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Oilfield Flare Gas Electricity Systems (OFFGASES) Project

Submitted by:
The Interstate Oil and Gas Compact Commission
P.O. Box 53127
Oklahoma City, OK 53127-3127

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Prepared by
Rachel Henderson, Projects Director
Interstate Oil and Gas Compact Commission (IOGCC)
P.O. Box 53127
Oklahoma City, OK 53127-3127

Robert Fickes,
California Oil Producers Electric Cooperative (COPE)
301 E. Ocean Bld., Suite 300
Long Beach, CA 90802-4830

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PREFERRED UPSTREAM MANAGEMENT PROJECTS (PUMP) III
Oilfield Flare Gas Electricity Systems (OFFGASES) Project

ABSTRACT

The *Oilfield Flare Gas Electricity Systems (OFFGASES)* project was developed in response to a cooperative agreement offering by the U.S. Department of Energy (DOE) and the National Energy Technology Laboratory (NETL) under Preferred Upstream Management Projects (PUMP III). Project partners included the Interstate Oil and Gas Compact Commission (IOGCC) as lead agency working with the California Energy Commission (CEC) and the California Oil Producers Electric Cooperative (COPE).

The project was designed to demonstrate that the entire range of oilfield "stranded gases" (gas production that can not be delivered to a commercial market because it is poor quality, or the quantity is too small to be economically sold, or there are no pipeline facilities to transport it to market) can be cost-effectively harnessed to make electricity. The utilization of existing, proven distribution generation (DG) technologies to generate electricity was field-tested successfully at four marginal well sites, selected to cover a variety of potential scenarios: high Btu, medium Btu, ultra-low Btu gas, as well as a "harsh," or high contaminant, gas.

Two of the four sites for the OFFGASES project were idle wells that were shut in because of a lack of viable solutions for the stranded noncommercial gas that they produced. Converting stranded gas to useable electrical energy eliminates a waste stream that has potential negative environmental impacts to the oil production operation. The electricity produced will offset that which normally would be purchased from an electric utility, potentially lowering operating costs and extending the economic life of the oil wells.

Of the piloted sites, the most promising technologies to handle the range were microturbines that have very low emissions. One recently developed product, the Flex-Microturbine, has the potential to handle the entire range of oilfield gases. It is deployed at an oilfield near Santa Barbara to run on waste gas that is only 4% the strength of natural gas.

The cost of producing oil is to a large extent the cost of electric power used to extract and deliver the oil. Researchers have identified stranded and flared gas in California that could generate 400 megawatts of power, and believe that there is at least an additional 2,000 megawatts that have not been identified. Since California accounts for about 14.5% of the total domestic oil production, it is reasonable to assume that about 16,500 megawatts could be generated throughout the United States. This power could restore the cost-effectiveness of thousands of oil wells, increasing oil production by millions of barrels a year, while reducing emissions and greenhouse gas emissions by burning the gas in clean distributed generators rather than flaring or venting the stranded gases.

Most turbines and engines are designed for standardized, high-quality gas. However, emerging technologies such as microturbines have increased the options for a broader range of fuels. By demonstrating practical means to consume the four gas streams, the project showed that any gases whose properties are between the extreme conditions also could be utilized. The economics of doing so depends on factors such as the value of additional oil recovered, the price of electricity produced, and the alternate costs to dispose of stranded gas.

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INTRODUCTION

This is the final Technical Report submitted in compliance with the United States Department of Energy's (DOE) National Energy Technology Laboratory Preferred Up-Stream Management Practices (PUMP) III Assistance Grant Number DE-FC26-02NT15444 awarded to the Interstate Oil and Gas Compact Commission (IOGCC). This is a joint project between the IOGCC and the California Oil Producers Electric Cooperative (COPE) with funding provided by the DOE and the California Energy Commission (CEC). Several oil companies also contributed matching funds accounting for more than 1/3 of the total project costs.

EXECUTIVE SUMMARY

All oil produced contains some gas. In some cases, gas, which is separated at the wellhead, can be delivered to natural gas pipelines. In many other cases, associated gas is too strong, too weak, too small in quantity, or too far from a pipeline to be delivered. Gas that can not be delivered to a commercial market because it is poor quality, or the quantity is too small to be economically sold, or there are no pipeline facilities to transport it to market is often referred to as “stranded gas.” Stranded gas is usually flared, vented, or injected back into the ground. A far better solution is to use it to generate power --- power that is needed for oilfield exploration and production processes. Additionally, this clean power source could be economically sold to local distribution utilities. Conceivably, if the potential 2,200 megawatts (MW) of stranded gas had been available to local utilities, the California Energy Crisis of 2001 could have been avoided.

The OFFGASES (Oilfield Flare Gases) Project was conceived to find practical ways to consume stranded gas from oil wells in California. The work was performed with funds from the California Energy Commission’s PIER Program, the U.S. Department of Energy’s PUMP III Program, and contributions from small oil producers and distribution generation (DG) equipment installers and providers. The objective of this project was to demonstrate that proven distribution generation technologies, utilizing flare and waste casing-head gases as a fuel source, can be applied to generate electricity at marginal oil well sites.

The original budget for the project was $2.7 million, including $1.5 million from the CEC, $1 million from PUMP III and $2,000,000 from project participants. COPE received an executed copy of the California Energy Commission (CEC) grant on April 9, 2003, which allowed the PUMP III project to move forward. The CEC approved funding for $1 million instead of the $1.5 million requested.

The reduced funding required either modifying the scope of work or additional appropriations from other sources. Three microturbines, valued at $112,000, were donated by the South Coast Air Management District along with additional cost share contributions amounting to $370,000 from program participants and an amended form DOE F 4600.1. The modifications were completed and the IOGCC received approval to commence work on May 9, 2003.

Project work entailed field-testing the use of stranded oilfield gas to generate electricity through distributed generators at four separate sites selected for their disparity.

(1) High Btu gas (more than 1,300 Btu per cubic foot)
(2) Medium Btu gas (900 to 1200 Btu per cubic foot)
(3) Ultra-low Btu gas (15 to 42 Btu per cubic foot)
(4) Harsh gas (very high in sulfur, carbon dioxide, and nitrogen).

Field-tests involved site selection, obtaining required permits, equipment selection, installation, and adjustments for individual sites. Each of the test sites demonstrated successful use of stranded gas for electricity generation.

The High Btu and Medium Btu sites had been shut in for several years because there was no acceptable method of disposing of associated stranded gas. Both sites were located in urban neighborhoods where a flare would be an offensive nuisance to neighbors in close proximity to the oilfields. Re-injection of the gas into the formation would have caused a pressure buildup that would have decreased severely oil production.

The Harsh site had a working flare. High electrical energy costs from the local utility threatened the economic viability of the site. Utilizing distribution generation (DG) technology to produce the power required to run the oilfield and exporting additional power to the utility has extended the economic life of this oilfield. Voltage support and VAR support to the utility distribution system were an additional benefit of the project.

The Ultra-low Btu site had been adding 300,000 cubic feet of non-stranded pipeline-quality gas to ultra-low gas so it could be incinerated in a thermal oxidizer. This project reduced the amount of pipeline-quality gas used. The long-range goal is to increase the generation capacity to consume all the ultra-low quality gas, thus eliminating the need for pipeline-quality gas.

The project found that the best technology to recover stranded gas is the microturbine. Small, modular, and low in emissions, the microturbine can be tailored to meet the rugged, variable conditions in the oilfield. One recently developed system, the Flex-Microturbine, has the potential to cover the entire range of oilfield gases. Such a unit could simplify and accelerate elimination of most stranded oilfield and flare gas.

Most turbines and engines are designed for standardized, high-quality gas. However, emerging technologies such as microturbines have increased the options for a broader range of fuels. By demonstrating practical means to consume four different gas streams, the project showed that gases whose properties are in between extreme conditions can be utilized.

Each of the four field tests was successful, demonstrating that a wide variety of gases can be used to generate power. The economics of doing so depends on factors such as: (1) the value of additional oil recovered; (2) the price of electricity produced; (3) alternate costs to treat and condition stranded gas to make it suitable to run in DG equipment; and (4) the cost to dispose of stranded gas.

Currently, these projects are expensive to design and construct. Researchers identified many sites where the stranded gas generating capacity was many times that of the electric load of that facility. Without the ability to sell excess power generated by DG, producers face a negative cash flow resulting from high installation, operating, and maintenance costs.

DG has proven to be a technical success in extending the life and productivity of marginal oilfields. The sale of electricity from stranded gas projects could be a source of new revenue that has the potential to extend the life of otherwise marginal oilfields.

PROJECT INTRODUCTION

In declining oilfields, it becomes more difficult and expensive to extract oil – researchers estimate that about 1/3 to ½ of the operational expenses associated with extraction and production of oil from marginal wells is the cost of energy expended to recover the oil. Most oil wells generate gas, which is separated at the wellhead, of varying amounts. In some cases, this gas can be delivered to natural gas pipelines. In many other cases, associated gas is too strong, too weak, too small in quantity, or too far from a pipeline to be delivered. Gas that can not be delivered to a commercial market because it is poor quality, or the quantity is too small to be economically sold, or there are no pipeline facilities to transport it to market is often referred to as "stranded gas." Stranded gas, is usually flared, vented, or injected back into the ground.

Stranded gas has become an increasing problem for both small and large oil producers. By utilizing stranded gas to generate useful electricity in the field at a reasonable cost, there is the possibility of direct environmental and economic benefits. Waste gas will be consumed, rather than vented, flared, re-injected or incinerated, decreasing potential impacts to the environment. Producers will experience a decrease in operational expenses and an increase in production. On a global scale, more power would be available to the nation, reducing reliance on imported oil and gas.

Turning stranded gas into distributed generation seemed to be a likely solution to stranded gas issues. Some early attempts from COPE members resulted in failure and frustration over what seemed to be insurmountable problems with air quality requirements, utility interconnection, equipment reliability and cost, and building and safety requirements. The OFFGASES team set out to develop solutions to these problems along with any other challenges discovered in the process and to demonstrate that distributed generation was a viable solution.

EXPERIMENTAL

The objective of the OFFGASES project was to demonstrate that existing, proven distribution generation technologies, utilizing flare and waste casing-head gases as a fuel source, can be applied to generate electricity at marginal oil well sites. This was accomplished through field-testing the use of stranded oilfield gas to generate electricity through distributed generators at four sites. Field-tests involved site selection, obtaining required permits, equipment selection, installation, and adjustment for individual sites. Each of the test sites demonstrated the successful use of stranded gas for electricity generation. Four sites were selected to cover the wide range of possible stranded gas qualities found in California oilfields:

High Btu gas (more than 1,300 Btu per cubic foot)	TERMO Company	Long Beach, CA
Medium Btu gas (900 to 1200 Btu per cubic foot)	St. James project	Los Angeles, CA
Ultra-low Btu gas (15 to 42 Btu per cubic foot)	DCOR	Rincon, CA
Harsh gas (Very high in sulfur, carbon dioxide, and nitrogen)	Drilling & Production Co.	Maricopa, CA

With the exception of medium Btu gas, which is similar to natural gas, none of the other gases have been used to generate power. Most turbines and engines are designed for standardized, high-quality gas. However, recent emergent technologies have increased power generation options to a broader range of fuels.

For each pilot site, researchers identified the following key tasks:

(1) <u>Site selection</u>: COPE members provided a list of potential volunteer sites. From that selection, gas sampling was performed to determine gas heat content, gas quality, gas flow rates, and gas contaminants. Sites were selected to provide the most representative family of flare and "shut-in" gas solutions.

(2) <u>Permitting:</u> Identify and obtain required permits.

(3) <u>Equipment selection</u>: Gas analysis was used to select generation and cleanup equipment. Gas analysis, pressure, flow rates, and variability, as well as other factors such as equipment size, and location-specific variables, were considered.

(4) <u>Install equipment</u>: Install necessary equipment for testing.

(5) <u>Monitor and maintain</u>: Pilot sites were monitored for 12 to 18 months to assess the success of the demonstrations. Critical parameters included reliability, maintainability, and operability. Technical adjustments were made to mitigate operational challenges during the monitoring period.

(6) <u>Technology transfer</u>: The results of the study were communicated through several presentations at California Petroleum Technical Transfer Conferences (PTTC), IOGCC meetings, and publication in professional journals.

High Btu Location

The TERMO Company in Long Beach was chosen for the high Btu site. A key factor in selecting this site was a prior attempt and failure by the operator to install DG at an oilfield. The site had three oil wells that had produced 10-15 barrels per day and about 6-8 mcf of 1500-1600 Btu gas. These wells had been shut in and idle for about five years because the Btu content of the gas was much higher than the 1150 maximum and the pipeline that had previously delivered the gas to market was beyond repair and abandoned.

One Capstone 30kW microturbine, donated by the operator, was installed along with a free water separator and a small compressor. This microturbine was the only one available with a turbine small enough for application at this site.

The gas produced from this small site was found to be very unstable in both volume and quality. During winter months the gas volumes would drop during the late evening and early morning due to what was assumed to be a drop in ambient temperature. This made it extremely difficult to tune the microturbine to the well conditions. A contracted expert, who was involved in the initial development of the Capstone C-30, was engaged to assist researchers in adjusting the microturbine from 30 kW to 19 kW. Not only did the workovers allow the turbines to run consistently 24 hours per day, they increased production from 10 – 15 barrels per day to 35 – 40 barrels per day.

The high Btu site also experienced several delays due to major well bore repairs and microturbine problems during the first quarter of 2005 but has been operating consistently the past year. This project site is performing extremely well using waste casing-head gas to run microturbines to generate electricity for the pumping units at the site.

Medium Btu Location

The St. James project, at 814 W. 23rd Street in Los Angeles, is the medium Btu location and was selected as the first test site because it is typical of many oilfields in California, and is geographically close to service personnel and equipment suppliers. This site had 18 active oil wells**,** producing about 150 barrels per day and 200 to 300 mcf/day of 1250 Btu gas.

Previously, the field had a contract with Southern California Gas to sell up to 300 mcf/day of gas from production. However, when pipeline quality standard for maximum Btu was lowered to 1150 Btu/scf, inconsistencies in quality frequently caused the gas system to be automatically shut down by the utility. When shut-downs occurred, gas and oil flow were disrupted. As a result of difficulties with stranded gas, the field had been shut in and left idle for more than three years. When the site was returned to production after being idle, the site initially averaged about 80 barrels per day and 110 mcf/day gas.

The wells at this site were producing in several different production zones and as a result the energy content of each site varied between 800 and 1400 Btus a cubic foot. After sampling each well, it was found that three wells contributed gas well above the 1150 maximum allowable. Researchers segregated the gas from these wells, allowing the remainder of the gas to meet the pipeline specification. Three Capstone microturbines, along with a free water separator and a small refrigeration unit recommended by the microturbine manufacturer were installed.

Capstone microturbines, donated by Los Angeles' Air Quality Management District (AQMD), were chosen because the size fit well with the volume and quality of gas researchers needed to burn. Capstone's R&D department agreed to work collaboratively with the research team to find solutions to problems as the project progressed. Researchers found that the refrigeration unit did little to condition the gas and that all that was needed in the conditioning process was the free water separator.

Testing at this site was completed in March 2006 after 24 months of operation. The three microturbines at the site worked extremely well. COPE arranged with the University of Southern California – Irvine to include the St. James site in its on-line monitoring Website so anyone can log on and evaluate the system at any time. The on-line monitoring well data is available at http://www.apep.uci.edu/DER/AQMD/. However, the monitoring site data have not been updated since December 15, 2004, pending Air Quality Management District renewal of the project with the university. The St. James site is denoted as site No. 20.

The St. James site was the target of citizen complaints regarding excessive noise once the microturbines were installed and we were requested to investigate and provide recommendations. Capstone and Cal Power were contacted for ideas for possible noise abatement and mitigation techniques. A sound meter was acquired and spot readings were performed to establish a baseline.

Several trial fixes were attempted during July 2004 with limited success. The ambient noise level exceeded existing city ordinance allowable levels with, or without, the microturbines operating at the site. The primary issue for citizen complaints was the high-pitch whine emanating from the microturbines. Trial fixes were completed in August with the installation of a prototype design installed on all three microturbines. The noise suppression equipment has reduced the whine significantly and the sound level is now considered to be acceptable. A photograph of the various noise suppression designs can be seen in the August 2004 Status Report located in the Appendix of the previous Technical Progress Report submitted to DOE.

During May 2005 the St. James project owner advised COPE of continuation of the noise complaint arbitration and requested assistance with reduction of the microturbine whine. Mitigation action previously taken by COPE and the owner had reduced the noise level for the site but the condition was not completely satisfactory. A consultant retained to perform a more detailed noise survey and provide recommendations submitted a report on May 7, 2005, recommending utilizing noise blankets and lagging to reduce the tonal signature of the microturbines.

In July 2005 a contract was awarded to Sound Waves to provide noise suppression covers for the microturbines. One cover was fabricated and installed on MT #1 during July with positive results. The owner advised COPE on August 4th that the noise complaint had been resolved and requested that any additional work be discontinued on the remaining two covers. Monitoring of the microturbine performance compared to the other two units has not shown any adverse effects from the cover.

Low Btu Location

Initially, COPE was negotiating with Chevron to use one of its well sites for the low BTU project, but negotiations fell through due to contract demands by Chevron that were in conflict with DOE's contract requirements with the IOGCC. Therefore, COPE had to secure an alternative site for the low BTU project. The selected alternative site is operated by DCOR, at its Rincon operation. DCOR is a California operator that specializes in purchasing production sites that are economically marginal and maximizing oil and gas production through streamlined operations and new technologies.

The gas stream selected came from an Amine Gas Process plant, a process that removes CO_2 from gas and has a waste stream composed mostly of CO_2 with 15Btu to 45Btu methane carryover. DCOR was adding 300 mcf of non-stranded pipeline quality gas to this ultra-low quality gas to bring the total Btu content up to 350 Btu/scf, allowing it to incinerate in a thermal oxidizer.

The long-range goal for this site is to increase the generation capacity to consume all the ultra-low quality gas, thus eliminating the need for pipeline quality gas through the thermal oxidizer. A Flex-Microturbine, a Capstone Microturbine modified by Flex to burn on ultra low Btu gas, was chosen because conventional technology can not sustain combustion below 350 Btu/scf.

Another feature of the Flex-Microturbine is that it accepts fuel at atmospheric pressure, eliminating the need to compress a low Btu gas, which can be costly and complicated if gas has a varying Btu content as in this case. Replacing the thermal oxidizer with the turbine could result in a potential savings of 200,000 cubic feet per day, valued at $1,200 - $2,000 a day, or $400,000 - $700,000 per year. Additionally, the site could generate 80 kW of electricity for internal use.

Delays related to the failed Chevron negotiations for the low Btu project site required a no-cost extension of the agreement with DOE through September 2007. This extension was required to have adequate time for installation of equipment and for operation to determine the success of the research using the Flex-Microturbine with very low Btu gas.

Obtaining pertinent permits for sites has been one of the significant barriers to success. Mr. Bob Fickes, President of COPE, has been successful in obtaining approval from the local air management board, which was interested in the potential of decreasing waste/flare gas and using it for the generation of electricity. After securing appropriate permits, installation at this site is now complete.

Due to widely varying gas quality, the turbine experienced immediate difficulties that resulted in overheating and failure of key components. Adjustments included redesigning controls and installing failsafe procedures regarding overheating. The site is now complete and fully operational, successfully disposing of 42 Btu gas.

Harsh Location

Drilling and Production Companies' Maricopa oil field was chosen for the harsh site because it allowed experience with Pacific Gas and Electric (PG&E), one of the three public electric utilities in California. The site was not atypical of many other oil producers in the greater Bakersfield area, and the site owner was enthusiastic to be part of the project.

This site produces about 135 barrels of oil per day and 265 mcf of 550 Btu stranded gas. Energy content is o 500 to 700 btu per cubic foot. The gas has a high concentration of carbon dioxide (CO_2), nitrogen, and about 5,000 - 6,000 ppm hydrogen sulfide (H_2S). In order to meet air quality requirements, significant reductions in sulfur were necessary.

H_2S removal on a large scale is widely practiced in refineries; however, finding economical removal systems for smaller operations are more difficult. Several options were evaluated and a sulfa-treat system was selected. This proprietary system utilizes an absorbing medium to remove sulfur. Although still determined to be an economical solution, the consumption of sulfa-treat material was twice as much as was anticipated.

An Ingersol Rand (IR) 70kW microturbine, chosen to demonstrate another type of technology, was installed along with a heat loop to re-use waste heat from the microturbine to separate the water from the oil in shipping tanks. About 40 mcf/day of the gas production is being used for generation and the rest is being flared.

PG&E has set a restriction on the amount of electricity it will allow us to export to the grid. Currently PG&E is not paying for the exported power even though they are selling it at retail prices to another customer on the grid. An existing PG&E electrical tariff will not allow the sale and export of excess power from a self-generation project if the power is less than 1,000 kW. Recent legislation has led to California Public Utilities calling for the three public utilities to develop standard offer contracts for the purchase of power from small DG projects. Contract language was submitted in January 2008 and we hope to have contracts available to us by summer 2008. COPE is currently working with California state regulators to sell excess electricity and hope to have a tariff in place later this year. If this contract becomes available, the site owner plans to add generation to consume most of the remaining gas and sell the electricity to PG&E.

At the harsh, site, installation has been completed and operations began on September 5, 2006. The turbines have run more than 95% of the time discounting PG&E outages and turbine shut-ins due to PG&E export limitations.

This site experienced many delays related to unnecessary conditions from PG&E for interconnection that required an 18-month extension that was approved in September 2004.

RESULTS AND DISCUSSION

Each of the sites presented unique challenges, but ultimately were technical successes. All sites are operating with reasonable consistency, except for the low Btu site, where a lack of funds prevented completion of the project. The technologies selected were appropriate, although there were some limitations – each of the systems, with the exception of the Flex Microturbine, require a fuel compressor, which can cause limitations to operations when there are changes in fuel quality or if there is moisture in the fuel.

