 90 percent removal, by using an activated carbon bed in the syngas stream. The ability to burn pet coke in IGCC units also has an advantage related to mercury emissions, because pet coke does not contain mercury. Conventional coal units rely on mercury removal in the wet limestone scrubbers and selective catalytic reduction equipment that is not explicitly designed for mercury removal. The mercury contained in certain types of coal can be very difficult to remove in these systems. The use of activated carbon injection can aid mercury removal in conventional coal units, but this renders the flyash unsuitable for beneficial reuse and it must be disposed of in a proper manner.

CO_2 capture from coal derived syngas is a commercially proven process that has been used for decades in gasification plants around the world. This technology can be applied to IGCC units to remove CO_2 from the syngas prior to use in the combustion turbine. Although CO_2 is not currently regulated, it is possible that CO_2 regulation could be enacted sometime during the operating lifetime of Polk Unit 6. This unit will be engineered and constructed to have the ability to add the equipment necessary for carbon capture. As I previously stated, conventional coal units will have to perform CO_2 capture from the flue gas stream, which will require much larger and more expensive equipment to capture carbon than IGCC technology.

The byproducts produced from the IGCC process can generally be beneficially reused, which provides the benefit of minimizing potential issues associated with byproduct disposal. The slag produced from Polk Unit 6 will be sold to the cement industry. The sulfur that is removed from the syngas will be converted into sulfuric acid and sold for industrial uses. Some of the byproducts from conventional coal units can also be sold; however, the use of advanced pollution control equipment often negatively impacts the ability to sell these byproducts.

IGCC units generally consume about one third less water than conventional coal units. This is due to the fact that combined cycle systems use less water than steam cycle systems. A table showing water losses from various coal generation technologies is presented in Document No. 1 of my Exhibit No. _____ (MJH-1). Polk Unit 6 will also use the existing cooling reservoir which requires less makeup water than cooling tower systems.

IGCC units are more efficient than most conventional coal units. Combined cycle is a more efficient process than using a steam turbine alone. Oxygen blown IGCC units consume a large amount of power in the air separation process; however, even with this internal power demand, IGCC units are still extremely efficient. Conventional coal combustion units can improve cycle efficiency by operating at higher steam pressures and temperatures. Units that operate above 3,208 psi are known as "supercritical units" since the steam is above the thermodynamic "critical point" of water, or the point at which there is no distinguishable difference between steam and water. Some proposed supercritical units operating at extreme steam temperature and pressures have efficiencies equal to or perhaps slightly better than IGCC units. While increasing the pressure and temperature of the steam improves cycle efficiency, it also imposes additional demands on the system components which increases cost and may reduce reliability. Units that operate at very high pressure and temperature are sometimes termed "ultra-supercritical"; however, this is more of a marketing description than a thermodynamic property.

Q. What has been the reliability of Polk Unit 1?

A. The reliability of Polk Unit 1 was lower than desired during early operations due to issues with new technology and application at a larger scale than previously done. As Tampa Electric worked through these issues, reliability steadily increased. While operating on a coal and pet coke blend, Polk Unit 1 is as reliable as a typical coal-fired unit, with availability of approximately 80 percent. A table of historical availability for Polk Unit 1 is presented in Document No. 2 of my Exhibit No. _____ (MJH-1). As I previously discussed, IGCC units have the inherent capability to produce power by using a backup fuel for the combined cycle power block. Polk Unit 1 uses distillate oil as a backup fuel. Therefore, overall power production availability for Polk Unit 1 has been above 90 percent, which is superior to almost all conventional coal-fired units.

