Report Title:	**Climate Change Fuel Cell Program**
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Submitting Organization:	**Verizon** **741 Zeckendorf Boulevard** **Garden City, New York**

Disclaimer

Abstract

Verizon is presently operating the largest Distributed Generation Fuel Cell project in the USA. Situated in Long Island, NY, the power plant is composed of seven (7) fuel cells operating in parallel with the Utility grid from the Long Island Power Authority (LIPA).

Each fuel cell has an output of 200 kW, for a total of 1.4 mW generated from the on-site plant. The remaining power to meet the facility demand is purchased from LIPA.

The fuel cell plant is utilized as a co-generation system. A by-product of the fuel cell electric generation process is high temperature water. The heat content of this water is recovered from the fuel cells and used to drive two absorption chillers in the summer and a steam generator in the winter. Cost savings from the operations of the fuel cells are forecasted to be in excess of $250,000 per year. Annual NOx emissions reductions are equivalent to removing 1020 motor vehicles from roadways. Further, approximately 5.45 million metric tons (5 millions tons) of CO2 per year will not be generated as a result of this clean power generation.

The project was partially financed with grants from the New York State Energy R&D Authority (NYSERDA) and from Federal Government Departments of Defense and Energy.

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Executive Summary

Verizon has constructed and is presently operating the largest Fuel Cell project of its kind in the United States. Situated in Long Island, New York, the on-site power plant is composed of seven (7) fuel cells manufactured by UTC Fuel Cells of South Windsor, Connecticut operating in parallel with the Utility grid from the Long Island Power Authority (LIPA).

The Central Office, which is a call routing center, is a facility of approximately 91,440 square meters (300,000 square feet) in operation 24 hours/day. It houses about one thousand employees, a critical Network monitoring center for the entire North East corridor, provides telecommunication services to 35,000 customers, several airports, 911 emergency services and last but not least, the New York State Lottery System.

The average electrical load of the building is 2.5 mW with peaks to 3.3 mW in the summer months. Each fuel cell has an output of 200 kW, for a total of 1.4 mW for the plant. The remaining power to meet the building demand is purchased from LIPA.

The plant is a combined heat and power (CHP) system. The fuel cells operate on natural gas. The hydrogen component is extracted and reacts with the ambient oxygen to generate electricity. A by-product of this process is high temperature hot water. The heat content of this water is recovered to drive two absorption chillers in the summer and a steam generator in the winter. Cost savings from the operation of the fuel cells are forecasted to be in the excess of $ 250,000 per year.

In addition, the fuel cell plant design incorporates features that allow Verizon to participate in LIPA's electrical peak reduction program during the summer. One of the three (3) emergency diesel generators available on site to provide back up power to the telecommunication equipment is used during summer peak demand periods to supplement the fuel cell capacity and operate in a "stand alone" island mode. This strategy allows LIPA to redirect it commercial grid resources throughout the community in high demand hot days thus minimizing the possibility of power interruptions. In order to maximize allowable operating hours permitted under the New York State Facility air permit a bi-fueled system was installed. The engine utilizes a mixture of natural gas/low sulfur diesel oil reducing NOx emissions to maximize operating hours.

The plant operation is facilitated and monitored by a state of the art electronic Program Logic Controller (PLC).

The project was partially financed with grants from the Federal Government Departments of Defense and Energy and from the New York State Energy R&D Authority (NYSERDA).

For the first time, fuel cells are effectively powering a major telecommunication facility, providing clean on site electrical power and co-generation while adding an additional layer of Network reliability to the facility. As well as, providing a responsible approach

to a cleaner environment by reducing annual NOx emissions equivalent to removing 1020 motor vehicles from roadways, it eliminates approximately 5.45 million metric tons (5 million tons) of CO_2 per year that would be released by a traditional power generation approach.

Section 1: Description of the project

Introduction:

Verizon is a Fortune 10 company, one the largest telecommunications provider in the nation. Network reliability is of paramount importance. A loss of power in a Central Office (CO) will affect the economy and well being of the area it serves as well as Verizon's revenues and negatively impact a significant customer base in the geographical area.

Between 1999 and 2001, when this project started, Verizon experienced several commercial power outages/interruptions from the local power utility that cost several hundred thousand dollars in damaged equipment and revenue losses.

In Verizon's view, the existing commercial power grid in their operating area was becoming aged and overtaxed by the on-going building development and increased technology driven power demand. The stated reliability of the commercial grid, depending on the source, is about "four nines" (99.99%), an optimistic number. Verizon's power reliability need in 100%. Further, local resident resistance to new commercial power plant sitings coupled with significant real estate development projects created the concern for further degradation in the existing local commercial utility grid reliability. A creative, more reliable means of power generation was required, in concert with the local utility's base service provisions.

Site selection:

With this goal in mind, Verizon embarked on a search to find a facility that would benefit the most from a highly reliable, creative on-site fuel cell power source.

The search criteria for identifying this facility included the following:

- Critical nature of the facility as far as telecommunications services provided to the community.
- High costs of energy in the selected area.
- A proper balance of heating and cooling needs in order to recover and reuse the thermal energy generated by the fuel cells.

Verizon conducted an exhaustive survey of its CO's throughout the country and selected the facility at 741 Zeckendorf Boulevard in Garden City, Long Island, New York as the project candidate.

741 Zeckendorf Blvd Garden City – Site Profile

This facility met all the desired criteria.

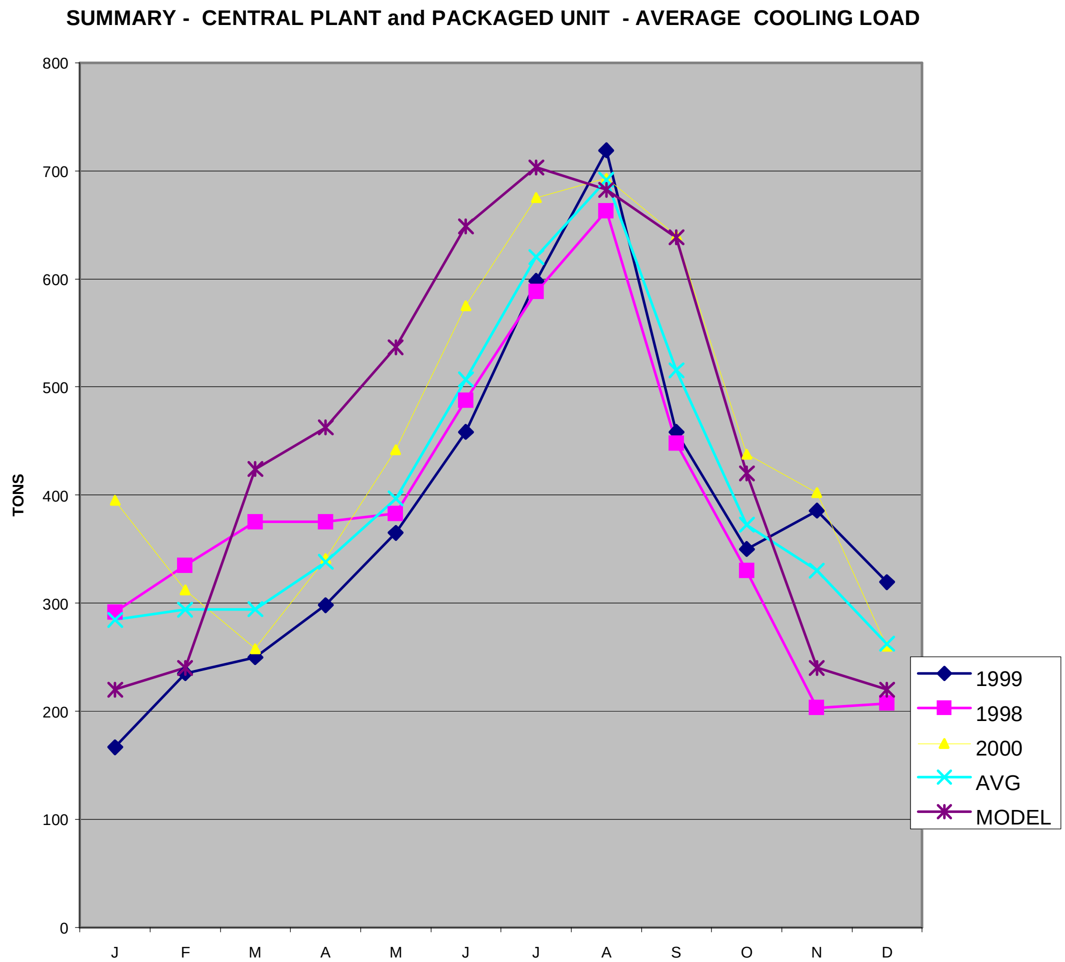
- It serves approximately 35,000 customers, several airports, 911 emergency and last but not least, the New York State Lottery system.
- It has high electrical costs: Electrical pricing on Long Island is historically in the top 4 in the country, between 0.094 eur ($0.12) and 0.011 eur ($0.14/ Kwh).
- The 89,001.6 meters (292,000 square foot), single story facility is of mixed occupancy, distributed 1/3 office use and 2/3 electronic switching equipment. It also includes a critical telecommunications 24/7 monitoring Center that serves most of the North East Verizon's foot print. and has a zero tolerance for commercial power interruptions.
- It is located in a commercial/industrial area

741 Zeckendorf Blvd. Garden City NY -Selected Site

Heating and cooling systems:
Heating for the facility is provided by two 200hp steam boilers. The boilers are fired from low sulfur diesel fuel.

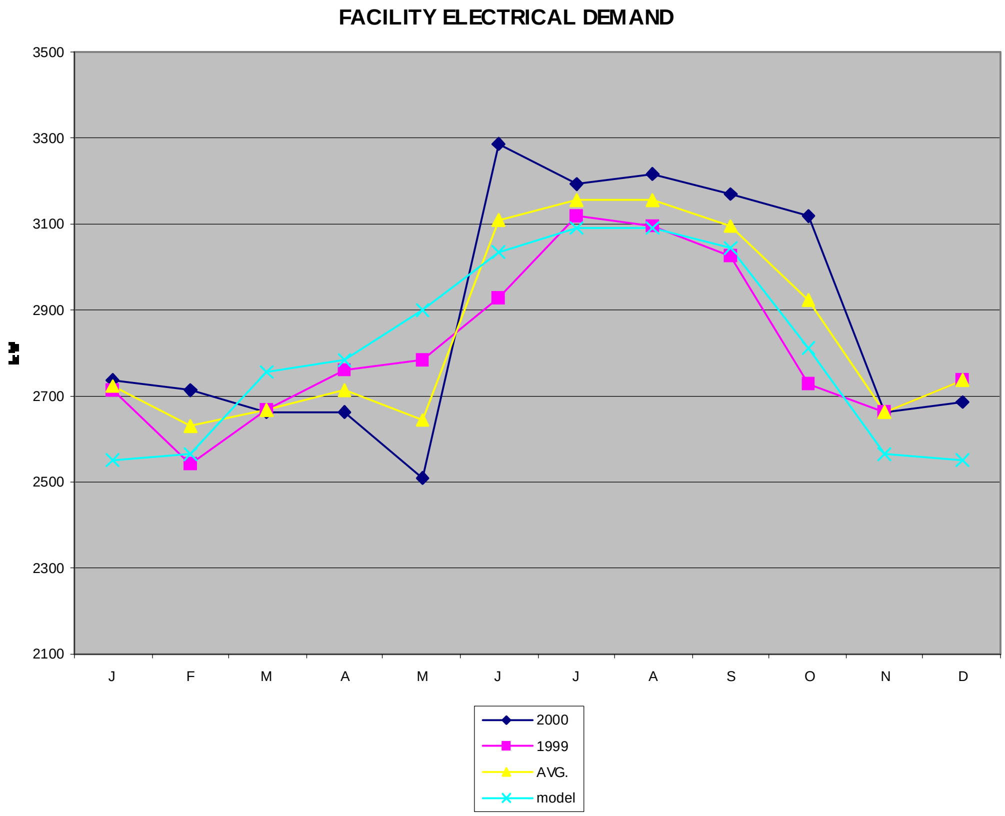
The cooling for the facility is met by a combination of electrical centrifugal chillers and unitary equipment distributed throughout the building. Office cooling requirements, as well as those of a small number of electronic switching equipment areas are met by three 500-ton electric centrifugal chillers and associated equipment such as cooling towers. The majority of the electronic switching area cooling is met by standalone packaged unitary systems (computer room type).
While office areas required heat in the winter and intermediate seasons and comfort cooling in the summer, telecommunications switching areas required a higher degree of controlled environment cooling all year round.

The cooling load in the facility provided by these three chillers and unitary systems historically varies from a low of 3.06 Gjoules (240 tons) to a maximum of 9.42Gjoules (740 tons). Generally, as the outside air temperature drops below 10 degrees celsius (50 °F), the central plant chillers and cooling towers are shut down. and outside air satisfies "free cooling" and ventilation requirements adequately. Conversely, telecommunications switching equipment is sensitive to a narrow variation of temperature and relative humidity and contains electronic equipment that generate a continuos concentrated heat load irrespective of the outside weather conditions



Facility Power needs:

Long Island Power Authority (LIPA) provides electric power for the facility through five distribution transformers that step the utility power down from 3.8kV to 480V. The electrical load in the facility varies over the year from a low of about 2.2MW to a maximum of 3.3MW with an average load of 2.5MW. As a back-up in the event of a loss of the commercial utility electrical power, this facility has three (3) on-site 2 MW diesel engines for emergency use. These engines are fueled with low sulfur diesel fuel.



At the time of the inception of the project, no natural gas was used at this facility, but two major natural gas lines on the north and west side of the facility existed and were available.

DG Plant technology selection:

In 1998, Verizon created an Energy Group whose sole mission was to reduce the company's energy costs while optimizing energy use. The task force studied and recommended the use of Fuel Cells for this facility, because they provide a highly reliable source of power with the added advantage of virtually no emissions generated in the process. Jon Chesnut, Verizon's specialist was put in charge of the project. After months of research, contacts with various Fuel Cells manufacturers, evaluation of proposed equipment, Jon selected UTC as the preferred fuel cell manufacturer for the following main reasons:

- As of June 1999, the selected fuel cells model #PC25C were the only commercially available in the size that fit the project magnitude.
- Actual operating data was available from several operating UTC installations, as opposed to other fuel cell manufacturers that were in the development stage and had no established track record.
- The Department of Defense offered to provide a climate change grant for the seven fuel cells.

Feasibility studies:

Verizon engaged the services of The Syska Hennessy Group (Syska) and through shared funding from Verizon and the Department of Energy (DOE) via the Oak Ridge National Laboratory (ORNL); Syska received a subcontract to perform 12 tasks. These tasks were:

1. Analyze facility's Existing Electrical System
2. Evaluate Building Heating and Cooling System
3. Evaluate Heat Recovery Options
4. Assess Site Utilities
5. Develop Schematic Design for the project
6. Develop project Cost Estimate
7. Evaluate Reliability
8. Evaluate Permitting
9. Review Optimization
10. Study Utility Pricing Study
11. Evaluate Emissions Impact
12. Business Case Development

Once these twelve tasks were completed, design would commence.

Initial scheme:

From these tasks, a schematic design was developed for the DG power plant. In the interest of reliability, Verizon requested that the hybrid plant to be a mix of new technology and existing technology, totally divorced from the utility, thereby operating on "island mode" as a stand-alone. The "new" technology to be used was Phosphoric Acid Fuel Cells and the "existing" technology was natural gas fired engine/generators. Each of these technologies had "pros" and "cons", but together it was felt by the team that they provided a highly reliable arrangement.

One of the first encountered challenges came from the fuel cells themselves. Fuel cells require a signal to synchronize with and cannot react quickly to load changes. These drawbacks were overcome by paralleling the fuel cells with natural gas fired reciprocating engine/generators which would provide a frequency signal for the cells to follow and absorb any sudden load fluctuations.
The combination of the seven 200 kW fuel cells and the 3000 kW engine/generators meant 4.4 MW of power could be produced. Since the maximum power required by the facility totaled approximately 3.2 MW, the project scope could be reduced by the loss of a 1MW engine/generator and one fuel cell and still met the building needs.

The rejected heat from these fuel cells is produced in two streams of hot water. The first stream is called "low grade" hot water that is about .477 Gjoules (450,000 BTU's) of 71.16 degrees Celsius (160 °F) water for ancillary equipment cooling. The second stream is called "high grade" hot water and is .477 Gjoules (450,000 BTU's) of 126.68 degrees celsius (260 °F) water that will produce 0.45Kgms/hr (1 lb/hr) of steam per KW of power and, coupled with the jacket water from the engines. This stream is available for recovery and re-use, by means of a steam generator in the winter for heating, and hot water absorbers in the summer for cooling.

Although the proposed DG plant was going to produce power in an "island mode", Verizon elected not to "close the door"' on the local utility. Negotiations on a potential partnering arrangement for this power plant, whereby the Utility would own the natural gas fired reciprocating engine generators and sell Verizon the thermal and electrical energy they produced was explored. Verizon and LIPA foresaw the emergence of a "high availability" power market and worked together to make this project a "win" for both the electrical and telecommunications industry.

While this scheme certainly had benefits, the combined design fuel cells/engines proved to be in the end too expensive, in investment capital as well as maintenance costs and was not pursued beyond conceptual design. Syska's participation in this project was terminated during the last quarter of 2002.

Final scheme:

The conceptual design was re-evaluated by the project team with an eye towards cost optimization, while continuing to maintain a creative highly reliable approach. In 2003, Keyspan Business Solutions (KSB) was selected to provide design and construction documents for the revised project scheme. Operating the plant in "island mode" was abandoned in favor of the following:

- The 7 fuel cells were retained and will produce approximately 1.4 MW
- The remaining power to meet the building demand (up to 3.3 MW) will be purchased from LIPA.

In this scheme, the fuel cells operate in parallel with the Utility grid. This approach reduced the cost of construction. The heat generated by the fuel cells will be used to drive a steam generator in the winter and two (2) 0.89 gigajoules (70 ton) hot water absorbers during the summer.

In addition, Verizon elected to participate in LIPA's peak reduction program during the summer. This project impacted the Fuel Cell Plant because some of our on-site emergency engines would be used to supplement the fuel cell capacity, reducing LIPA's required commercial power to the facility during peak power summer demand periods, but requiring the integration of on-site peaking engines into the design.

This decision proved to be a design challenge, as it involved:

- Satisfying LIPA's concern that no power would be fed back to the commercial grid during summer operation of the on-site generators/fuel cells. A single line diagram showing the fuel cell interconnection with the commercial grid is included in Appendix A.

- Evaluating NYSDEC (New York State Department of Environmental Conservation) air permitting requirements for limited on-site power generation. File and obtain an NYSDEC Air State Facility Permit to operate a limited use, on-site emissions source while meeting the accepted emission cap requirements associated with the air permit. In fact, in a effort to maximize operating hours below the permitted NOx emission cap, one of the engines was modified to allow the use of a mixture of natural gas/low sulfur diesel oil as a bi-fueled engine. See the documents relating Stack Testing in Appendix B.
- Phase the operation of the fuel cells with the leading on-site peaking engine.

In addition, construction permits and zoning concerns had to be obtained and addressed from the Town of Hempstead, which had jurisdiction on the construction site.

Following contract negotiations with KSB, the design and construction phase started on 4/7/2003. Construction documents were completed in November.

Section 2: Construction phase

Introduction:

The project was filed with the Town of Hempstead, Department of Buildings. After an extensive review, construction permits were secured in the last quarter of 2003. The initial construction "kick-off" meeting occurred on December 4, 2003 It was mainly focused on the introduction of Keyspan/WDF Inc. and Verizon Operations personnel to the existing team project: The meeting agenda focused on:

- review of critical coordination and reporting requirements
- review of safety measures and plans
- discussion of construction schedules

WDF was a subsidiary of Keyspan and was selected to oversee the construction of the new plant.

Project schedule:

The initial project construction interval was estimated to be 12 months from the date of construction start to substantial completion of the project. With an additional two months forecasted for performance testing, punch list development and correction. The project was forecasted to be completed and ready for service on December 30, 2004. A critical path analysis identifying the interrelationship of key materials, components and work operations and their relationship to the over-reaching construction schedule was established. Needless to say that as the project progressed, this schedule required amendment to reflect the design changes necessary and unforeseen site specific field conditions that occurred.

Construction highlights:

1. Abandoned underground fuel storage tanks

   The first consequence of unforeseen field conditions occurred as soil borings were being taken in the eastern parking lot adjacent to the pole school, exactly on the proposed site of the fuel cell farm. It had been previously reported that an abandoned 30,280 liters (8000 gallon) underground storage tank (UST) may be existing this area. An investigation was initiated and excavations commenced. What was discovered was not a 30,280 liters (8000 gallon) UST but two 113,550 liters (30,000 gallon) UST's abandoned in place. This discovery was problematic and raised several important questions that required resolution prior to proceeding with the project:

   - Was the ground soil contaminated and was site remediation necessary?
   - Were there additional regulatory impacts that needed to be addressed?
   - Should the underground petroleum storage tanks be removed?
   - What would be the impact on the construction costs already budgeted ad allocated?