High Btu Location

The high Btu well site experienced problems related to design changes to the on-site compressor, gas production fluctuation (where the site routinely run out of gas in the evenings) possibly due to decreased ambient temperatures keeping the gas in liquid form, and repairs to the well bore. The repairs to the well bore took longer than expected due to the shortage of work-over rigs.

During July 2005, repair work was completed, the well was placed back on-line; and the microturbine was re-started for electrical generation. Shortly afterward the microturbine was shut down due to a problem with the fuel-to-air ratio control valve. This valve was repaired in late August-early September but shortly afterward the control board experienced problems and required repair work that again forced shutdown of the microturbine. Discovery of a third party repair and maintenance group has solved the gas fluctuation problems by permitting operators to turn down the throttle, allowing the turbine to run continuously. Reliability has increased to more than 90% after this change.

Production initially increased from 0 to 15 barrels per day, and rose to 35 – 40 barrels per day, with an estimated benefit of $461,000 per year. Total project cost was $397,000.

The turbine returned three idle wells to service and the operator is investigating installation of microturbines at other sites.

Solving the stranded gas problem along with the reduction of operating cost from the reduced electrical bills have allowed this small oilfield to take advantage of the current higher oil prices. Without technically viable economic solutions for stranded gas, many wells that could turn a profit at today's oil prices will remain idle and possibly abandoned

Medium Btu Location

Operations began for the St. James site in the first quarter of federal fiscal year 2004 (late December 2003). A long delay in getting this site ready for start-up was experienced due to its location in downtown Los Angeles, which made permitting extremely difficult. Air quality permit requirements proved to be the greatest hurdle. Mr. Bob Fickes, President of COPE, was successful in obtaining approval from the California Energy Commission stipulating that utilizing waste/flare gas for the generation of electricity, as this project is doing, qualifies as an environmentally friendly renewable resource activity. This allows operators utilizing the methods researched for this project extra tax benefits and should facilitate permitting. The project also broke ground on how operators will be able to deal with excess "waste gas" or electricity generated when utilizing distributed energy equipment.

Continuous production from the site has been ongoing since May 2004. The project was successful in taking an idle well and returning it to economical production that provided approximately 50 barrels of oil per day from 2004 to 2006. Utilizing the microturbines evaluated during the project; the site is still producing. However, project operators have not monitored production since 2006, when the contract expired.

The site had significant payback potential because both oil and gas were being suppressed as a result of tight gas quality requirements. The 90 kW of power generated by the microturbines could be used onsite and there was no need to export excess power.

18 idle wells were returned to production at an initial rate of 50 barrels per day. Production increased to 80 barrels a day, and the gas produced was valued at $950 per day. Total economic impact is estimated at $2,700,000 per year, and project costs were $497,000. The operator recovered his investment in the project of approximately $100,000 within one year. As a result of this success, the operator has acquired nine additional microturbines and is considering installing them on his wells.

Low Btu Location

As was the case with high Btu and harsh gas sites, there was a lot of interest among California oil producers in hosting the low Btu site. Several operators volunteered, and a site north of Ventura was selected. This site processes off-shore oil production. Water is first stripped from the oil; then gas. The gas contains a high percentage of CO_2, which must be removed to bring the gas to pipeline quality. The CO_2 contains residual hydrocarbons, mostly methane, and has a heating value of only 15 to 42 Btus a cubic foot. The CO_2 was processed through a thermal oxidizer where the residual methane and hydrocarbons were destroyed. The thermal oxidizer uses 200,000 cubic feet of natural gas daily to destroy the hydrocarbons in the low Btu gas.

It was determined that the Flex-Microturbine was the only feasible way to convert the low Btu gas into electricity, so that technology was selected even though it was not yet fully commercial. Flex-Microturbines are designed to run on gas as low as 15 Btus per cubic foot, and also can run on any stronger gas. Another feature of the Flex-Microturbine is that it accepts fuel at atmospheric pressure. This was important because it is very expensive and complicated to compress a low Btu gas. It is even more complicated if the gas has a varying Btu content, such as the gas in this circumstance.

The site “destroyed” 500,000 cubic feet of 15 to 45 Btu gas a day in its thermal oxidizer, which consumed about 200,000 cubic feet of natural gas each day at a daily value of $1,500 - $2,000. If Flex-Microturbines could replace the thermal oxidizer, 200,000 cubic feet of natural gas a day would be saved, a value of about $1,200 to $2,000 a day, or $400,000 to $700,000 annually. In addition, the site would generate 80 kW of electricity for internal use or sale. While there were several problems to be overcome, the Flex system was started and operated on low Btu gas. Unfortunately, the project ran out of funds, and the low Btu gas project was terminated prematurely. $329,000 of project funds had been spent before funding ran out.

Additionally, external circumstances changed during the project – the site had a CHP system that provided necessary heat for oil operations that was destroyed in a fire. The thermal oxidizer is now the sole source of heat for the site and is currently fired with about 400,000 cubic feet of natural gas per day. The client is now investigating alternate means to generate power with its surplus gas.

Harsh Gas Location

The Harsh site incorporated many technological and economic challenges. Prior to the OFFGASES project, 30% to 40% of the stranded noncommercial gas was being burned in boilers to create heat for the oil-water separation, while the remainder was disposed of at a flare. Taking the waste heat from the IR 70kW turbine and running it through a heat exchanger has reduced the need for boiler heat. The turbine required lower concentrations of sulfur in the gas so a proprietary sulfur removal system was installed. Though this system works very well operationally, the costs were higher than anticipated, which put strains on the overall economics of the project. Work continues to find a more economic medium for sulfur removal.

All Microturbine manufacturers advertise that their machines will run on any quality of gas in the 400 to 2000 Btu/scf range. However, The IR machine does not have a significant turn-down ratio with the low Btu gas range of 300 to 400 Btu required by the power plant. Additionally, going from one range to another required retrofitting the valve and control programming, which could negate the equipment's warranty and service agreement. The system continues to run, but concerns continue that the gas may become too rich for the plant.

Of the three utilities that researchers worked with on the OFFGASES project, PG&E required the most additional equipment to interconnect with their system. Many of their requirements, in the opinion of the OFFGASES team, had little if any technical merit. A great deal of time was consumed battling these requirements. PG&E placed a restriction on the amount of power that could be exported -- power that was free to PG&E. The company then was able to sell to another customer at retail electrical tariff rates. PG&E required researchers to install two export limiting devises in tandem, which is extremely unusual. Researchers were not able to find another utility in the nation with this requirement. If this arbitrary limit were exceeded, the generator would be automatically shut down. The oilfield would be forced to purchase "standby" power from PG&E at a greatly elevated price. A single incident during a month would negate all savings from the generator. In an attempt to mitigate these types of shut-ins, the operator installed electrical heaters in the summer to try to limit the amount of gas exported.

During frequent PG&E electrical outages the induction generators would be shut down automatically, not because of any of the required safety devices but because it is technically impossible for induction generators to run on a non-energized electrical grid. This built in safety factor is one of the reasons the OFFGASES team decided to use induction generators exclusively. During these utility outages, the field goes on the expensive standby power charges because the utility has taken the generators off with its power outage.

Sulfa-treat system operating costs average $325 per day. There was no immediate oil production increase because the site was already able to flare gas. Between the cost of sulfur removal and limited opportunities for the turbine to produce power, the anticipated economics of this site did not materialize. The recommended changes in tariffs that require utilities to purchase power from stranded gas would eliminate this problem.

The project cost $262,000 and current annual savings are about $22,000. If the stranded gas tariff were implemented, the site owner plans to put in an additional 250 kW generator, which would generate between $203,000 and $286,000. This would reduce flaring to emergency use only and would consume nearly all of the site's stranded gas.

Technology Transfer

An important part of this project is ensuring that the knowledge gained is communicated to a wide audience of producers and others who might benefit from the lessons learned. As a result, the IOGCC and other members of the project team are actively seeking opportunities for speaking engagements and presentation of papers, both technical and general.

The OFFGASES team gave two presentations at IOGCC conferences and four additional presentations at the West Coast Petroleum Technical Transfer Conferences (PTTC). The

OFFGASES PTTC conferences were well attended. Six additional projects are in development as a result of technology transfer efforts. In addition, three industry publications and technical journals have been published.

CONCLUSIONS

The OFFGASES project demonstrated the ability to burn a variety of gas qualities using DG technology. The four demonstration sites had gas quality ranging from 45 Btu/scf to 1600 Btu/scf and high concentrations of CO_2 and nitrogen. One site had 5,000-7,000 ppm hydrogen sulfide, a toxic and potentially lethal amount. OFFGASES found solutions to these extreme conditions and successfully operated DG under these conditions.

Most oil operators treat stranded gas as a waste stream that has no value and therefore their only concern is to get rid of it in a manner that is environmentally prudent with the least amount of effort. Since this waste stream is viewed as valueless, it is seldom measured, which makes it extremely difficult to determine results in terms of mcf recovered. The return of idle fields to production, the extension of the life of marginal wells, and increases in efficiency and production demonstrate the potential large-scale impact of DG technology.

Key successes of the project include air quality regulatory compliance, interconnection of DG with a variety of electrical utilities, mitigation of noise and other neighbor complaints in urban areas, development of an economical and effective gas conditioning system and development of standard construction and safety systems. Most importantly, the project promoted technologies and techniques that will extend the life and production of marginal and/or idle oilfields.

<u>DG air quality compliance</u>. DG was operated in compliance with California's strict air quality regulations. OFFGASES partnered with South Coast Air Quality Management District and helped to develop appropriate and prudent regulations and standards. Because the gas consumed can have such a large variation from project to project, operators learned a great deal about different gas feed stocks and their emissions.

<u>DG utility interconnection</u>. The project demonstrated successful and economical interconnection of DG with a variety of electrical utilities, including SCE, PG&E and LADWP.

<u>DG urban construction.</u> The DG project was constructed in highly populated urban areas and successfully mitigated noise and other neighbor complaints. For example, a sound-proofing system was developed that eliminated more than 90% of the sound from the units, allowing them to be placed in highly populated areas.

<u>Gas conditioning system.</u> Researchers developed an economical and effective gas conditioning system allowing minimum equipment to produce gas suitable for use in DG. The standard gas processing system has been used in several installations outside of the OFFGASES project.

Construction and safety standards. Researchers developed standard construction and safety systems to comply with local building and safety requirements. A set of standard drawings and electrical schematics was developed that can be modified easily for different types of sites to be used to get building permits from local agencies.

Marginal oilfields. The research project demonstrated technologies that can extend the life of marginal oilfields. Two of the four well sites had been idle for several years prior to OFFGASES due to stranded gas and no viable method of disposal. OFFGASES returned these fields to production, and they are producing successfully today.

Producers and operators who would like to implement DG still face economic challenges. Many, if not most, small oil producers have much more stranded gas potential than they have equivalent electrical load to consume the electricity. To date, there is no tariff to sell back the power on a wholesale level.

RECOMMENDATIONS

Currently, these projects are expensive to design and construct. Researchers identified many sites where the stranded gas generating capacity was many times that of the electric load of that facility. Without the ability to sell the excess power generated by DG, producers face a negative cash flow resulting from high installation, operating, and maintenance costs.

DG has proven to be a technical success in extending the life and productivity of marginal oilfields. The sale of electricity from stranded gas projects would be a new revenue stream that would extend the life of otherwise marginal oilfields.

The Flex-Microturbine has the potential to use all stranded and flare gas with virtually the same power plant. No other technology has this flexibility. The Flex can handle from 15 Btu gas to 2,000 Btu gas. It has virtually no emissions. Further development of the Flex-Microturbine is needed to make it commercially viable, and its commercialization will be a big boon to the oil industry.

The largest impediments to the success of these “stranded gas to electricity” projects are still in the regulatory, electrical tariff, and public policy areas.

Regulatory**.** There is a strong market of electricity buyers wanting to purchase electricity produced in an environmentally friendly way. Some businesses and households are willing to spend a premium if the power is produced in a way that helps the environment. Compared to traditional renewable power sources, (wind, solar, biomass and landfill), stranded gas generation is much cheaper to produce. Because it is not classified as renewable, under current regulations, it is nearly impossible to sell power from stranded gas projects. Regulators need to work with utilities and industry to develop regulations that allow recognition and easy access to markets for the sale of this power.

Electrical Tariff. The Public Utilities Regulatory Policy Act of 1978 requires that all "QF" qualified projects be offered a Standard Offer contract to sell power to the utilities at "Short Run Avoided Cost" (SRAC) prices. It is up to each state to set the formula for SRAC. The SRAC formula in California has needed modification for nearly a decade. There has been a fierce battle between the electrical utilities and industry over this formula. The CPUC, which approves contracts between utilities and industry, has discouraged new standard offer contracts until SRAC issues are resolved. Therefore, only renewal of existing standard offer contracts has been attempted during this time period. The California Independent System Operator (CAISO) schedules the power to the electrical grid. It has an arbitrary minimum of 1,000kW, or 1MW from any generating location. The addition of the potential 200MW to 2,000MW from stranded gas generation would be a great asset to the CAISO. Development of this additional generation would require the CAISO to drop its minimum threshold to allow DG size projects to participate.

Public Policy. Power produced from stranded gas reduces air emissions from flaring, venting of natural gas, and boiler steam generators through CHP. However, these projects currently receive no credit or recognition for the help they give to the environment. The state of California has a requirement that renewable energy equal 20% of the total energy purchased by all utilities. For years, the state's three major utilities have not complied with this requirement. Renewable energy is typically much more expensive to produce than energy from stranded gas. Stranded gas does not qualify as part the renewable electrical portfolio. Therefore, no benefit or recognition is given to those who develop the projects or those who purchase the power from these projects. Public policy should support all forms of environmentally friendly generation. Wind, solar, biomass, and landfill are all sources of energy that need to be supported and developed, but the nation should not turn its back on taking advantage of stranded gas as a resource.

REFERENCES

None

BIBLIOGRAPHY

None

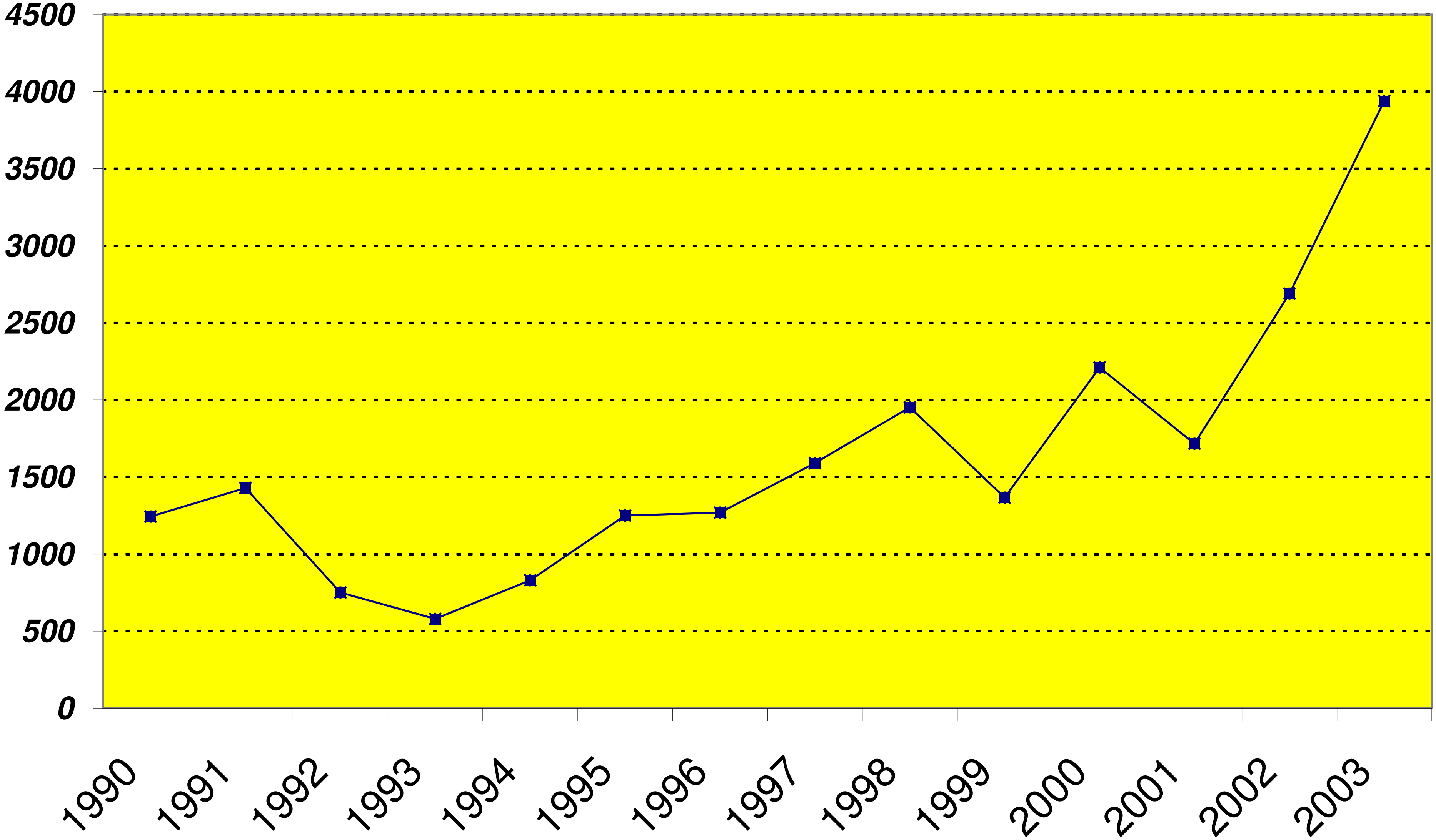
LISTS OF ACRONYMS AND ABBREVIATIONS

AQMD	Air Quality Management District
BTU	British Thermal Units
CAISO	California Independent System Operator
CEC	California Electric Cooperative

CHP	Combined heat and power
CO2	Carbon Dioxide
COPE	California Oil Producers Electric Cooperative
CPUC	California Public Utilities Commission
DG	Distributed Generation Technology
DOE	U. S. Department of Energy
H2S	Hydrogen Sulfide
IOGCC	Interstate Oil and Gas Compact Commission
IR	Ingersoll Rand
LADWP	Los Angeles Department of Water and Power
mcf	thousand cubic feet
MW	Megawatt
NETL	National Energy Technology Laboratory
OFFGASES	Oilfield Flare Gas Electricity Systems
PAC	Project Advisory Committee
PG&E	Pacific Gas & Electric
PIER	Public Interest Energy Research
PUMP	Preferred Upstream Management Practices
PURPA	Public Utilities Regulatory Policy Act
QF	Qualifying Facility (under PURPA guidelines)
R&D	Research and Development
SCAQMD	Southern California Air Quality Management District
SCE	Southern California Edison
SRAC	Short Run Avoidance Cost (cost of utility to turn on additional electrical generation. This cost is used to set the price of power from QF projects)
scf	Standard cubic feet

ATTACHMENTS

California Natural Gas Vented and Flared (MMcf)



June 2003

Gas Analysis Summary - Offgases Project

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
UDC	**PG&E**	**SCE**	**PG&E**	**PG&E**	**PG&E**	**PG&E**	**PG&E**	**SCE**	**LADWP**	**LADWP**	**PG&E**	**PG&E**	**PG&E**	**LADWP**	**LADWP**	**PG&E**
OFFGASES PROJECT CLASS	HARSH		LOW BTU	LOW BTU	LOW BTU	LOW BTU	LOW BTU		MED BTU	MED BTU	MED BTU		HIGH BTU MED BTU	MED BTU	MED BTU	LOW BTU
RANK	PRIMARY		PRIMARY	PRIMARY	PRIMARY	PRIMARY	PRIMARY		PRIMARY	PRIMARY	SECONDARY		SECONDARY	SECONDARY	SECONDARY	SECONDARY
Gross Btu/CuFt Dry	1057.3	1190	71.8	158.1	107.9	92.3	85.6	1329	1286	1254	807	1027	1440	1186	1171	49.1
	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%
Oxygen	2.982	4.91	0.537	4.606	3.988	0.607	0.297	0.43	--	0.1	0.7	0.22	0.081	0.16	--	--
Nitrogen	11.647	19.18	1.265	18.879	15.606	2.559	1.322	2.77	--	0.67	2.55	0.91	0.435	0.94	2.87	0.275
Carbon Dioxide	7.478	0.59	93.657	62.781	73.355	89.845	91.79	4.36	1.09	1.12	17.24	0.38	0.806	1.1	0.579	97.602
Methane	63.094	53.57	3.86	13.224	6.071	6.423	6.096	75.61	83.12	83.1	79.4	95.47	71.58	81.61	80.61	1.35
Ethane	4.25	5.00	0	0	0	0	0	2.52	5.38	5.34	0.097	2.27	9.353	8.54	8.871	--
Propane	3.564	6.09	0	0	0	0	0	4.06	4.2	4.27	0	0.38	9.913	5.51	5.221	--
Iso Butane	1.418	1.59	0	0	0	0	0	1.02	0.89	0.85	0	0.23	1.29	0.77	0.654	--
n-butane	1.665	3.55	0	0.2	0.031	0	0	3.47	1.88	1.86	--	0.07	3.434	1.12	0.928	0.105
Iso Pentane	1.115	1.71	0	0	0	0	0	1.47	0.71	0.68	--	0.03	0.68	0.13	0.126	--
n-Pentane	0.40	1.33	0	0	0	0	0	1.21	0.67	0.63	--	0.01	0.616	0.09	0.079	--
Hexanes	1.823	2.48	0.681	0.492	0.949	0.566	0.494	1.67	2.06	0.93	--	0.03	1.812	0.03	--	0.667
Heptane	--	--	--	--	--	--	--	0.81	--	0.34	--	--	--	--	--	--
Carbon Monoxide	0	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Octane	--	--	--	--	--	--	--	0.60	--	--	--	--	--	--	--	--
Hydrogen Sulfide/ppm	5630	2	610	91	120	520	1300	--	1.75	--	--	--	--	--	--	--