Q. Is IGCC cleaner than conventional coal fired units regarding regulated emissions such as SO_2, NO_x and PM?

A. Yes, as described in the testimony of witness Carpinone, Tampa Electric's proposed IGCC unit will have much lower emissions than any conventional coal plant recently proposed in the state of Florida. Recently, emissions comparisons have been made between existing IGCC facilities and proposed coal-fired facilities entering service five years from now. The existing IGCC plants were designed more than 15 years ago. Just as improvements have been made in conventional coal technology to the point that the coal fired units currently being planned have emissions near to existing IGCC plants, IGCC technology has also progressed. The new generation of IGCC plants will be cleaner than the proposed conventional coal fired units. The new IGCC units will also have environmental advantages of cost-effective mercury removal, and the ability to deal with CO_2 emissions.

Q. How will Tampa Electric's previous experience designing, building, owning and operating an IGCC unit enhance the operation of Polk Unit 6?

A. Tampa Electric has made numerous advances in state of the art IGCC technology in its more than 10 years of operation of Polk Unit 1. During initial operations, Tampa Electric overcame technical challenges associated with the scale up of equipment and demonstration of new technologies. The reliability of the generating equipment steadily improved into the early 2000's. Advances were also made in the IGCC plant emission control equipment that reduced SO_2 emissions by 30 percent and NO_x emissions by 40 percent, compared to initial operations.

Tampa Electric is committed to incorporating lessons learned from Polk Unit 1 to the greatest extent possible when designing Polk Unit 6. This should allow Polk Unit 6 to avoid a protracted startup and problem solving period during early operations.

Q. How did Tampa Electric develop successful operating practices for the application of IGCC technology at Polk Unit 1?

A. Polk Station has developed extensive O&M practices and procedures specifically tailored to the requirements of an IGCC plant. Operational procedures ensure that equipment is operated safely and in accordance with environmental regulations. The station maintenance department has developed preventative and predictive maintenance procedures to ensure equipment reliability. Lessons learned from operating the existing IGCC unit are continuously incorporated into the maintenance program. These existing O&M practices are directly applicable to Polk Unit 6.

Q. Will Tampa Electric's experience operating Polk Unit 1 affect staffing and training for Polk Unit 6?

A. Yes. The operations of Polk Unit 6 will be improved by incorporating the staffing and training successes of Polk Unit 1. Polk Station operates in a high performance self-directed team environment where front line craft personnel perform O&M tasks and are well trained to ensure the safe and reliable operation of the facility. These successful human resources practices will also be used for the staffing and operation of Polk Unit 6.

Operational training for Polk Unit 1 was conducted with the use of a plant simulator, which was necessary since personnel did not have experience with the operation of an IGCC facility. However, training of new personnel for Polk Unit 6 will be greatly enhanced by the ability to conduct on-the-job training at Polk Unit 1.

Q. Please describe the advantages of using the existing Polk Station site to locate the proposed IGCC generating unit.

A. The Polk Station site consists of over 2,800 acres in southwest Polk County. The Polk Station site was originally selected by a 17-member community based task force which selected the site as the most suitable for developing the needed generating facilities.

There is substantial existing infrastructure at the Polk Station site that will support Polk Unit 6. A 750 acre cooling reservoir exists at the site that can be used to serve the majority of the cooling requirements of Polk Unit 6.

The site is currently served by four 230 kV transmission circuits and can be upgraded to handle the additional output of Polk Unit 6. The existing on-site substation can be readily expanded to accommodate switching for Polk Unit 6. This expansion is described in more detail in witness Thomas J. Szelistowski's testimony.

Polk Station is accessed by paved roads for truck and other vehicle traffic, and an existing rail line is used for large equipment deliveries. Facilities to unload rail cars for coal delivery will be added to serve Polk Unit 6. The site has the space to accommodate a coal storage yard. Polk Station is currently served by a natural gas pipeline that can provide fuel for gasifier warm-up and operation of the power block up to full load output. Additionally, another natural gas pipeline is located nearby and could potentially be extended to the site, if needed.

Polk Station has an existing administration building, control room, warehouse, maintenance shop, construction management building, first aid building and laboratory that can, with modifications, serve Polk Unit 6. The site has over 40 acres of space immediately adjacent to the footprint of Polk Unit 6 that can be used for new equipment deliveries and construction staging.