The services of Envirotrac Corporation, an environmental remediation contractor were engaged and excavation commenced to expose the buried UST's. Envirotrac was required to determine the condition of abandonment, conduct soil samplings to determine contamination if any, interface with the regulatory agency (Nassau County Department of Health Services) and based on soil sampling results, physical conditions and regulatory determinations, recommend a course of action (physical tank removal or legal abandonment) to proceed.

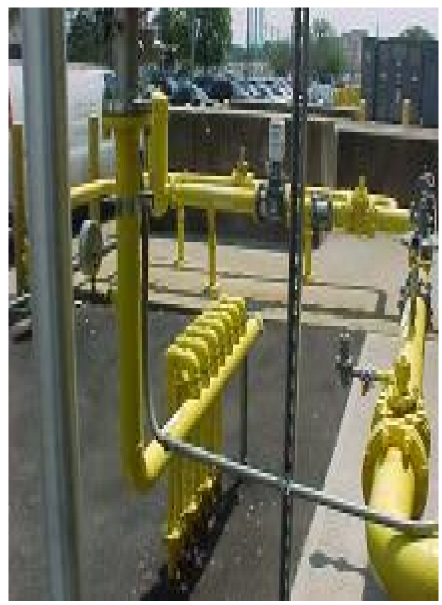
Excavation commenced and the underground storage tank field was exposed. Initial Soil samples were taken around the tank perimeters and subterranean piping runs and submitted for laboratory analysis, while the tanks shells were opened to determine the state of abandonment. It was observed that all tanks had a minimal amount of concrete slurry pumped into them, however they were not thoroughly cleaned and there was approximately 10.16 centimeters (4 ") of residual # 6 product in one tank while another was filled with water. The Nassau County Department of Health (NCDOHS) was contacted for an on site inspection and guidance on legal closure. The initial soil samples returned from the laboratory with no evidence of contamination and the NCDOHS required that a further geo-probe analysis be conducted around the entire tank foot print to a depth of approximately 1.52 meters (5'-0") below the tank bottoms (approximately 6.71-7.62 meters (22'-24') below grade).

All geo-probe samples returned clean and the NCDOHS authorized legal in-place closure of these tanks. The tank interiors were thoroughly cleaned and all product and water was removed. The shell cavities were then completely filled with concrete slurry and all openings were closed. All distribution piping was completely removed and penetrations sealed. Further, at the request of the NCDOHS a complete geo-physical survey was conducted to determine if there were any other UST's on site. None were found. The site was back filled, compacted and paved. This field condition added approximately 71,339.48 EUR ($ 90,000) to the project cost.

2. Natural Gas Service

One of the first significant construction activities of the project was to route natural gas supply to the fuel cells. The fuel cell plant is in a location in the northeast portion of the eastern employee parking lot of the facility. The parking lot serves approximately 220 employee vehicles and it was critical the disruption of parking spaces be held to a minimum. The Keyspan natural gas main was located across Zeckendorf boulevard (a 4-lane heavily traveled main road) approximately 700 feet from the desired connection point at the fuel cells. The challenge was to install this natural gas line under the main roadway and through the employee parking lot to the fuel cell area without significantly disrupting normal operations. Utilizing hydro-jetting technology, we were able to install the natural gas main under the 4-lane roadway without requiring excavation, barricading, sheet piling or traffic diversion of any type. Once across Zeckendorf boulevard the natural gas line paralleled the facility property line and continued to be hydro jetted in place. As the natural gas line turned left towards the fuel cell farm, hand excavation and trenching were required to avoid existing buried telecommunications cabling in place at the facility. Prior to excavating a full utility sub-surface identification survey was required to carefully identify the location of all buried utility services. The natural gas line was installed in the fuel cell area with a minimum amount of disruption to employees and vehicular traffic on the main roadway.

Natural gas distribution lines to fuel cells



Natural gas meter and manifold to fuel cells

3. **Underground lines**:

Within the fuel cell plant perimeter, all piping and conduits are installed underground. The excavation process was extensive, with some trenches as deep as 8 feet. Close coordination was required to insure accurate elevations of piping levels


subterranean piping installation

Once the trenches were dug, the installation of the lines started. It was a delicate operation since some lines were installed on top or crossing other lines. The deepest conduits/pipes in place, the trench was backfilled and carefully compacted (so as not to damage the conduits/pipes below). The underground conduit/piping included:

- Deionized Water
- Nitrogen
- Natural gas
- High Grade Hot Water (HGHW)
- Power conduits
- Instrumentation/Control conduits


Piping installed at various elevations

4. <u>High Grade Water Lines</u>

The High Grade Hot Water lines were of the double walled type. They were constructed in large assemblies above ground lowered by crane into the trenches were final welding of the inside pipe occurred. They were constructed by certified welders and then tested; when the pressure test proved satisfactory, the welding of the outside pipe took place.

HGHW lines overlaying subterranean piping

These supply and return lines came above ground next to the fuel cell pads and along side of the building wall. Along the wall they were installed on a vertical rise to the roof parapet, then routed to the air cooled condensers.

Subterranean piping extending up to fuel cell foundations

Piping and structural supports for air cooled condensers and electrical conduits

Roof mounted Air Cooled Condensers

The fuel cell area was at this stage backfilled and the concrete pads for the fuel cells were poured.

Piping to and from fuel cells and foundation forms for the fuel cell modules

5. <u>Gas Piping to Bi-fueled Engine</u>

The fuel piping installation included the addition of natural gas line to power the bi-fueled engine, used as a peak shaver. The bi-fueled engine is used during the summer months when facility electrical demand is at a peak and commercial power was most vulnerable to interruption.

A bi-fueled engine was utilized to maximize the annual allowable operating hours while maintaining the facility annual NOx threshold emission cap of 20,411.64 Kilograms (45,000 lbs.) specified in the New York State Department of Environmental Conservation State Facility Air permit.

This diesel provides double duty also being utilized as and on-site emergency generator for Verizon's operations. In addition to being utilized as a peak shaver it provided back up on site power to critical telecommunication systems, in the event of a commercial power failure or significant fuel cell operating event. Natural gas supply was obtained by extending the gas service from the fuel cells

The routing of the gas line to the stand-by engine to be bi-fueled was vertical along the building wall, horizontal on the roof, then penetrated the roof above the engine in the diesel room. The line terminated in the generator room.


Natural Gas service entrance into diesel room

Natural gas train on bi-fueled diesel engine

6. Fuel Cell Delivery and Rigging

The fuel cells were delivered to the site on June 19, 2004. Rigging the fuel cells in place required the use of a telescoping crane of significant size to accomplish this task. Close coordination was necessary because of space restrictions.

Telescoping crane

Rigging fuel cells onto concrete pads

7. Co-generation of high grade water

The high grade hot water generated by the fuel cells is recovered to power two absorbers in the summer and a steam generator in the winter. A variable speed drive pump was selected to control the flow of high grade water as the output of recovered heat increases as the fuel cell ages.

Steam Generator in boiler room

Hot Water Absorption unit

8. Electrical transformers

Several transformers were replaced because of age and to facilitate the operation of the new plant. Before, the power is metered after the transformers and they therefore were the responsibility of LIPA. In the new design, Verizon owns them.

Transformer bank in parking lot

High Voltage entrance – 13,800V
Isolation transformer and neutral grounding reactor

9. De-ionization and Reverse Osmosis systems

The fuel cell make-up water treatment system was house in a small building. It includes a de-ionizer and a reverse osmosis system.

Make up water is required to operate the fuel cells at ambient temperature above its balance point temperature. The balance point is a specific temperature at which the power module condenses just enough water from the power module exhaust to meet the generating process requirements.

de-ionizing system to fuel cells

Reverse Osmosis system to fuel cells

10. Nitrogen flushing system

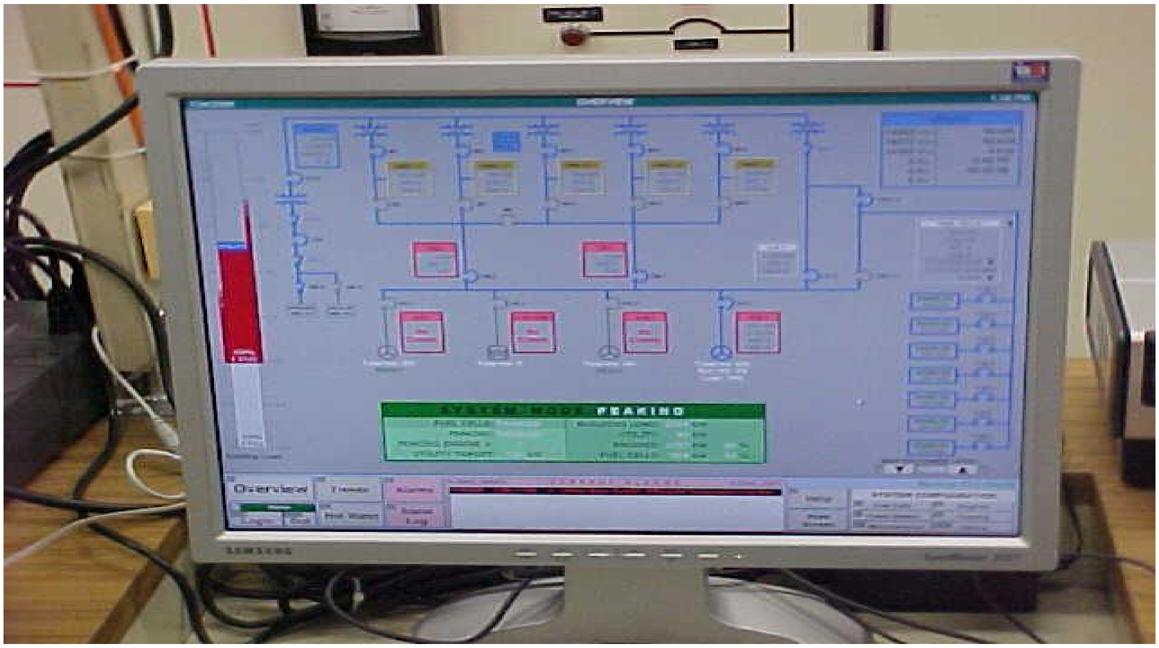
The nitrogen required to flush the fuel cell upon start up and shut down is stored in bottles. From a manifold each fuel cell is fed to purge the explosive mixture (hydrogen and oxygen) in the cell stack assembly.

Nitrogen cage for flushing fuel cells

11. Programmable Logic Controller

The PLC (Programmable Logic Controller) is the brain of the system and control operations a well as monitor performances and alarms. More information on the PLC capabilities will be displayed in further sections of this report.

This system was designed by Rex Automation and is described in more detail in the section: Plant Monitoring.



Programmable Logic Controller for fuel cell system

Section 3: Start-up / Commissioning

3-1. PRE-COMMISSIONING CHECK LIST

No.	Activity	Provided/ Performed By	Remarks
1	Single line Drawings(Electro-mechanical)	WDF/KBS/Ideal	Review /check
2	Modes of operation	WDF/KBS/VZ	Review /check
3	Factory Test sheets for Fuel cells & ancillary equipment	UTC/VZ	Review /check
4	Equipment Start - Up procedures	Ideal/UTC/Elemco /Thermax	Review /check
5	Flush Clean and pressure test pipes	Contractor/ WDF/KBS	Check procedure & compliance
6	Flush, Clean and pressure test A/C Heat Exch.	Contractor/ WDF/KBS/UTC	Check procedure & compliance
7	Load test Bi-fuel engine	VZ/Contractor	Test /Record
8	Commissioning of R.O. plant	VZ/Contractor	Test /Record
9	Test of DTT and RTU(installed by LIPA)	LIPA	LIPA to confirm
10	Calibration / testing of Protective Relays	Elemco	Perform / Record
11	Test High and low voltage cables	Elemco	Perform / Record
12	Test 52 IT(LIPA 1010)	Elemco	Perform / Record
13	Test transformer TX-LS-(3.75MVA)	Elemco	Perform / Record
14	Test 52TS(LIPA1020)	Elemco	Perform / Record
15	Test Zig-Zag transformer(435 KVA)	Elemco	Perform / Record
16	Test Grounding Resistance	Elemco	Perform / Record
	Training and operational procedure for:		
17	52 IT	WDF/KBS/Elemco /Ideal	Provide and document
18	52 TS	WDF/KBS/Elemco /Ideal	Provide and document

19	LS-1	WDF/KBS/Elemco /Ideal	Provide and document
20	TXFC1	WDF/KBS/Elemco /Ideal	Provide and document
21	TXFC-2	WDF/KBS/Elemco /Ideal	Provide and document
22	Kirk key Inter lock system for FC and LS-1	WDF/KBS/Elemco /Ideal	Provide and document
23	Grid Re-connection Procedure	WDF/KBS/Elemco /VZ	Prepare and submit for approval
24	Test PLC Operation	Ideal	Perform and confirm
25	Interconnect Agreement	LIPA / VZ	Review for final approval
27	Instrument, Mechanical and Electrical Tag list.	WDF/KBS	Prepare and submit for approval
28	Load Testing procedure for FC,abs.Chillers	UTC/VZ/Thermax	Review and confirm specs compliance
29	MOP for installation of new Transformers	Elemco/VZ	To be Approved by VZ

3-2. Transitional operation

To maintain continuity of electric power during transformer replacement, the building loads will be fed by 3750 KVA transformer utilizing a temporary HA/feeder.

The following tasks will be completed during Transitional Operation:

- Review pre-commissioning checklist and confirm compliance.
- Confirm (from LI PA) that DTT and RTU have been tested and are operational.
- Copy of grid-reconnect procedure to be posted in Cubicle of 52-IT and 52-TS.
- Follow the Method of Procedure for installation of new transformers.
- At the end of Transitional operation, the building will be connected permanently to the new service
- Fuel cells collector panel will be fed by breaker TXFC-1

3-3. Start up/Commissioning of Fuel cells and A/C Heat Exchangers

Fuel cell start up will resume after permanent power is available to the collector panel.

Each Fuel cell to be tested independently according to factory approved procedure. The testing shall be for minimum of:

- 30 minutes on 50% load (100 KW).
- 30 minutes on 75% load (150KW).
- 60 minutes on 100% load (200KW).

Fuel cells will be tested in manual mode under controlled conditions. Building load will be available for individual and collective testing. The total maximum out put of 7 fuel cells is 1400KW.

Operating parameters (screen #010) will be recorded to establish base line for future reference. A/C heat exchangers will be inspected for any leaks under different loads.

In addition to above, the following functions will be demonstrated for each FC:

- Dynamic testing of safeties.
- Ramp up to full load.
- Shut down due to network fault(simulated test)
- Auto-restart and grid connection after removal of network fault.
- Locking and unlocking of export breaker by Kirk Key
- Opening of export breaker on loss of grid power (by simulating loss of grid power).
- Attempt to re-connect to the grid if power returns within the grid

reconnect time delay (programmed as 3-3000 sec) and ramp up to full load.

- Function of power factor control

Special conditions for testing on emergency bus:

- Testing will be during normal working hours only.
- UTC/KEM will notify Verizon prior to synchronize and export power from first Fuel cell.
- The units will be load tested one at a time utilizing facility load.
- Power will be exported from FC only with TXFC-1 in closed position.
- The units will remain in Idle /Water conditioning mode during nights and week ends.
- Depending on work progress, it may be possible to test more than one Fuel cell per day.
- In case of Power shut down from LI PA, emergency generators will feed the bus and power to the FC's will be restored after 45-60 seconds by automatic opening of TXFC-1 and closing of TXFC-2.
- LI PA power outage to be notified immediately to UTC/KEM by Verizon.

After satisfactory completion of individual load tests, fuel cells will be kept in water conditioning mode until PLC is installed and the project is ready for "SYSTEM TEST".

See typical Manufacturer’s test data in Appendix C.

3-4. SYSTEM TEST

Series of tests shall be performed to confirm operational compliance of generator(s) and Fuel cells running with and without grid connection. The following are the key elements of the system test:

- Run generators and confirm load sharing.
- Run Generator & Fuel cells paralleled to the grid and share Bldg. load.

Pre-Test conditions:

- Verizon to confirm all three engines (DG1, DG2 and DG3 are in working condition and ready for system test.
- Engineer of record has been provided with latest drawings, PLC control logic and updated "Modes of Operation".
- Verizon has an acceptable MOP for the test, and this document to be attached to the MOP.

A. <u>Run generators and confirm load sharing (Mode # 6 Loss of Power)</u>

<u>Equipment Status (Normal OFF-peak with fuel cells Connected to the grid):</u>

> Breaker 1010 & 1020 (52IT & 52 TS) are closed.
> Commercial Breakers M1, M4, M11, M14, M17 are closed.
> Emergency Breakers M2, M3, M12, M13, M16 are open.
> Breaker 420 (LS-1) is racked in, open and enabled by Kirk key.
> Breaker 410(TXFC-1) is closed.
> Five Fuel cells are running, connected to the grid and exporting Power.
> Plant in auto control (with PLC)
> DG1, DG2 and DG3 are off line. All engine breakers (DG-1, DG-2, and DG-3) are open.
> Power to the building is being provided by the electric utility and FC's.

- **<u>Test Sequence (Mode #6 Loss of utility power):</u>**

- Simulate power outage (loss of utility power)
- Check engines start and pick up bldg. load.
- Verify and note KW/KVARS sharing % of available Bldg. load.
- Check/confirm TXFC-1 is open.
- Check/confirm TXFC-2 is closed.
- Fuel cells return to IDLE state. For the purpose of this test, fuel cells are configured to remain isolated until operator initiates grid connection manually.
- Generators supply auxiliary power to the Fuel cell collector Bus.
- Emergency Breakers M2, M3, M12, M13, M16 are closed.
- Commercial Breakers M1, M4, M11, M14, M17 are open.
- Power to the bldg. is being provided by Generator(s).The building is operating on emergency power.
- Record key parameter (see attached sample test sheet).
- Return the building to normal by removing power outage signal.
- Check/confirm status of breakers as mentioned above for normal off peak mode.

B) <u>Run Generator(s) connected to the grid and share Bldg. load</u>

<u>Equipment Status (Normal off peak without Fuel cells):</u>

- Breaker 1010 & 1020 (52IT & 52 TS) are closed.
- Commercial Breakers M1, M4, M11, M14, M17 are closed.
- Emergency Breakers M2, M3, M12, M13, M16 are open.
- Emergency Bus Breakers EM-1 and EM-2 are closed.
- Breaker 420 (LS-1) is racked in, open and is enabled by Kirk key.
- Breaker 410(TXFC-1) is closed. Fuel cells export breakers disabled and are in idle mode.
- Plant in auto control (with PLC)
- Breakers DG1& DG2 and DG3 are open.
- Power to the building is provided by the electric utility.

<u>Test Sequence:</u>

- Check/confirm DG3 is running at no load
- Close breaker DG3.
- Synchronize DG3 and connect to the grid by closing LS-1.

- Verify DG3 picks up load as required to maintain min.100KW import.
- Verify and note engine KW, P.F. and import power (see attached sample test sheet)
- Power to the building is being provided by the electric utility and DG3.
- Repeat the above sequence with DG1 and DG2
- Fail engines sequentially to verify that next available engine starts and picks up load **(verify Mode # 7)**
- Verify stability, min.100KW import and note P.F, KW
- Return the Bldg. to normal power.

C) Run Generator and Fuel Cells parallel to the grid and share Bldg.load (Mode # 3 On Peak/Peak shaving)

Equipment Status:

- As in SEQ." A"
- Check/confirm Fuel cells are not connected to the grid and in IDLE state.
- Confirm breakers DG1, DG2 &DG3 are open.

Test Sequence:

- Start closing export breakers of 5 selected Fuel cells at minimum power (export 10 KW each).
- Ramp up the power out put of each Fuel cell to 100%.
- Verify stability. Note Fuel cell load, P.F. and utility import.
- Simulate peaking period from PLC by changing time settings.
- DG 3 (selected peaking engine) starts, Breaker DG3 closes.
- PLC issues a signal for closing LS-1 and DG3 is synchronized to the grid.
- Verify system stability and note key operating parameters of FC's, DG3 and utility (see attached sample test sheet)
- Power to the Bldg. is being provided by DG3, Fuel cells and utility.

Before returning to normal off peak operation (Mode # 5), the following modes will be tested and verified:

Mode # 4 - On Peak/Loss of selected engine.

Test procedure:

> Confirm 5 fuel cells (only 5 cells are used in this case to avoid exporting power to the grid. This is a LIPA's request) and one of the engines are running in parallel to the grid.
> Simulate engine failure.
> The next available engine should start and synchronize automatically to the grid.

Mode # 4A On Peak/loss of selected fuel cell.

Test procedure:

> Confirm 5 fuel cells and one of the diesel engines is running parallel to the grid.
> By operator interface panel, open export breaker of one of the Fuel Cells.
> The operating engine will ramp up to take extra 200Kw load.

Notes

- Verizon to add any specific tests required to verify load management and/ or engine & network safeties.
- At the end of this test Fuel cells will be configured for automatic re-connection to the grid (as per system design).

3-5. Start Up / Commissioning of Absorbers:

Two 70 ton absorbers were installed and piped into the existing chilled water header. These two units generate 45 degree F chilled water using the High Grade Hot Water (HGHW) from the output of the fuel cells. However, it is understood that the initial capacity of the HGHW from the fuel cells will generate only enough HGHW to run only one unit. As the fuel cell stacks age, they will generate more waste heat and the additional HGHW will be diverted to the second absorbers to increase the chiller water output. To take into account the flow variations, a variable speed pump was installed.