	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32
	SCE	**SCE**	**SCE**	**SCE**	**SCE**	**SCE**	**SCE**	**PG&E**	**PG&E**	**PG&E**	**SCE**	**SCE**	**SCE**	**SCE**	**PG&E**	**SCE**
		HIGH BTU			HIGH BTU	HIGH BTU			HARSH	HARSH	HIGH BTU					
		SECONDARY			SECONDARY	SECONDARY			SECONDARY	SECONDARY	PRIMARY					
Gross Btu/CuFt Dry	1371	1612	1589	1507	1612	1635	1563	796.6	374	282.6	1642.9	1600	940	944	367	1747
	%	%	%	%	%	%	%	%	%	%	%	%	%	%		
Oxygen	0.03	--	--	--	--	--	--	0.227	2.567	1.371	0	0.01	4.285	4.27	0.93	
Nitrogen	0.44	0.27	0.21	0.28	0.29	0.27	0.18	1.327	14.631	13.854	0	0.43	23.288	23.29	19.4	
Carbon Dioxide	4.25	4.55	3.38	3.27	2.66	1.82	2.97	23.007	57.757	57.979	3.67	2.41	6.414	6.414	49.15	
Methane	73.75	66.47	65.82	70.67	66.66	65.12	65.29	73.768	21.699	26.356	36.93	69.62	50.834	50.834	27	
Ethane	6.39	4.58	7.23	5.93	7.31	7.99	8.12	0.648	0.079	0	19.04	6.93	3.242	3.24	1.44	
Propane	6.42	7.85	8.54	6.93	7.94	9.9	10.41	0.25	0	0.078	31.72	5.75	5.61	5.61	1.19	
Iso Butane	0.9	1.3	1.49	1.25	1.32	1.6	1.65	0.169	0.01	0	4.2	1.16	1.292	1.29	0.11	
n-butane	2.66	4.38	4.9	3.94	4.36	4.9	5.02	0.133	0.057	0.136	3.75	2.87	2.934	2.93	0.13	
Iso Pentane	0.7	1.73	1.85	1.56	1.66	1.64	1.51	0.093	0.215	0.119	0.47	1.18	0.958	0.96	0.07	
n-Pentane	0.64	1.86	1.84	1.51	1.72	1.6	1.41	0	0.122	0.107	0.18	1.39	0.56	0.56	0.04	
Hexanes	3.82	7.01	4.74	4.66	6.08	5.16	3.44	0.379	2.863	0	0.03	8.24	0	0	0.55	
Heptane	--	--	--	--	--	--	--	--		--	0					
Carbon Monoxide	--	--	--	--	--	--	--	--		--	0					
Octane	--	--	--	--	--	--	--	--		--	0					
Hydrogen Sulfide/ppm	1.5	12	2.5	3	2	--	--	--	480	660	0	0	0	0	143000	

09/26/2003 02:28 18057698314 DRILPRO MARICOPA CAL PAGE 01

Midway Laboratory Inc.
Petroleum-Industrial-Environmental
315 Main Street P.O. Box 1151
Taft California 93268

State Certificate # 1396
Phone # (661) 765-2364
Fax # (661) 765-6920
E-Mail midlab@gte.net

NATURAL GAS ANALYSIS

Rev 1/23/03

Customer: Drilling and Production
Attention: Darin Holden

Log #: 6963-3
Date Received: 9/9/2003
Date Completed: 9/9/2003
Report Date: 9/11/2003

Sample Description: Boiler Gas W/O Sweet

Analytical Parameter: Natural Gas Analysis

Constituent	Mole %	Wt. %	Lv. %
Oxygen	1.292	1.292	0.575
Nitrogen	4.675	4.093	2.251
Carbon Dioxide	52.622	72.386	61.882
Methane	40.066	20.091	34.062
Ethane	0.094	0.088	0.118
Propane	0.138	0.190	0.191
Iso-Butane	0.045	0.082	0.074
N-Butane	0.056	0.101	0.088
Iso-Pentane	0.068	0.153	0.125
N-Pentane	0.042	0.094	0.076
Hexanes Plus	0.259	0.744	0.559
Hydrogen Sulfide	0.644	0.686	0.463
Total	100.000	100.000	100.000

Hydrogen Sulfide, ppm 6439
Total Sulfur, as H2S ppm Not Requested

Physical Data	dry	wet		
BTU cu.ft. Ideal	434.68	427.11	GPM	0.2212
BTU cu.ft. real	435.93	428.35	z..factor	0.9971
BTU/lb. Ideal	5156.15	5066.43	F..factor	9795
Sp. Gr. Ideal	1.0971		Sp. Vol.	11.79
Sp. Gr. Real	1.0998			

CHONS	% by Wt.
% Carbon	36.010
% Hydrogen	5.289
% Oxygen	53.923
% Nitrogen	4.093
% Sulfur	0.686
Total	100.000

References
ASTM D 6228-98
ASTM D 1945-96
ASTM D 1946-94
ASTM D 3588-91
GPA 2145-00

Michael E. Mayfield
Laboratory Director
Midway Laboratory Inc.

Strata-Analysts GROUP

California Oil Producers Electric
301 E Ocean Ave #300
Long Beach, CA 90801

Date Sampled: August 26, 2004
Date Reported: August 26, 2004

Lab ID: 040676
File ID: 08-26-04 Cherry #6

Attention: Bob Fickes
CC: Orlando Toledo
CC:

Pressure: psig
Temperature: Deg F.

Sample ID: Termo Cherry #6

GC/TCD (ASTM D1945, GPA 2261)

Analysis Results: (Detection Limit = 0.01)	Mole %		G/MCF	
OXYGEN	0.58			
NITROGEN	2.38			
CARBON DIOXIDE	2.63			
TOTAL INERTS:	*5.59*	(sum)		(sum)
METHANE	58.73			
ETHANE	6.05			
PROPANE	7.52		2.08	
iso-BUTANE	2.08	22.11	0.68	7.98
n-BUTANE	6.04		1.91	
iso-PENTANE	3.34	13.99	1.22	5.39
n-PENTANE	4.24		1.54	
HEXANE+	6.41		2.63	
Total	100.00			

Specific Gravity*	1.114				
			Dew Point:		Deg F.
Hydrogen Sulfide:		ppm(vol)			
			Water Content:		lbs/MMCF
Mercaptan Sulfur: (GPA 2194)		ppm(vol)			
			HHV:	1763	
			LHV:	1613	
Gross BTU/ft^{3*}	1763	(dry gas)			
	1732	(Water Vapor Saturated)			

*=Calculated Result (ASTM D3588-91)

Reviewed by:

Bruce Barron

1842 East 29th St., Signal Hill, CA 90755
Tel: 562-426-0199 Fax: 562-426-5664
www.strata-analysts.com

Strata-Analysts GROUP

St. James Oil Company
1235 South Broadway
Los Angeles, CA 90015

Date Sampled: May 24, 2004
Date Reported: May 24, 2004

Lab ID: 040421
File ID: 05-24-04 Incoming Wells 1 & 4

Attention: Charles Sudderth
Victor Lopez

CC:

Pressure: psig
Temperature: Deg F.

Sample ID: St James
Incoming Wells 1 & 4

GC/TCD (ASTM D1945, GPA 2261)

Analysis Results: (Detection Limit = 0.01)	Mole %		G/MCF	
OXYGEN	0.00			
NITROGEN	0.00			
CARBON DIOXIDE	0.78			
TOTAL INERTS:	*0.78*	(sum)		(sum)
METHANE	72.80			
ETHANE	13.42			
PROPANE	7.49		2.07	
iso-BUTANE	1.25	5.51	0.41	1.90
n-BUTANE	2.17		0.69	
iso-PENTANE	0.63	2.09	0.23	0.80
n-PENTANE	0.53		0.19	
HEXANE+	0.93		0.38	
Total	100.00			

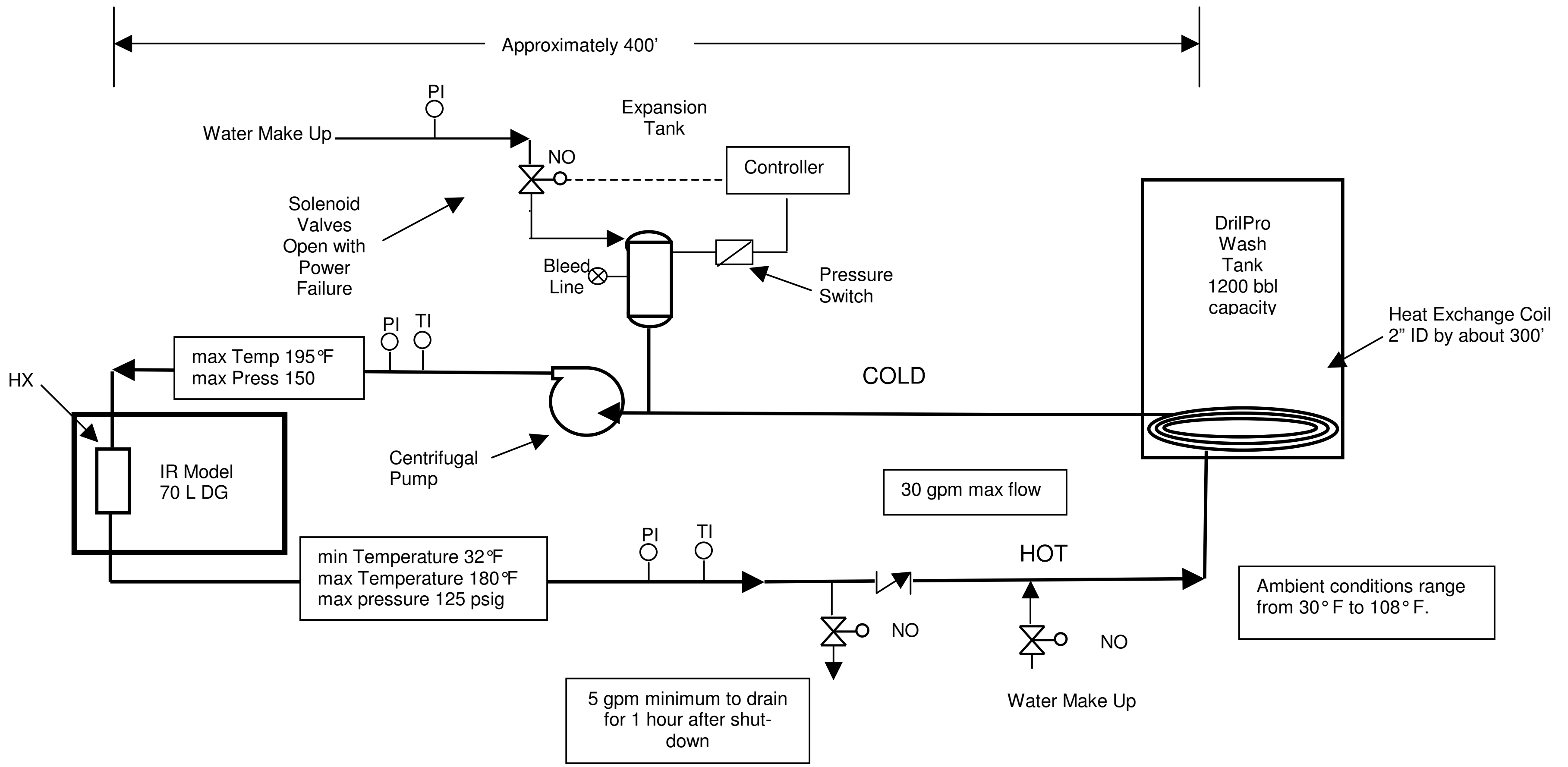
Specific Gravity*	0.794				
			Dew Point:		Deg F.
Hydrogen Sulfide:		ppm(vol)			
			Water Content:		lbs/MMCF
Mercaptan Sulfur: (GPA 2194)		ppm(vol)			
			HHV:	1363	
			LHV:	1239	
Gross BTU/ft^3*	1363	(dry gas)			
	1340	(Water Vapor Saturated)			

*=Calculated Result (ASTM D3588-91)

Reviewed by:

Bruce Barron

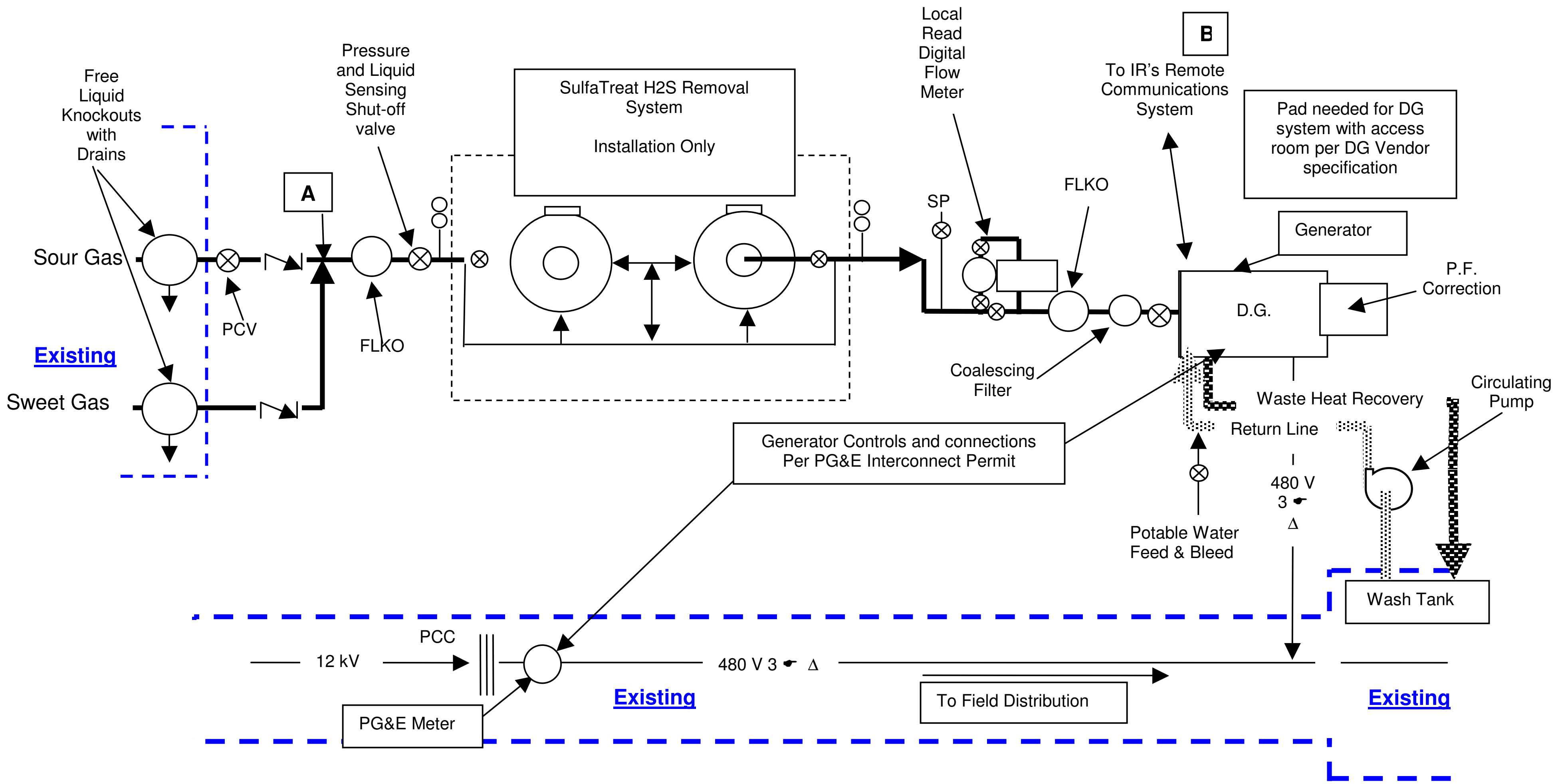
1842 East 29th St., Signal Hill, CA 90755
Tel: 562-426-0199 Fax: 562-426-5664
www.strata-analysts.com



COPE Offgases Project, Harsh Gas Site
Drilling & Production Company, Maricopa, California

Heat Transfer Loop Arrangements
No Scale

Jul 06 jch/cwz/rt **Sketch 105 Rev 6**



A

DrilPro says that the field will automatically equalize the Sweet and Sour Gas pressures at this point.

B

Data as Provided by IR Remote Communications System and listed on pages 23, 24, and 25 of the 70 Series Remote Communication Manual

Pressure & Temperature Gauges

COPE Offgases Project - Flow Diagram
Harsh Gas Site - Drilling & Production, Maricopa

Mechanical & Electrical Arrangements

Jul 06 **jch/cwz** **Sketch 100 rev 18**

COPE - Offgases

MICROTURBINE INSTALLATION
ST. JAMES OIL
814 WEST 23rd STREET
LOS ANGELES, CALIFORNIA 90017

TENG & ASSOCIATES, INC.
ENGINEERS / ARCHITECTS / PLANNERS
330 N. BRAND BOULEVARD
GLENDALE, CALIFORNIA 91203

PROJECT NO. 26-6289-06

INDEX OF DRAWINGS

ISSUED FOR CONSTRUCTION - JANUARY 05, 2004

TENG
TENG & ASSOCIATES, INC.
ENGINEERS/ARCHITECTS/PLANNERS
330 N. BRAND BLVD., GLENDALE, CA 91203
TELEPHONE: 818/539-1100

NO.	DATE	DESCRIPTION	BY
1	01-22-04	ISSUED FOR PERMIT	TDN

REVISIONS

DATE	DECEMBER 17, 2003
DRAWN	tm
CHECKED	JDC
APPROVED	TDN
PROJECT NO.	00-9016-00

OFFGASES
MICRO TURBINES

St. James Oil Field
814 WEST 23rd STREET
LOS ANGELES, CALIFORNIA 90018

TITLE SHEET

G1.0

ELECTRICAL NOTES:

1. DEFINITIONS

"FURNISH" MEANS TO "SUPPLY" AND USUALLY REFERS TO DELIVERY OF AN ITEM OF EQUIPMENT TO THE PROJECT SITE, READY FOR INSTALLATION.

"INSTALL" MEANS TO SET IN PLACE, CONNECT AND PLACE IN FULL OPERATIONAL ORDER.

"PROVIDE" MEANS TO "FURNISH" AND "INSTALL".

"EQUIVALENT" MEANS TO MEET THE SPECIFICATIONS OF THE REFERENCED PRODUCT OR ITEM ON ALL SIGNIFICANT ASPECTS, WHERE SIGNIFICANT ASPECTS SHALL BE DETERMINED BY THE ENGINEER.

"FUTURE", "BY OTHERS", "REFER (DISCIPLINE) DIVISION" AND SIMILAR EXPRESSIONS INDICATE WORK THAT MAY BE PERFORMED UNDER THE CONTRACT DOCUMENTS BUT, NOT NECESSARILY UNDER THE DIVISION OR DISCIPLINE ON WHICH THE NOTE APPEARS. THE CONTRACTOR SHALL BE RESPONSIBLE FOR COORDINATING THE WORK WITH SUPPLIERS, SUBCONTRACTORS, EMPLOYEES, ETC. SHOULD CLARIFICATION OF ANY PORTION OF THE WORK BE REQUIRED, CONTACT THE ARCHITECT/ENGINEER PRIOR TO SUBMITTING BID.

2. CODES

THE WORK SHALL COMPLY WITH ALL APPLICABLE LOCAL, MUNICIPAL, AND NATIONAL CODES. THIS WOULD INCLUDE, BUT IS NOT LIMITED TO, THE CURRENT CITY BUILDING CODE, NFPA, ANSI, OSHA, AND ALL OTHER LOCAL OR MUNICIPAL BUREAUS AND DEPARTMENTS WHICH HAVE AUTHORITY OVER THE PROJECT; ANYTHING IN THESE CONTRACT DOCUMENTS NOT WITHSTANDING. THIS SHALL NOT BE CONSTRUED AS WAIVING COMPLIANCE WITH ANY REQUIREMENTS OF THE PLANS AND SPECIFICATIONS WHICH MAY BE IN EXCESS OF ANY REQUIREMENTS OF THESE CODES.

3. INTERPRETATION OF THE DOCUMENTS

THE CONTRACTOR SHALL CAREFULLY COMPARE THE DRAWINGS AND SPECIFICATIONS, CHECKING THE MEASUREMENTS AND CONDITIONS UNDER WHICH CONSTRUCTION IS TO BE IMPLEMENTED. FOR CLARIFICATION BETWEEN VARIOUS DRAWINGS AND/OR SPECIFICATIONS, THE DISPUTED ISSUE SHALL BE REFERRED TO THE ENGINEER BEFORE ANY WORK IS EXECUTED. THE CONTRACTOR SHALL STATE IN THEIR PROPOSAL ANY EXCEPTIONS NECESSARY TO MAKE THIS WORK A COMPLETE AND READY-TO-USE INSTALLATION. IF NOT SO-STATED IN THE CONTRACTOR'S PROPOSAL, ANY SUCH WORK WILL NOT BE CONSIDERED ADDITIONAL.

4. COORDINATION

THE ELECTRICAL DRAWINGS ARE DIAGRAMMATIC IN NATURE AND SHALL NOT BE SCALED. TO THIS EXTENT, DATA GIVEN ON THE DRAWINGS IS AS EXACT AS COULD BE SECURED. THE CONTRACTOR SHALL COORDINATE THE EXACT LOCATION OF ALL REQUIRED WORK AND EQUIPMENT WITH THAT OF THE OTHER TRADES. WHERE THERE ARE POTENTIAL CONFLICTS, THE CONTRACTOR SHALL OBTAIN AND VERIFY EXACT LOCATIONS, MEASUREMENTS, LEVELS, SPACE REQUIREMENTS, ETC. AT THE SITE AND SHALL SATISFACTORILY ADAPT HIS WORK TO ACTUAL FIELD CONDITIONS.