Tampa Electric has established relationships with dozens of service providers and specialty contractors located in the immediate area surrounding the site. This network is indispensable for both general plant maintenance activities and work that is specific to an IGCC plant. With these providers, the company has established a level of knowledge and familiarity with Tampa Electric's Polk Station site, IGCC plant equipment and facilities, and safety procedures that will be directly applicable to Polk Unit 6.

OTHER ENVIRONMENTAL CONSIDERATIONS

Q. Does IGCC technology have the capability to utilize renewable fuels?

A. Yes. IGCC units can accommodate a portion of biomass in the fuel feedstock. Polk Unit 1 has been successfully tested with up to five percent by weight of biomass in the fuel feedstock without adverse impacts to gasifier operation or unit emissions. Specific material handling systems must be designed for successful use of biomass on an ongoing basis. Due to its low energy density, the cost of biomass as a fuel is strongly dependent on harvesting and transportation costs.

Q. Did Tampa Electric consider the potential for future CO_2 regulation when selecting IGCC technology for Polk Unit 6?

A. Yes. Tampa Electric considered potential CO_2 regulation when selecting IGCC technology for its next unit. IGCC technology has a clear advantage over other coal-based power generation systems for carbon capture. The removal of CO_2 from coal-derived syngas is a proven technology that is in commercial service in dozens of facilities around the world. Tampa Electric considered this advantage in selecting the best alternative for baseload capacity addition.

Q. What potential option exists for the long term storage of CO_2 that is captured from the power generation process?

A. The most commonly considered option for long term CO_2 storage is geologic sequestration. Tampa Electric has worked with the University of South Florida to evaluate the potential of geologic storage of CO_2 beneath the Polk Station. This study identified a deep saline aquifer with an appropriate confining layer above it that appears to be capable of storing large quantities of CO_2. There are public policy issues involving the permitting of large quantity injection wells and long term liability for the sequestered CO_2. These issues must be resolved to make sequestration viable as a solution to CO_2 emission control.

Q. How does the process for removing CO_2 for an IGCC unit compare to the removal process for a conventional coal unit?

A. As I described earlier, in the coal gasification process, coal is converted to a fuel gas at high pressure. The CO_2 can be removed from this low volume fuel gas before it is burned in the combustion turbine to produce power. The equipment needed for CO_2 removal from the high pressure, low volume fuel gas is much smaller and more effective than proposed post-combustion systems for removing CO_2 from the flue gases of combustion-based processes. The energy required to cool the gas, release the absorbed CO_2 and compress it for storage is also much less for IGCC units than the proposed systems for post combustion removal and storage from conventional coal units. The costs of CO_2 capture for various power generating technologies have been evaluated by the DOE's National Energy Technology Laboratory ("NETL") in its report issued on May 15, 2007 and are shown in Document No. 3 of my Exhibit No. _____ (MJH-1).

Q. Is carbon capture capability commercially proven for either IGCC technology or conventional coal technology?

A. For IGCC technology, the processes and technology required to capture CO_2 from syngas are known and currently being used commercially at numerous industrial, non-power generation gasification facilities around the world. In addition, the processes and technology required to sequester CO_2 are also currently being used at several sites, including the Dakota Gasification Plant in Beulah, North Dakota, which currently sells over 1 million tons per year of CO_2 for use in enhanced oil recovery. While it is true that there are no operating IGCC power plant facilities currently performing CO_2 capture and sequestration, each of the technical issues associated with implementation at an IGCC power plant has been commercially demonstrated at other, non-power plant gasification facilities. Installation of CO_2 capture and sequestration equipment has not occurred due primarily to the cost of the equipment and the impact to the unit's operation.