Each absorber was started and tested in Spring 2006 to demonstrate its operating capacity.

3-6. Start Up / Commissioning of Unfired Steam Generator:

The Unfired Steam Generator is installed to provide a nominal 3,000 pph of steam at 8 psi into the existing steam distribution header using the High Grade Hot Water (HGHW) from the output of the fuel cells. However, it is understood that the initial capacity of the HGHW from the fuel cells will generate approximately 1,830 pph of steam. As the fuel cell stacks age, they will generate more waste heat and the capacity of the Unfired Steam Generator will increase accordingly to its nominal output. The Unfired Steam Generator is designed for the following capacities and temperatures:

Steam Generation:	3,000 pph		
High Grade Hot Water:	265 F inlet	240 F outlet	285 gpm

The Unfired Steam Generator system was started and tested to demonstrate these capacities to the extent practical. The Fuel Cell Heat recovery system delivers the HGHW to the unfired steam generator and reduces the return temperature below its inlet temperature in accordance with the manufacturer's projected operating curve for the flow measured (+/-5%).

3-7. Problems Encountered & Corrective Measures

The following were the major problems encountered during start up:

1. Tripping of inter Tie breaker (52IT) on high voltage:

The problem was found in relay settings, which was reviewed and corrected by the design engineer

2. Power factor:

This was the major problem encountered during commissioning of the power plant. During normal operation with utility and Fuel cells on line, the power factor remained within LIPA's approved limits(maximum lagging 0.85). Whenever generator was put on line to share building load with Fuel cells and utility, the system power factor dropped to 0.4 and some times even lower. After a couple of different approaches, it was determined that Power factor controller of generator needed additional control unit. With the help and efforts of Verizon Power group and control engineer, additional precision signal controller was added and rewired to allow proper sharing of KVARS between the grid and the engines.

The system was tested again in different modes and found satisfactory. LI PA installed data recording instruments to confirm and verify power factor improvement.

3. Shut down of Fuel cells during automatic mode transfer (OFF peak to ON Peak and vice versa:

Fuel cells are protected against out of range changes in grid parameters (under/over voltage, frequency, loss of power, return of power etc). It was determined that frequent opening and closing of export breaker was causing the units to shut down during mode transfer.

After careful review of the control circuits, it was noted that coil of the control relay for enabling export breaker was wired to a circuit from emergency panel of the building. During engine start up and shut down, this panel loses power momentarily (due to ATS switching) causing the relay to chatter. After consulting concerned parties, the control wiring scheme was changed. The relay coil is presently wired through the fuel cell UPS that controls export breaker operation. Since function of control relay is not associated with starting and stopping of engines, the Fuel cells operation is not affected by change in system operating modes.

Section 4: Plant Monitoring, Data Collection & Load Management System

PLC & Operator Interface

1. Sequence of PLC Operations:

- Normal conditions
- Emergency conditions
- Alarms

2. **Metering , Alarms and Data Logging**

- Power Metering
- Fuel Cell-Power Level Control
- Engine Load margin
- Engine/Generator Parameters
- Building Load Power Bar
- Trend Charts
- Real Time Values of Fuel, Heat Recovery, temperatures
- Data Reports in Excel Format
- Data and Alarm Path
- Redundancy

3. **PLC screens**

- Overview
- Fuel Cell power level set points
- Peaking engine
- Trends
- HGHW systems

1. Normal Conditions

The system is in Normal mode when the utility feed to the building is available, the Power Failure Relay, (PFR) is picked up and the *Return to Normal Delay* Timer times out.

Off-Peak / On-Peak

Whether or not the current moment in time is considered Off or On-Peak is determined by the PLC based upon times and dates entered at the Operator PC.

In both On-Peak and Off-Peak modes of operation under Normal conditions, the following breaker configuration exists:

- Interconnect Breaker 52IT is closed.
- Commercial Breakers M1, M4, M11, M14, M17 are closed.
- Emergency Breakers M2, M3, M12, M13, M16 are open.
- Emergency Bus Breakers EM-1 and EM-2 are closed.
- Breaker TXFC-1 is closed.

Normal, Off-Peak Operation

Breaker LS-1 is open.

All engine/generators are off.

Normal, On-Peak Operation

Breaker LS-1 is closed.
One engine/generator is on line with its power level controlled by the PLC.

Once TXFC-1 or TXFC-2 is closed onto a live bus, the PLC cannot cause a fuel cell to stop delivery of power once it has been manually "turned on". The PLC can only command a minimum power level of zero which will yield an individual fuel cell output of about 10 KW.

From the perspective of the PLC, each fuel cell may be individually specified as enabled or disabled at the Operator PC. The commanded power level for a disabled fuel cell is set to zero percent. This will yield approximately 10 kW output or 10 kW consumed power depending upon whether or not the fuel cell has been "turned on".

For each enabled fuel cell, an associated *Normal Power Level* is set at the Operator PC.

During On-Peak operation, the PLC controls engine load to yield a *Target Purchased Power* equal to a value set at the Operator PC.

- If, during Peaking operation, the *Minimum Peaking Engine Load* is reached, further reductions in building load will be annunciated as the PLC reduces engine load. If fuel cells are in service, an operator may reduce the fuel cell *Normal Power Level* which will cause the engine to see additional load and may clear the alarm.

The transition from Off-Peak to On-Peak proceeds as follows:

1. The following Peaking Mode Permissives must be met
    - Peaking Mode Enable Checkbox is checked
    - Current Date and Time are within the configured Peaking Window
    - PLC Control Switchboard Switch is set to ON
    - Utility "SW A" is closed and "SW B" is open
    - Utility breakers closed (52IT and 52TS)
    - Utility Power to at least one Feeder
    - Current System Mode is NOT Emergency
    - Utility Power Meter communication is OK
    - Fuel Cell Transfer to the Utility Bus is complete
2. The PLC sounds the alarm horn for a configurable time period (60 seconds).
3. The PLC issues a run signal to the Primary Engine selected on the Peaking screen and holds the engine load command to the 0%.
4. Once the PLC sees that the engine is running, the engine breaker and LS-1 are closed it will begin controlling engine load to meet the *Target Purchased Power.*

    - If the Primary Peaking Engine fails to start or the Engine Breaker fails to close, within the Peaking Mode Alarm Delay time (60 sec. configurable) the PLC will alarm and retry from step 2 with the next Enabled Backup Peaking Engine.
    - During the peaking period, a warning and alarm are generated if Utility power exceeds the Peaking Failure threshold (300 kW, configurable) for longer than the Alarm Delay time (10 min. configurable). This alarm will initiate a "Simulate Power Failure" condition that will cause hardwired circuits to transfer the building to Emergency power. This alarm remains in effect until the end of the peaking period.

The transition from On-Peak to Off-Peak proceeds as follows:

1. The PLC's run signal to the engine is turned off.
2. Hardwired circuits open the DG and LS-1 breakers.

2. Emergency Conditions

Engine Load Margin = Engine Load minus *Minimum Emergency Engine Load*

The system is in Emergency mode when any of the following conditions are true and the *Utility Failure Alarm Delay* timer (2 sec, configurable) times out.

- Breaker 52IT is open
- Breaker 52TS is open
- The Power Failure Relay (PFR) drops out

The transition from Normal to Emergency proceeds as follows:

1. The fuel cell load command is set to zero percent.
2. If necessary, the PLC's run signal to the engine turns off.
   Hardwired circuits open the DG and LS-1 breakers.
3. TXFC-1 trips as soon as the last utility feeder breaker opens.
4. Hardwired circuits start and load the Emergency engines.
5. Once an Emergency Feeder breaker is closed the PLC closes TXFC-2
6. Once engine load exceeds the *Engine Low Warning Power Level* plus the fuel cell Emergency Power Level for 0.5 minutes (configurable) the fuel cell load command is set to the *Emergency Power Level.*

- If, during Emergency operation, the *Engine Low Warning Power Level* is reached, further reductions in building load will be annunciated. If fuel cells are in use, an operator may reduce the fuel cell *Emergency Power Level* which will cause the engines to see additional load and may clear the alarm.

- During Emergency Mode, if engine power falls to less than 50% of the Low Warning Level for longer than 5 seconds, all fuel cell Power Level Set points are held to 0% (4mA) until the System Mode returns to Normal or Peaking.

The transition from Emergency to Normal proceeds as follows:

1. Once the Power Failure Relay indicates that Utility power is available the fuel cell load command is set to zero percent.
2. Once a Utility Feeder breaker is closed the PLC trips TXFC-2 and closes TXFC-1
3. Once Utility power exceeds the fuel cell *Normal Power Level* for 0.5 minutes (configurable) normal operation of the fuel cells and peaking engine is resumed.

PLC Control Switch

When switch PLCS is set to OFF, all discrete PLC outputs are forced off and analog outputs are set to 4 ma.

3. Alarms

8-Bit Serial To Opto22		(1 is most Critical) **Severity**	
CHR Pos.	Bit Pos.		**Description**
0	**0**	**2**	EM-1: L1-L2 Volts Low Warning
0	**1**	**2**	EM-1: L2-L3 Volts Low Warning
0	**2**	**2**	EM-1: L3-L1 Volts Low Warning
0	**3**	**2**	EM-1: L1-L2 Volts High Warning
0	**4**	**2**	EM-1: L2-L3 Volts High Warning
0	**5**	**2**	EM-1: L3-L1 Volts High Warning
0	**6**	**3**	EM-1: Phase 1 Amps Low Warning
0	**7**	**3**	EM-1: Phase 2 Amps Low Warning
	0	**3**	EM-1: Phase 3 Amps Low Warning
	1	**2**	EM-1: Phase 1 Amps High Warning
	2	**2**	EM-1: Phase 2 Amps High Warning
	3	**2**	EM-1: Phase 3 Amps High Warning
	4	**1**	EM-1: Phase 1 Amps High Alarm
	5	**1**	EM-1: Phase 2 Amps High Alarm
	6	**1**	EM-1: Phase 3 Amps High Alarm
	7		Not Used (Reserved)
2	**0**	**2**	EM-2: L1-L2 Volts Low Warning
2	**1**	**2**	EM-2: L2-L3 Volts Low Warning
2	**2**	**2**	EM-2: L3-L1 Volts Low Warning
2	**3**	**2**	EM-2: L1-L2 Volts High Warning
2	**4**	**2**	EM-2: L2-L3 Volts High Warning
2	**5**	**2**	EM-2: L3-L1 Volts High Warning
2	**6**	**3**	EM-2: Phase 1 Amps Low Warning
2	**7**	**3**	EM-2: Phase 2 Amps Low Warning
3	**0**	**3**	EM-2: Phase 3 Amps Low Warning
3	**1**	**2**	EM-2: Phase 1 Amps High Warning
3	**2**	**2**	EM-2: Phase 2 Amps High Warning
3	**3**	**2**	EM-2: Phase 3 Amps High Warning
3	**4**	**1**	EM-2: Phase 1 Amps High Alarm
3	**5**	**1**	EM-2: Phase 2 Amps High Alarm
3	**6**	**1**	EM-2: Phase 3 Amps High Alarm
3	**7**		Not Used (Reserved)
4	**0**	**2**	SWBD A1: L1-L2 Volts Low Warning
4	**1**	**2**	SWBD A1: L2-L3 Volts Low Warning
4	**2**	**2**	SWBD A1: L3-L1 Volts Low Warning
4	**3**	**2**	SWBDA1: L1-L2 Volts High Warning

8-Bit Serial To Opto22		(1 is most Critical) Severity	Description
CHR Pos.	Bit Pos.		
4	4	**2**	SWBD A1: L2-L3 Volts High Warning
4	5	**2**	SWBD A1: L3-L1 Volts High Warning
4	6	**3**	SWBD A1: Phase 1 Amps Low Warning
4	7	**3**	SWBD A1: Phase 2 Amps Low Warning
5	0	**3**	SWBD A1: Phase 3 Amps Low Warning
5	1	**2**	SWBD A1: Phase 1 Amps High Warning
5	2	**2**	SWBD-A1: Phase 2 Amps High Warning
5	3	**2**	SWBD A1: Phase 3 Amps High Warning
5	4	**1**	SWBD A1: Phase 1 Amps High Alarm
5	5	**1**	SWBD A1: Phase 2 Amps High Alarm
5	6	**1**	SWBD A1: Phase 3 Amps High Alarm
5	7		Not Used (Reserved)
6	0	**2**	SWBD A2: L1-L2 Volts Low Warning
6	1	**2**	SWBD A2: L2-L3 Volts Low Warning
6	2	**2**	SWBD A2: L3-L1 Volts Low Warning
6	3	**2**	SWBD A2: L1-L2 Volts High Warning
6	4	**2**	SWBD A2: L2-L3 Volts High Warning
6	5	**2**	SWBD A2: L3-L1 Volts High Warning
6	6	**3**	SWBD A2: Phase 1 Amps Low Warning
6	7	**3**	SWBD A2: Phase 2 Amps Low Warning
7	0	**3**	SWBD A2: Phase 3 Amps Low Warning
7	1	**2**	SWBD A2: Phase 1 Amps High Warning
7	2	**2**	SWBD A2: Phase 2 Amps High Warning
7	3	**2**	SWBD A2: Phase 3 Amps High Warning
7	4	**1**	SWBD A2: Phase 1 Amps High Alarm
7	5	**1**	SWBD A2: Phase 2 Amps High Alarm
7	6	**1**	SWBD A2: Phase 3 Amps High Alarm
7	7		Not Used (Reserved)
8	0	**2**	SWBDG1: L1-L2 Volts Low Warning
8	1	**2**	SWBD G1: L2-L3 Volts Low Warning
8	2	**2**	SWBD G1: L3-L1 Volts Low Warning
8	3	**2**	SWBD G1: L1-L2 Volts High Warning
8	4	**2**	SWBD G1: L2-L3 Volts High Warning
8	5	**2**	SWBD G1: L3-L1 Volts High Warning
8	6	**3**	SWBD G1: Phase 1 Amps Low Warning
8	7	**3**	SWBD G1: Phase 2 Amps Low Warning
9	0	**3**	SWBD G1: Phase 3 Amps Low Warning
9	1	**2**	SWBD G1: Phase 1 Amps High Warning
9	2	**2**	SWBD G1: Phase 2 Amps High Warning
9	3	**2**	SWBD G1: Phase 3 Amps High Warning
9	4	**1**	SWBD G1: Phase 1 Amps High Alarm
9	5	**1**	SWBD G1: Phase 2 Amps High Alarm
9	6	**1**	SWBD G1: Phase 3 Amps High Alarm
9	7		Not Used (Reserved)
10	0	**2**	SWBD G2: L1-L2 Volts Low Warning
10	1	**2**	SWBD G2: L2-L3 Volts Low Warning

8-Bit Serial To		(1 is most Critical) **Severity**	**Description**
CHR Pos.	Bit Pos.		
10	2	**2**	SWBD G2: L3-L1 Volts Low Warning
10	3	**2**	SWBD G2: L1-L2 Volts High Warning
10	4	**2**	SWBD G2: L2-L3 Volts High Warning
10	5	**2**	SWBD G2: **L3-L1** Volts High Warning
10	6	**3**	SWBD G2: Phase 1 Amps Low Warning
10	7	**3**	SWBD G2: Phase 2 Amps Low Warning
11	0	**3**	SWBD G2: Phase 3 Amps Low Warning
11	1	**2**	SWBD G2: Phase 1 Amps High Warning
11	2	**2**	SWBD G2: Phase 2 Amps High Warning
11	3	**2**	SWBD G2: Phase 3 Amps High Warning
11	4	**1**	SWBD G2: Phase 1 Amps High Alarm
11	5	**1**	SWBD G2: Phase 2 Amps High Alarm
11	6	**1**	SWBD G2: Phase 3 Amps High Alarm
11	7		Not Used (Reserved)
12	0	**2**	SWBD B/C1: L1-L2 Volts Low Warning
12	1	**2**	SWBD B/C1: L2-L3 Volts Low Warning
12	2	**2**	SWBD B/C1: L3-L1 Volts Low Warning
12	3	**2**	SWBD B/C1: L1-L2 Volts High Warning
12	4	**2**	SWBD B/C1: L2-L3 Volts High Warning
12	5	**2**	SWBD B/C1: L3-L1 Volts High Warning
12	6	**3**	SWBD B/C1: Phase 1 Amps Low Warning
12	7	**3**	SWBD B/C1: Phase 2 Amps Low Warning
13	0	**3**	SWBD B/C1: Phase 3 Amps Low Warning
13	1	**2**	SWBD B/C1: Phase 1 Amps High Warning
13	2	**2**	**SWBD** B/C1: Phase 2 Amps High Warning
13	3	**2**	SWBD B/C1: Phase 3 Amps High Warning
13	4	**1**	SWBD B/C1: Phase 1 Amps High Alarm
13	5	**1**	SWBD B/C1: Phase 2 Amps High Alarm
13	6	**1**	SWBD B/C1: Phase 3 Amps High Alarm
13	7		Not Used (Reserved)
14	0	**2**	LS-1 L1-L2 Volts Low Warning
14	1	**2**	LS-1 L2-L3 Volts Low Warning
14	2	**2**	LS-1 L3-L1 Volts Low Warning
14	3	**2**	LS-1 L1-L2 Volts High Warning
14	4	**2**	LS-1 L2-L3 Volts High Warning
14	5	**2**	LS-1 L3-L1 Volts High Warning
14	6	**3**	LS-1 Phase 1 Amps Low Warning
14	7	**3**	LS-1 Phase 2 Amps Low Warning
15	0	**3**	LS-1 Phase 3 Amps Low Warning
15	1	**2**	LS-1 Phase 1 Amps High Warning
15	2	**2**	LS-1 Phase 2 Amps High Warning
15	3	**2**	LS-1 Phase 3 Amps High Warning
15	4	**1**	LS-1 Phase 1 Amps High Alarm
15	5	**1**	LS-1 Phase 2 Amps High Alarm
15	6	**1**	LS-1 Phase 3 Amps High Alarm
15	7		Not Used (Reserved)

8-Bit Serial To Opto22		(1 is most Critical) **Severity**	**Description**
CHR Pos.	Bit Pos.		
16	0	**2**	Load Bank: L1-L2 Volts Low Warnina
16	1	**2**	Load Bank: L2-L3 Volts Low Warning
16	2	**2**	Load Bank: L3-L1 Volts Low Warning
16	3	**2**	Load Bank: L1-L2 Volts High Warning
16	4	**2**	Load Bank: L2-L3 Volts High Warning
16	5	**2**	Load Bank: L3-L1 Volts High Warning
16	6	**3**	Load Bank: Phase 1 Amps Low Warning
16	7	**3**	Load Bank: Phase 2 Amps Low Warning
17	0	**3**	Load Bank: Phase 3 Amps Low Warning
17	1	**2**	Load Bank: Phase 1 Amps High Warning
17	2	**2**	Load Bank: Phase 2 Amps High Warning
17	3	**2**	Load Bank: Phase 3 Amps High Warning
17	4	**1**	Load Bank: Phase 1 Amps High Alarm
17	5	**1**	Load Bank: Phase 2 Amps High Alarm
17	6	**1**	Load Bank: Phase 3 Amps High Alarm
17	7		Not Used (Reserved)
18	0	**2**	Generator #1: L1-L2 Volts Low Warning
18	1	**2**	Generator #1: L2-L3 Volts Low Warning
18	2	**2**	Generator #1: L3-L1 Volts Low Warning
18	3	**2**	Generator #1: L1-L2 Volts High Warning
18	4	**2**	Generator #1: L2-L3 Volts High Warning
18	5	**2**	Generator #1: L3-L1 Volts High Warning
18	6	**3**	Generator #1: Phase 1 Amps Low Warning
18	7	**3**	Generator #1: Phase 2 Amps Low Warning
19	0	**3**	Generator #1: Phase 3 Amps Low Warning
19	1	**2**	Generator #1: Phase 1 Amps High Warning
19	2	**2**	Generator #1: Phase 2 Amps High Warning
19	3	**2**	Generator #1: Phase 3 Amps High Warning
19	4	**1**	Generator #1: Phase 1 Amps High Alarm
19	5	**1**	Generator #1: Phase 2 Amps High Alarm
19	6	**1**	Generator #1: Phase 3 Amps High Alarm
19	7		Not Used (Reserved)
20	0	**2**	Generator #2: L1-L2 Volts Low Warning
20	1	**2**	Generator #2: L2-L3 Volts Low Warning
20	2	**2**	Generator #2: L3-L1 Volts Low Warning
20	3	**2**	Generator #2: L1-L2 Volts High Warning
20	4	**2**	Generator #2: L2-L3 Volts High Warning
20	5	**2**	Generator #2: L3-L1 Volts High Warning
20	6	**3**	Generator #2: Phase 1 Amps Low Warning
20	7	**3**	Generator #2: Phase 2 Amps Low Warning
21	0	**3**	Generator #2: Phase 3 Amps Low Warning
21	1	**2**	Generator #2: Phase 1 Amps High Warning
21	2	**2**	Generator #2: Phase 2 Amps High Warning
21	3	**2**	Generator #2: Phase 3 Amps High Warning
21	4	**1**	Generator #2: Phase 1 Amps High Alarm
21	5	**1**	Generator #2: Phase 2 Amps High Alarm