REFER TO ARCHITECTURAL/MECHANICAL DRAWINGS FOR PLANS, ELEVATIONS AND DETAILS INDICATING THE LOCATIONS OF CEILING ELEMENTS (E.G., LIGHTS, SPRINKLERS, DIFFUSERS, ETC.) AND WALL ELEMENTS. CEILING MOUNTED ITEMS SHALL BE INSTALLED IN ACCORDANCE WITH THE ARCHITECTURAL REFLECTIVE CEILING PLANS. IF LOCATION FOR AN ITEM IS NOT SHOWN ON THE ARCHITECTURAL DRAWINGS, VERIFY THE EXACT LOCATION OF THE ITEM WITH THE ARCHITECT PRIOR TO INSTALLATION. THESE REQUIREMENTS APPLY TO ALL CEILING TYPES IN ALL AREAS.

5. SITE EXAMINATION

THE CONTRACTOR SHALL VISIT THE SITE, EXAMINE THE PREMISES, AND MAKE A THOROUGH SURVEY OF THE CONDITIONS UNDER WHICH CONSTRUCTION WILL BE IMPLEMENTED. THE SUBMISSION OF A PROPOSAL WILL BE CONSTRUED AS EVIDENCE THAT SUCH AN EXAMINATION HAS BEEN MADE AND, ANY LATER CLAIMS FOR LABOR, EQUIPMENT, OR MATERIALS REQUIRED FOR DIFFICULTIES ENCOUNTERED WHICH COULD HAVE BEEN FORESEEN HAD SUCH AN EXAMINATION BEEN MADE, WILL NOT BE RECOGNIZED.

6. PERMITS

THE CONTRACTOR SHALL OBTAIN AND PAY FOR ALL PERMITS, INSPECTIONS, AND FEES REQUIRED FOR THE EXECUTION OF THIS WORK. SCHEDULING OF ALL REQUIRED INSPECTIONS SHALL BE THE RESPONSIBILITY OF THE CONTRACTOR.

7. SAFETY

THE CONTRACTOR SHALL TAKE ALL STEPS NECESSARY TO ENSURE THE SAFETY OF THE CLIENT'S EMPLOYEES, BUILDING EMPLOYEES AND GUESTS AS WELL AS THEIR OWN FORCES, BY ADEQUATELY PROTECTING ANY EXPOSED LIVE CABLE, EQUIPMENT, OR DEVICES THROUGHOUT THE COURSE OF THIS WORK.

8. FIRESAFING

ALL PENETRATIONS IN WALLS, FLOORS, OR CEILINGS SHALL BE SUITABLY CLOSED UP AND SEALED WITH A FIRESAFING COMPOUND LISTED IN THE MOST RECENT FACTORY MUTUAL RESEARCH CORPORATION (FMRC) APPROVAL GUIDE. PRODUCTS SIMILAR TO THOSE MANUFACTURED BY 3M ARE PREFERRED.

9. TEMPORARY POWER AND LIGHTING

THE CONTRACTOR SHALL PROVIDE TEMPORARY POWER AND LIGHTING FOR THIS WORK DURING CONSTRUCTION. TEMPORARY LIGHTING SHALL AT LEAST BE THE EQUAL OF (1)100-WATT FIXTURE EVERY 100 SQUARE FEET, WITH A MINIMUM ONE FIXTURE PER ROOM. TEMPORARY LIGHTING SHALL BE LEFT IN PLACE UNTIL PERMANENT LIGHTING IS COMPLETELY OPERATIONAL. COORDINATE TEMPORARY POWER REQUIREMENTS WITH THE OTHER TRADES AND PROVIDE ADEQUATE PROVISIONS. THE CONTRACTOR SHALL PERFORM ALL COORDINATION WITH THE OWNER AND/OR LANDLORD.

10. CABLING

UNLESS SPECIFICALLY NOTED OTHERWISE IN THE PLANS, ALL CABLING SHALL BE (2) #12 AND (1) #12 G IN 3/4 " C.

11. CABLE SIZING

BRANCH CIRCUIT CABLE SIZE SHALL BE ADJUSTED BASED ON THE CONDUCTOR LENGTH, AS INDICATED BELOW:

A. 120/208V CABLING FROM PANEL TO ELECTRICAL LOAD SHALL BE AS FOLLOWS, UNLESS OTHERWISE INDICATED:

LESS THAN 100 FEET, USE #12 AWG MINIMUM
FROM 100 TO 200 FEET, USE #10 AWG MINIMUM
FROM 200 TO 250 FEET, USE #8 AWG MINIMUM

B. 277/480V CABLING FROM PANEL TO ELECTRICAL LOAD SHALL BE AS FOLLOWS, UNLESS OTHERWISE INDICATED:

FROM 0 TO 150 FEET, USE #12 AWG MINIMUM
FROM 150 TO 250 FEET, USE #10 AWG MINIMUM
FROM 250 TO 300 FEET, USE #8 AWG MINIMUM

12. CONDUIT/RACEWAY SYSTEMS

THE CONDUIT ROUTINGS INDICATED ARE ONLY DIAGRAMMATIC IN NATURE. FIELD CONDITIONS SHALL DICTATE THE CONTRACTOR'S EXACT CONDUIT ROUTING. THE CONTRACTOR SHALL BE RESPONSIBLE FOR SIZING AND LOCATING PULL BOXES PER THE NEC AND FOR COORDINATION WITH OTHER DISCIPLINES. ALL EXPOSED RACEWAYS SHALL BE INSTALLED PARALLEL OR PERPENDICULAR TO WALLS OR STRUCTURAL MEMBERS, SUCH AS TO FOLLOW STRUCTURAL SURFACE CONTOURS AND NOT OBSTRUCT PASSAGEWAYS. MULTIPLE RACEWAYS SHALL BE RUN TOGETHER, IN GROUPING. ALL EXPOSED CONDUIT SHALL BE ROUTED PERPENDICULAR, PARALLEL AND TIGHT TO COLUMNS AND BEAMS. ALL EXPOSED CONDUIT SHALL BE COORDINATED WITH THE ARCHITECT/ENGINEER PRIOR TO INSTALLATION. EXTRA TIME SHOULD BE ALLOWED FOR THIS REVIEW AND APPROVAL. NO ADDITIONAL COST TO OWNER WILL BE ALLOWED DUE TO LACK OF COORDINATION.

EMERGENCY SYSTEMS SHALL BE RUN IN SEPARATE RACEWAY/CONDUIT SYSTEM(S).

A SEPARATE INSULATED EQUIPMENT GROUNDING CONDUCTOR SHALL BE PULLED WITH THE CIRCUIT CONDUCTORS, WHETHER OR NOT INDICATED ON THE DRAWINGS. METAL RACEWAY OR CABLE ARMOR/SHEATH SHALL NOT BE USED AS THE PRIMARY EQUIPMENT GROUNDING CONDUCTOR. RACEWAY SYSTEMS SHALL BE MECHANICALLY AND ELECTRICALLY CONTINUOUS AND SHALL BE BONDED AT ALL POINTS TO THE INSULATED EQUIPMENT GROUNDING CONDUCTOR IN ACCORDANCE WITH THE APPLICABLE PROVISIONS IN ARTICLE 250 OF THE NEC.

REFER TO THE ARCHITECTURAL DRAWINGS FOR PAINTING OF RACEWAY.

13. PAINTING

ALL NEWLY INSTALLED RACEWAY SHALL BE PAINTED TO MATCH THE ADJACENT WALL OR CEILING SURFACE, UNLESS NOTED OTHERWISE PER THE ARCHITECTURAL PLANS OR SPECIFICATIONS.

14. LIGHTING

UNLESS NOTED OTHERWISE, THE LIGHT SWITCH LOCATED IN A ROOM SHALL CONTROL ALL THE LIGHTING FIXTURES IN THAT ROOM. LIGHTING FIXTURES SCHEDULED FOR EQUIPMENT AREAS SHALL BE INSTALLED AFTER ALL MAJOR PIECES OF MECHANICAL EQUIPMENT ARE IN PLACE. ARRANGE LIGHTING FIXTURES TO PROVIDE ADEQUATE ILLUMINATION OF CONTROLS, RACKS, ETC.

15. EQUIPMENT

ALL MATERIALS AND EQUIPMENT PROVIDED IN THIS WORK SHALL BE NEW AND SHALL HAVE THE APPROPRIATE UL LISTING AND/OR FM APPROVAL.

16. RECEPTACLES

UNLESS SPECIFICALLY NOTED OTHERWISE IN THE PLANS, ALL RECEPTACLE CABLING SHALL BE (2) #12 AND (1) #12 G IN 3/4 " C.

17. PANELBOARDS

ALL PANELBOARDS IN WHICH WORK OCCURS PER THESE DOCUMENTS, SHALL BE PROVIDED WITH UPDATED-TYPEWRITTEN DIRECTORIES. FROM FLUSH-MOUNTED PANELBOARDS, STUB-OUT ONE 3/4" CONDUIT INTO THE CEILING CAVITY FOR EACH SET OF 3 SPARES AND/OR SPACES OR FRACTION THEREOF EITHER SET.

18. EQUIPMENT CONNECTIONS

PROVIDE FINAL CONNECTIONS FOR ALL EQUIPMENT FURNISHED UNDER OTHER DIVISIONS OF THIS CONTRACT. PROVIDE A FLEXIBLE CONNECTION TO ALL VIBRATION PRODUCING EQUIPMENT.

19. MECHANICAL EQUIPMENT

ALL MECHANICAL EQUIPMENT WILL BE INSTALLED BY THE DIVISION 15 CONTRACTOR. COORDINATE THE EXACT LOCATION AND NATURE OF ANY REQUIRED ELECTRICAL CONNECTION TO BE PROVIDED FOR MECHANICAL EQUIPMENT PRIOR TO ROUGH-IN.

VERIFY THE ELECTRICAL SERVICE REQUIRED FOR EACH ITEM OF MECHANICAL EQUIPMENT WITH THE MECHANICAL CONTRACTOR PRIOR TO FURNISHING SUCH POWER. REFER MECHANICAL DRAWING FOR MECHANICAL EQUIPMENT REQUIRING ELECTRICAL CONNECTIONS. MAKE CONNECTION AND PROVIDE APPROPRIATE WIRE, CONDUIT AND OVERCURRENT PROTECTION FOR EQUIPMENT.

REFER TO MECHANICAL DRAWINGS FOR MOTORS THAT ARE TO BE INTERLOCKED.

THE DISCONNECTING MEANS FOR ALL MECHANICAL EQUIPMENT SHALL BE ACCESSIBLE AND HAVE CLEARANCES AS REQUIRED BY THE NEC.

20. MISCELLANEOUS SUPPORTING MEMBERS

ALL ANGLES, CHANNELS, AND OTHER MISCELLANEOUS STEEL, BOLTS, THREADED RODS, ETC., REQUIRED TO SUPPORT LIGHT FIXTURES, LADDER TRAY OR OTHER ELECTRICAL EQUIPMENT OR DEVICES SHALL BE FURNISHED AND INSTALLED BY THE CONTRACTOR. ALL THREADED RODS SHALL BE A MINIMUM OF 5/8" IN DIAMETER.

21. INTERFERENCE WITH OCCUPANCY

WHERE THE BUILDING IS OCCUPIED AND SHALL CONTINUE TO BE BOTH OCCUPIED AND FULLY FUNCTIONAL DURING THE IMPLEMENTATION OF THIS WORK, IT IS IMPERATIVE THAT THE WORK COVERED BY THESE DOCUMENTS BE EXECUTED WITH A MINIMUM OF INCONVENIENCE TO BUILDING PERSONNEL AND FUNCTION.

22. ELECTRICAL SERVICE DISRUPTIONS

ANY WORK INVOLVING A TASK WHICH EXPOSES ACTIVE BUS SHALL BE PERFORMED DURING THE OWNER'S DESIGNATED MAINTENANCE HOURS (TYPICALLY 12:00 AM TO 6:00 AM LOCAL TIME). THIS RESTRICTION INCLUDES REMOVING THE COVER FROM ANY PANEL BOARD, SWITCHBOARD, MCC ETC. ALL WORK WHICH EXPOSES ACTIVE BUS SHALL REQUIRE A MOP (METHOD OF PROCEDURE) TO BE FILED WITH THE OWNER. THIS MOP SHALL BE WRITTEN BY THE CONTRACTOR IN COORDINATION WITH THE OWNER, AND MUST BE APPROVED BY THE OWNER PRIOR TO THE COMMENCEMENT OF SUCH WORK. THE CONTRACTOR SHALL PROVIDE A MINIMUM OF 7 DAYS NOTICE TO THE OWNER FOR WORK REQUIRING A MOP. ANY WORK WHICH REQUIRES AN ELECTRICAL SERVICE DISRUPTION, IN ADDITION TO REQUIRING AN MOP, SHALL BE CLOSELY COORDINATED WITH THE OWNER. ALL DISRUPTION SHALL OCCUR AT TIMES AND OF DURATIONS ACCEPTABLE TO THE OWNER. THE CONTRACTOR SHOULD ANTICIPATE THAT THERE ARE GOING TO BE BLOCKS OF TIME, DURING WHICH THE OWNER WILL NOT ALLOW SERVICE DISRUPTIONS. THE OWNER WILL PROVIDE THE CONTRACTOR WITH THESE DATES AS THEY BECOME AVAILABLE.

23. WORK NEAR ACTIVE EQUIPMENT

ANY WORK NEAR ACTIVE COMMUNICATIONS EQUIPMENT SHALL BE DONE DURING THE OWNER'S DESIGNATED MAINTENANCE HOURS (TYPICALLY 12:00 AM TO 6:00 AM LOCAL TIME). THE CONTRACTOR SHALL PROTECT THE COMMUNICATIONS EQUIPMENT PER THE OWNER'S LATEST STANDARDS, AND TO THE SATISFACTION OF THE OWNER'S CONSTRUCTION ENGINEER. EQUIPMENT PROTECTION WHICH IS TO REMAIN IN PLACE FOR MORE THAN 24 HOURS SHALL BE CONSTRUCTED IN SUCH A WAY AS TO ALLOW ACCESS TO THE EQUIPMENT, AS WELL AS ACCOMMODATE EQUIPMENT VENTILATION REQUIREMENTS.

24. DEMOLITION, RELOCATION AND ALTERATION

PROVIDE REMOVAL, RELOCATION, REROUTING AND RECONNECTION OF EXISTING ELECTRICAL SYSTEMS, AS REQUIRED TO ACCOMPLISH ALTERATION, RESTORATION AND NEW WORK. VERIFY THAT ALL REUSED EQUIPMENT IS IN GOOD WORKING ORDER.

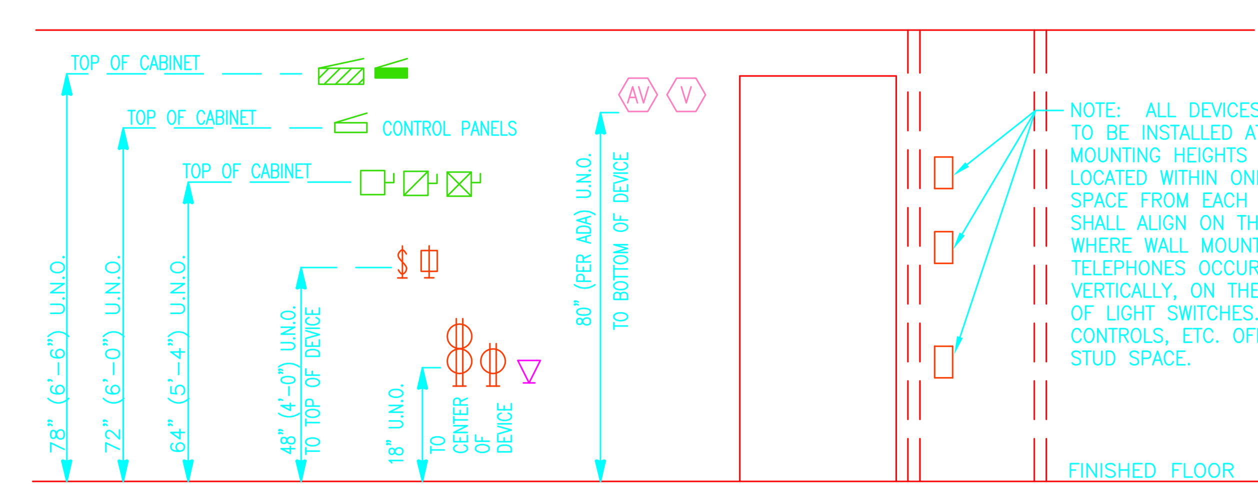
ALL MATERIAL AND/OR EQUIPMENT INDICATED FOR SALVAGE SHALL BE DELIVERED TO THE LOCATION DIRECTED BY THE OWNER. ALL OTHER DEMOLITION MATERIAL SHALL BECOME THE PROPERTY OF THE CONTRACTOR AND SHALL BE PROPERLY REMOVED FROM THE SITE.

ALL ELECTRICAL OPENINGS NOT USED SHALL BE CAPPED AND SEALED.

EXISTING CONDITIONS WERE OBTAINED FROM AVAILABLE DRAWINGS AND ARE NOT GUARANTEED TO BE COMPLETE OR CORRECT. THE CONTRACTOR SHALL SURVEY AND VERIFY EXISTING CONDITIONS PRIOR TO SUBMITTING BID AND STARTING WORK.

25. LUG REQUIREMENTS

ALL LUGS SHALL BE TWO-HOLE, LONG-BARREL, COMPRESSION TYPE LUGS WITH INSPECTION HOLES. LUGS SHALL BE FORMED WITH NON-FLASHING TYPE DIES, SUCH AS PRODUCED BY THE THOMAS AND BETTS COMPANY. EACH LUG SHALL BE HEXAGONALLY SHAPED UNDER A MINIMUM OF 10 TONS OF COMPRESSIVE FORCE. EACH LUG SHALL BE CRIMPED TWICE UPON INSTALLATION AND WILL BE INSPECTED BY THE OWNER. THERE SHALL BE NO "SHINERS" ABOUT ANY LUG.



NOTES:

1. HEIGHTS SHOWN ARE TYPICAL TO CENTERLINE OF BOX UNLESS NOTED OTHERWISE. ALL DUPLEX RECEPTACLES SHALL BE MOUNTED VERTICALLY.
2. WHEREVER DEVICES ARE INDICATED TO BE ABOVE DOORS, DEVICE SHALL BE CENTERED BETWEEN TOP OF DOOR TRIM AND CEILING LINE.
3. MOUNTING HEIGHTS SHOWN ON ARCHITECTURAL ELEVATIONS SHALL GOVERN OVER THOSE SHOWN ABOVE.
4. FOR CEILINGS BELOW 7'-4", FIRE ALARM STROBE OR HORN/STROBES SHALL BE WALL MOUNTED 6" BELOW FINISHED CEILING.