Q. Will carbon capture affect the proposed unit's operation?

A. Yes. The addition of carbon capture and sequestration equipment would affect the operation of Polk Unit 6. Energy is required to perform the removal of CO_2 from syngas and for the compression needed for geologic sequestration. The amount of energy needed varies with the quantity of CO_2 that is required to be removed. The level of CO_2 removal that will be required from power generation units in the future is unknown at this time. For IGCC units, there are three levels of removal that represent potential design points; however, these design points are neither equally likely nor equally cost-effective and otherwise feasible. Each succeeding carbon removal level would require greater costs and a larger reduction in the net output of Polk Unit 6. Document No. 4 of my Exhibit No. _____ (MJH-1) describes each of the levels and their effects on plant operations.

The overall cost of CO_2 removal will be a function of the percentage of CO_2 required to be removed. Studies have concluded that the costs and impacts of CO_2 capture are lower for IGCC technology than for other fossil fuel based generating technology. The most recent and comprehensive studies on CO_2 capture and storage are: "The Future of Coal" performed by the Massachusetts Institute of Technology ("MIT"), published in April 2007 and "Cost and Performance Baseline for Fossil Energy Plants" performed by the NETL, published on May 15, 2007. These studies indicate that CO_2 capture and storage at the 90 percent level will decrease IGCC plant efficiency by 15 to 19 percent and will decrease supercritical pulverized coal ("SCPC") plant efficiency by 24 to 30 percent. The studies also conclude that CO_2 capture and storage at the 90 percent level will increase the cost of electricity from IGCC plants by 27 to 32 percent and will increase the cost of electricity from SCPC plants by 61 to 81 percent.

The addition of CO_2 capture and storage at the 90 percent level to natural gas combined cycle ("NGCC") units is estimated by NETL to reduce efficiency by 14 percent and increase the cost of electricity by 43 percent.

The addition of carbon removal equipment will also increase the demand for water at power generating facilities. For IGCC technology, the increase is estimated a relatively modest 14 percent as compared to the estimated 123 percent increase for conventional coal units. A comparison of raw water usage for various technologies is shown in Document No. 5 of my Exhibit No. _____ (MJH-1).

Q. In conclusion, is IGCC technology experimental and does it require unique skills that are beyond the capability of utility companies to operate?

A. No. Gasification technology has been commercially used for over 100 years. Coal gasification was used for street lighting in London in the middle 1800's. Germany used coal gasification to fuel their war effort during World War II. South Africa made extensive use of coal gasification for the manufacture of liquid transportation fuels when faced with trade restrictions in the 1980's and 1990's and continues to do so today.

Q. Please summarize your testimony.

A. Tampa Electric's selection of IGCC technology to provide additional solid fueled, baseload generating capacity is appropriate and well founded. Polk Unit 1 has the lowest fuel cost on the Tampa Electric system, and the unit has been independently rated as the cleanest coal fired power plant in North America.

The IGCC system in use at Polk is no longer a "demonstration technology." Coal gasification has been used for over 100 years. IGCC, the use of coal derived syngas to power a combustion turbine in combination with a steam turbine, has been practiced for over 20 years. Commercial systems are now available from major international corporations such as GE, ConocoPhillips, the Shell Group, and Siemens Power.

IGCC offers unsurpassed fuel flexibility and is capable of operating on a wide variety of coals, low cost pet coke and can incorporate biomass as a portion of the fuel feedstock. The power block can also operate using natural gas as a fuel, which is flexibility no other solid fuel technology can offer.

The emissions from IGCC have always been very low. Polk Unit 6 will be even cleaner and will have significantly lower emissions of SO_2, NO_x, PM and mercury than the latest proposed pulverized coal units. IGCC also uses one third less water than pulverized coal technology.

The reliability of IGCC units has improved over time. Early design issues have been resolved and the lessons learned will be incorporated into Polk Unit 6. Unit availability is estimated at an outstanding 95 percent.