8-Bit Serial To Opto22		(1 is most Critical) **Severity**	**Description**
CH R Pos.	Bit Pos.		
21	6	**1**	Generator #2: Phase 3 Amps High Alarm
21	7		Not Used (Reserved)
22	0	**2**	Generator #3: L1-L2 Volts Low Warning
22	1	**2**	Generator #3: L2-L3 Volts Low Warning
22	2	**2**	Generator #3: L3-L1 Volts Low Warning
22	3	**2**	Generator #3: L1-L2 Volts High Warning
22	4	**2**	Generator #3: L2-L3 Volts High Warning
22	5	**2**	Generator #3: L3-L1 Volts High Warning
22	6	**3**	Generator #3: Phase 1 Amps Low Warning
22	7	**3**	Generator #3: Phase 2 Amps Low Warning
23	0	**3**	Generator #3: Phase 3 Amps Low Warning
23	1	**2**	Generator #3: Phase 1 Amps High Warning
23	2	**2**	Generator #3: Phase 2 Amps High Warning
23	3	**2**	Generator #3: Phase 3 Amps High Warning
23	4	**1**	Generator #3: Phase 1 Amps High Alarm
23	5	**1**	Generator #3: Phase 2 Amps High Alarm
23	6	**1**	Generator #3: Phase 3 Amps High Alarm
23	7		Not Used (Reserved)
24	0	**2**	Utility: L1-L2 Volts Low Warning
24	1	**2**	Utility: L2-L3 Volts Low Warning
24	2	**2**	Utility: L3-L1 Volts Low Warning
24	3	**2**	Utility: L1-L2 Volts High Warning
24	4	**2**	Utility: L2-L3 Volts High Warning
24	5	**2**	Utility: L3-L1 Volts High Warning
24	6	**3**	Utility: Phase 1 Amps Low Warning
24	7	**3**	Utility: Phase 2 Amps Low Warning
25	0	**3**	Utility: Phase 3 Amps Low Warning
25	1	**2**	Utility: Phase 1 Amps High Warning
25	2	**2**	Utility: Phase 2 Amps High Warning
25	3	**2**	Utility: Phase 3 Amps High Warning
25	4	**1**	Utility: Phase 1 Amps High Alarm
25	5	**1**	Utility: Phase 2 Amps High Alarm
25	6	**1**	Utility: Phase 3 Amps High Alarm
25	7.		Not Used (Reserved)
26	0	**2**	Fuel Cells: L1-L2 Volts Low Warning
26	1	**2**	Fuel Cells: L2-L3 Volts Low Warning
26	2	**2**	Fuel Cells: L3-L1 Volts Low Warning
26	3	**2**	Fuel Cells: L1-L2 Volts High Warning
26	4	**2**	Fuel Cells: L2-L3 Volts High Warning
26	5	**2**	Fuel Cells: L3-L1 Volts High Warning
26	6	**3**	Fuel Cells: Phase 1 Amps Low Warning
26	7	**3**	Fuel Cells: Phase 2 Amps Low Warning
27	0	**3**	Fuel Cells: Phase 3 Amps Low Warning
27	1	**2**	Fuel Cells: Phase 1 Amps High Warning
27	2	**2**	Fuel Cells: Phase 2 Amps High Warning
27	3	**2**	Fuel Cells: Phase 3 Amps High Warning

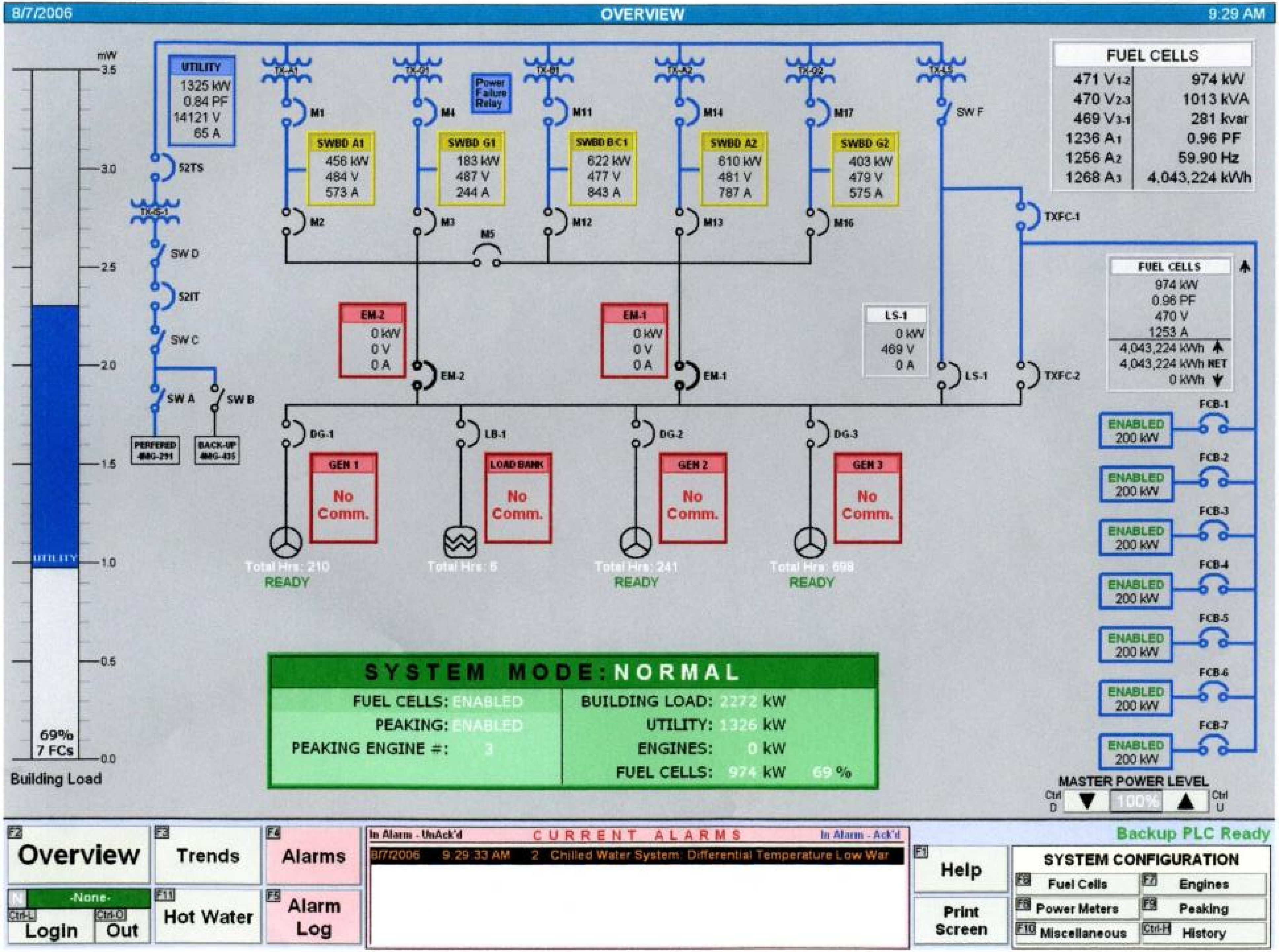
This page not used

8-Bit Serial To Opto22		(1 is most Critical) Severity	Description
CHR Pos.	**Bit Pos.**		
27	4		Fuel Cells: Phase 1 Amos Hiah Alarm
27	5		Fuel Cells: Phase 2 Amps High Alarm
27	6		Fuel Cells: Phase 3 Amps High Alarm
27	7		Not Used (Reserved)
28	0		Engine #1 Did Not Start For Peaking
28	1		Engine #2 Did Not Start For Peaking
28	2		Engine #3 Did Not Start For Peaking
28	3		Peaking Mode Not Using Engine #3
28	4		Engine #3 Natural Gas Low Flow
28	5		DG-1 Breaker Did Not Close for Peaking
28	6		DG-2 Breaker Did Not Close for Peaking
28	7		DG-3 Breaker Did Not Close for Peaking
29	0		LS-1 Breaker Did Not Close for Peaking
29	1		LS-1 Breaker is closed while System Mode is Normal or
29	2		Lockout Relay 86IT is Closed
29	3		Lockout Relay 86TS is Closed
29	4		Lockout Relay 86B is Closed
29	5		LI PA Preferred Source Not Connected (SW A Open)
29	6	**3**	52-IT Breaker Open
29	7	**3**	52-TS Breaker Open
30	0		No Power to Feeder A1
30	1		No Power to Feeder G1
30	2		No Power to Feeder B/C1
30	3		No Power to Feeder A2
30	4		No Power to Feeder G2
30	5		No Power to Fuel Cell Bus
30	6	**3**	FCB-1 Breaker Open
30	7	**3**	FCB-2 **Breaker** Open
31	0	**3**	FCB-3 Breaker Open
31	1	**3**	FCB-4 Breaker Open
31	2	**3**	FCB-5 Breaker Open
31	3	**3**	FCB-6 Breaker Open
31	4	**3**	FCB-7 Breaker Open
31	5		TXFC-1 Breaker is Not Open
31	6		TXFC-1 Breaker is Not Closed
31	7		TXFC-2 Breaker is Not Open
32	0		TXFC-2 Breaker is Not Closed
32	1		Load Management Battery Supply Failure
32	2		Engine #1 Failure (EFR1)
32	3		Engine #2 Failure (EFR2)
32	4		Engine #3 Failure (EFR3)
32	5	**2**	Engine #1 Low Load During Emergency Mode
32	6	**2**	Engine #2 Low Load During Emergency Mode
32	7	**2**	Engine #3 Low Load During Emergency Mode
33	0	**2**	Engine #1 Low Load During Peaking Mode
33	1	**2**	Engine #2 Low Load During Peaking Mode

8-Bit Serial To Opto22		(1 is most Critical) **Severity**	**Description**
CHR Pos.	Bit Pos.		
33	2	**2**	Enaine #3 Low Load Durina Peakina Mode
33	3	**2**	Generator #1 High kW Warning
33	4	**2**	Generator #2 High kW Warning
33	5	**2**	Generator #3 High kW Warning
33	6		Generator #1 High kW Alarm
33	7		Generator #2 High kW Alarm
34	0		Generator #3 High kW Alarm
34	1		Generator #1 Power Factor Low
34	2		Generator #2 Power Factor Low
34	3		Generator #3 Power Factor Low
34	4		Generator #1 Power Factor High
34	5		Generator #2 Power Factor High
34	6		Generator #3 Power Factor High
34	7	**2**	Generator #1 kW Not Tracking Load Command (Low
35	0	**2**	Generator #2 kW Not Tracking Load Command (Low
35	1	**2**	Generator #3 kW Not Tracking Load Command (Low
35	2	**2**	Generator #1 kW Not Tracking Load Command (High
35	3	**2**	Generator #2 kW Not Tracking Load Command (High
35	4	**2**	Generator #3 kW Not Tracking Load Command (High
35	5	**1**	Peaking Purchase Power Not Tracking Target (Low
35	6	**1**	Peaking Purchase Power Not Tracking Target (High
35	7	**2**	Hot Water System: Fuel Cell Output Temperature Low
36	0	**2**	Hot Water System: Fuel Cell Output Temperature High
36	1	**2**	Hot Water System: Supply Temperature Low Warning
36	2	**2**	Hot Water System: Supply Temperature High Warning
36	3	**2**	Hot Water System: Return Temperature Low Warning
36	4	**2**	Hot Water System: Return Temperature High Warning
36	5	**2**	Hot Water System: Differential Temperature Low
36	6	**2**	Hot Water System: Differential Temperature High
36	7	**2**	Chilled Water System: Differential Temperature Low
37	0	**2**	Chilled Water System: Differential Temperature High
37	1		Power Failure Relay (PFR) Dropped Out
37	2		System Normal Relay Indicates Engine Control Problem
37	3		Operator Disabled PLC Control (PLCS Switch)
37	4		Fuel Cell Setpoints Suppressed During Emergency Due to Low
37	5		Device Trouble: PLC A
37	6		Device Trouble: Chassis A, Slot 01, SRM Module
37	7		Device Trouble: Chassis A, Slot 03, CNB Module
38	0		Device Trouble: PLC B
38	1		Device Trouble: Chassis B, Slot 01, SRM Module
38	2		Device Trouble: Chassis B, Slot 03, CNB Module
38	3		Device Trouble: I/O Chassis, Slot 00, CNB Module
38	4		Device Trouble: I/O Chassis, Slot 02, OF8 Module
38	5		Device Trouble: I/O Chassis, Slot 03, IF8 Module
38	6		Device Trouble: I/O Chassis, Slot 06, IB32 Module
38	7		Device Trouble: I/O Chassis, Slot 07, IB32 Module

8-Bit Serial To Opto22		(1 is most Critical) **Severity**	**Description**	
CHR Pos.	Bit Pos.			
39	0		**Device** Trouble	I/O Chassis, Slot 11, OW16I Module
39	1		Device Trouble	I/O Chassis, Slot 12, OW16I Module
39	2		Device Trouble	I/O Chassis, Slot 13, OW16I Module
39	3		Device Trouble	Flex I/O, Slot X, ACN Module
39	4		Device Trouble	Flex I/O, Slot 0, IE8 Module
39	5		Device Trouble	Flex I/O, Slot 1, IB16 Module
39	6		Device Trouble	AnyBus Comm. Module for Power
39	7	**2**	Device Trouble	EM-1 Power Meter
40	0	**2**	Device Trouble	EM-2 Power Meter
40	1	**2**	Device Trouble	SWBD A1 Power Meter
40	2	**2**	Device Trouble	SWBD A2 Power Meter
40	3	**2**	Device Trouble	SWBDG1 Power Meter
40	4	**2**	Device Trouble	SWBD G2 Power Meter
40	5	**2**	Device Trouble	SWBD B/C1 Power Meter
40	6	**2**	Device Trouble	LS-1 Power Meter
40	7	**2**	Device Trouble	Load Bank Power Meter
41	0	**1**	Device Trouble	Generator #1 Power Meter
41	1	**1**	Device Trouble	Generator #2 Power Meter
41	2	**1**	Device Trouble	Generator #3 Power Meter
41	3	**1**	Device Trouble	Utility Power Meter
41	4	**1**	Device Trouble	Fuel Cells Power Meter
41	5	**1**	Peaking Failure Warning: Utility kW High ("Simulate	
41	6	**1**	Peaking Failure Alarm: Utility kW High ("Simulate Power	
41	7	**2**	Peaking Failure Due to Fuel Cell Transfer to Utility Bus	
42	0	**3**	"Peaking Enable" Checkbox is Unchecked	
42	1	**1**	"Force Peaking Now" Checkbox is Checked	
42	2	**1**	Peaking Failure Warning: Utility PF Low	
42	3	**1**	Peaking Failure Alarm: Utility PF Low	
42	4	**1**	Peaking Failure Warning: Utility PF High	
42	5	**1**	Peaking Failure Alarm: Utility PF High	
42	6		Spare	
42	7		Spare	
43	0		Spare	
43	1		Spare	
43	2		Spare	
43	3		Spare	
43	4		Spare	
43	5		Spare	
43	6		Spare	
43	7		Spare	
44	0		Spare	
44	1		Spare	
44	2		Spare	
44	3		Spare	
44	4		Spare	
44	5		Spare	

8-Bit Serial To Opto22		(1 is most Critical) **Severity**	**Description**
CH R Pos.	Bit Pos.		
44	6		SDare
44	7		Spare
45	0		Spare
45	1		Spare
45	2		Spare
45	3		Spare
45	4		Spare
45	5		Spare
45	6		Spare
45	7		Spare
46	0		Spare
46	1		Spare
46	2		Spare
46	3		Spare
46	4		Spare
46	5		Spare
46	6		Spare
46	7		Spare
47	0		Spare
47	1		Spare
47	2		Spare
47	3		Spare
47	4		Spare
47	5		Spare
47	6		Spare
47	7		Spare
48	0		Spare
48	1		Spare
48	2		Spare
48	3		Spare
48	4		Spare
48	5		Spare
48	6		Spare
48	7		Spare
49	0	**1**	No Communication With PLC A or PLC B
49	1		Not Used (Reserved)
49	2		Not Used (Reserved)
49	3		Not Used (Reserved)
49	4		Not Used (Reserved)
49	5		Not Used (Reserved)
49	6		Not Used (Reserved)
49	7		Not Used (Reserved)


8/7/2006
OVERVIEW
9:29 AM
mW
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
UTILITY
69%
7 FCs
Building Load
UTILITY
1325 kW
0.84 PF
14121 V
65 A
52TS
TX-IS-1
SW D
52IT
SW C
SW A
SW B
PERFERED
4MG-291
BACK-UP
4MG-435
TX-A1
TX-G1
TX-B1
TX-A2
TX-G2
TX-LS
Power Failure Relay
M1
M4
M11
M14
M17
SW F
SWBD A1
456 kW
484 V
573 A
SWBD G1
183 kW
487 V
244 A
SWBD B-C1
622 kW
477 V
843 A
SWBD A2
610 kW
481 V
787 A
SWBD G2
403 kW
479 V
575 A
M2
M3
M12
M13
M16
M5
TXFC-1
EM-2
0 kW
0 V
0 A
EM-1
0 kW
0 V
0 A
LS-1
0 kW
469 V
0 A
EM-2
EM-1
LS-1
TXFC-2
FUEL CELLS
471 V1-2
470 V2-3
469 V3-1
1236 A1
1256 A2
1268 A3
974 kW
1013 kVA
281 kvar
0.96 PF
59.90 Hz
4,043,224 kWh
FUEL CELLS
974 kW
0.96 PF
470 V
1253 A
4,043,224 kWh
4,043,224 kWh NET
0 kWh
DG-1
LB-1
DG-2
DG-3
GEN 1
No Comm.
LOAD BANK
No Comm.
GEN 2
No Comm.
GEN 3
No Comm.
Total Hrs: 210
READY
Total Hrs: 6
Total Hrs: 241
READY
Total Hrs: 698
READY
FCB-1
FCB-2
FCB-3
FCB-4
FCB-5
FCB-6
FCB-7
ENABLED 200 kW
ENABLED 200 kW
ENABLED 200 kW
ENABLED 200 kW
ENABLED 200 kW
ENABLED 200 kW
ENABLED 200 kW
SYSTEM MODE: NORMAL
FUEL CELLS: ENABLED
PEAKING: ENABLED
PEAKING ENGINE #: 3
BUILDING LOAD: 2272 kW
UTILITY: 1326 kW
ENGINES: 0 kW
FUEL CELLS: 974 kW 69 %
MASTER POWER LEVEL
Ctrl D
100%
Ctrl U
F2 Overview
F3 Trends
F4 Alarms
-None-
Ctrl-L Login
Ctrl-O Out
F11 Hot Water
F5 Alarm Log
In Alarm - UnAck'd
CURRENT ALARMS
In Alarm - Ack'd
8/7/2006 9:29:33 AM 2 Chilled Water System: Differential Temperature Low War
F1 Help
Print Screen
Backup PLC Ready
SYSTEM CONFIGURATION
F6 Fuel Cells
F7 Engines
F8 Power Meters
F9 Peaking
F10 Miscellaneous
Ctrl-H History

8/7/2006 | **FUEL CELLS** | System Mode: NORMAL | 9:34 AM

Login Required
M Maintenance
S Supervisory

POWER LEVEL SETPOINT

FUEL CELL	Enable	kW Normal	kW Emergency	SCALING (kW) 4 mA (S)	SCALING (kW) 20mA (S)
1	✓	200	10	0	200
2	✓	200	10	0	200
3	✓	200	10	0	200
4	✓	200	10	0	200
5	✓	200	10	0	200
6	✓	200	10	0	200
7	✓	200	10	0	200

Enter the expected Fuel Cell Ouptut at a Setpoint of 0% and at a Setpoint of 100%

Master Enable	Master Power Level (%) Normal	Master Power Level (%) Emergency
✓	100	100

Total Expected Fuel Cell Ouput: 1400kW

S Fuel Cell Enable Delay on Transfer to Emergency (Min.) 0.5

When Emergency Mode starts, the Fuel Cell Power is set to 0% until the engine load exceeds the Minimum Emergency Engine Load plus the Fuel Cell Emergency Power Level for the specified time.

S Fuel Cell Enable Delay on Transfer to Normal (Min.) 0.5

When transitioning from Emergency to Normal or Peaking, the Fuel Cell Power is set to 0% until Utility power exceeds the Fuel Cell Normal Power Level for the specified time.

M Fuel Cell Breaker Open Alarm Delay (Sec.) 10

An Alarm is generated anytime a Fuel Cell Breaker is open.