1 EQUIPMENT AND DEVICE MOUNTING HEIGHT DETAIL

NTS

TENG

TENG & ASSOCIATES, INC.
ENGINEERS/ARCHITECTS/PLANNERS
330 N. BRAND BLVD., GLENDALE, CA 91203
TELEPHONE: 818/539-1100

NO.	DATE	DESCRIPTION	BY
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OFFGASES
MICRO TURBINES

St. James Oil Field
814 WEST 23rd STREET
LOS ANGELES, CALIFORNIA 90018

ELECTRICAL NOTES

E1.0

ABBREVIATIONS LIST

A,AMP	AMPERE
AC	ALTERNATING CURRENT
A/C	AIR CONDITIONING
ACCU	AIR COOLED CONDENSING UNIT
AF	AMP FRAME
AFF	ABOVE FINISHED FLOOR
AIC	AMPS INTERRUPTING CURRENT
AM	AMMETER
AS	AMMETER SWITCH
AT	AMP TRIP
ATS	AUTOMATIC TRANSFER SWITCH
AWG	AMERICAN WIRE GAUGE (WIRE SIZE)
BMS	BUILDING MANAGEMENT SYSTEM
BTRY	BATTERY
C	CONDUIT
CB	CIRCUIT BREAKER
CCTV	CLOSED-CIRCUIT TELEVISION
CH	CHILLER
CH.	CHARGER
CCT	CIRCUIT
CM	CIRCULAR MILS
COGB	CENTRAL OFFICE GROUND BAR
COMM	COMMERCIAL OR COMMUNICATIONS
CONN	CONNECTOR
CRAC	COMPUTER ROOM AIR CONDITIONER
CT	CURRENT TRANSFORMER
DC	DIRECT CURRENT
DCGB	DC GROUND BAR
DDC	DIRECT DIGITAL CONTROL
DIAG	DIAGRAM
DISC	DISCONNECT
DP	DISTRIBUTION PANEL
DWG	DRAWING
EDH	ELECTRIC DUCT HEATER
EF	EXHAUST FAN
EMER	EMERGENCY
EMT	ELECTRICAL METALLIC CONDUIT
ENCL	ENCLOSURE
EQUIP	EQUIPMENT
EWC	ELECTRIC WATER COOLER
EX	EXISTING, TO REMAIN
FDR	FEEDER
FLA	FULL-LOAD AMPS
FMS	FACILITY MANAGEMENT SYSTEM
FUT	FUTURE
G	GROUND WIRE
GFI	GROUND FAULT INTERRUPTER
GRD	GROUND
H-O-A	HAND-ON/OFF-AUTO
HP	HORSE POWER
HPS	HIGH PRESSURE SODIUM
HT	HEIGHT
HTR	HEATER
HV	HIGH VOLTAGE
IG	ISOLATED GROUND
J	JUNCTION BOX
KCMIL	KILO CIRCULAR MILS (WIRE SIZE)
KV	KILOVOLT
KVA	KILOVOLT AMPERE
KW	KILOWATT
LPI	LIGHTNING PROTECTION INSTITUTE
LTG	LIGHTING
LV	LOW VOLTAGE
M	METER
MAN	MANUAL
MCB	MAIN CIRCUIT BREAKER
MCC	MOTOR CONTROL CENTER
MDP	MAIN DISTRIBUTION PANEL
MECH	MECHANICAL
MFR	MANUFACTURER
MGB	MAIN/MASTER GROUND BAR
MH	MAN HOLE
MISC	MISCELLANEOUS
MOP	METHOD OF PROCEDURE
MS	MOTION SENSOR
MSGB	MASTER STATION GROUND BAR
MSS	MAIN SERVICE SWITCH
MTG	MOUNTING
MTS	MANUAL TRANSFER SWITCH
NC	NORMALLY CLOSED
NEUT	NEUTRAL
NFPA	NATIONAL FIRE PROTECTION ASSOCIATION
NIC	NOT IN CONTRACT
NTS	NOT TO SCALE
OC	ON-CENTER (MEASUREMENT)
OCPD	OVER-CURRENT PROTECTIVE DEVICE
OFCI	OWNER-FURNISHED, CONTRACTOR-INSTALLED
P	POLE
PBO	PROVIDED (AND INSTALLED) BY OTHERS
PDU	POWER DISTRIBUTION UNIT
PH	PHASE
PNL	PANEL
PRI	PRIMARY
PVC	POLYVINYL CHLORIDE (CONDUIT)
PWR	POWER
RECP	RECEPTACLE
RGC	RIGID STEEL CONDUIT
RMC	RIGID METALLIC CONDUIT
SD	SMOKE DETECTOR
SEC	SECONDARY
SF	SUPPLY FAN
SP	SINGLE-POLE OR SPARE
STD	STANDARD
SW	SWITCH
TB	TERMINAL BLOCK
TEL	TELEPHONE
TRGB	TERMINAL GROUND BAR
TVSS	TRANSIENT VOLTAGE SURGE SUPPRESSION
UG	UNDERGROUND
UH	UNIT HEATER
UL	UNDERWRITERS' LABORATORY
UNO	UNLESS NOTED OTHERWISE
V	VOLTS
VA	VOLT-AMPERES
VAC	VOLTAGE, ALTERNATING CURRENT
VAV	VARIABLE AIR VOLUME (HVAC)
VDC	VOLTAGE, DIRECT CURRENT
VFC	VARIABLE FREQUENCY CONTROLLER (HVAC)
VFD	VARIABLE FREQUENCY DRIVE (HVAC)
VM	VOLT METER
VS	VOLTAGE SENSOR
W	WATT OR WIRE
WP	WEATHER PROOF
WSA	WIRE SIZING AMPS
XFMR	TRANSFORMER

SYMBOL LIST

SYMBOL	DESCRIPTION
2b	SINGLE POLE SWITCH – NUMBER INDICATES CIRCUIT, LETTER INDICATES SWITCHING CONTROL.
2P	TWO POLE SWITCH
2b 3W 4W	THREE WAY SWITCH – NUMBER INDICATES CIRCUIT, LETTER INDICATES SWITCHING CONTROL. "4W" DENOTES FOUR WAY SWITCH.
M	MANUAL MOTOR STARTER SWITCH (INCLUDES THERMAL OVERLOADS)
T	THERMAL OVERLOAD SWITCH. "TP", PROVIDE WITH PILOT LIGHT
	SINGLE POLE SWITCH WITH PILOT LIGHT
	DIMMER SWITCH (600W, UNO)
	DUPLEX RECEPTACLE – 20A, 120 VOLT, 1P, 3W, NEMA 5-20R.
	QUADRUPLEX RECEPTACLE – 20A, 120 VOLT, 1P, 3W, NEMA 5-20R. (TWO DUPLEX RECEPTACLES WITH COMMON COVERPLATE).
GFI	GROUND FAULT INTERRUPTER RECEPTACLE.
WP	WEATHER PROOF ENCLOSURE CONTAINING GROUND FAULT INTERRUPTER RECEPTACLE
	SINGLE TWIST-LOCK ISOLATED-GROUND RECEPTACLE – 20A, 120 VOLT, 1P, 2W + 2G, NEMA L14-20. PROVIDE ORANGE RECEPTACLE WITH WHITE COVERPLATE.
	DUPLEX ISOLATED-GROUND RECEPTACLE – 20A, 120 VOLT, 1P, 2W + 2G, NEMA 5-20R. PROVIDE ORANGE RECEPTACLE WITH WHITE COVERPLATE.
	QUADRUPLEX ISOLATED-GROUND RECEPTACLE – 20A, 120 VOLT, 1P, 2W + 2G, NEMA 5-20R (TWO DUPLEX RECEPTACLES WITH COMMON COVERPLATE). PROVIDE ORANGE RECEPTACLE WITH WHITE COVERPLATE.
A	120V.-30A-1PH.-2P-3W. LOCKING, NEMA L5-30R. CCT TO 30A 1P CB WITH (2)#10 AND (1)#10 GRD IN 3/4"C, UNO.
	FUSE
	CIRCUIT BREAKER – THERMAL MAGNETIC UNLESS NOTED OTHERWISE
	CIRCUIT BREAKER – DRAWOUT TYPE
J	JUNCTION BOX WITH BLANK COVER
J	CEILING OR WALL MOUNTED JUNCTION BOX WITH BLANK COVER AND A MAX. 6'-0" LENGTH OF 3/4" SEALTITE FLEXIBLE CONDUIT.
	PANEL, SURFACE-MOUNTED
	POWER DISTRIBUTION PANEL
	MISCELLANEOUS PANELS AND CABINETS
	COMBINATION STARTER AND NON-FUSED DISCONNECT SWITCH
	NON-FUSED DISCONNECT SWITCH. 3P-30A UNLESS NOTED OTHERWISE. PROVIDE LIQUID TIGHT FLEXIBLE CONDUIT AND MAKE FINAL CONNECTION.
	FUSED DISCONNECT SWITCH. 3P-30A UNLESS OTHERWISE NOTED. PROVIDE LIQUID-TIGHT FLEXIBLE CONDUIT AND MAKE FINAL CONNECTION.
	TELEPHONE/DATA OUTLET – PROVIDE OUTLET BOX WITH BLANK COVER PLATE 18" ABOVE FINISHED FLOOR ON 3/4" CONDUIT WITH BUSHED END CONTAINING NYLON PULL WIRE STUBBED INTO ACCESSIBLE CEILING CAVITY.
W	TELEPHONE OUTLET. WALL-MOUNTED AT 52" AFF.
A	FLUORESCENT LUMINAIRE PER LUMINAIRE SCHEDULE.
	LIGHTING FIXTURE CONNECTED TO THE EXIT AND EMERGENCY LIGHTING SYSTEM.
	WALL-MOUNTED EMERGENCY LIGHTING FIXTURE WITH INTEGRAL BATTERY POWER SUPPLY.
#3	DIRECTIONAL EXIT SIGN, WHERE SHADING INDICATES LIGHTED FACE AND THE ARROW INDICATES THE STENCILED EXIT DIRECTION. CONNECT ALL EXIT SIGNS TO THE EXIT AND EMERGENCY LIGHTING SYSTEM. NUMBER INDICATES THE STENCILED INSCRIPTION.

SINGLE-FACE

- #1 "FIRE ESCAPE"
- #2 "STAIRWAY"
- #3 "EXIT"
- #4 "FIRE ESCAPE"
- #5 "STAIRWAY"
- #6 "EXIT"
- #7 "FIRE ESCAPE"
- #8 "STAIRWAY"
- #9 "EXIT"
- #10 "FIRE ESCAPE"
- #11 "STAIRWAY"
- #12 "EXIT"

DOUBLE-FACE

- #13 FLUSH OR RECESSED
- #14 TRIANGLE
- #15 ELEVATOR
- #16 FIRE ESCAPE
- #17 "STAIRWAY"
- #18 "EXIT"
- #19 "FIRE ESCAPE"
- #20 "STAIRWAY"
- #21 "EXIT"
- #22 "FIRE ESCAPE"
- #23 "STAIRWAY"
- #24 "EXIT"

SYMBOL LIST (CONTINUED)

SYMBOL	DESCRIPTION
	MOTOR WITH HORSEPOWER RATING AS INDICATED. PROVIDE LIQUID-TIGHT FLEX CONNECTION AND JUNCTION BOX.
	EQUIPMENT IDENTIFICATION TAG.
	CONDUIT, STUBBED DOWN
	CONDUIT, STUBBED UP
	CONDUIT RUN CONCEALED IN CEILING OR WALL
	CONDUIT RUN CONCEALED BELOW FINISHED FLOOR
	CONDUIT RUN EXPOSED ON CEILING OR WALL

ARROWHEAD DENOTES HOMERUN TO PANELBOARD, SLASH LINES INDICATE QUANTITY OF WIRE, NEUTRAL WIRE SHOWN AS A LONG LINE, PHASE WIRE AND SWITCH LEGS SHOWN AS SHORT LINES, GROUND WIRE SHOWN AS A LONG LINE WITH A DOT, AND ISOLATED GROUND WIRE SHOWN AS A LONG DOTTED LINE.

SYMBOL	DESCRIPTION
EPO	EMERGENCY POWER OFF SWITCH AS REQUIRED PER NEC 645, MTD. 42" ABOVE FINISHED FLOOR. SWITCH SHALL BE RED-COLORED, MUSHROOM-HEAD TYPE WITH PROTECTIVE COVER. PROVIDE PLACARD ABOVE SWITCH INDICATING THE ASSOCIATED LOAD.
UR-1:19	50-FOOT CORD REEL WITH ISOLATED-GROUND QUADRUPLEX TYPE RECEPTACLE (DANIEL WOODHEAD #953 OR APPROVED EQUAL), WHERE "UR-1" DENOTES THE HOMERUN PANEL AND "19" DENOTES THE CIRCUIT NUMBER. CORD REEL SHALL BE MOUNTED TO BUILDING STRUCTURE ABOVE. PROVIDE A STOP TO THE CORD REEL TO MAINTAIN AN ELEVATION OF 7'-0" ABOVE FINISHED FLOOR. VERIFY EXACT LOCATION WITH THE OWNER PRIOR TO ROUGH-IN. REFER TO FLOOR PLAN FOR PANEL DESIGNATION AND CIRCUIT NUMBER.
A (AT)	AIR TERMINAL, (1/2" X 24") COPPER WITH BRONZE PARAPET BASE. REFER TO DETAILS.
B (AT)	AIR TERMINAL, (1/2" X 24") COPPER WITH BRONZE FLAT-SURFACE BASE. REFER TO DETAILS.
C (AT)	AIR TERMINAL, (1/2" X 24") COPPER WITH BRONZE PARAPET BASE AND DOWN CONDUCTOR. REFER TO DETAILS.
EX (AT)	AIR TERMINAL, (1/2" X 24"), EXISTING TO REMAIN.
SM	BOND, TAP CONDUCTOR TO STEEL OR METALLIC OBJECT. REFER TO DETAILS.
T	BOND, TAP CONDUCTOR TO GROUNDING/LIGHTNING SYSTEM CONDUCTOR. REFER TO DETAILS.
F	BOND, TAP CONDUCTOR TO METALLIC FENCING. REFER TO DETAILS.
	COPPER, CLASS 1 LIGHTNING CONDUCTOR. REFER TO NOTES FOR SIZING AND DETAILS FOR INSTALLATION.
	COPPER GROUNDING CONDUCTOR. REFER TO NOTES FOR SIZING AND DETAILS FOR INSTALLATION.
	GROUND ROD, (3/4" X 10', UNO) COPPER-CLADDED WITH CADWELD CONNECTIONS. REFER DETAILS FOR INSTALLATION.
AV	AUDIBLE GENERAL ALARM WITH VISUAL STROBE
SD	SMOKE DETECTOR
HD	HEAT DETECTOR
S	FIRE ALARM PULL STATION
	WALL MOUNT PASSIVE INFRARED MOTION DETECTOR WITH OVER-RIDE SWITCH
MD	CEILING MOUNTED PASSIVE INFRARED MOTION DETECTOR
MD	WALL MOUNTED PASSIVE INFRARED HALLWAY MOTION DETECTOR
	RACEWAY/CONDUIT UP FROM PLAN VIEW
	RACEWAY/CONDUIT DOWN FROM PLAN VIEW

TENG
TENG & ASSOCIATES, INC.
ENGINEERS/ARCHITECTS/PLANNERS
330 N. BRAND BLVD., GLENDALE, CA 91203
TELEPHONE: 818/539-1100

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MICRO TURBINES

St. James Oil Field
814 WEST 23rd STREET
LOS ANGELES, CALIFORNIA 90018

ELECTRICAL SYMBOLS AND ABBREVIATIONS

E1.1

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05-18-2004 15:13:53 (XREF) Cope_ttb.dwg

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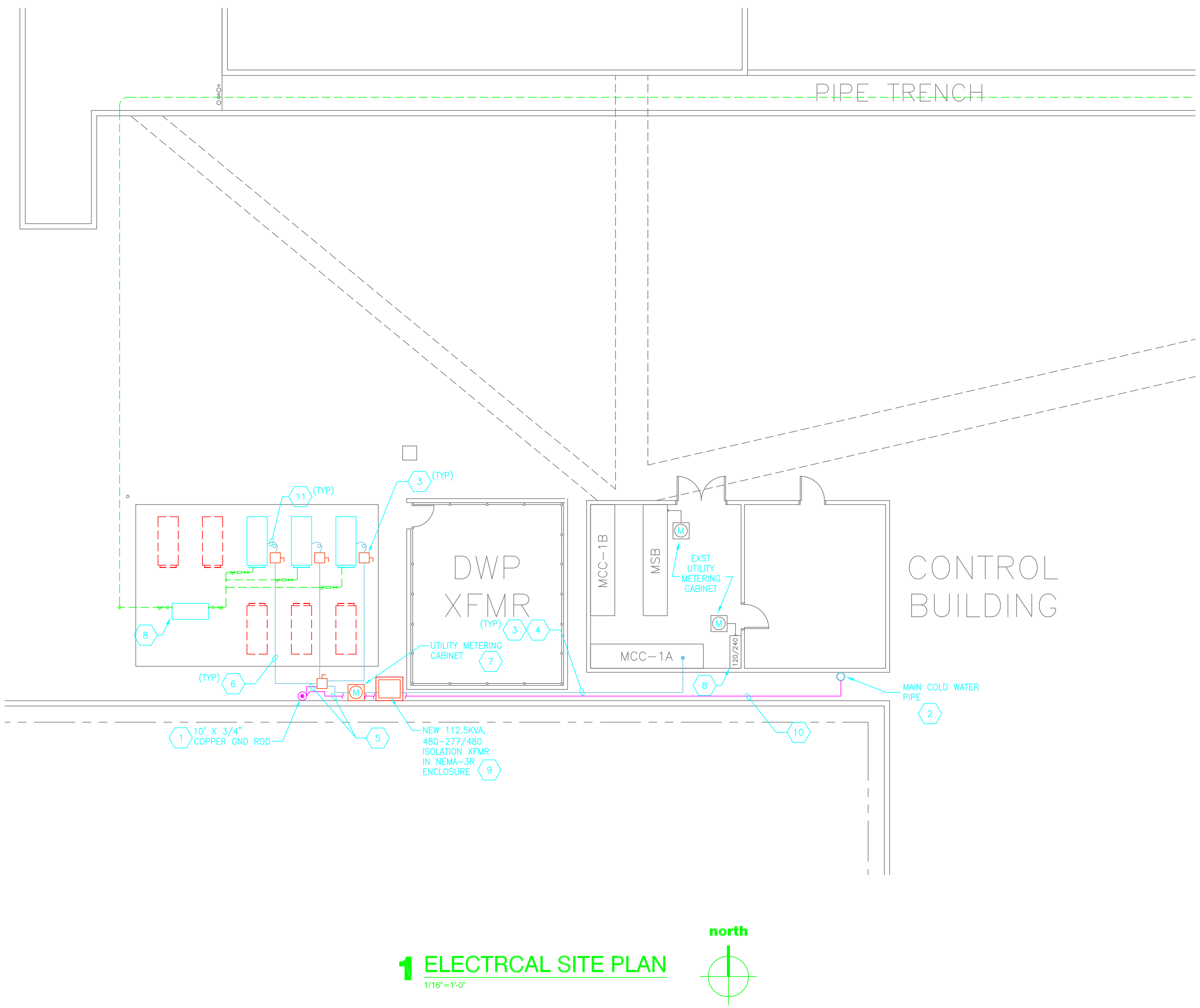
TENG & ASSOCIATES, INC.
ENGINEERS/ARCHITECTS/PLANNERS
330 N. BRAND BLVD., GLENDALE, CA 91203
TELEPHONE: 818/539-1100

GENERAL NOTES - INSTALLATION:

SEE DRAWING E1.1 FOR GENERAL NOTES.

KEY NOTES:

1. REFER TO DETAILS 4/E5.0 AND 5/E5.0 FOR CONNECTION TO THE GROUND ROD.
2. REFER TO DETAIL 3/E5.0 FOR CONNECTION TO THE MAIN COLD WATER PIPE.
3. INSTALLATION OF THE NEW EQUIPMENT SHALL MEET THE BRACING REQUIREMENTS FOR SEISMIC ZONE 4. REFER TO DRAWING E4.0 FOR THE REQUIRED ANCHORING.
4. INSTALL PULL BOXES AS REQUIRED BY THE LATEST EDITION OF NEC.
5. GROUND CONDUCTOR, REFER TO DRAWING 2/E3.0 FOR THE REQUIRED SIZE.
6. FEEDER CONDUITS ARE SURFACE MOUNTED FROM EACH MICROTURBINE GENERATOR TO THE 200A DISCONNECT LOCATED ON THE SOUTH WALL. PROVIDE A STEEL RAMPED COVER OVER THE CONDUIT TO PROVIDE SURFACE PROTECTION.
7. PROVIDE METERING EQUIPMENT AS REQUIRED BY DWP. COORDINATE EXACT LOCATION OF THE METERING CABINET WITH DWP REPRESENTATIVE.
8. PROVIDE 2#12, 1#10, IN 3/4"C., AND CONDUCTOR ON THE SPARE 20A BREAKER AT POSITION #14, FROM THE EXISTING 120/240V PANEL, TO SERVE THE NEW REFRIGERATOR/DRYER.
9. PROVIDE HOUSKEEPING PAD.
10. REFER TO DETAIL 1/E5.0 FOR SUPPORTING THE GROUND CONDUCTOR.
11. PROVIDE LIQUID TIGHT METALLIC FLEXIBLE CONDUIT. LENGTH OF THE FLEXIBLE METALLIC CONDUIT SHALL NOT EXCEED 6'.



1 ELECTRCAL SITE PLAN
1/16"=1'-0"

NO.	DATE	DESCRIPTION	BY
1	01-22-04	ISSUED FOR PERMIT	TDN

REVISIONS

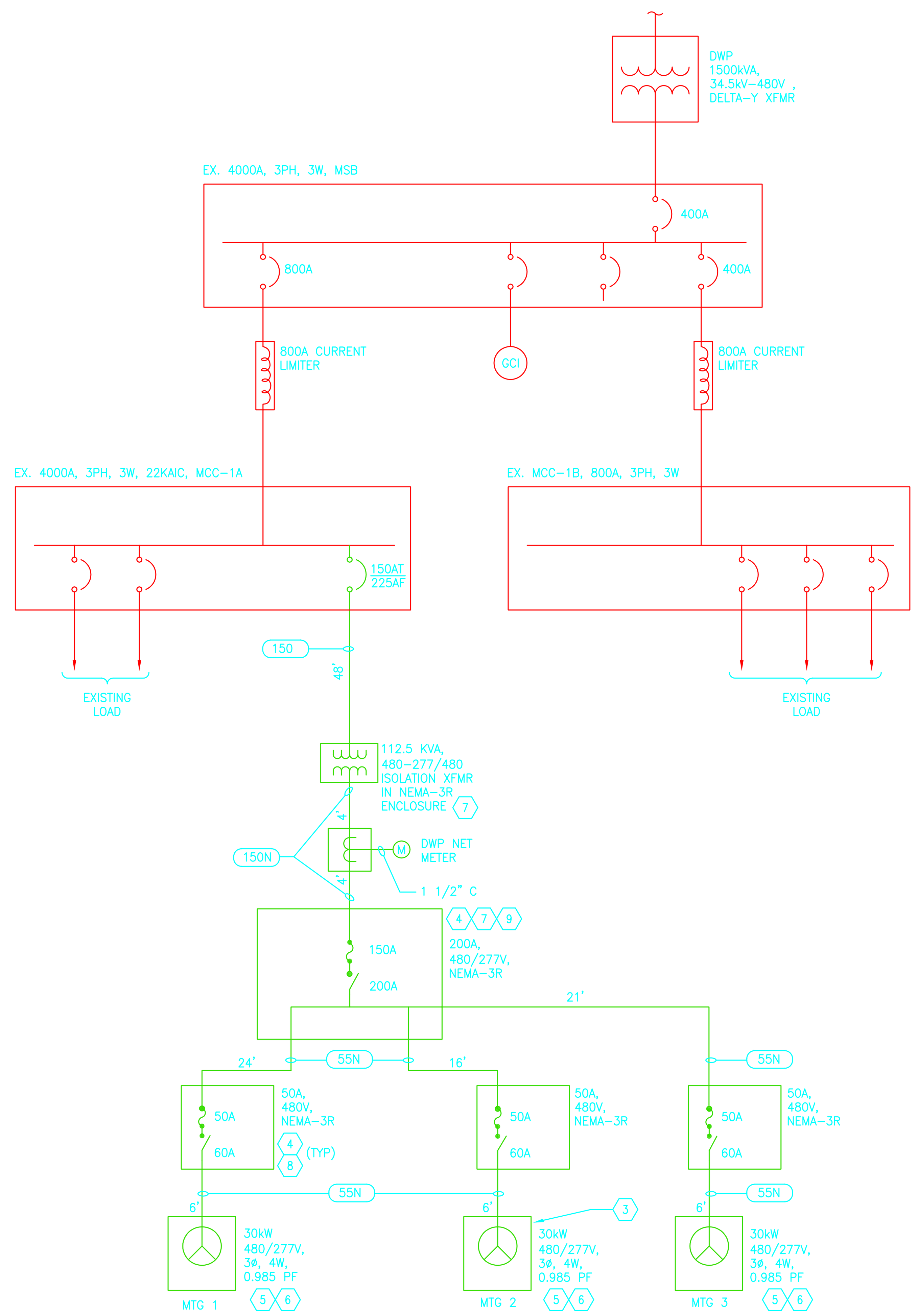
DATE	DECEMBER 17, 2003
DRAWN	JCM
CHECKED	JDC
APPROVED	TDN
PROJECT NO.	00-9016-00

OFFGASES MICRO TURBINES

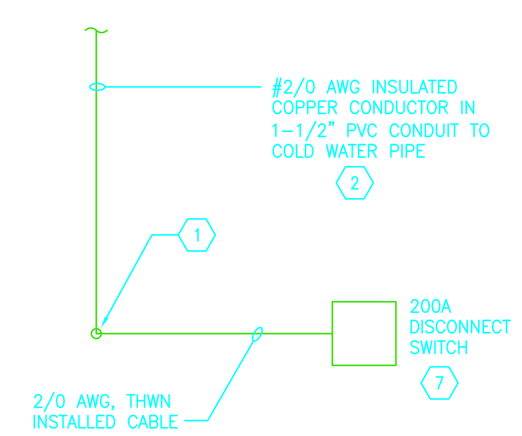
St. James Oil Field
814 WEST 23rd STREET
LOS ANGELES, CALIFORNIA 90018

ELECTRICAL SITE PLAN

E2.1



1 ELECTRCAL SINGLE-LINE DIAGRAM
NTS



2 GROUNDING SINGLE-LINE DIAGRAM
NTS

GENERAL NOTES: SINGLE–LINE DIAGRAM

1. PROVIDE EACH NEW OR MODIFIED ELECTRICAL ENCLOSURE (E.G., DISCONNECT SWITCH, PANEL, ATS, ETC.) WITH A PHENOLIC LABEL, COLORED BLACK WITH ENGRAVED WHITE LETTERING. EACH LABEL SHALL INCLUDE AT LEAST TWO LINES OF TEXT: THE EQUIPMENT NAME IN 1"–TALL LETTERING ON THE FIRST LINE AND ITS "FED FROM" CIRCUIT INFORMATION IN 1/2"–TALL LETTERING ON THE SECOND LINE. WHERE APPLICABLE, ADD A THIRD LINE WITH 1/2"–TALL LETTERING OF ITS "FEEDS"–LOAD INFORMATION.