The advantages of locating the new generating unit at the existing Polk Station site are significant. The site, which was originally selected by a community-based group, is adequately sized for the expansion and has significant infrastructure already in place such as the cooling reservoir, the four transmission lines that can be upgraded, the existing natural gas line, and the existing rail line. In addition, the experienced staff, general service buildings and local contractor support will benefit Polk Unit 6.

While Polk Unit 6 makes sense for the challenges of today, it is also well positioned for the future. Renewable sources of energy, such as biomass, are increasingly discussed as potential requirements in the future. Should the economics of biomass as a fuel change, or if a renewable energy standard is enacted, the IGCC technology will be capable of gasifying biomass as a portion of the fuel feedstock.

Although no regulations currently exist restricting the emissions of CO_2, the concern over greenhouse gases is increasing the potential for future CO_2 regulations. IGCC technology has a very important advantage with respect to CO_2 capture. Proven technology is commercially available for the removal of CO_2 from coal derived syngas. This is not the case for other fossil fueled technologies. Polk Unit 6 will be designed to allow for the addition of the equipment needed to address CO_2 emissions. However, the capture and storage of CO_2 from power plant emissions will add significant cost to the electricity produced and should not be considered lightly.

To conclude, IGCC is an excellent technology choice for generation expansion at the Polk Station site. It offers the greatest fuel flexibility, lowest environmental impact and best capability to deal with potential future regulations. Tampa Electric believes Polk Unit 6 is the best option for its customers and the Florida environment.

Q. Does this conclude your testimony?

A. Yes, it does.

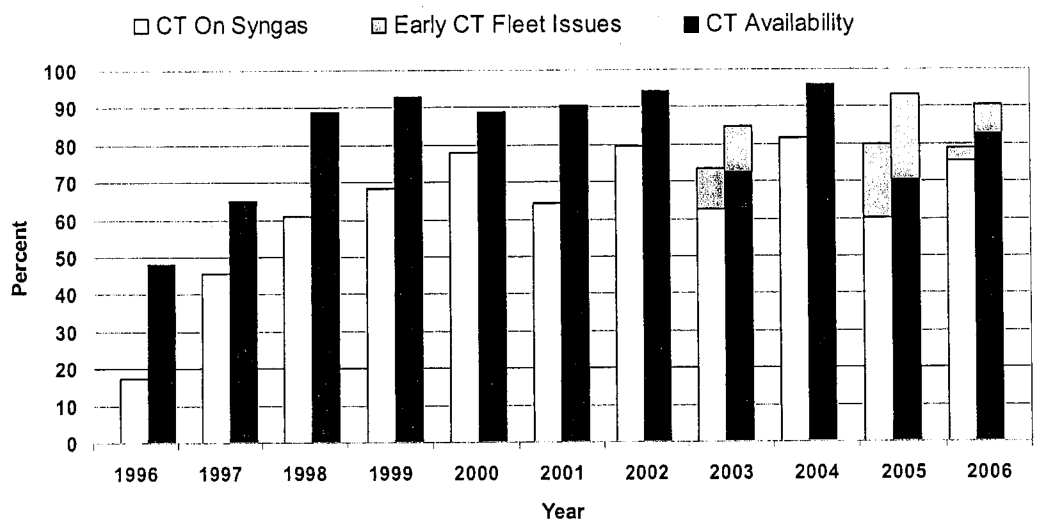
Water Loss Comparison
Solid Fuel Fired Generating Technologies
(Gallons per MWH)

This table provides the estimated water losses for IGCC, subcritical pulverized coal and SCPC technologies. SCPC has 33 percent higher water use than IGCC. All cases are without carbon capture.