F2 Overview | F3 Trends | F4 Alarms
N -None-
Ctrl-L Login | Ctrl-O Out | F11 Hot Water | F5 Alarm Log

In Alarm - UnAck'd | CURRENT ALARMS | In Alarm - Ack'd

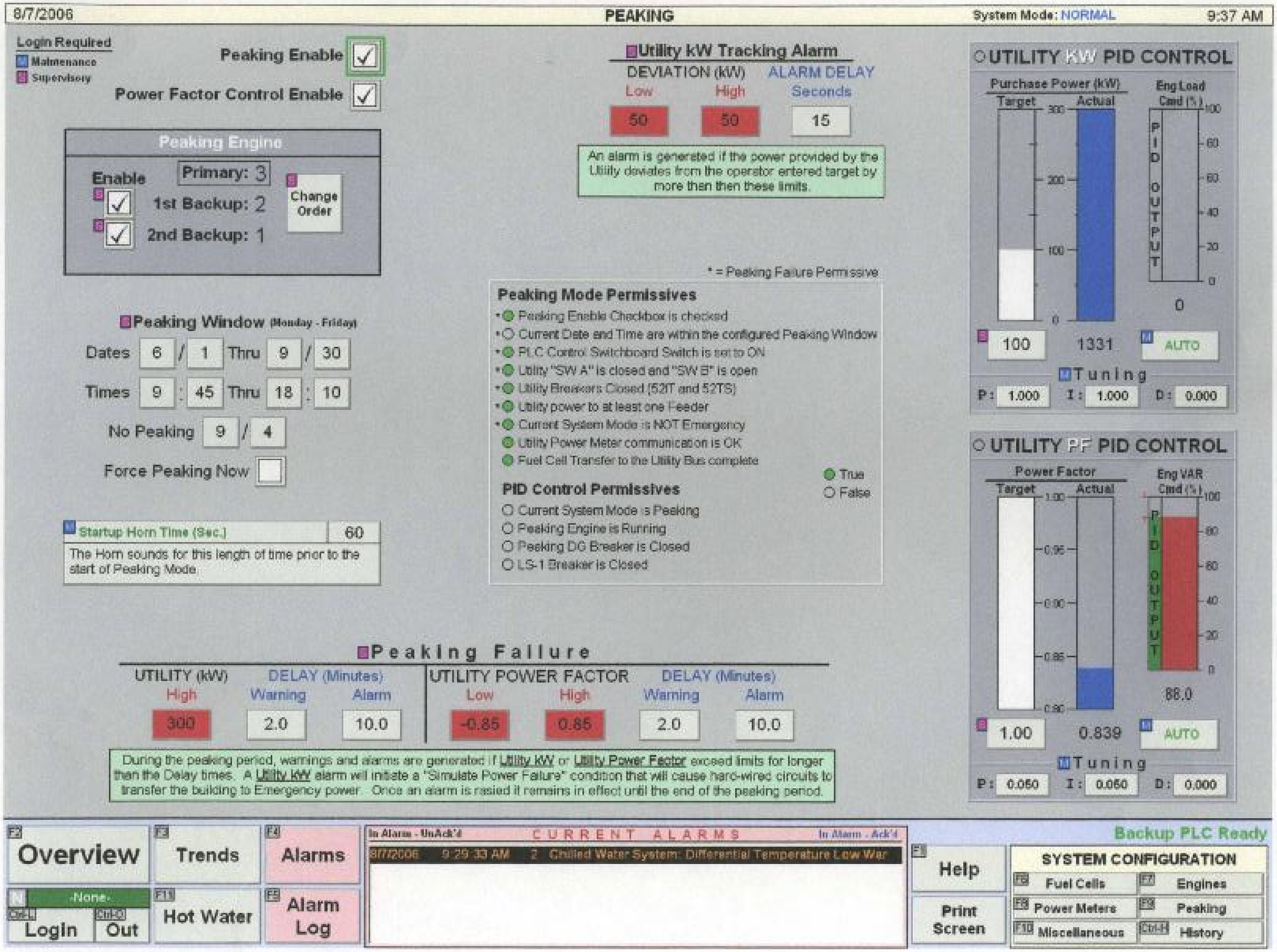
8/7/2006 9:29:33 AM 2 Chilled Water System: Differential Temperature Low War

F1 Help | Print Screen

Backup PLC Ready

SYSTEM CONFIGURATION

F6 Fuel Cells	F7 Engines
F8 Power Meters	F9 Peaking
F10 Miscellaneous	Ctrl-H History


8/7/2006
PEAKING
System Mode: NORMAL
9:37 AM
Login Required
Maintenance
Supervisory
Peaking Enable
Power Factor Control Enable
Peaking Engine
Enable
Primary: 3
1st Backup: 2
2nd Backup: 1
Change Order
Peaking Window (Monday - Friday)
Dates 6 / 1 Thru 9 / 30
Times 9 : 45 Thru 18 : 10
No Peaking 9 / 4
Force Peaking Now
Startup Horn Time (Sec.) 60
The Horn sounds for this length of time prior to the start of Peaking Mode.
Utility kW Tracking Alarm
DEVIATION (kW)
Low 50
High 50
ALARM DELAY Seconds 15
An alarm is generated if the power provided by the Utility deviates from the operator entered target by more then then these limits.
* = Peaking Failure Permissive
Peaking Mode Permissives
* Peaking Enable Checkbox is checked
* Current Date and Time are within the configured Peaking Window
* PLC Control Switchboard Switch is set to ON
* Utility "SW A" is closed and "SW B" is open
* Utility Breakers Closed (52T and 52TS)
* Utility power to at least one Feeder
* Current System Mode is NOT Emergency
Utility Power Meter communication is OK
Fuel Cell Transfer to the Utility Bus complete
True
False
PID Control Permissives
Current System Mode is Peaking
Peaking Engine is Running
Peaking DG Breaker is Closed
LS-1 Breaker is Closed
Peaking Failure
UTILITY (kW) High 300
DELAY (Minutes) Warning 2.0 Alarm 10.0
UTILITY POWER FACTOR Low -0.85 High 0.85
DELAY (Minutes) Warning 2.0 Alarm 10.0
During the peaking period, warnings and alarms are generated if Utility kW or Utility Power Factor exceed limits for longer than the Delay times. A Utility kW alarm will initiate a "Simulate Power Failure" condition that will cause hard-wired circuits to transfer the building to Emergency power. Once an alarm is rasied it remains in effect until the end of the peaking period.
UTILITY KW PID CONTROL
Purchase Power (kW)
Target
Actual
Eng Load Cmd (%)
PID OUTPUT
0
100
1331
AUTO
Tuning
P: 1.000 I: 1.000 D: 0.000
UTILITY PF PID CONTROL
Power Factor
Target
Actual
Eng VAR Cmd (%)
PID OUTPUT
88.0
1.00
0.839
AUTO
Tuning
P: 0.050 I: 0.050 D: 0.000
F2 Overview
F3 Trends
F4 Alarms
-None-
Ctrl-L Login
Ctrl-O Out
F11 Hot Water
F5 Alarm Log
In Alarm - UnAck'd
CURRENT ALARMS
In Alarm - Ack'd
8/7/2006 9:29:33 AM 2 Chilled Water System: Differential Temperature Low War
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SYSTEM CONFIGURATION
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F8 Power Meters
F9 Peaking
F10 Miscellaneous
Ctrl-H History

8/7/2006 **TREND** System Mode: 9:40 AM

Power Meters
- SWBD A1
- Average Volts
- Average Amps
- kW

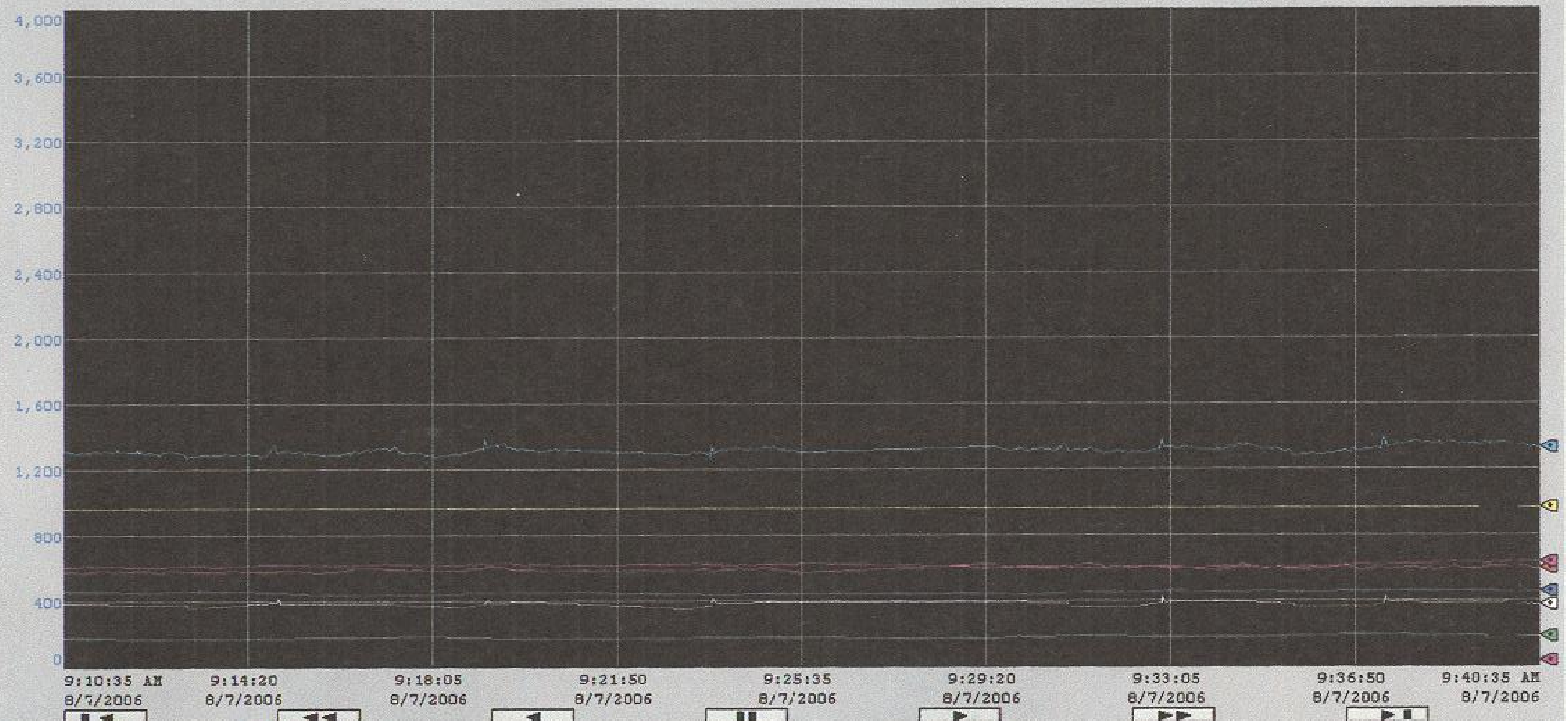
Breakers
- Utility Bus
- Fuel Cell Bus
- Emergency Bus

- Engines/Generators
- Peaking

Fuel Cells
- Fuel Cell 1
- Power Level
- Hot Water System

- System Info

ZOOM TO DEFAULT



Caption	9:40:35 AM	Min	Max	Units
SWBD A1	459	0	4,000	kW
SWBD G1	188	0	4,000	kW
SWBD B/C1	600	0	4,000	kW
SWBD A2	643	0	4,000	kW
SWBD G2	384	0	4,000	kW
Utility	1,336	0	4,000	kW
Fuel Cells	973	0	4,000	kW
Generator #1	0	0	4,000	kW
Generator #2	0	0	4,000	kW
Generator #3	0	0	4,000	kW
EM-1	0	0	4,000	kW
EM-2	0	0	4,000	kW
LS-1	0	0	4,000	kW
Load Bank	0	0	4,000	kW

Zoom Out | ----------- Days ----------- 30 7 1 | ----------- Hours ----------- 12 4 1 | --- Minutes --- 30 10 | Zoom In

F2 **Overview** | F3 **Trends** | F4 **Alarms**

N -None- Ctrl-L **Login** Ctrl-O **Out** | F11 **Hot Water** | F5 **Alarm Log**

In Alarm - UnAck'd **CURRENT ALARMS** In Alarm - Ack'd

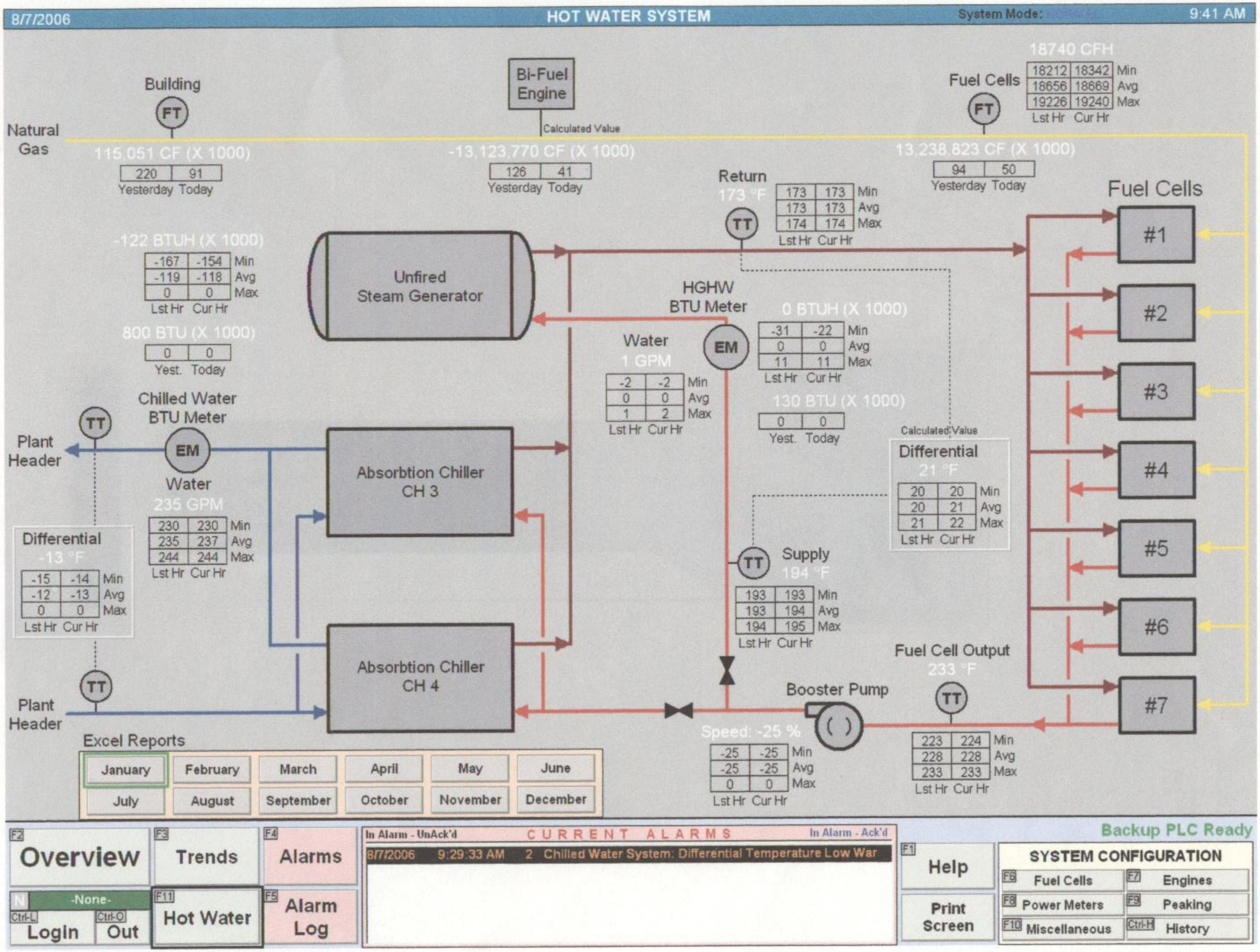
8/7/2006 9:29:33 AM 2 Chilled Water System: Differential Temperature Low War

F1 **Help** | **Print Screen**

Backup PLC Ready

SYSTEM CONFIGURATION

F6 Fuel Cells	F7 Engines
F8 Power Meters	F9 Peaking
F10 Miscellaneous	Ctrl-H History



8/7/2006
HOT WATER SYSTEM
System Mode:
9:41 AM
Building
FT
Natural Gas
115,051 CF (X 1000)
220 91
Yesterday Today
Bi-Fuel Engine
Calculated Value
-13,123,770 CF (X 1000)
126 41
Yesterday Today
Fuel Cells
FT
18740 CFH
18212 18342 Min
18656 18669 Avg
19226 19240 Max
Lst Hr Cur Hr
13,238,823 CF (X 1000)
94 50
Yesterday Today
Fuel Cells
#1
#2
#3
#4
#5
#6
#7
Return
173 °F
TT
173 173 Min
173 173 Avg
174 174 Max
Lst Hr Cur Hr
-122 BTUH (X 1000)
-167 -154 Min
-119 -118 Avg
0 0 Max
Lst Hr Cur Hr
800 BTU (X 1000)
0 0
Yest. Today
Unfired Steam Generator
HGHW BTU Meter
EM
0 BTUH (X 1000)
-31 -22 Min
0 0 Avg
11 11 Max
Lst Hr Cur Hr
130 BTU (X 1000)
0 0
Yest. Today
Water
1 GPM
-2 -2 Min
0 0 Avg
1 2 Max
Lst Hr Cur Hr
Chilled Water BTU Meter
TT
EM
Plant Header
Water
235 GPM
230 230 Min
235 237 Avg
244 244 Max
Lst Hr Cur Hr
Absorbtion Chiller CH 3
Calculated Value
Differential
21 °F
20 20 Min
20 21 Avg
21 22 Max
Lst Hr Cur Hr
Differential
-13 °F
-15 -14 Min
-12 -13 Avg
0 0 Max
Lst Hr Cur Hr
Supply
194 °F
TT
193 193 Min
193 194 Avg
194 195 Max
Lst Hr Cur Hr
Fuel Cell Output
233 °F
TT
Absorbtion Chiller CH 4
TT
Plant Header
Booster Pump
Speed: -25 %
-25 -25 Min
-25 -25 Avg
0 0 Max
Lst Hr Cur Hr
223 224 Min
228 228 Avg
233 233 Max
Lst Hr Cur Hr
Excel Reports
January
February
March
April
May
June
July
August
September
October
November
December
F2 Overview
F3 Trends
F4 Alarms
N -None-
Ctrl-L Login
Ctrl-O Out
F11 Hot Water
F5 Alarm Log
In Alarm - UnAck'd
CURRENT ALARMS
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Print Screen
Backup PLC Ready
SYSTEM CONFIGURATION
F6 Fuel Cells
F7 Engines
F8 Power Meters
F9 Peaking
F10 Miscellaneous
Ctrl-H History

VERIZON - MEDIA RELATIONS

September 21, 2005
12:00 p.m. EST

PARTICIPANTS:

1. ERIC RABE, MODERATOR
2. IVAN SEIDENBERG, CHAIRMAN AND CEO, VERIZON
3. ADOLPHO REYES, PROJECT EXECUTIVE, VERIZON
4. PAT HOFFMAN, U.S. DEPARTMENT OF ENERGY
5. MICHAEL BALBONI, NEW YORK SENATOR
6. JAN VAN DAKKUM, PRESIDENT, UTC POWER

ERIC RABE:

Welcome to a Verizon News Conference to describe a major fuel cell project that we have underway at our Garden City, Long Island Central Office in New York State. We thank you for being here in the room with us, and we thank those of you who are on the phone.

We're here today to announce a major step forward in alternative energy and clean alternative energy, we might add. A significant advance in reliable power, especially in cases of emergencies, but at any time. And an economical alternative to burning fossil fuels for electricity. And all of that will be discussed in detail by our speakers today.

In just a moment, we'll hear from Ivan Seidenberg, who is, of course, the Chairman and CEO of Verizon. To describe the project here on Long Island, Adolfo Reyes, who is a Verizon Executive, who has been responsible for creating this project here. His name is R-E-Y-E-S, Adolfo Reyes. And after Adolph speaks, Pat

Hoffman of the U.S. Department of Energy, will join us. And then Jon Van Dakkum, who is the President of UTC Power, which is the Company that builds the energy providing fuel cells that we have here on Long Island.

So, we'll get right to the program. Then we'll take a few questions, both from the phone and from people here in the audience. So, let me introduce now Ivan Seidenberg, Chairman and CEO of Verizon.

IVAN SEIDENBERG, CHAIRMAN AND CEO, VERIZON:

OK. Thank you very much. And good afternoon, everyone. Thank you for being with us, those of you who are here in person, and those of you who are participating by conference call.

Today is a terrific day in the advancement of technology for both the power and the communications industries. For the first time the alternative power source known as 'fuel cells' are providing electrical power for a major communications facility here in Garden City, including our switch that serves over 35,000 customers.

This energy efficient technology has great potential to save costs, lower greenhouse gas emissions, and make the network even more reliable in the event of any emergency. It's good for Long Island, the community, and its certainly good as a precedent for our whole country.

Just off to my right you'll see seven fuel cells manufactured by the great United Technologies Company. And I would say they're humming away, but you can hardly even hear them. They are joining hydrogen and oxygen atoms to generate electricity.

The beauty is this chemical process generates no pollution, zero, nothing, nada. The only byproducts in this electrical, mechanical process are heat and pure water.

Never before has this technology been put to work on such a scale. While this is still technically a pilot project, these cells have been running for several months now. So, this is a very big step in moving this technology from the lab to the real world.

Just a couple of comments on why this is so important Obviously, first, because it helps the environment. By using these fuel cells instead of traditional methods we reduce pollution by the amount that will be eliminated by 700 cars over the course of a year. As we talk, these cells are generating more than a megawatt of power, enough to power more than 400 homes, without impacting the environment. In fact, much of the electricity we're using for this news conference today comes from these fuel cells.