2. PROVIDE TESTING DATA FOR CABLES AND EQUIPMENT AS INDICATED IN THE SPECIFICATIONS BEFORE ENERGIZING THE NEW SYSTEM.

3. THE CONTRACTOR SHALL PROVIDE THE ALARM WIRING FROM THE NEW EQUIPMENT TO THE BUILDING ALARM BOX. COORDINATE WITH BMS CONTRACTOR AND THE PROJECT MANAGER.

KEY NOTES: SINGLE–LINE DIAGRAM

1 INSTALL 10'X3/4" GROUND ROD. ALL CONNECTION TO THE ROD SHALL BE MADE BY EXOTHERMIC WELD.

2 REFER TO DETAIL 3/E5.0 FOR REQUIRED CONNECTOR.

3 INSTALL CONTROL WIRING BETWEEN MTG1, MTG2, AND MTG 3. MTG1 SHALL BE UTILIZED AS MASTER UNIT.

4 THE FUSIBLE DISCONNECT SWITCHES SHALL BE MOUNTED IN A WEATHER PROOF ENCLOSURE. THE ENCLOSURE SHALL NOT BE MOUNTED ON MICRO TURBINE UNITS. THE DISCONNECT SWITCHES SHALL BE EQUIPPED WITH PAD LOCK SO THAT THE DISCONNECT SWITCHES CAN LOCKED IN "OPEN" POSITION. MOLDED CASE SWITCHES OR BREAKERS SHALL NOT BE UTILIZED AS DISCONNECTING MEANS.

5 MICRO TURBINES PROTECTIVE RELAY SETTINGS SHALL BE SET AS FOLLOW:
- UNDER VOLTAGE RELAY: 428V FOR OVER 1.9 SECONDS.
- FAST UNDER VOLTAGE RELAY: 264V FOR OVER 0.065 SECONDS.
- OVER VOLTAGE RELAY: 524V FOR OVER 1.9 SECONDS.
- FAST OVER VOLTAGE: 600V FOR OVER 0.015 SECONDS.
- OVER FREQUENCY: 60.5 HZ FOR OVER 0.07 SECONDS.
- UNDER FREQUENCY: 59.3 HZ FOR OVER 0.07 SECONDS.
- RATE OF CHANGE OF FREQUENCY: ACTIVE ANTI–ISLANDING PROTECTION INSTALLED.

6 PROVIDE 3/4" CONDUIT WITH PULL STRING FROM THE MICRO TURBINE TO THE CONTROL BUILDING. COORDINATE LOCATION OF REMOTE MONITORING PANEL WITH THE OWNER.

7 REFER TO DETAIL 2/E5.0 FOR DISCONNECT SWITCH AND TRANSFORMER GROUNDING REQUIREMENT.

8 PROVIDE CURRENT LIMITING FUSES "J CLASS" FOR ALL NEW DISCONNECT SWITCHES.

9 THE MICRO TURBINES TOTAL MAXIMUM FAULT CURRENT CONTRIBUTION IS 174A.

FEEDER SCHEDULE

(NOTE: ALL FEEDER TAGS SHOWN MAY NOT BE UTILIZED)

TAG	CONDUCTORS	CONDUIT	TAG	CONDUCTORS	CONDUIT
IG	ISOLATED GROUND CONDUCTOR	SEE NOTES	–	–	–
EX	EXISTING FEEDER	–	PBO	PROVIED BY OTHERS.	SEE NOTES
20	(3)#12, (1)#12 G	3/4"	20N	(4)#12, (1)#12 G	3/4"
30	(3)#10, (1)#10 G	3/4"	30N	(4)#10, (1)#10 G	3/4"
40	(3)#8, (1)#10 G	1"	40N	(4)#8, (1)#10 G	1"
55	(3)#6, (1)#8 G	1"	55N	(4)#6, (1)#8 G	1–1/4"
70	(3)#4, (1)#8 G	1–1/4"	70N	(4)#4, (1)#8 G	1–1/4"
85	(3)#3, (1)#8 G	1–1/4"	85N	(4)#3, (1)#8 G	1–1/4"
95	(3)#2, (1)#6 G	1–1/2"	95N	(4)#2, (1)#6 G	1–1/2"
110	(3)#1, (1)#6 G	1–1/2"	110N	(4)#1, (1)#6 G	2"
150	(3)#1/0, (1)#6 G	1–1/2"	150N	(4)#1/0, (1)#6 G	2"
175	(3)#2/0, (1)#6 G	2"	175N	(4)#2/0, (1)#6 G	2"
200	(3)#3/0, (1)#6 G	2"	200N	(4)#3/0, (1)#6 G	2"
230	(3)#4/0, (1)#4 G	2"	230N	(4)#4/0, (1)#4 G	2–1/2"
255	(3)250KCMIL, (1)#4 G	2–1/2"	255N	(4)250KCMIL, (1)#4 G	3"
285	(3)300KCMIL, (1)#4 G	2–1/2"	285N	(4)300KCMIL, (1)#4 G	3"
310	(3)350KCMIL, (1)#3 G	3"	310N	(4)350KCMIL, (1)#3 G	3"
335	(3)400KCMIL, (1)#3 G	3"	335N	(4)400KCMIL, (1)#3 G	3"
380	(3)500KCMIL, (1)#3 G	3"	380N	(4)500KCMIL, (1)#3 G	3–1/2"
400	2 SETS–((3)#3/0, (1)#3 G)– TOTAL OF (6)#3/0AWG, (2)#3AWG	2"	400N	2 SETS–((4)#3/0, (1)#3 G, (1)#3IG)– TOTAL OF (8)#3/0AWG, (4)#3AWG	2–1/2"
475	(3)750KCMIL, (1)#2 G	3–1/2"	475N	(4)750KCMIL, (1)#2 G	4"

NOTES:

1. WHEN USING PARALLEL RUNS FOR A FEEDER, THE EQUIPMENT GROUNDING CONDUCTOR IN EACH PARALLEL RUN SHALL BE SIZED FOR THE TOTAL AMPACITY OF THE OVER CURRENT PROTECTION DEVICE. REFER TO NEC ARTICLE 250–95.

2. WHERE OVER CURRENT PROTECTION DEVICES (OCPD) ARE INDICATED WITH THE "LSIG" NOTATION (OR ANY COMBINATION THEREOF), PROVIDE OCPD WITH PROGRAMMABLE TRIP UNITS WHERE:
   L = LONG TERM TRIP
   S = SHORT TERM TRIP
   I = INSTANTANEOUS TRIP
   G = GROUND FAULT TRIP
   EO = ELECTRICALLY OPERATED

3. OFCI – OWNER–FURNISHED, CONTRACTOR–INSTALLED
   PBO – PROVIDED (AND INSTALLED) BY OTHERS.

4. IG – ISOLATED GROUND NOTATION: WHERE THE FEEDER IS DESIGNATED WITH THE "IG" NOTATION; AN ADDITIONAL GROUNDING CONDUCTOR OF THE SAME SIZE SPECIFIED FOR EQUIPMENT GROUNDING SHALL BE PROVIDED, ROUTED AND TERMINATED PER THE ISOLATED GROUND DETAIL.

5. CONDUIT SIZES ARE MINIMUM. INCREASE FOR LONG OR DIFFICULT RUNS.

6. ABOVE 86°F AMBIENT INCREASE WIRE SIZE PER NEC.

7. USE 90°C COPPER WIRE MINIMUM OR AS DIRECTED.

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TENG & ASSOCIATES, INC.
ENGINEERS/ARCHITECTS/PLANNERS
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TELEPHONE: 818/539-1100

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PROJECT NO.	00–9016–00

OFFGASES
MICRO TURBINES

St. James Oil Field
814 WEST 23rd STREET
LOS ANGELES, CALIFORNIA 90018

PARTIAL ELECTRICAL SINGLE-LINE DIAGRAM

E3.0

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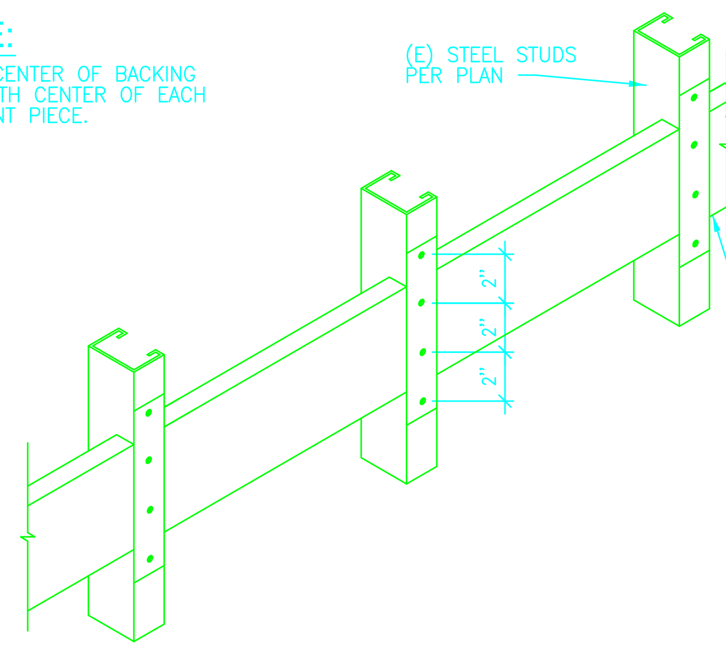
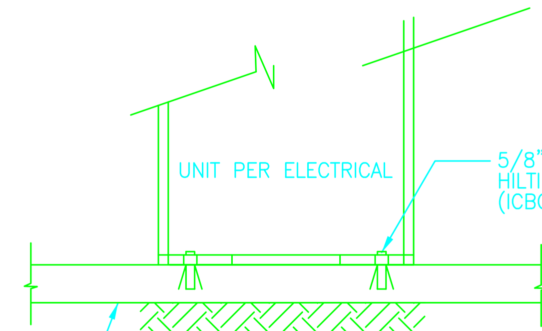
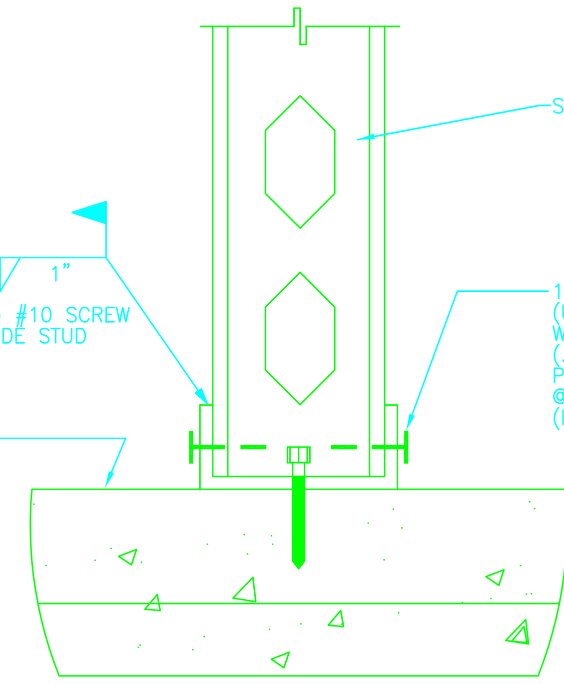
NOTE:
LOCATE CENTER OF BACKING PLATE WITH CENTER OF EACH EQUIPMENT PIECE.



1 BACK STUD DETAIL
NTS



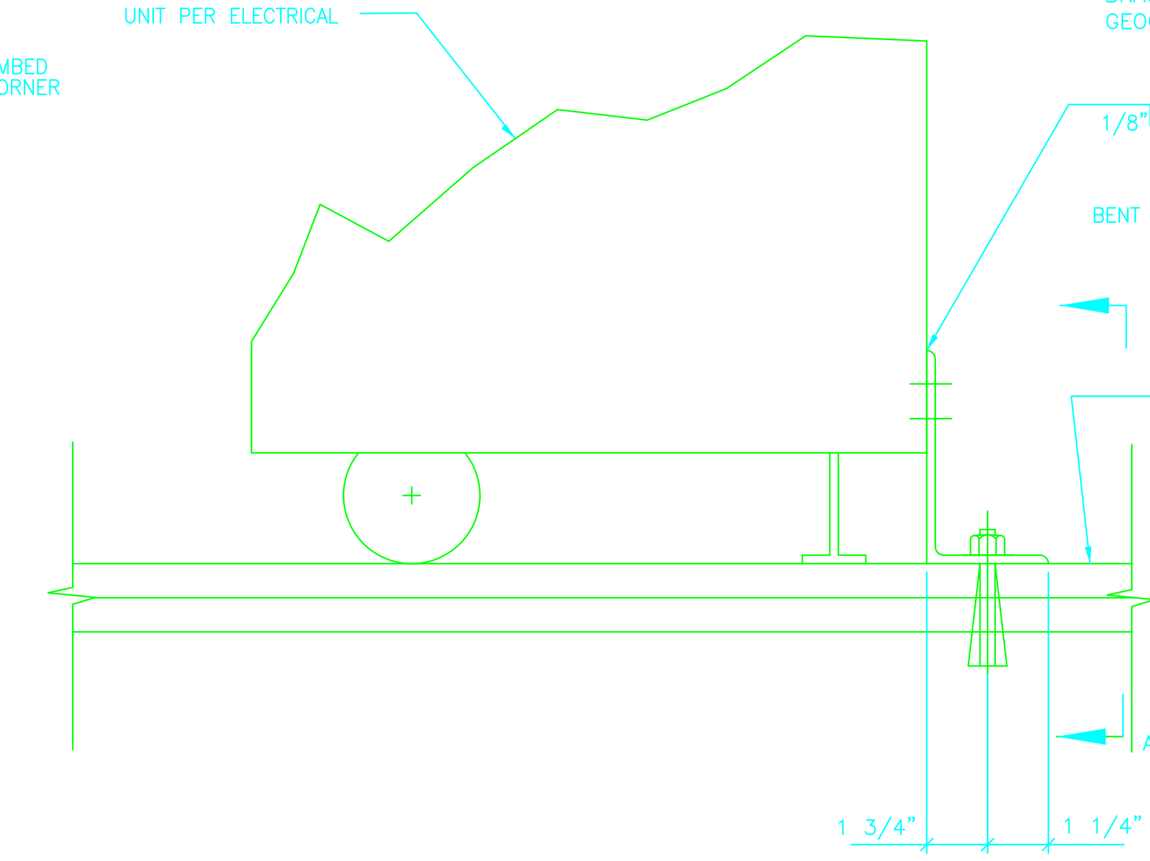
2 ANCHORAGE DETAIL
NTS

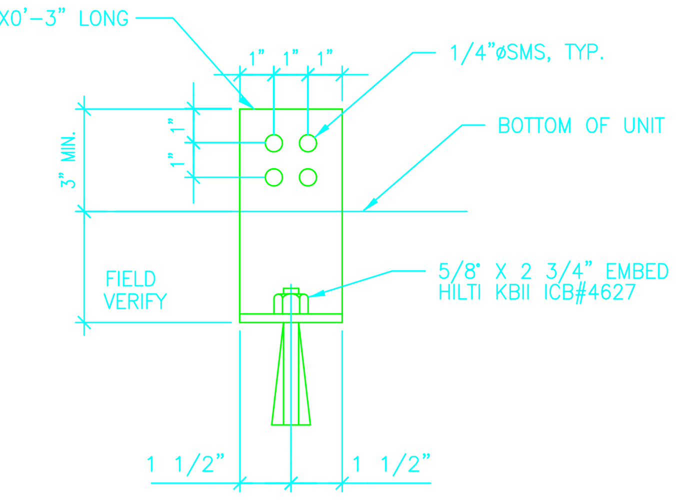


3 METAL STUD BOTTOM TRACK
NTS

NOTES: EQUIPMENT ANCHORING

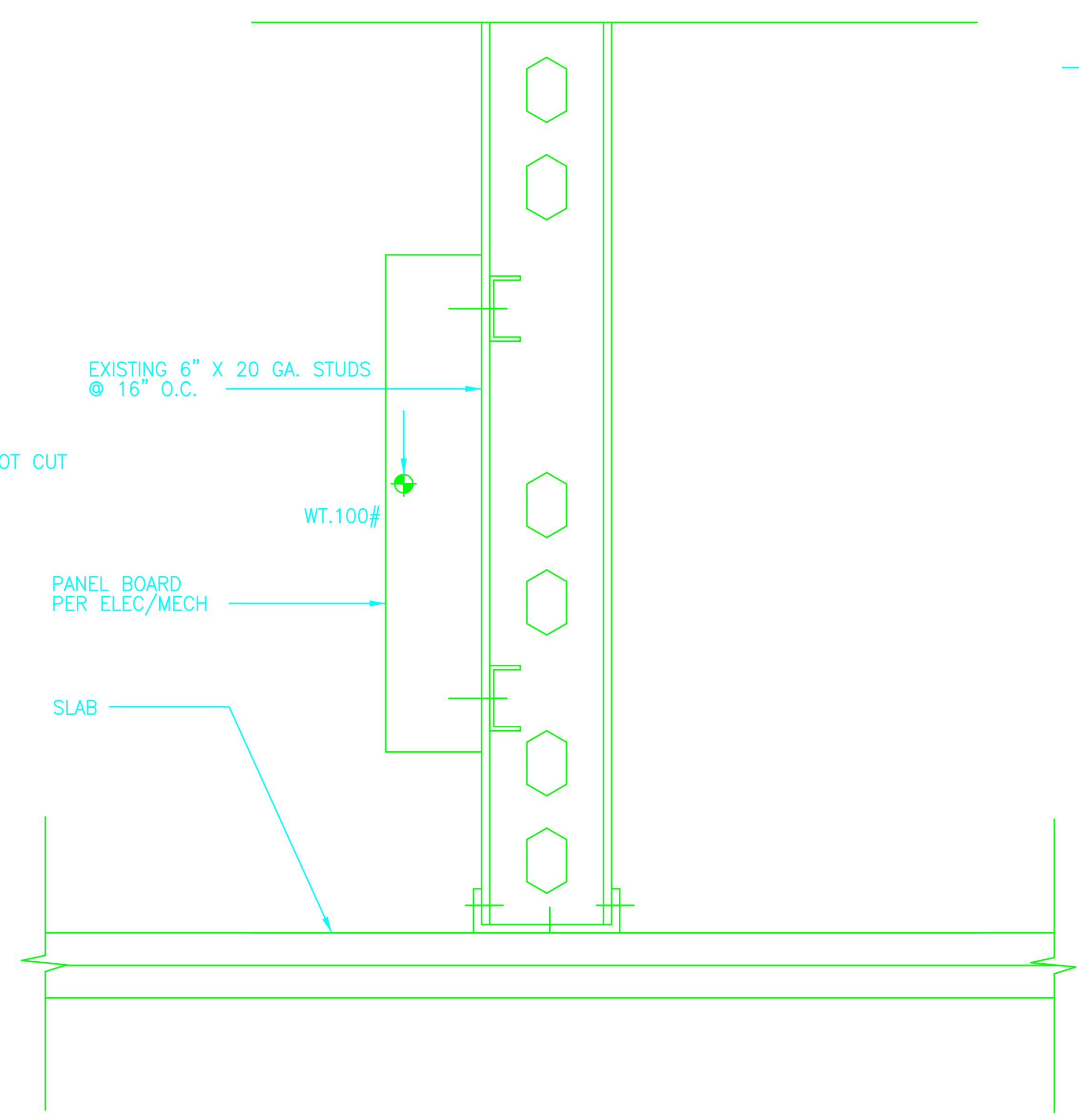
1. THE CONTRACTOR SHALL OBTAIN AND APPLY THE MANUFACTURER'S RECOMMENDATIONS FOR SEISMIC BRACING OF THE EQUIPMENT TO BE INSTALLED AS PART OF THIS WORK. BRACING SHALL CONFORM WITH THE REQUIREMENTS FOR THE GEOGRAPHICAL LOCATION/ZONE OF THE PROJECT.