	GE IGCC	Sub-critical PC	SCPC
Process losses			
Coal drying moisture			
Water lost in gasification shift	16.7		
Ash quench blowdown	8.4		
Water with slag	3.3		
Water lost in COS hydrolysis	0.0		
Sour water blowdown	0.5		
Water with gypsum		9.3	8.3
Total	**28.9**	**9.3**	**8.3**
Flue gas losses			
Gas Turbine flue gas	78.0		
Incinerator flue gas			
Boiler flue gas		107.0	94.8
Total	**78.0**	**107.0**	**94.8**
Cooling water losses			
Cooling tower blowdown	233.3	364.3	324.6
Cooling tower evaporation	473.8	739.4	659.1
Total	**707.1**	**1,103.7**	**983.7**
Grand total	**814.0**	**1,220.0**	**1,086.8**

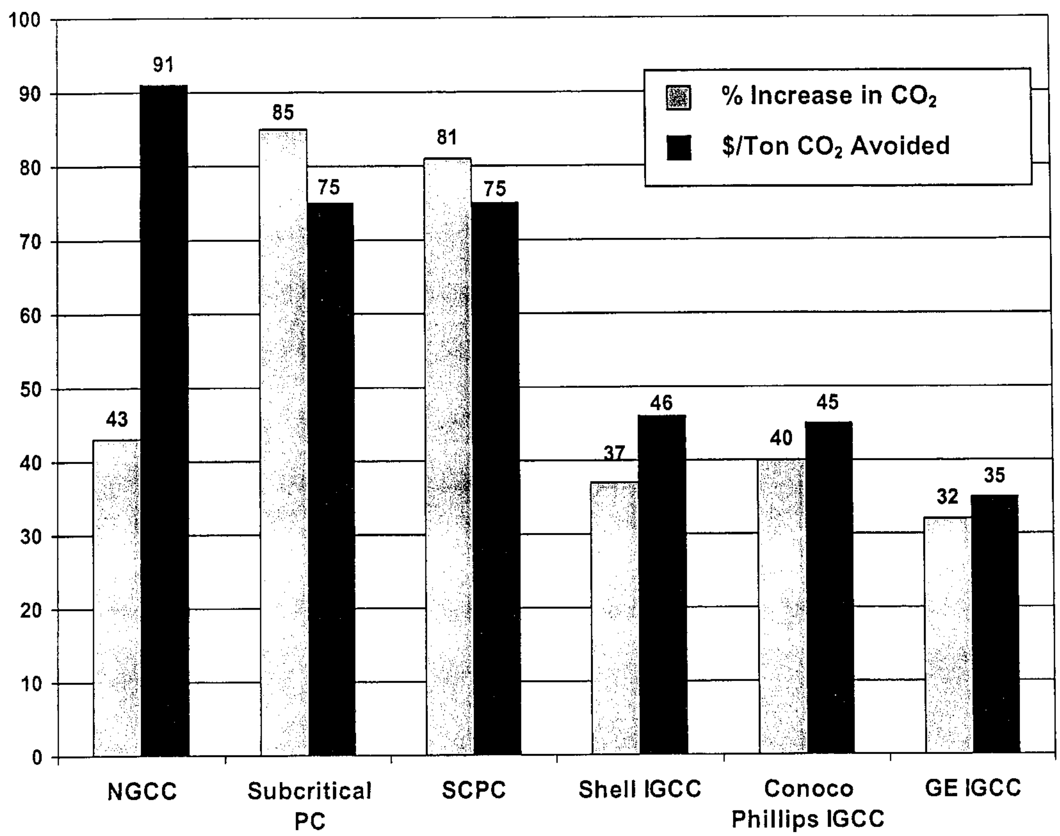
Source: National Energy Technology Laboratory, prepared for The United States Department of Energy, *Power Plant Water Usage and Loss Study*, August 2005, Table 9-1, p. 84.

Polk Unit 1 Availability



Source: Tampa Electric's Polk Unit 1 performance records

CO_2 Mitigation Costs



Source: "Cost and Performance Baseline for Fossil Energy Plants", Final Results, U.S. Department of Energy National Energy Technology Laboratory, May 15, 2007

Note: The GE IGCC case is applicable to Polk Unit 6.