Another key advantage is network reliability. While all of our central offices have backup power in the form of generators and batteries, installing fuel cells adds yet another layer of reliability in the event of any catastrophe or disaster.

Third, the cost factor, we expect that up front we'll save some $250,00 annually just by this project.

Finally, I'd like to acknowledge, publicly acknowledge our partners. You'll hear from many of them in a moment The U.S. Department of Energy provided a considerable up front support to help get us going, and we expect additional funding from the New York State Energy Research & Development Authority. They're trying to provide incentives to business to do the right thing.

During this pilot project we will remain connected to the commercial power grid supplied by our friends at the Long Island Power Authority. Keyspan is supplying the natural gas that's being used to supply the hydrogen for the sales, and they also oversaw the construction of the project.

Oak Ridge National Labs also contributed their expertise and support. Of course, there's UTC Power, which manufactured the cells, and you'll hear from Jan in a moment. And you'll hear from many of the partners we have today.

What I'd like now is to turn the podium over to a real expert, Adolfo Reyes, who has been on this project. He's from Verizon. He told me he's a grad of Texas A&M. How do you get from Texas A&M to Garden City? It's up to you.

But it's my pleasure to introduce my colleague, Adolfo Reyes.

ADOLPHO REYES, PROJECT EXECUTIVE, VERIZON:

Thank you, Ivan. And good afternoon, everyone.

As these fuel cells work quietly beside us here, this day on one hand marks the end of a very successful six-year effort but it also represents a promising new beginning. Cost efficiency, quality products and services, and environmental responsibility are key business strategies for maintaining industry leadership.

In 1999 these key elements drove our decision to power a major Verizon facility using an alternative energy source. Back then we simply weren't sure we could do something on this scale. Through the untiring efforts of a terrific team of people inside and outside Verizon we developed a plan based on fuel cell technology.

Now our engineering and power experts knew the fuel cells were a proven technology. The answer, we thought, was whether fuel cells could be feasibly integrated within our existing power system and backup systems to improve the reliability of our network, to lower our energy costs, and to help the environment.

After nearly three years of detailed research we concluded that this trial was worth pursuing. We announced our plans for the project in 2002, and since then weVe been working with our partners to plan, engineer, build, and bring such a facility online.

As part of our site selection process, we looked for a building that would put fuel cells technology to the test on a large and realistic scale. Verizon had land line in 28 States and the District of Columbia while we took a careful look nationally.

Our facility here in Garden City came to the front quickly. It's a significant Verizon facility with a mixed use of functions. About 40% of this building is a sophisticated computerized system involved in routing or switching our customers' calls and data through our network. The remaining 60% involved administrative space, as well as a regional network monitoring center.

In short, this 292,000 square foot facility provided an ideal lab for testing fuel cells in a real 7 x 24, heavy power demand situation, and in an area that sees varied weather conditions throughout the year.

Again, working with our partners we designed and built the power plan you see here today. Seven 200 Kilowatt fuel cells in parallel with lights (ph) of commercial grid, providing approximately 2.7 megawatts of power needed to sustain the facility.

Through an electro-chemical process involving hydrogen, oxygen, and an electrolyte material these fuel cells produce electricity while giving off heat and water as byproducts. Special heat recovery features then use the energy from these byproducts to offset up to one-third of the building's heating and cooling load. Our ability to balance and manage power to the building will reduce Verizon's annual energy cost by $250,000.

And in the event of an emergency or other unplanned disaster, these fuel cells provide a fourth power source complementing LIPA’s commercial power grid and our existing batteries and onsite generators. This further strengthens the reliability of our outstanding network and is good news to our Verizon customers here in Long Island.

And one more bit of good news. This plant will reduce 11.1 million pounds of greenhouse gas emissions annually throughout the course of the trial. So, we're lowering costs, improving the reliability of our network, helping the environment and enhancing Verizon's industry leadership. That's a business grand slam.

Now, we began running the new system for real over the Summer, and we have had excellent results so far. We look forward to now observing and tracking system metrics over the next several years and to sharing our data with the Department of Energy and others.

I would like to take a moment, now, to recognize the Project Team and ask that they stand and be recognized for a great job. Team Members!

The Team will also be available after the press conference to provide more technical details and a tour of the new plant.

One final note, this is not the only place where we're looking at fuel cells and alternate power technologies. While they are a primary power source here, fuel cells can also be configured as a backup power source. We're exploring that application on some of our network elements outside our switching centers. These are the huts and cabinets you may see in local neighborhoods.

Today we have battery backups in those elements, but in several locations, including Albany and Ronkonkoma here in New York State we've been testing much smaller fuel cells as a possible replacement to batteries.

So, as we place this stake in the ground and move forward with the largest fuel cell projects in the country I've been asked on more than one occasion if this means we're going to deploy this technology on a mass scale? The answer is we don't know yet.

But as I stated earlier, this is the beginning. Fuel cell technology is now the primary power source at a major Verizon facility. We have every expectation that what this trial will tell us is that this technology works. We'll then start making decisions on what we do elsewhere.

Now, without further ado, let me introduce our next speaker, Pat Hoffman from the U.S. Department of Energy. Pat.

PAT HOFFMAN, U.S. DEPARTMENT OF ENERGY:

Thank you, Ivan. Adolfo, thank you very much.

Good afternoon. It is a privilege to stand here today and reflect on many of the positive changes that have impacted and improved the North American electric grid. The Federal Government has passed energy legislation, strengthened our rules on grid reliability.
We have published findings on the blackouts, and work with industry to improve utility practices and training. We have hardened our system against cyber attack, but most importantly we've developed advanced clean technologies and have deployed them into the United States.

I said all of these positive things but I also recognize that we still have a long way to go. Hurricane Katrina is yet another reminder of our vulnerable way of life to the loss of electric power. Telecommunications is one of the keys to emergency response and to the normal functions of everyday life. Without electricity mere is no telecommunications, no power to recharge cell phone batteries, no refrigeration of the food we eat, no pumps for removing sewage or delivering clean water.

The good news is that we do have some solutions. Working with leaders from across the United States, such as Verizon, UPC, Keyspan (ph), and Oak Ridge National Laboratory, we are here to honor an example of American ingenuity and entrepreneurship. Verizon recognized this opportunity and had the foresight to spearhead a public private partnership to complete this exciting and successful project.

The Energy Policy Act of 2005 strongly supports activities such as this, that boost grid reliability, resiliency, energy efficiency, and security of our critical infrastructure. We stand here today excited about this project that captures all these attributes.

The distributed energy system, the fuel cells, engine system here, offer many pluses. It can provide support and flexibility to the grid, especially during peak demand, and can provide Verizon with power for critical operations if the grid goes down. It is efficient and clean. It is a combined heat and power system that provides multiple services, electricity, cooling, and heating.

This facility is a tribute to the creative engineering design and business management leadership. The technology innovation of this type doesn't just happen. It requires a lot of work from scientists, engineers, architects, technicians, and even the financial community. And I do want to recognize all the Team that has been involved in that

But most of all it requires leadership, a leadership that is willing to take risks and try new approaches, new technologies, new tools and new techniques.

The Department hopes to continue to play a catalytic role in this enterprise. It can focus on the scientific assets of the national laboratories. It can support projects that lower technical risk. It can cost share key activities. We can work with the State and Federal Regulators to identify unnecessary barriers and recommend potential solutions. We can support innovation.

It is the Department's hope that the telecom industry will be interested in replicating this concept, this system, to strengthen their own operations as well as local grid. I understand that there are many, approximately 22,000 facilities, of this type across the country representing more than 2 gigawatts of connected load. The potential benefit from our perspective are enormous to society, to the environment, and to the bottom line. We can call that a win, win solution.

I surely appreciate being here today, and I hope to work together to continue to support innovative projects, such as this, that will result in a cleaner, more efficient, reliable and secure future for America. Thank you.

ERIC RABE:

Thank you, Pat Hoffman, for those remarks. We're joined now by New York Senator Michael Balboni who is the Chair of the Veteran Homeland Security and Military Committee in the New York Senate and is a Representative of Long Island in the New York Legislature. Senator Balboni.

MICHAEL BALBONI, NEW YORK SENATOR AND CHAIR OF THE VETERAN HOMELAND SECURITY AND MILITARY COMMITTEE IN THE NEW YORK SENATE AND REPRESENTATIVE OF LONG ISLAND IN THE NEW YORK LEGISLATURE:

Shortly after 9-111 was privileged to take a tour of the Verizon Facility that sits at Ground Zero. And as I toured the building what became so clear was that our infrastructure that we all rely on is so vulnerable. Part of the building was damaged and very well might have been destroyed if things had gone just a little bit different on that horrible day.

And when you consider that on that day one of the unexpected consequences of the attack was that we lost cellular systems in the size and scale of the City of Pittsburgh, you began to realize that communication really was at risk.

As I have worked on the Committee from the State of New York, and as I chair a National Committee of Legislators, what we understand, perhaps better than anybody else, is that it's not about government Government can provide the lead, government can provide the resources, but 80% of the assets of this nation reside in private hands and private control. If the private sector decides to remain disengaged from the effort to make this country more secure and more ready to respond to whatever nature or man throws at us, well, we will then truly remain 80% vulnerable.

Today's project marks, in my estimation, one of the most significant contributions to the effort to engage the private sector. On their own initiative, understanding that continuity of service is crucial, not just to market share but also to this nation, Verizon has engaged upon an environmental friendly, unique product and process that's going to really enhance the capabilities for this nation.

I hope that what we're standing next to is a model for other corporations to begin the proactive analysis that says, 'we need to think outside the box,' and continue to have people willing to put their reputations on the line, their resources on the line, and their companies on the line, to do new things to better not only New York but the nation as a whole.

When I talk to people I get the clear sense that America expects us, government and private sector, to have this all figured out. What we've seen after Katrina is that the expectations are here and the response was here. That's unacceptable. It's projects like this that will continue to make us ready to handle whatever is thrown at us. And I want to congratulate Verizon for the foresight, the commitment, and, frankly, the patriotism to continue to believe I this nation and in the State.

Thank you very much.

ERIC RABE:

Thank you, Senator Balboni. Now, I want to introduce Jon Van Dakkum, who is the President of UTC Power, which is the Company that's built the fuel cells that we're using here. Jan.

JAN VAN DAKKUM, PRESIDENT, UTC POWER:

Thank you, Eric. It's wonderful to be here on Long Island, next to a megawatt of power being generated, and having this meeting in a very quiet and very clean, environmentally very sound pen next to the equipment It's amazing that you actually can have these kind of meetings next to a megawatt of power, that generate electricity at 40% efficiency, we recapture the heat move the heat into chillers, cool the facility, and have an 80% efficiency.

I would like to commend Ivan Seidenberg and his Leadership Team for Division (ph). I would compliment the Implementation Team across all of the businesses that have been represented here for the installation of this equipment right here on site. It was an absolute, fabulous, effective job that is an example of how various companies can work together for the common good while at the same time reducing energy costs, providing a number of different type of energies into one location that gives us the security as well as safety environment. It's a fantastic job.

Clearly, this didn't happen just by Verizon and by UTC Power; we had many partners along the way. We have LIPA, the local Long Island Power Authority, that clearly provides the interconnection to this. We are connected to the grid as a facility and we have to run in concert with the grid.

We have Keyspan who not only provides the gas but also the installation work. The DOD and DOE, our government entities that have helped us provide the funding for research and development to get this installation as well as support technology going.

Oak Ridge National Labs, a very close partnership between us and the Labs. And last, but not least, our New York entity, NYSERDA that is always right behind us or next to us, making sure that these projects get funded, get tracked, and make sure that they deliver on their promises.

I would say this is the largest fuel cell installation in the United States. And I think I can stretch it a little bit further, although I have not been able to verify this because there's not enough data, but I believe this is the largest fuel cell installation in the world. So, this is a commercial operation, this is not a demonstration project, this is commercial. We are relying on this power and the cooling to run this project all together.

The Cells clearly offers significant benefits to the residents of Long Island, and I think if Verizon had any kind of model, it is this kind of model that provides for service when most needed.

We can see Hurricane Katrina, we can see what might happen with Hurricane Rita. These facilities are an absolute must to stay with communication.

This is industry leading, and I leave it with that. We have plenty of time for questions of why this is industry leading, but clearly you are the winners here.

I compliment Verizon and Long Island and New York on bringing this technology to this area. Connecticut is known for fuel (ph) companies, where we manufacture it. New York is known for implementation. In applying these into the grid and making sure that this technology, indeed, has a life and be useful into serving our customers' needs.

Thank you so much, and good luck with this facility.

ERIC RABE: At this point, we will take questions from reporters who are here in the room, if you have any, and also from those of you on the phone. It'll take just a second to organize that, so give us just a moment.

Why don't we take the first question from Shenai Cam (ph). Somebody - we'll get a microphone back to you, Shenai (ph), so that people on the phone can also hear your question.

OPERATOR: Thank you. If you do have a question from the phone line, please press star, one.

SHENAI CARU (ph): How much is the project costing Verizon? I know you've got some outside funding. And, also, when do you see any time when you might be able to expand this to more facilities? If so, when? Maybe the project has a timeline that you'll decide?

ERIC RABE: I'm going to direct that question to Adolfo Reyes.

ADOLFO REYES: OK, thank you. The project cost us about $13 million and that includes some grant money that we got from the U.S. Department of Energy, and are still awaiting from NYSERDA. We weren't really focused on up front costs, however. Our purpose here was to focus on the three key elements that you've heard over and over today. And that is improving network reliability, reducing operating costs over time, and helping the environment. And so that was really our driver, and I think we've got a tremendous outcome here in the plant to our right

As far as what we're doing in other locations, we are looking, as I mentioned, we're looking at the same technology in a backup power mode. We're also looking at micro turbine technology at a couple of locations out West. And, of course, we have a very thorough energy conservation program. All of our building standards and construction materials always include energy efficiency.

ERIC RABE: Other questions here? We have a question on the phone, let's go to that question now.

OPERATOR: Your question is from Vince Vittore of Telephony Magazine.

VINCE VITTORE, TELEPHONY MAGAZINE: Yes, I was just wondering if you kind of describe a little bit about how the mixture of the fuel cells and the commercial power is going to work? Are all, are switching and routing being handled with the fuel cells? Is there a mixture of some sort there?

ERIC RABE: Again, Adolfo Reyes.

ADOLFO REYES: OK. Thank you. The system is designed to operate in parallel with LIPA commercial grid. So, for example, today we have about a megawatt of power being produced by the fuel cells. The balance of the roughly 2.7 megawatts taken to sustain this facility is being provided by the commercial grid.

The system is designed failsafe, so if something were to happen to the fuel cell plant the entire power would be shifted over to the commercial grid. If something were to happen to the commercial grid our onsite batteries and generators would kick-in and service would be, to the building would be maintained. So, it's a failsafe design.

ERIC RABE: Do we have further questions, either here in the room or on the phone? I'm getting a signal that we do not, so we'll wrap it up at that point. Thank you very much for your attention.

We have issued a news release on this project which you should be able to find on the PR Newswire, and it's certainly available from us, if you call us at New York at 212-395-0500 we'll get that to you and give you any additional information you need.

This is Eric Rabe speaking. Mark Marshon (ph) is also available to help you with this, any questions you may have, and Mark is available at the normal number or through the 212-395-0500 number.

Thank you very much for your attention. We appreciate your presence here at the news conference. Have a great day.

END

More Comments on Verizon's Garden City, N.Y., Fuel Cell Project

Robert B. Catell, chairman and CEO of KeySpan Corporation:

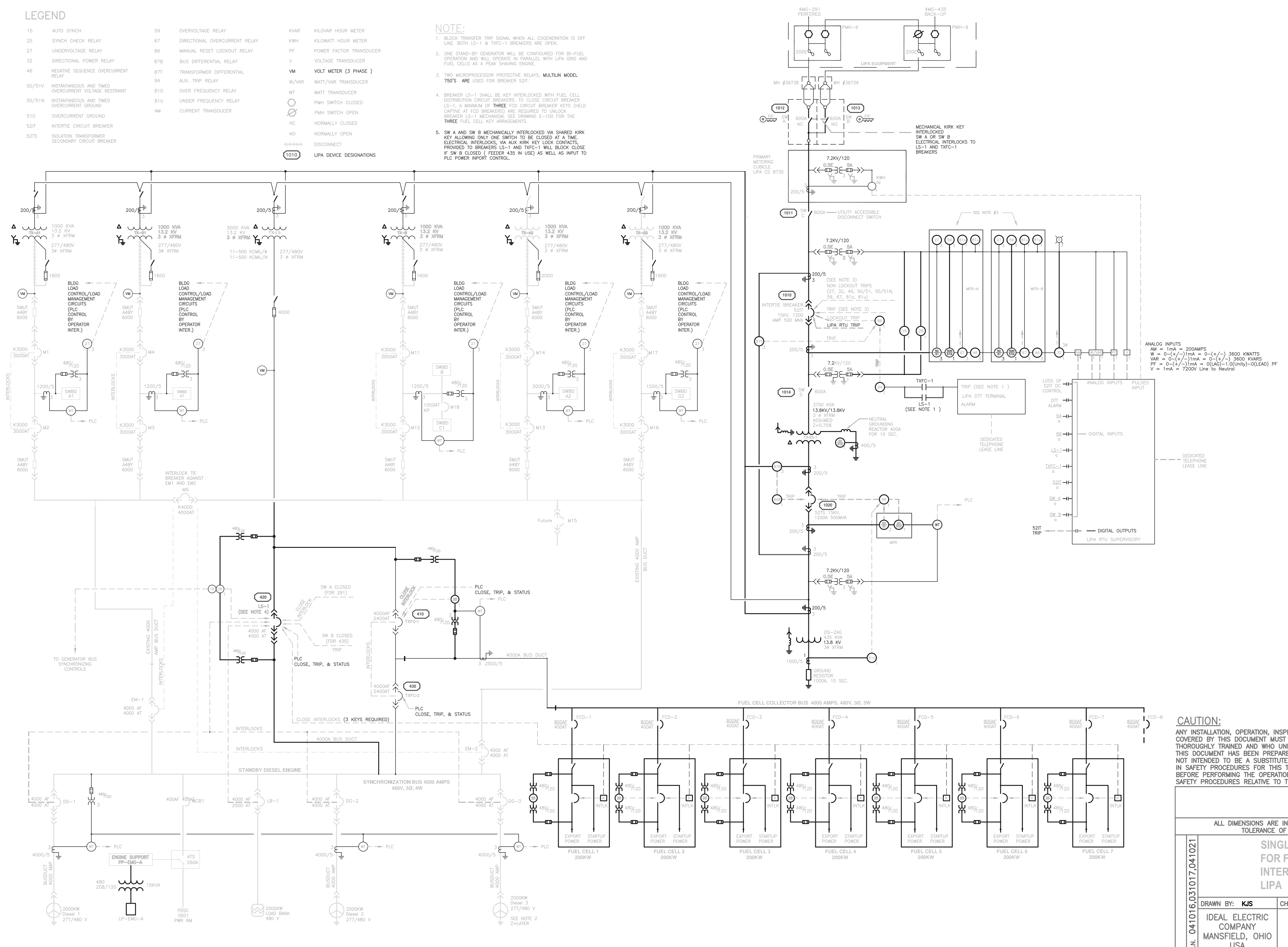
"KeySpan has long supported fuel cell technology as a means to produce electric power cleanly, efficiently and cost-effectively. The Verizon fuel-cell installation will set an example of environmentally sound energy production for other corporations and communities in America to emulate."

Peter R. Smith, president, New York State Energy Research and Development Authority:

"Verizon is taking a key step forward by integrating fuel-cell generated power into its Garden City switching station. NYSERDA is providing $425,000 toward this innovative combined heat and-power project, which will enhance energy security to the Verizon . network, improve environmental performance, and support all facility related operations including standby power in the event of an outage"

Bruce Germano, vice president retail services for the Long Island Power Authority:

"Verizon's vision to provide clean, renewable technologies that benefit the environment and contribute to energy independence is important to Long Island. We are proud to be a part of this project, and extremely pleased to work in partnership with one of our most important customers to find energy solutions that will help them achieve their business goals."