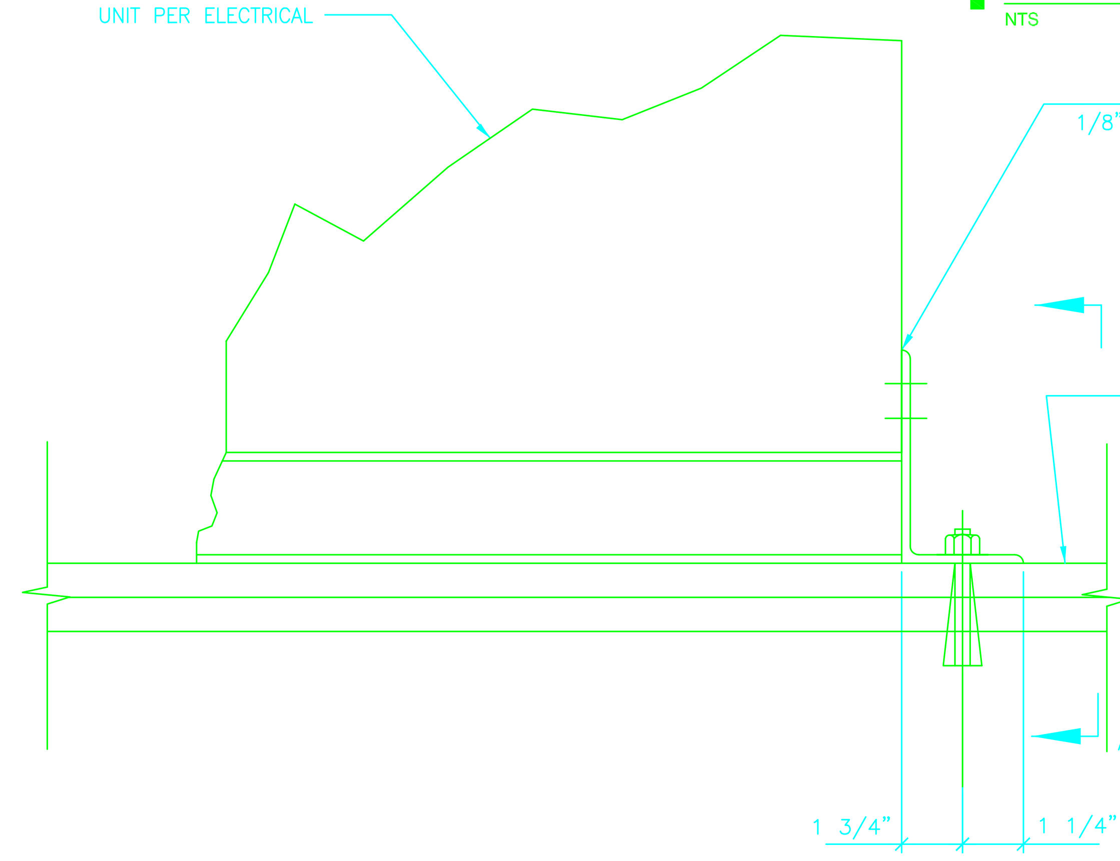


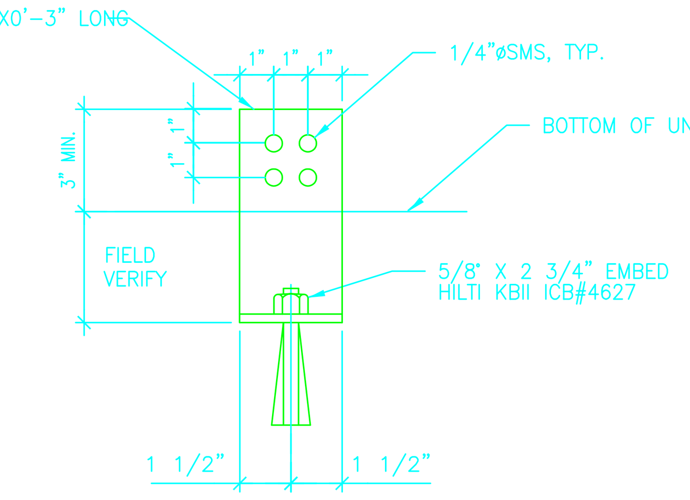
SECTION A–A

4 ANCHORAGE DETAIL
NTS



5 ANCHORAGE AT EXISTING STUDS
NTS





SECTION A–A

6 ANCHORAGE DETAIL
NTS

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PROJECT NO.	00-9016-00

OFFGASES MICRO TURBINES

St. James Oil Field
814 WEST 23rd STREET
LOS ANGELES, CALIFORNIA 90018

EQUIPMENT ANCHORING

E4.0

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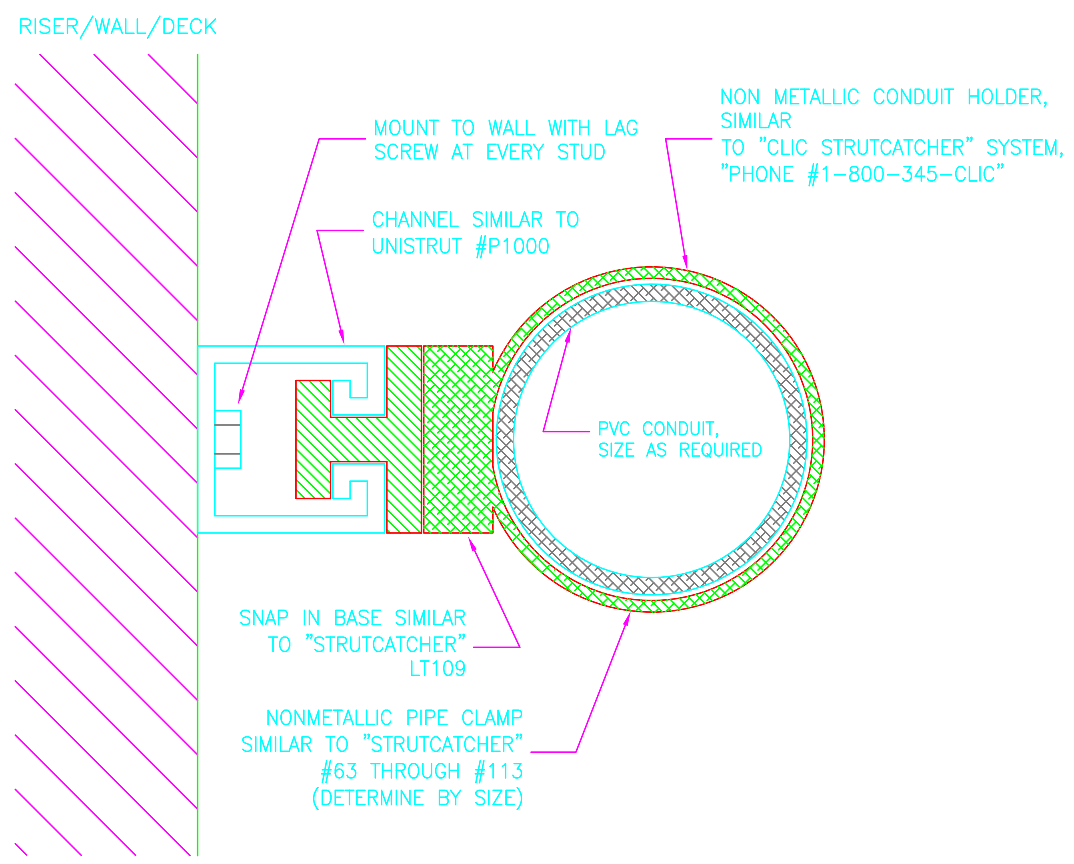
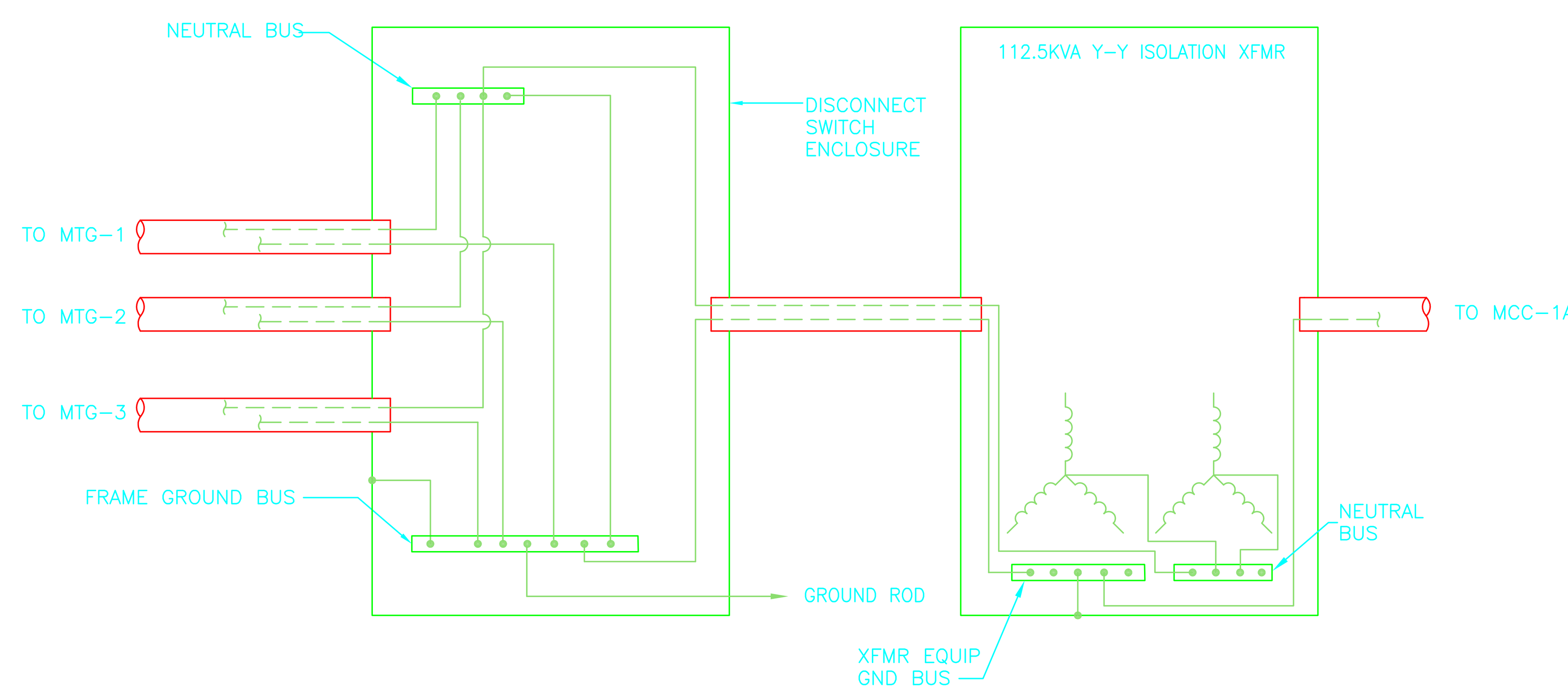


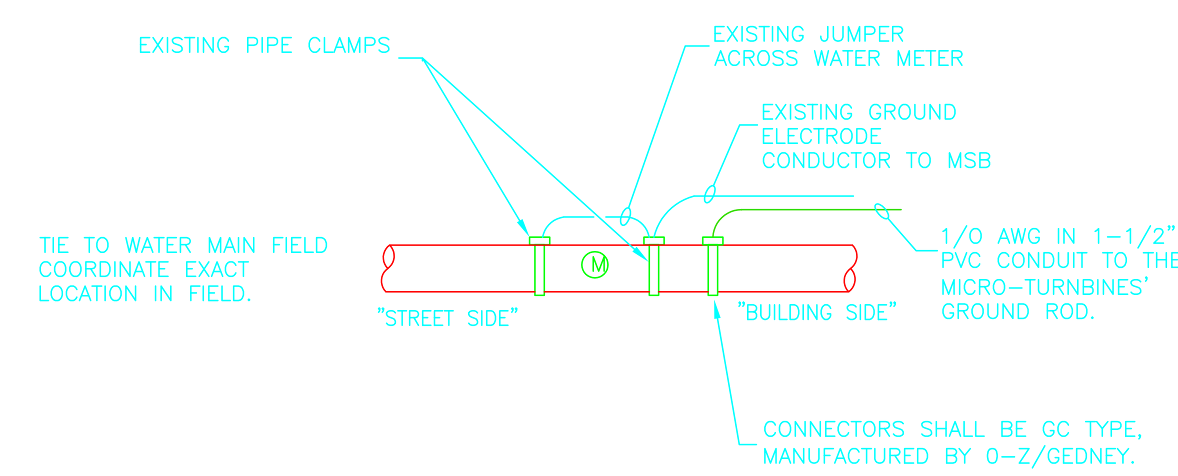
1 GROUND CONDUCTOR SUPPORT

NTS



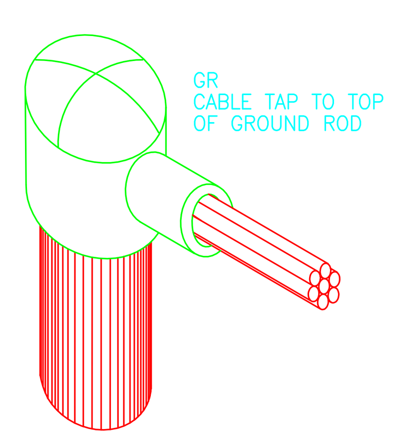
2 MICRO-TURBINE GROUNDING CONNECTION

NTS



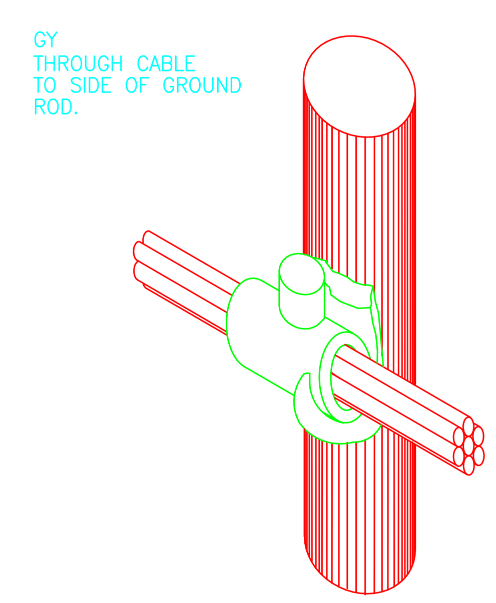
3 CONNECTION TO THE MAIN WATER PIPE

NTS



4 CADWELD: MOLD NO. 1

NTS



5 CADWELD: MOLD NO. 2

NTS

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OFFGASES
MICRO TURBINES

St. James Oil Field
814 WEST 23rd STREET
LOS ANGELES, CALIFORNIA 90018

ELECTRICAL DETAILS

E5.0

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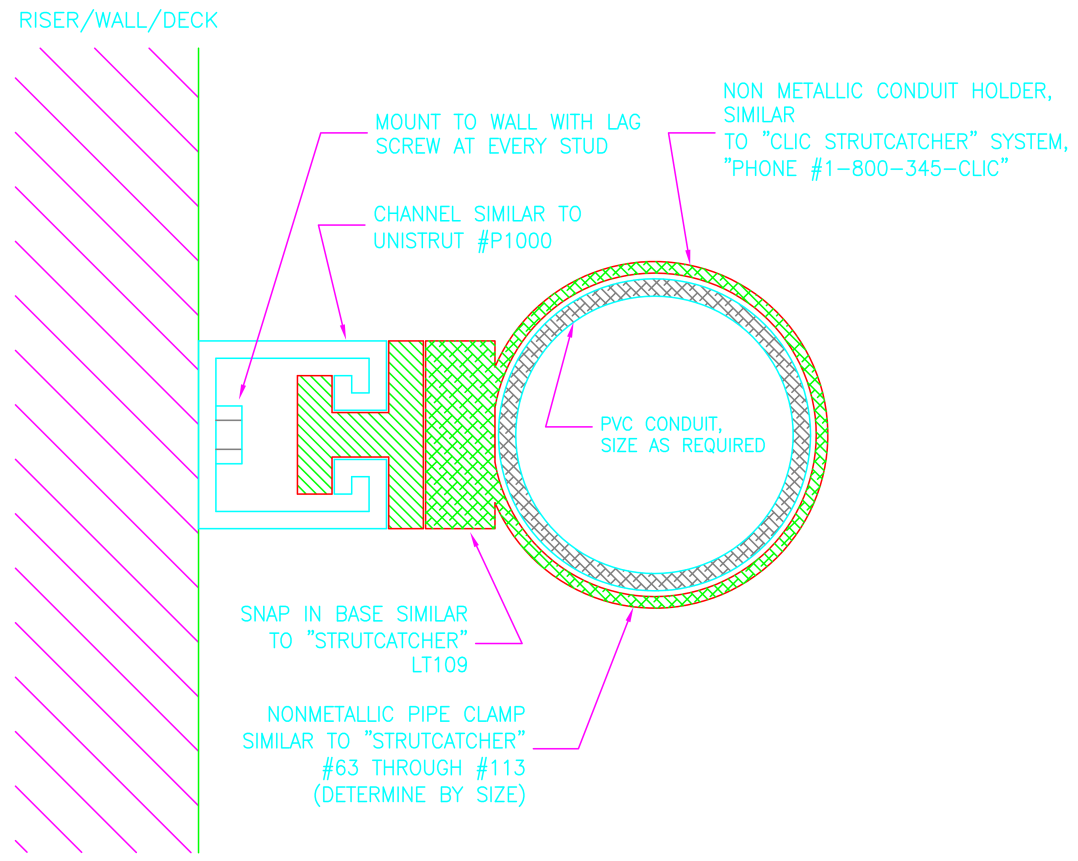
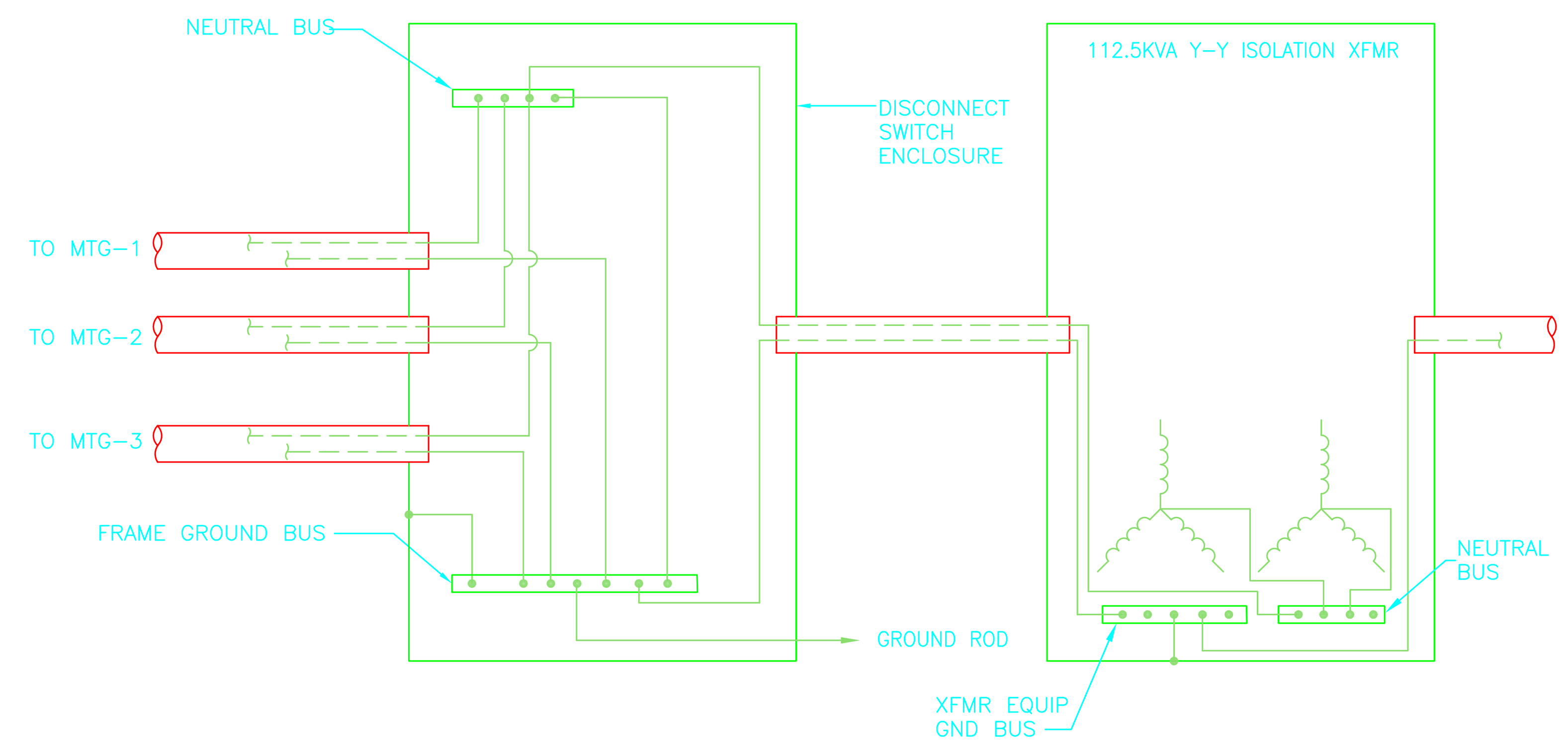