Description of Potential CO_2 Removal Levels

Removal of CO_2 up to approximately the 20 percent level can be accomplished by capturing the CO_2 naturally occurring in the syngas, or the "native CO_2." This may be the removal scenario that is most feasible, due to non-linear escalating costs and operational issues associated with increasing the level of removal. Since the presence of CO_2 in the syngas acts to suppress NO_x emissions, changes such as increasing the amount of moisture in the syngas, would be required to ensure environmental compliance after the CO_2 is removed. These systems, along with the compression required for geologic sequestration would result in a net power output reduction and a plant efficiency reduction from the plant. Detailed engineering would be required to determine the precise operational impacts and to develop an estimate of the capital cost of these modifications.

In the event more than 20 percent of CO_2 must be removed, additional equipment to increase the concentration CO_2 prior to its removal from the syngas will be required. This is a gasification practice using the water-gas shift reaction, which takes a portion of the carbon monoxide ("CO") in the syngas and reacts it with water to form CO_2 and hydrogen. The use of the shift reaction allows more of the carbon present in the feedstock to be converted to CO_2 in the syngas which would be removed prior to combustion.

The shift reactor, or reactors, can be located prior to, or after the sulfur removal system. If located prior to the sulfur removal system, the reaction is termed "sour shift" and uses a cobalt-molybdenum catalyst to promote the reaction. Shift reactors located downstream of the sulfur removal system are termed "sweet shift" and use iron oxide catalysts. Each configuration has specific process requirements and advantages/disadvantages. Both sour and sweet shift reaction systems are well understood and commercially available systems.

Removal of CO_2 at approximately the 50 percent level has been proposed by various parties as a target that approaches natural gas equivalency, meaning CO_2 emissions from a coal plant employing 50 percent CO_2 removal would be in the same range as the emissions from a natural gas plant without CO_2 removal. In the event that 50 percent of CO_2 must be removed, it is expected to require the addition a single shift reactor and dedicated absorber/stripper system for CO_2 removal. As with the 20 percent removal scenario, changes would be required to the NO_x control equipment to ensure environmental compliance with the CO_2 removal. The partial shift reaction will increase the percentage of hydrogen in the syngas. Modification may be required to the CT combustion hardware to accommodate the increased Hydrogen concentration. These systems, along with the compression required for geologic sequestration of CO_2 at the 50 percent level, would result in a significant power output reduction and a significant plant efficiency reduction. Performance and cost estimates are not currently available at this removal level but would be non-linear to the 20 percent removal case due to the need to incorporate syngas shift.

Removal of CO_2 at approximately the 90 percent level has been proposed by various parties as a practical maximum achievable level. Additional study is needed to identify the optimal configuration needed to remove carbon at this level. As with the 20 percent and 50 percent removal scenarios, changes would be required to the NO_x control equipment to ensure environmental compliance after the CO_2 is removed. The shift reaction will significantly increase the percentage of hydrogen in the syngas. This will require the use of a combustion system designed to accommodate high hydrogen fuels. These systems have been commonly applied in industrial gas turbines and have been successfully tested at the scale needed for IGCC turbines. However, according to the MIT and NETL study, these systems, along with the compression required for geologic sequestration would result in a plant efficiency reduction of 19 to 25 percent, and an increase in the cost of electricity from 27 to 32 percent from the non-carbon capture baseline case.

The same MIT and NETL studies estimate a plant efficiency reduction of 24 to 30 percent, and an increase in the cost of electricity from 61 to 81 percent by adding CO_2 capture and storage at the 90 percent level to an SCPC unit.

The addition of CO_2 capture will increase water demand for all generating technologies. The NETL conducted a study and found the increase is much smaller for IGCC technology at an estimated 14 percent than for conventional coal generation technologies at an estimated 123 percent. The NETL water usage information is provided in Document No. 5 of my Exhibit No. _______ (MJH-1).