LEGEND

15	AUTO SYNCH	59	OVERVOLTAGE RELAY	KVAR	KILOVAR HOUR METER
25	SYNCH CHECK RELAY	67	DIRECTIONAL OVERCURRENT RELAY	KWH	KILOWATT HOUR METER
27	UNDERVOLTAGE RELAY	86	MANUAL RESET LOCKOUT RELAY	PF	POWER FACTOR TRANSDUCER
32	DIRECTIONAL POWER RELAY	87B	BUS DIFFERENTIAL RELAY	V	VOLTAGE TRANSDUCER
46	NEGATIVE SEQUENCE OVERCURRENT RELAY	87T	TRANSFORMER DIFFERENTIAL	VM	VOLT METER (3 PHASE)
50/51V	INSTANTANEOUS AND TIMED OVERCURRENT VOLTAGE RESTRAINT	94	AUX. TRIP RELAY	W/VAR	WATT/VAR TRANSDUCER
50/51N	INSTANTANEOUS AND TIMED OVERCURRENT GROUND	81O	OVER FREQUENCY RELAY	WT	WATT TRANSDUCER
51G	OVERCURRENT GROUND	81U	UNDER FREQUENCY RELAY	⬡	PMH SWITCH CLOSED
52IT	INTERTIE CIRCUIT BREAKER	AM	CURRENT TRANSDUCER	⌀	PMH SWITCH OPEN
52TS	ISOLATION TRANSFORMER SECONDARY CIRCUIT BREAKER			NC	NORMALLY CLOSED
				NO	NORMALLY OPEN
				xxxxx	DISCONNECT
				(1010)	LIPA DEVICE DESIGNATIONS

NOTE:

1. BLOCK TRANSFER TRIP SIGNAL WHEN ALL COGENERATION IS OFF LINE. BOTH LS-1 & TXFC-1 BREAKERS ARE OPEN.
2. ONE STAND-BY GENERATOR WILL BE CONFIGURED FOR BI-FUEL OPERATION AND WILL OPERATE IN PARALLEL WITH LIPA GRID AND FUEL CELLS AS A PEAK SHAVING ENGINE.
3. TWO MICROPROCESSOR PROTECTIVE RELAYS, MULTILIN MODEL 750'S ARE USED FOR BREAKER 52IT.
4. BREAKER LS-1 SHALL BE KEY INTERLOCKED WITH FUEL CELL DISTRIBUTION CIRCUIT BREAKERS. TO CLOSE CIRCUIT BREAKER LS-1, A MINIMUM OF THREE FCD CIRCUIT BREAKER KEYS (HELD CAPTIVE AT FCD BREAKERS) ARE REQUIRED TO UNLOCK BREAKER LS-1 MECHANISM. SEE DRAWING E-100 FOR THE THREE FUEL CELL KEY ARRAGEMENTS.
5. SW A AND SW B MECHANICALLY INTERLOCKED VIA SHARED KIRK KEY ALLOWING ONLY ONE SWITCH TO BE CLOSED AT A TIME. ELECTRICAL INTERLOCKS, VIA AUX KIRK KEY LOCK CONTACTS, PROVIDED TO BREAKERS LS-1 AND TXFC-1 WILL BLOCK CLOSE IF SW B CLOSED (FEEDER 435 IN USE) AS WELL AS INPUT TO PLC POWER INPORT CONTROL.

REV.	DESCRIPTION	BY
0	FEBUARY 17, 2005	KJS
1	MARCH 3,2005 ADDED SWA/SWB KK MECH. INT'LOCK WITH REF. TO NEW NOTE 5 REV'D FC KK REQ'T REV'D PT RATIO ADDED VM TO BLDG TFR FEEDERS ADDED TXFC-1 & LS-1 INT'LOCK WITH DTT TRIP ADDED CONNECTION OF 27 FUNC'S ADDED RTU TRIP OF 52IT	KJS
2	JULY 26, 2005 ADDED LIPA DEVICE DESIGNATIONS REVISED TXFC-1 INT'LOCK WITH SW A (LIPA #1012) AND SW B (LIPA #1013)	KJS

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SINGLE LINE DIAGRAM FOR FUEL CELLS WITH INTERCONNECT WITH LIPA

S.N. 041016,031017,041021

DRAWN BY: KJS | CHECKED BY: KJS

IDEAL ELECTRIC COMPANY MANSFIELD, OHIO USA

14DK-6507

KEA -VERIZON-E101-R2

Gannett Fleming

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Scott

May 26, 2005
File # 44089

Mr. Ajay Shah, P.E.
Regional Air Pollution Control Engineer
Region I
New York State Department
of Environmental Conservation
SUNY Building 40
Stony Brook, New York 11790

Re: Stack Test Results
Verizon Communications
741 Zeckendorf Blvd., Garden City NY
DEC ID 1-2820-00669/00001

Dear Mr. Shah:

Attached for your review is the test report for the stack test that was performed at the above-referenced facility on April 29, 2005 in accordance with the DEC-approved protocol.

Engine ENG3 powers a 1600 kw generator that is used for peak shaving. The engine is equipped with aftermarket controls that enable the dual fuel fired unit to achieve reduced NOx emissions.

Verizon had originally planned to install a 2250 kw generator, but the engine had to be derated to 1600 kw in order to comply with a contractual agreement with LIPA.

NOx emissions averaged 3.31 grams/Bhp-hour for the three runs.

Please contact me at (516) 671 8440 if you have any questions.

Very truly yours,

GANNETT FLEMING, INC.

FREDERICK H. INYARD, P.E.
Vice President

cc: Humberto Roman

R:\PROJECTS\44000\44089\zeckendorf blvd\LTR 2005-05-26 StackTestTrans.doc

TEST REPORT FOR
NO_X EMISSIONS EVALUATION AT
VERIZON COMMUNICATIONS GARDEN CITY

VERIZON COMMUNICATIONS GARDEN CITY
741 ZECKENDORF BLVD.
GARDEN CITY, NEW YORK 11530

FACILITY ID: 1-2820-00669/00001

SUBMITTED TO:	NEW YORK STATE DEPT. OF ENVIRONMENTAL CONSERVATION STONY BROOK, NEW YORK
PREPARED BY:	ENVIRONMENTAL LABORATORIES INC. FARMINGDALE, NEW YORK
TEST DATE:	APRIL 29, 2005
REPORT DATE:	MAY 24, 2005

ENVIRONMENTAL LABORATORIES INC.
ENVIRONMENTAL MANAGEMENT SERVICES
CONSULTING - TESTING - MONITORING

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TEST REPORT FOR
NO_X EMISSIONS EVALUATION AT
VERIZON COMMUNICATIONS GARDEN CITY

VERIZON COMMUNICATIONS GARDEN CITY
741 ZECKENDORF BLVD.
GARDEN CITY, NEW YORK 11530

FACILITY ID: 1-2820-00669/00001

Prepared for:

Mr. Rick Inyard
Vice President
Gannett Fleming Engineers and Architects
480 Forest Avenue
Locust Valley, NY 11560

Prepared by:

Environmental Laboratories Inc.
57 Verdi Street
Farmingdale, New York 11735
Tel: (631) 420-1866
Fax: (631) 420-1767

Test Date:
April 29, 2005

Report Date:
May 24, 2005

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TABLE OF CONTENTS

SECTION 1.0
INTRODUCTION

Environmental Laboratories Inc. (ELI) under a contract to Gannett Fleming Engineers and Architects, Locust Valley, NY provided technical and sampling support for a State Air Facility Permit Compliance emissions program at the Verizon Communication Garden City Power Plant.

Verizon Communications owns and operates the power plant complex at its Garden City, New York facility (Facility). The Facility consists of two (2) boilers (BLR1 and BLR2), two (2) oil-fired internal combustion engines (IC Engines) (ENG1 and ENG2), which are used on an emergency basis only, and seven (7) fuel cells (FC1 through FC7). Additionally, the Facility contains a 1,600 KW dual fuel-fired IC Engine (ENG3), which IS utilized for electrical demand peak shaving. This report presents the objectives, approach and resulting evaluations used to develop the NO_x emissions rate factors for ENG3. The NO_x emission rate factors, combined with the yearly operating records for the source, will enable Verizon to establish compliance with its capped NO_x emission limit of 22.5 TPY. Additionally, ENG3 source stack exit emission rates of opacity were evaluated by EPA RM 9.

1.1 Program Objective(s)

The objective was to perform compliance emission testing for NO_x, to establish the empirical data required to develop a plan for NO_x emissions compliance based on engine/generator output while simultaneously evaluating stack exit opacity emissions. Table 1-1 presents a summary of the test program results.

TABLE 1-1

VERIZON COMMUNICATIONS GARDEN CITY
IC ENGINE NO. 3 COMPLIANCE EMISSION TEST PROGRAM

SUMMARY OF TEST RESULTS (1)
TEST DATE: 4/29/05

	Load Set Points		
	Low	Mid	High
IC Engine Operating Data:			
Load, MW	0.57	1.09	1.59
Load, Bhp-hr	849	1,624	2,273.0
Total Heat Input Rate, MMBtu/hr	6.41	11.23	15.06
Ratio Oil/Gas (%)	85/15	85/15	85/15
Gaseous Emissions:			
O_2, $\%_{vd}$	14.5	13.2	11.9
NO_x:			
ppm_{vd}	255	325	506
lb/hr	5.80	10.80	19.17
gr/Bhp-hr	3.10	3.01	3.83
Opacity, % (2)	N/A	N/A	12.5

(1) Represents average of triplicate test runs.
(2) Maximum average six (6) minute Opacity observation.

SECTION 2.0
TECHNICAL APPROACH

2.1 Test Program Overview

The test program at the Verizon Communications Garden City's power plant was designed to meet the following objective(s):

1) Determine IC Engine ENG3 NO_x emissions at low, mid and high load set points; and,
2) Determine IC Engine ENG3 stack emissions of opacity (high load only).

The first objective was met by performing EPA Reference Method testing for NO_x, and O_2, volumetric flow rate. NO_x emissions testing consisted of triplicate twenty-one (21) minute test runs performed during low and mid loads; and triplicate sixty (60) minute test runs at high load. The second objective was met by performing triplicate sixty (60) minute EPA RM9 visual opacity observations while performing the high load NO_x emission testing. The testing matrix for all these parameters is presented in Table 2-1.

Source/Operating Conditions	Test Location	No. of Total Runs	Parameter(s) Measured	Sample Time per Run (minutes)	Test Method
1. IC Engine (1, 2) Load & Fuels	Engine Exhaust	3	Opacity	60	EPA 9
		3	NO_x	21-60	EPA 7E
		3	O_2	21-60	EPA 3/3A
		3	Volumetric Flow Rate (2)	21-60	EPA 19
2. Plant Process Data All Emission Sources	Plant Control Equipment	All Runs	N. Gas/Oil Consumption, Engine Output in KW,		Process Equipment

(1) During testing, IC Engine brake horsepower output were calculated based on actual engine output in KW. Calculation was based assuming 90-94% efficiency for electrical generation. Stack volumetric flow rate was based on EPA RM 19, Heat Rate Input Method utilizing EPA Fuel "F" Factors of 9,190 and 8,710 dscf/MMBtu @ 0% O_2 for fuel oil and natural gas-fired operation.

(2) Testing performed at low, mid and high load set points. NO_x testing at low and mid set points consisted of twenty-one (21) minute duration; high load testing for NO_x and Opacity consisted of sixty (60) minute test runs. All testing was performed in triplicate.

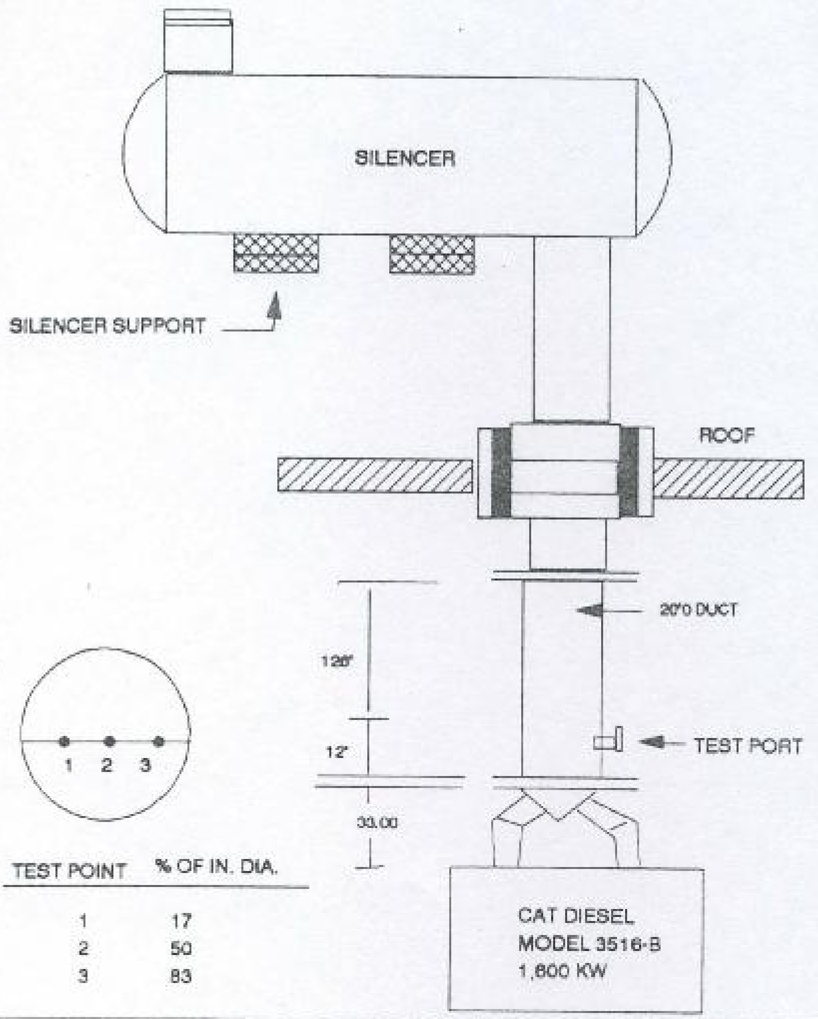
SECTION 3.0
EMISSION SOURCE DESCRIPTION

Verizon Communication Garden City operates a Caterpillar Model 3516B - 1,600 KW dual fuel IC Engine (ENG3) generator. The source is used for electrical demand peak shaving. The source is capable of dual fuel (i.e. natural gas/pilot oil ~15/85% by heat input).

The following table presents the IC Engine manufacture rate performance data:

Generator Load (KW)	IC Engine Load (Bhp-hr)	Calculated Heat Rate (Btu/KW-hr)
563	858	11,250
900	1,323	10,300
1,580	2,250	9,450

Figure 3-1 presents a schematic of the overall test point and exhaust duct configuration.



TEST POINT	% OF IN. DIA.
1	17
2	50
3	83

VERIZON COMMUNICATION GARDEN CITY
TEST PORT/POINT SCHEMATIC

ENVIRONMENTAL LABORATORIES INC.

FILE 1629

FIGURE 3-1

SECTION 4.0
TEST METHODOLOGIES

This section describes the sampling and analytical methods that was used for this test program. These reference methods and analytical techniques were chosen due to their proven success on previous compliance programs where they have generated consistent, reliable data for electric utilities, boiler plants and independent power producers.

4.1 Sample Locations

Sampling for NO_x emissions were performed at the IC engine exhaust duct test port, which are located up-stream of a silencer. Figure 3-1 presents the test port/point locations for the source. Due to ducting configurations, inadequate upstream and downstream distances were available for flue gas velocity profile testing of the IC engine exhaust. These test locations were used for gaseous emissions testing only. Engine opacity emissions were evaluated at the roof elevation.

4.2 Sample Trains

One sample train was used to conduct the gaseous exhaust stream sampling portion of the test program. Table 4-1 lists the sample train and sampling methods. The following section summarizes the test ...odology in more detail and discusses any deviations from the reference methodology. Appendix A contains further details on the standard methods.

4.2.1 Continuous Gaseous Measurements

NO_x, and O_2 were measured according to EPA reference methods using ELI's continuous emission monitoring system (CEM). The CEM system and test methods are described in detail in Appendix A. A heated Teflon sample line was used to prevent moisture condensation and a refrigerated cooler was used to prevent the loss of NO_2 in the sample line.

All CEMS direct calibrations and bias checks were performed in accordance with EPA Method 6C. All calibration gases were EPA Protocol standard. Table 4-2 presents a summary of the instrumental method analyzer operating range and calibration gas values.

TABLE 4-1
VERIZON COMMUNICATION GARDEN CITY
SAMPLE TRAINS USED FOR
EXHAUST GAS SAMPLING

Train	Sampling Method	Species to be Measured	No. of Replicates	Sample Duration	No. of Sample Points
CEM	EPA 3A & 7E	O_2 & NO_x	various	21-60 min.	3
Exhaust Gas Flow Rate	EPA 19	---	---	---	---

(1) During IC Engine operation, flue gas volumetric flow rate was determined by EPA Method 19. To accommodate the calculation of flue gas volumetric flow rate, natural gas and fuel oil consumption was recorded during testing of the IC Engine at each load condition.

TABLE 4-2
VERIZON COMMUNICATION GARDEN CITY
CEM INSTRUMENT AND CALIBRATION GASES

ANALYTE		**SPECIFICATION**
NO_x	Instrument	Thermo Electron Model 10AR
	Range	0-500, 1,300 ppm
	Calibration Gases	100% Nitrogen (Certified)
	Zero	EPA Protocol Gases
	Span	447.8, 1,230, balance N_2
	Mid-range	236.3, 623.2, balance N_2
	Low-range	138.0, 447.8, balance N_2
O_2	Instrument	Teledyne 320-P4
	Range	0-25% by vol.
	Calibration Gases	
	Zero	100% Nitrogen (Certified)
		EPA Protocol Gases
	Span	20.9% by vol., balance N_2
	Mid-range	12.8 by vol., balance N_2
	Low-range	5.2% by vol., balance N_2

Stack test requirements

- Stack testing can be requested by the NYSDEC at any time frame that it deems necessary.
- Stack re- tests for Title V permits are typically requested by the NYSDEC at five (5) year intervals.
- Stack re-tests for State Facility permits are typically not requested by the NYSDEC after the first successful test is completed.
- This permit is a State Facility permit and no retest has been requested.

^S&Ss^SBSS&iS^^s^i^. ft

RSS/APS/NPS/CVS

012	REF TUBE TEMP (PRIMARY)	1533	DE6
012R	REF TUBE TEMP (BACKUP)	1516	F
012	T£* TUBE TRMP DELTA	16	UET3r
I012ACT	ACTUAL FUEL FLOW	,■40.06	CE3F
T010	EJECTOR POSITION	38.67	PPH
HIMON	PHI MONITOR ^	1.03	
350	ANODE INLET TEMP	393	
002 '<	HDS BED TEMP	574	DE6F
001	PRE-OX TEMP (OPTIONAL)	512	DEGF
010	HDSINLETTEMP (OPT	570	DE6F
	BURNER AIR FLOW	277,*	DEGF
	CATHODE AIR VALVE POS	39,7	PPH
012	FUEL VALVE EXIT PRESS	9.99	%
150B	MOTOR COMP EXIT TEMP		PSIA
AN150	MOTOR COMP FAN		DEGF
AN165	FUEL COMP FAN		
IV720	FUEL SIDE N2 VALVE	CLOSED	
:V710	AIR SIDE N2 VALVE	CLOSED	

SETPOINT	1522
TOPFACT	DEGF 0.96
CONTMAX/MINLIM £	DEGF
SETPOINT	J I _____I DEGF
SETPOINT	40.0 PPH
FUELTOT(SCF)	37.45 %
PT350/FB (OPT)	1441450
HTR002 STATUS	0
FCV012 (FUEL VALVE)	ON
FT012ERR	44.19
SETPOINT	0.10
SETPOINT	280.5 PPH
TE011 (FUEL, DEGF)	39.9 % 94 I
TE150A(AMB.,F)	DEGF
MOTOR COMP FS150	
FUEL COMP FS165	
ANODCONF(LBS)	
AT210 (ADG ONLY)	

649.9A VDC 195.5V TE400FT 356.0F TE012FT 1533.0F VT310DEL 0.00V KWACNET 100.