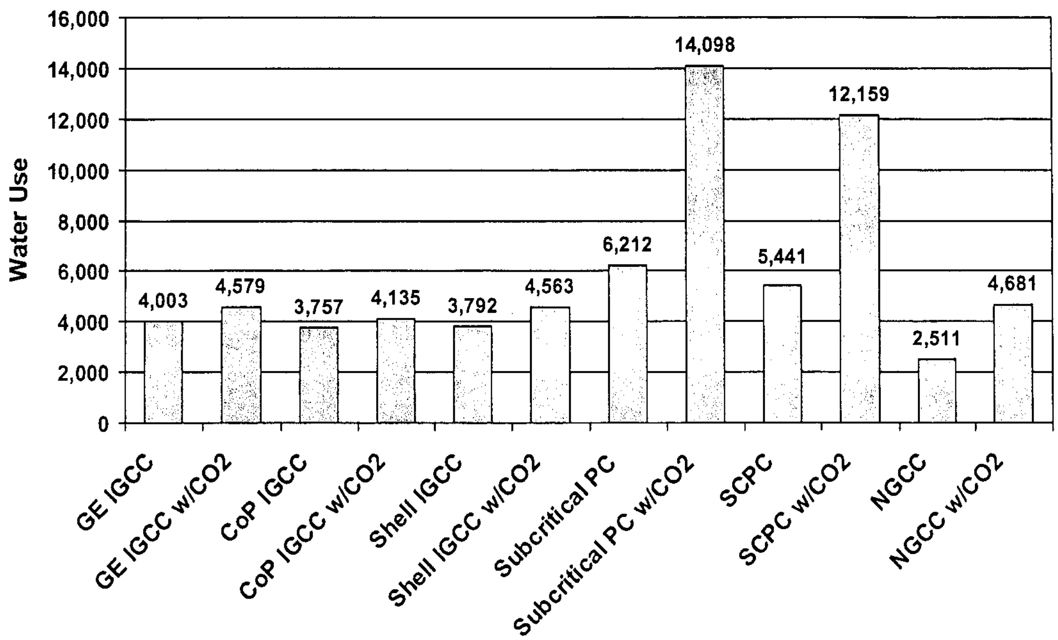
The sequestration of captured CO_2 from power plants is most often proposed via injection into deep saline aquifers. In order for this approach to be viable, the geologic structures must allow for large quantity injection and provide for an adequate confining layer to ensure that the CO_2 remains in storage. A study performed by the University of South Florida indicated that there was a suitable deep saline aquifer beneath the Polk Station site. Additional work is ongoing to confirm these findings and provide additional data on how the aquifer would respond to CO_2 injection. In addition to the technical aspects of CO_2 sequestration, there are currently no clear permitting guidelines for such facilities. The issue of long term liability for the sequestered CO_2 also needs to be addressed.

Sources:

1. Cost and Performance Baseline for Fossil Energy Plants, Final Results, National Energy Technology Laboratory, May 15, 2007
2. "The Future of Coal, Options for a Carbon-Constrained World", Massachusetts Institute of Technology, 2007
3. "IGCC Designs for CO_2 Capture and Conversion to Capture (Part 2)", Electric Power Research Institute Philadelphia PA, November 16, 2006
4. "Coal Fleet Experts Panel Discussion II: Designs and Economics for IGCC CO_2 Capture", Electric Power Research Institute, Tampa FL, March 20, 2007

Water Use Comparison
(Gallons per Minute)

The chart shows estimated water use for various technologies with and without CO_2 capture. GE cases are applicable to Polk Unit 6. Water use is lower for IGCC technology than for PC technology, with and without capture. Water use for IGCC technology is also lower than for NGCC technology in the CO_2 capture case.



Source: "Cost and Performance Baseline for Fossil Energy Plants", Final Results, DOE National Energy Technology Laboratory, May 15, 2007