P= 150 R= 160 60 W = 20 | A = 30 | N = 40 | C = 30 | L = 10 | I = 50

MAINMENU .PREVIOUS:,-?! ^OVERVIEW; ■SCREEN;«£l ^TABULAR ' wRSS' "v«--#| ^GRAPHICAL- fCVS? -GRAPHICAL- P:nTMS»^P| iELECTRiCAlPi ;,TABULARHlli #ivTABUliARf ' –":PRINTW«~>. ^SCREEN"

CREEN010 1 TOTAL EVENTS 3 OVERRIDES 9269 07/15/05 1156:59

Clear Clear All

Start Inbox - Microso... UTC Fuel Cells: ... TagServer RC25C Commu... 12:09 PM

STACK LOOP, ANC LOOP & WTS

FT012ACT= 39.99

	SEPARATOR TEMP (PRIMARY)
00ft	^ S^ARATQRlarMP 'BACKUP)
00C2L	* SEPARATOR TEMP DELTA
	STACK COOLANT INLET TEMP
	POLISHER TEMP
	CONDENSER EXIT TEMP
830	PMP830 SPEED
	CONDUCTIVITY
	SEPERATOR LEVEL
	WATER TANK LEVEL
P451	WTS FEED WATER PUMP
	ILS COOLANT TEMP (OPT)
MP	TEMP FOR REFHEATUP
NET	NET DC CURRENT
1400	ELEMENT 'A'
	ELEMENT B'

-*	, -_	TE012FT= 1532 F
355	JEGF	SHTPOINT
356	DEGF	SEP TEMP FACTOR
1	DEGF	STACK FLOW SWITCH
331	DEGF	SETPOINT
109	DEGF	F/W TEMP SW
134	DEGF	TE820 CONT. ERROR
100	%	VDCNORM (VOLTS)
HIGH		STEAM MODE: DISABLE
8.9	IN	PT350 0.0 IWC AIPFB
43.5	IN	WTSFB
ON		PUMP ON TIME (MIN)
0	DEGF	SETPOINT
315.0	DEGF	NCELLFACT
650.1	AMPS	LT450FT (IN)
OFF		ELEMENT *C'
OFF		ELEMENT "D"

353 DEG?
1.000 DEGF
ON
342.5 DEGF
ON 75 DEGF
185 (OPT.)
0.0 KW
2.71
0DEGF
▪ 43.5 IN
OFF OFF

IDC 650.1A|VDC 195.7V |TE400FT 356.0F|TE012FT 1532.0F|VT310DEL 0.00V |KWACNET 100. |

P= 150 I R= 160 I S= 6 jjĮ EH9K

MAIN MENU";'.	'• PREVIOUS'i ' .SCREEN"'?"	^OVERVIEW"'" ^TABULAR -■"■'	" TABULAR - S:	~ GRAPHICAL |K	^TABULAR/? S>	T^Cv^JWPi^*^*?^.^'-	P^PRfPPI llfgSCREENrsd

:REEN011 1 TOTAL EVENTS OVERRIDES 9269 07/15/05 1157:11

Gear Cleat All

/15/05 FT012A£T = 40.00 TE400FT= 355 F -T£0*2FT = 1532 F
57:19 eP= 155R= 160 S=> 60 W= 20^*20 N= 40 C= 30 L= 10 1= 50

OADTIME	TOTAL LOAD TIME	908 HR	TOTAL HOT TIME		937 HR
UHRSNET	NET AC MW HOURS	149 MWHR	»		

IACNET	NET AC POWER	99.54 KWAC	DISPATCHfcD POWER	100.0 KW
FACT	ACTUAL POWER FACTOR	0.88 *	DISPATCHED P.F.	0.88
'ARNET	NETKVARS	53.63 KVAR	DISPATCHED KVARS	54.0
M001	INSTANTANEOUS AMPS	AMPS	CT001-A NET AMPS A	140 AMPS
IDC	DC KILOWATTS	127 KWDC	CT002-B NET AMPS B	142 AMPS
.310A	TOP HALF STACK VOLTAGE	98.12 VOLTS	CT001-C NET AMPS C	143 AMP S
310B	BOT HALF STACK VOLTAGE	98.12 VOLTS	PT001 - AINVVOLT A-B	
310	DELTA HALF STACK VOLTAGE	0.00 VOLTS	PT001-BINVVOLTB-C	465 VOLTS
ICTOT	TOTAL STACK VOLTAGE	196.2 VOLTS	PT001 - CINV VOLT C - A	466 VOLTS
ICNORM	NORMALIZED VDCTOT	184.6 VOLTS	PT003 - A GRID VOLT A - B	466 VOLTS
CB0Q1	G/C BREAKER STATUS	CLOSED	PT003 - B GRID VOLT B - C	466 VOLTS
CB002	G/I BREAKER STATUS	OPEN	PT003 - C GRID VOLT C - A	465 VOLTS
DUR	F/B OR B/O DURATION	0 SEC		465 VOLTS

MAIN MENU... | .-'PREVIOUS' ^SCREEN■-.-; | 'OVERVIEW4 iTABUtARi | ;:RSS/CVSi. TABULAR:- | TABULAR. | iGBAPHtCADf | ^PPRINi;#*'fJ! i&iSCREEN.^ i

REEN014 | 1 TOTAL EVENTS | OVERRIDES | 9269 07/15/05 1157:19

Deal Clear All

5269 06/03/05 1151:09 ELECTRICAL • •

I-DC= 1254' VDC= 182,1" KWACN^T3 .--200. 4 IDCNORM= 1332.8 EVENTS: 0

TE400F"'= 352'- TE012FT= 154^ - VT310DEL-= -0.15 OVERRIDES.; Q

P 150 H 160 S '60 W 20 A JO ■ N '40 Q 30 L 10 I 50

.OADTIME	TOTAL LOAD TIME	47	HR	TOTAL HOT TIME	69
<IWHRSNET	NET AC MW HOURS	8.7	MWHR"	ZERO EXPORT OUT	. MC
'WRLIM	LOADSHARE POWER LIMIT	200.0	KW	POWER DISPATCH.	LCJCAL
CVACNET	NET AC POWER	200	KWAC	DISPATCHED POWER:	200
'FACT	ACTUAL POWER FACTOR	1.00		DISPATCHED P. F.	1.00
O/ARNET	NET KVAR	-1	KVAR	DISPATCHED KVAR:	0
ZM001	INSTANTANEOUS AMPS	1255	AMPS	ACTUAL POWER LIMI1	200
vWOC	DC KILOWATTS	229	KWDC	CT001-A NET AMPS A	239, 0
/T310A	TOP HALF STACK VOLTAGE	91.5	V	CT001-B NET AMPS B	239. 0
rr310B	30T HALF STACK VOLTAGE	91.3	V	CT001-C NET AMPS C	239. 5
/T310	DELTA HALF STACK VOLTS	-0.15	V	PT001-A INV VOLT A-B	484. , 8
/DCTOT	TOTAL STACK VOLTAGE	182.3	V	PT001-3 INV VOLT 3-C	486. 7
/DCNORM	NORMALIZED VDCTOT	172.0	V	PT001-C INV VOLT C-A	483.
C3001	G./C 3REAKER STATUS	CLOSED		PT003-A GRID VOL" r A-a	483, . 3
1C3002	G/I BREAKER STATUS	CLOSED		PT003-3 GRID VOL" 7 3-C	483 . 9
:3DUR	F/3 OR 3/0 DURATION	0	SEC	PT003-C GRID VOLT C-A	484 . 2

.Helpb 2Send 3ClrOvr 4ClrAll SLStScr oOper ZEvent 3Scr_10 9Scr_Il lOElec

!69 06/03/05 1151:04 STACK LOOP; ANC LOOP,. & WTS

IDC= 1254 VDC= 182.1 KWACNET= 200.4 IDCN0RM= 1332.5 EVENTS: 0

TE400FT=- 352 TE012FT= 1550 VT310DEL= -0.15 OVERRIDES: 0 P 150 R 160

S 50 W 20 A 30 N 40 C 30 L 10 I 50

SEPARATOR TEMP(PRIMARY)	352	DEGF	SETPOINT:	352
SEPARATOR TEMP (3ACKU-P)	•352	DEGF	SEP T2MP FACTOR (DEGF) 1.000	
SEP TEMP DELTA	0	DEGF		ON
COOLANT INLET TEMP	308	DEGF	STK FLOW SW (FS400)"	309
POLISHER TEMP	88	DEGF	SETPOINT:	O
CONDENSOR EXIT TEMP	211	DEGF	F/W TEMP SW (TS451)	N
PMP830 SPEED	52	0//0	TE820 CONT. ERR (DEGF)	-1
CONDUCTIVITY	NORMAL		VDCNORM (VOLTS)	
SEPERATOR LEVEL	8.5	IN	STEAM MODE : DISABLED (OPT.)	
WATER TANK LEVEL	44.5	IN	PT350 0.0 IWC AIPFB	0 KW
ILS COOLANT TEMP (OPT)	0	DEGF	WTSF3	0.0
WTS FEED WATER PUMP	OF =		SETPOINT:	
TEMP FOR REF HEATUP	315	DEGF		
^ET DC CURRENT	12 54	AMPS	0	
ELEMENT 'A'	OFF		PUMP ON TIME (MIN)	
ELEMENT 'B'	OFF			
FAN800 SPEED	59	3/. 0	0	
			PREV PUMP ON TIME (MIN)	3
			LT450FT (IN)	44.5
			ELEMENT 'C'	OFF
			ELEMENT '0'	OFF
			NCELLFACT	1.053

LDT_SCR

'T'Screen #: OlO'.Page #: 00 ScrFileID#: 9D16 ESC or Q = qui

9269 06/03/05 1150:55 RSS/APS/NPS/CVS

IDC= 1254" VDC= 182.1 KWACNET= 200.3 IDCNORM= 1332.4 EVENTS: 0

TE400FT= 352 TE012FT=- 1551 .■ VT310tfET = -0.22 OVERRIDES:* 0-

P 150ˉ R 160 S 60 W 20 A 30 N 40 C 30 L 10 I 50 -

TE012	REF TUBE TEMP (PRIMARY)	15 51	DEGF	SETPOINT:
TE012R	iEJF' TUBE- TEMP (BACKUP)	1533	DEGF	TEMPFACT:
TE012DEL	REF TUBE TEMP DELTA	13	DEGF	CONT MAX/MIN LIM
FT012ACT	ACTUAL FUEL FLOW	77.2	PPH	SETPOINT:
ZT010	EJECTOR POSITION	62.6	%	SETPOINT:
PHIMON	PHI MONITOR	1.01		FUELTOT (SCF)
TE3 50	ANODE INLET TEMP	393	DEGF	PT350/FB (OPT)
TE002	HDS 3ED TEMP	469	DEGF	HTR002 STATUS:
TE001	PRE-OX 3ED TEMP(OPT)	508	DEGF	FCV012 (FUEL VALVE)
TE010	HDS INLET TEMP(OPT)	408	DEGF	FT012ERR
FT140	BURNER AIR FLOW	542.2	PPH	
ZT110	CATHODE AIR VALVE ?OS	50.2		
PT012	FUEL VALVE EXIT PRESS	7.41		
TE1503	MOTOR COMP EXIT TEMP	33		
FAN150	MOTOR COMP FAN	ON		
FAN165	FUEL COMP FAN	ON		
CV720	FUEL SIDE N2 VALVE	CLOSED		
CV710	AIR SIDE ,N2 VALVE	CLOSED		

iHelpb 2Send 3C!rOvr 4ClrAll SLstScr SOper

%	SETPOINT;	50.3	
PSIA	TE011 (FUEL, DEGF)	78	
DEGF	TE150A (AMB.,F)		
	MOTOR COMP FS150	ON	
	FUEL COMP FS165	ON	
	ANODCONF (L3S)	0.0	
	AT201 (ADG ONLY) Event	0.0	3Scr_10 9Scr_
		I0E"	

9269 06/03/05 1045:31 ELECTRICAL

IDC= 922 -VDC= .-188.1. KWACNET= 149.9 IDCNORM= 979.7 EVENTS: 0

TE400FT= 3'52~ TE012FT= 1504' VT31UDEL= *-0-it* OVERRIDES: 0

P 150 R 160 S 60 W 20" A< 30 'N- *40* C 30 L 10* I 50

TOTAL LOAD TIME NET AC	46 .HR . 3. 5	TOTAL HOT TIME	53
MW HOURS LOADSHARE	-MWHR 200.0	~ZERO EXPORT OUT	150
POWER LIMIT NET AC	KW 150	POWER DISPATCH	LOCAL
POWER ACTUAL POWER	KWAC -1.00	DISPATCHED POWER:	150
FACTOR NET KVAR	0 KVAR 923	DISPATCHED P.F.	1.00
INSTANTANEOUS AMPS DC	AMPS 174	DISPATCHED KVAR:	0
KILOWATTS TOP HALF	KWDC 94.4 V	ACTUAL POWER LIMIT:	200
STACK VOLTAGE 80T HALF	94.2 V -0.15 V	CT001-A NET AMPS A	179.7
STACK VOLTAGE DELTA	188.5 v 177.3	CT001-3 NET AMPS B	181.6
HALF STACK VOLTS TOTAL	v CLOSED	CT001-C NET AMPS C	182.0
STACK VOLTAGE	CLOSED	PT001-A INV VOLT A-S	484.6
NORMALIZED VDCTOT G/C	0 SEC	PT001-3 INV VOLT 3-C	485.7
3REAKER STATUS G/T		PT001-C INV VOLT C-A	487.5
3REAKER STATUS F/B OR		PT003-A GRID VOL' A-3	484.9
3/0 DURATION		PT003-3 GRID VOLT B-C	485.0
		PT003-C GRID VOLT C-A	484.1

lHelpb 2Send 3c1rOvr 4C"IrAll 5LstScr oOper 7Event 3Scr_10 9Scr_ll lOElec

269 06/03/05 1045:24 STACK LOOP, AN'C LOOP, & 'ATS

IDC=? 922 VDC= 187.9 KWACNET= 149.8 IDCNORM= 979.3 EVENTS:' 0

TE400FT= 352' TEQ12FT= 1503 VT310DEL= -0-. 22 OVERRIDES: ' 0

P 150 R 160 S 60 W 20 A 30 N 40 C 30 L 10 I 50

E400	SEPARATOR TEMP(PRIMARY)-	352				
E400R	SEPARATOR TEMP(BACKUP)					
E400DEL	SEP TEMP DELTA					
E401	COOLANT INLET TEMP					
E431	POLISHER TEMP					
E820	CONDENSOR EXIT TEMP					
SD830	PMP830 SPEED					
E450	CONDUCTIVITY					
T400	SEPARATOR LEVEL					
T450	WATER TANK LEVEL					
E464	ILS COOLANT TEMP (OPT)					
MP451	'ATTS FEED WATER PUMP					
TARTTEMP	TEMP FOR REF HEATUP					
DCNET	NET DC CURRENT					
TR400	ELEMENT 'A'					
	ELEMENT '8'					
	FAN800 SPEED					
		352	DtGjF	SETPOINT:	352	
		352	DEGF	SEP TL-MP FACTOR (DEGF)	1.000	
		0	DEGF	STK FLOW SW (FS400)	ON	
		325	DEGF	SETPOINT:	325	
		84	DEGF	F/W TEMP SW (TS451)	ON	
		144	DEGF	TE820 CONT. ERR (DEGF)	-159	
		84	%	VDCNORM (VOLTS)	177.5	

315	DEGF	PREV PUMP ON TIME (N	100 %	NCELLFACT	1.063

Helpb 2Send 3clrOvr 4ClrAl^ 5L5tScr oOper 7Evenr 3Scr_10 9Scr_ll lOEiec

9269 06/03/05 1045*: 19' RSS/APS/NPS/CVS.-

IDC= 922 VDC= 188.0 KWACNET= 150.1 IDCNORMW -.79.? EVENTS: . 0"

TE400FT= 352 TE012FT= 1503 VT310DEL= -G..i5 . OVERRIDES: " 0

P 150 R 160 S 60 W 20 A 30 N 40 C 30 ' L- 10 I ■ 50"

TE(S12'	REF TUBE fEMP (PRIMARY)	' 150 3 "'.	*DF_CF	SETPOINT:	1499 0.99
TE012R'	REF TUBE TEMP (BACKUP)	1491	DEGF	TEMPFACT:	1.20 /0.89
TE012DEL	REF TUBE TEMP DELTA	12	DEGF	CONT MAX/MIN LIM	53.3 PPH
FT012ACT	ACTUAL FUEL FLOW	59.2	PPH	SETPOINT:	51.3 75424
ZT010	EJECTOR POSITION	53.1	%	SETPOINT:	0.0 0.0
PHIMON	PHI MONITOR	1.01		FUELTOT (SCF)	OFF
TE350	ANODE INLET TEMP	373	DEGF	PT350/F3 (OPT)	
TE002	HDS 3ED TEMP	590	DEGF	HTR002 STATUS:	
TE001	PRE-OX BED TEMP(OPT)	404	DEGF	FCV012 (FUEL	
TE010	HDS INLET TEMP(OPT)	427	DEGF	VALVE) 54.7	
FT140	BURNER AIR FLOW	392.1	PPH	FT012ERR	1.7
ZT110	CATHODE AIR VALVE PCS	43.2	°	SETPOINT:	393.3 PPH
PT012	FUEL VALVE EXIT PRESS	5.98	PSIA	SETPOINT:	43.2
TE150B	MOTOR COMP EXIT TEMP	36	DEGF	TE011 (FUEL, DEGF)	77
FAN150	MOTOR COMP FAN	ON		TE150A (AMB.,F)	53
FAN165	FUEL COMP FAN	ON		MOTOR COMP FS150	ON
CV720	FUEL SIDE N2 VALVE	:LOSED		FUEL COMP FS163	ON
CV710	AIR SIDE N2 VALVE	:LOSED		ANODCONF (L3S)	0.0
				AT201 (ADG ONLY)	0.0

2Send 3ClrOvr 4clrAll 5L5tScr oOper 7Event 3Scr_10 9Scr_ll lOElec

"iHelpb

VERIZON FUEL CELL PROJECT

Energy Savings Period from 5/31/2006 to 6/29/2006

Section 1: ENERGY DELIVERED

ELECTRIC				Usage Distribution			
Energy	Fuel cells	680688 kWh		Period 1.	198536 kWh		
	Engines	205485 kWh		Period 2.	497228 kWh		
	TOTAL	886173 kWh		Period 3.	190409 kWh		
THERMAL		670 therm/day	HGHW	29.00	days	=	**19,430** therms

Section 2: ENERGY CONSUMED

	From		31-May	to	29-Jun		
GAS		Meter Multiplier			Thermal Factor Rate xxx		
	6,716 MCF	X	10.0000	X	1.0380	=	**69,712** therms
Diesel						=	**0** gal

Section 3: AVOIDED ENERGY COSTS

ELECTRIC - LIPA Rate 285-Electric Delivery&Supply,secondary,Commercial,Large,Multiple Periods.

Energy Reduction			Rate: May .06$/kWh		Rate: June.06$/kWh	Costs
198,536 kWh		Period1.	$0.0610		$0.0610	11,706.06
497,228 kWh		Period2.	$0.0610		$0.0838	40,278.77
190,409 kWh		Period3.	$0.0748		$0.0748	13,767.83
			Fuel Price Adjustment ($/kWh)			
886,173 kWh	(Total)	x	$0.0664890			58,920.76
			Basic Service Charges			
Number of days in Billing cycle=	29	x	$1.3710 /day			39.76
		Adjustment in rates and charges @		$0.001711		1,516.60
				Avoided Energy Charges >		126,229.78
Demand Reduction			Rate: May 06 $/KW		Rate:June.06 $/KW	
2182 kW		Period2.	$0.0000		$13.4827	28,438.59
1000 kW		Period3.	$4.4181		$4.0020	3,868.60
				Avoided Demand Charges >		32,307.19
					Sub Total	158,536.96
	State and Local Taxes:		@	8.625%		13,673.81
					Total =	**$172,210.78**

THERMAL - KeySpan Energy Delivery Rate:

Gas Displaced

19,430 th. = **24,288** therms
80X% Eff.

24,288 th @ 0.9342 /th **$22,689.04**

Section 4: OPERATING ENERGY COST

	From		31-May	to	29-Jun	
Total Gas Consumed(FC's + bi-fuel engine)						
69,712 therms	**KeySpan Energy Delivery Rate:**		$0.9342 /th		Sub Total =	$65,124.04
Total Diesel Fuel Consumed by Engines						
14,801 ** gallons	**Diesel fuel Rate:**		$2.5000 /gal		Sub Total	$37,002.50
					Total	**$102,126.54**

Section 5: SAVINGS

Avoided Elect. Costs	172,210.78
Gas Displaced	22,689.04
Total Avoided Costs	$194,899.81
Less Operating energy cost	102,126.54
Savings	$92,773.28
Incentives	$0.00 (include amount received from DOE,Tax savings,NYSERDA,County etc)
Gross Savings	**$92,773.28**

Notes:

Period 1:Off Peak-Midnight to 7AM,Every day.All Year

Period 2: Peak-10 AM to 10 PM Monday to Saturday, June 1 to Sept. 30

Period 3: Other-All remaining Hours.

* * Fuel consumption for DG3 3 is calculated from Genset spec sheet for avg. running load of 1223 kw

VERIZON FUEL CELL PROJECT
ANNUAL SAVING SUMMARY
Year to Date 2005-2006

	Electric Savings		Gas Displaced Savings		Total Savings		Gas+Diesel oil Cost		Gross Savings	
Month	Actual Month	Cumulative	Actual Month	Cumulative	Actual Month	Cumulative	Actual Month	Cumulative	Actual Month	Cumulative
July-05	$102,266	$102,266	$0	$0	$102,266	$102,266	$73,476	$73,476	$28,790	$28,790
August-05	$115,585	$217,851	$0	$0	$115,585	$217,851	$91,588	$165,064	$23,997	$52,787
September-05	$101,145	$318,996	$0	$0	$101,145	$318,996	$76,954	$242,018	$24,191	$76,978
October-05	$139,327	$458,323	$7,351	$7,351	$146,678	$465,674	$178,234	$420,253	-$31,556	$45,421
November-05	$185,259	$643,582	$47,220	$54,571	$232,479	$698,153	$146,756	$567,009	$85,723	$131,145
December-05	$158,222	$801,804	$39,472	$94,043	$197,694	$895,847	$130,828	$697,837	$66,866	$198,011
January-06	$150,577	$952,381	$42,700	$136,743	$193,277	$1,089,124	$131,036	$828,873	$62,241	$260,252
February-06	$148,001	$1,100,383	$32,113	$168,856	$180,114	$1,269,239	$107,797	$936,670	$72,317	$332,569
March-06	$145,902	$1,246,285	$32,406	$201,262	$178,308	$1,447,546	$107,431	$1,044,101	$70,877	$403,446
April-06	$159,362	$1,405,647	$31,375	$232,637	$190,737	$1,638,284	$106,827	$1,150,928	$83,910	$487,356
May-06	$174,179	$1,579,826	$35,507	$268,144	$209,686	$1,847,970	$113,651	$1,264,579	$96,035	$583,391
June-06	$172,211	$1,752,037	$22,689	$290,833	$194,900	$2,042,870	$102,127	$1,366,705	$92,773	$676,164
Total	$1,752,037		$290,833		$2,042,870		$1,366,705		$676,164	

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