1 GROUND CONDUCTOR SUPPORT
NTS



2 MICRO-TURBINE GROUNDING CONNECTION
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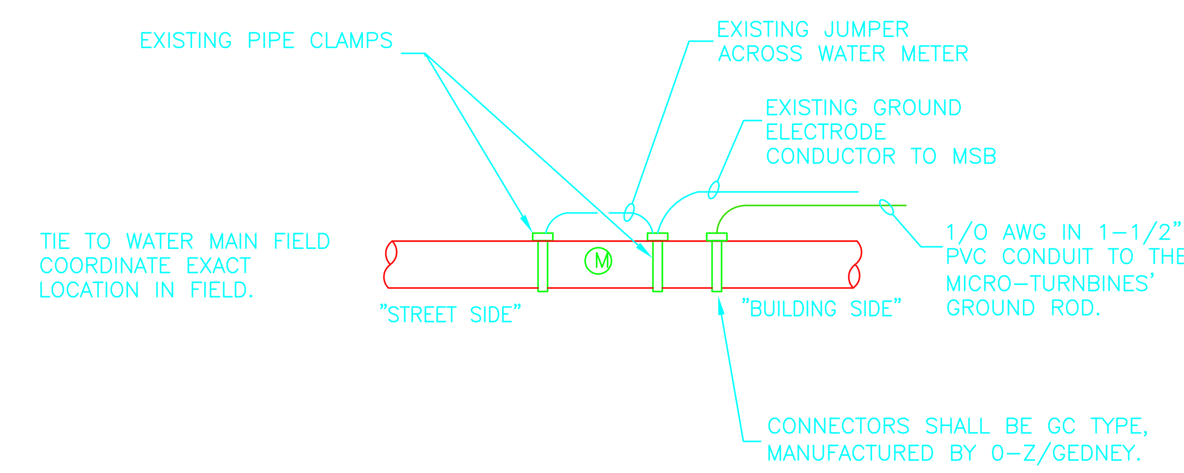
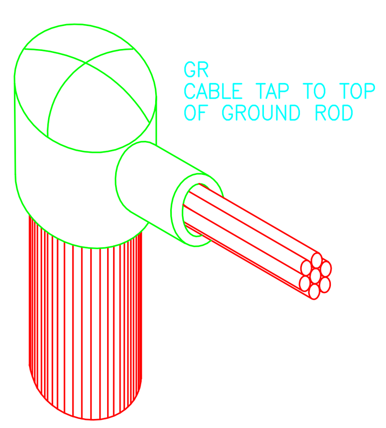
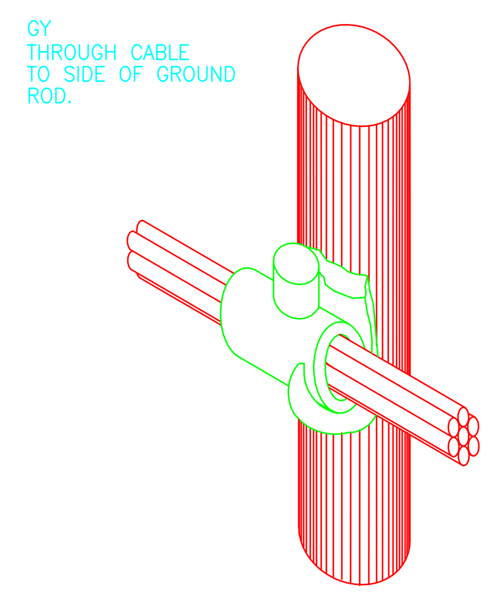


3 CONNECTION TO THE MAIN WATER PIPE
NTS



4 CADWELD: MOLD NO. 1
NTS



5 CADWELD: MOLD NO. 2
NTS

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OFFGASES MICRO TURBINES

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LOS ANGELES, CALIFORNIA 90018

ELECTRICAL DETAILS

E5.0

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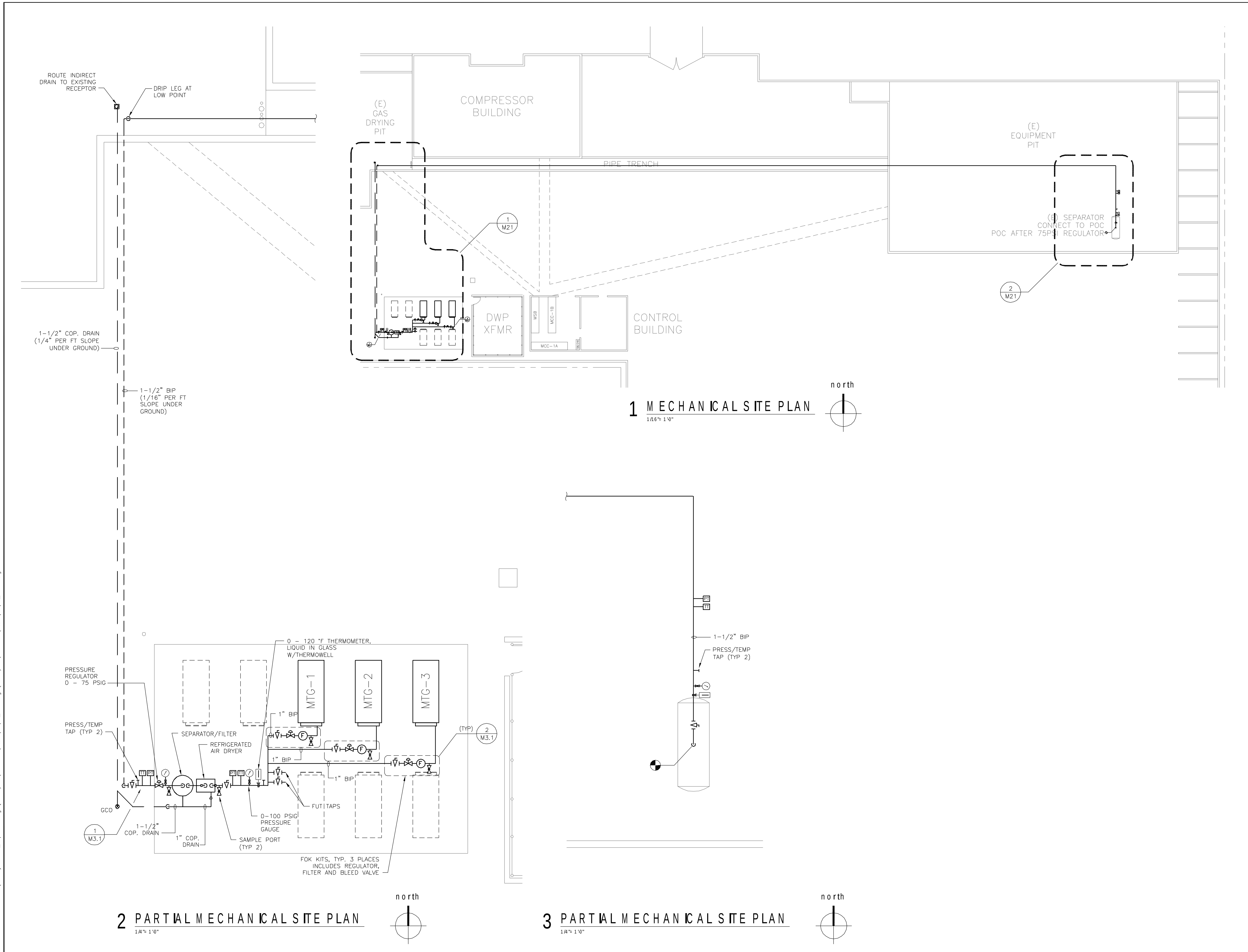

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NO.	DATE	DESCRIPTION	BY
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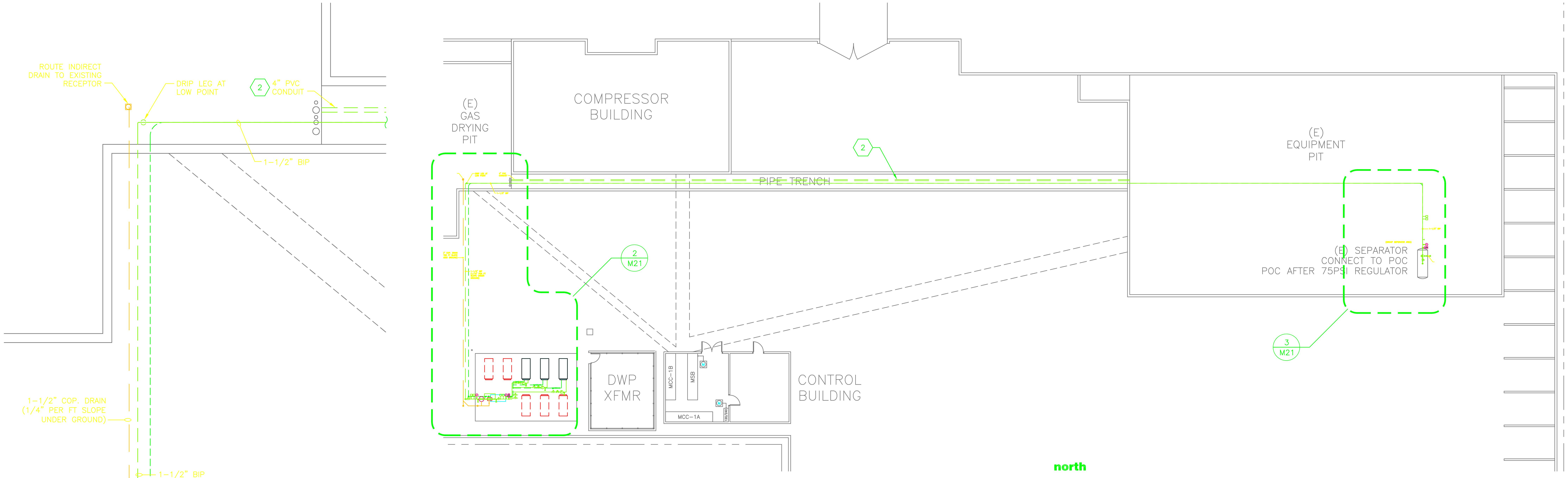
OFFGASES
MICRO TURBINES

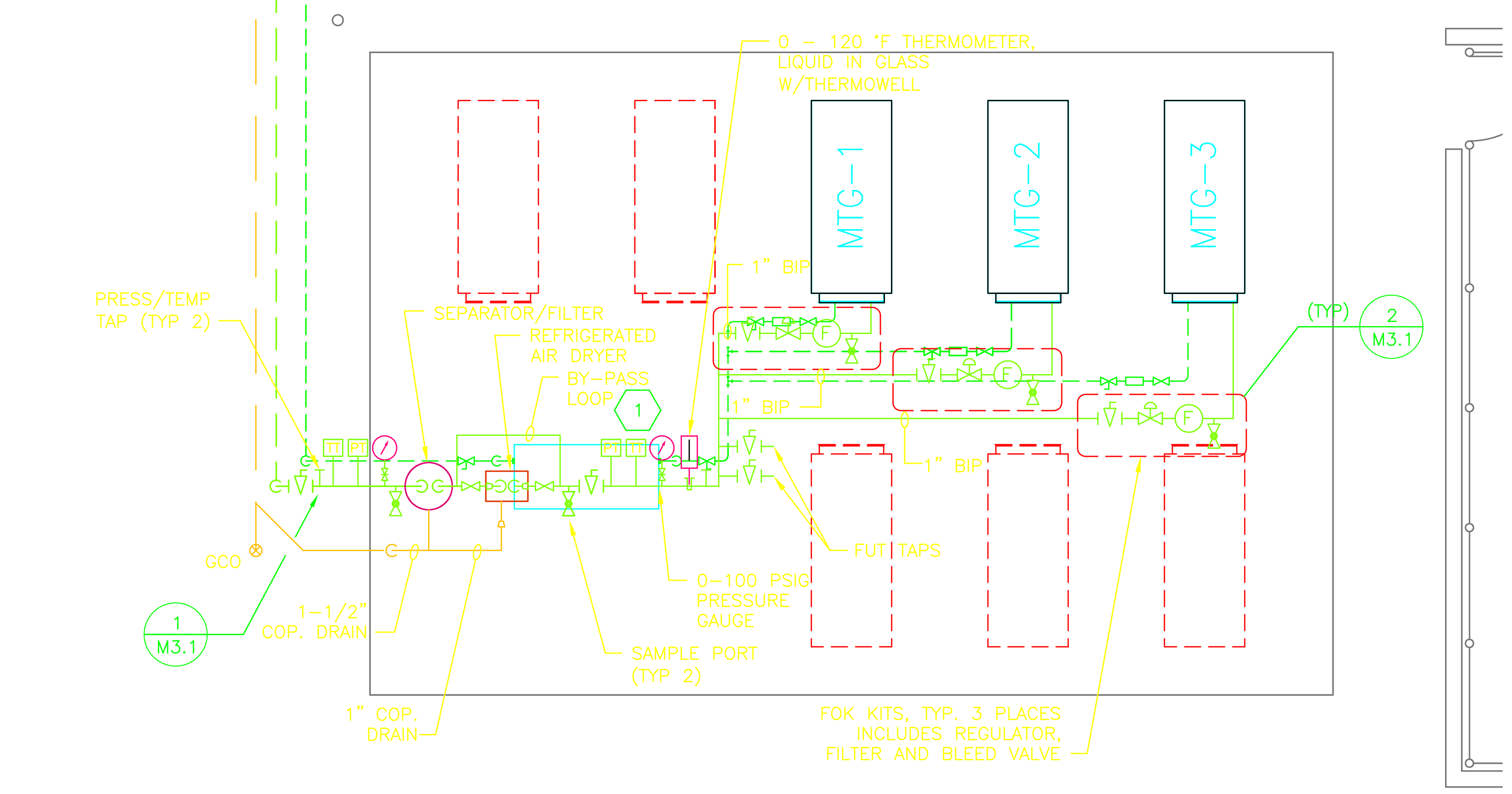
St. James Oil Field
814 WEST 23rd STREET
LOS ANGELES, CALIFORNIA 90018

MECHANICAL SITE PLAN AND PARTIAL PLANS

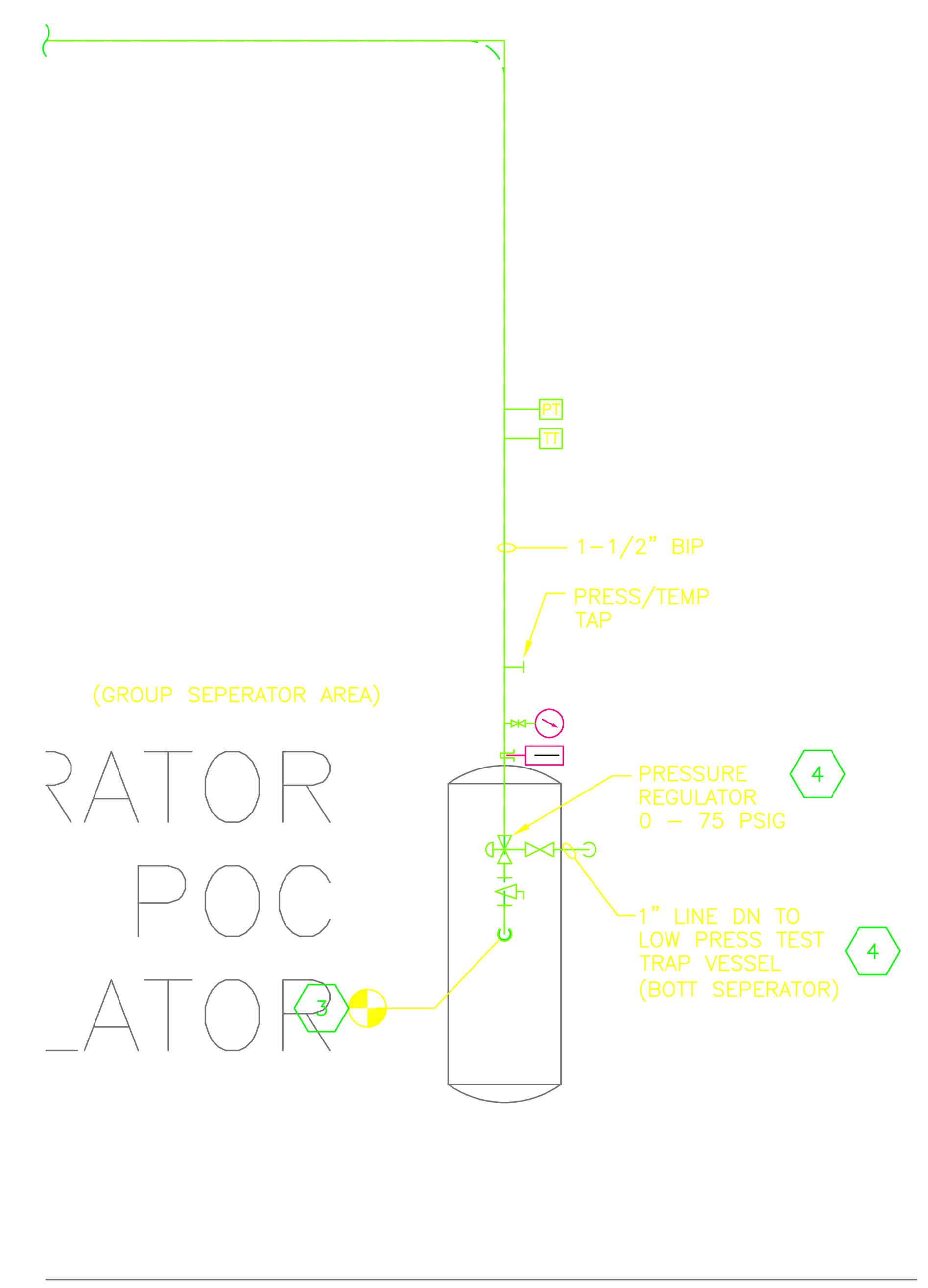
M 2.1



1 MECHANICAL SITE PLAN
1/16"=1'-0"
north



2 PARTIAL MECHANICAL SITE PLAN
1/4"=1'-0"
north



3 PARTIAL MECHANICAL SITE PLAN
1/4"=1'-0"
north

GENERAL NOTES:

1. SEE DRAWING M0.1 FOR ADDITIONAL NOTES.

KEY NOTES:

1. PROVIDE REFRIGERATED DRYER UNIT BY-PASS LOOP WITH ISOLATION VALVES.
2. PROVIDE (1) 4" PVC CONDUIT (EMPTY SLEEVE) IN TRENCH FOR FUTURE PIPING OR CONTROL WIRING.
3. CONNECT NEW 1 1/2" GAS LINE AT EXISTING 2" LINE AT THE GROUP TRAP VESSEL (TOP SEPERATOR).
4. INSTALL 75 PSI (20-90 PSI ADJ) BACK PRESSURE VALVE AND 1" BOTTOM DISCHARGE LINE DOWN TO LOW PRESSURE TEST TRAP VESSEL (BOTTOM SEPERATOR).

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OFFGASES MICRO TURBINES

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MECHANICAL SITE PLAN AND PARTIAL PLANS

M2.1

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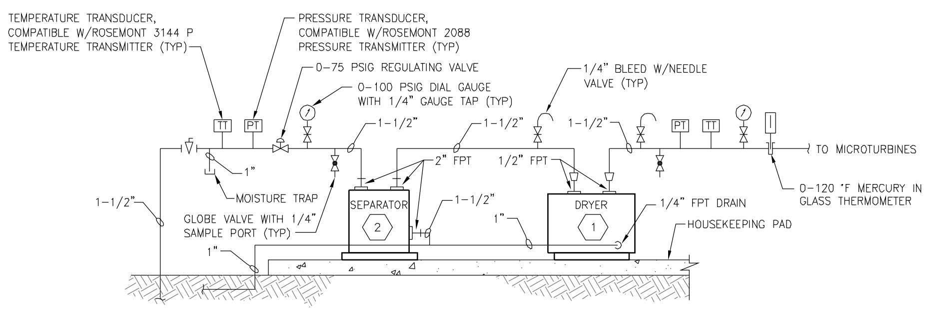
GENERAL NOTES:

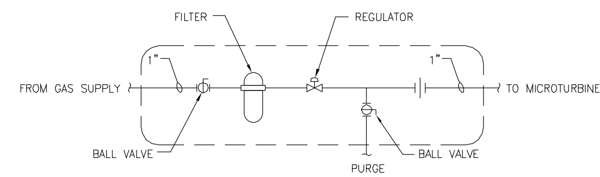
1. SEE DRAWING MO.1 FOR ADDITIONAL NOTES.

KEY NOTES:

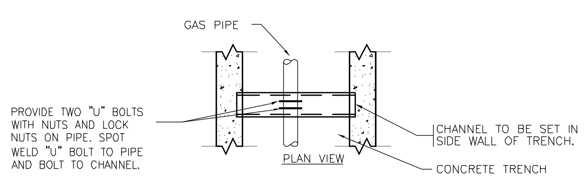
1. NEW GATE REFRIGERATED AIR DRYER, MODEL NGT SS 30.
2. HANOVER VERTICAL 2 PHASE SEPARATOR, 24" O.D. x 7'-6" SS @ 125#.



1 GAS CONDITIONING SCHEMATIC
NTS



2 FOK KIT SCHEMATIC
NTS



SCHEDULE		
SIZE OF PIPE	SIZE OF "U" BOLT	SIZE OF CHANNEL
1" TO 2"	3/8" DIA.	6" - 10 1/2#

SCHEDULE FOR 8 FT. SPAN OR LESS

3 PIPE TRENCH ANCHOR
NTS

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St. James Oil Field
814 WEST 23rd STREET
LOS ANGELES, CALIFORNIA 90018

MECHANICAL DETAILS AND SCHEMATICS

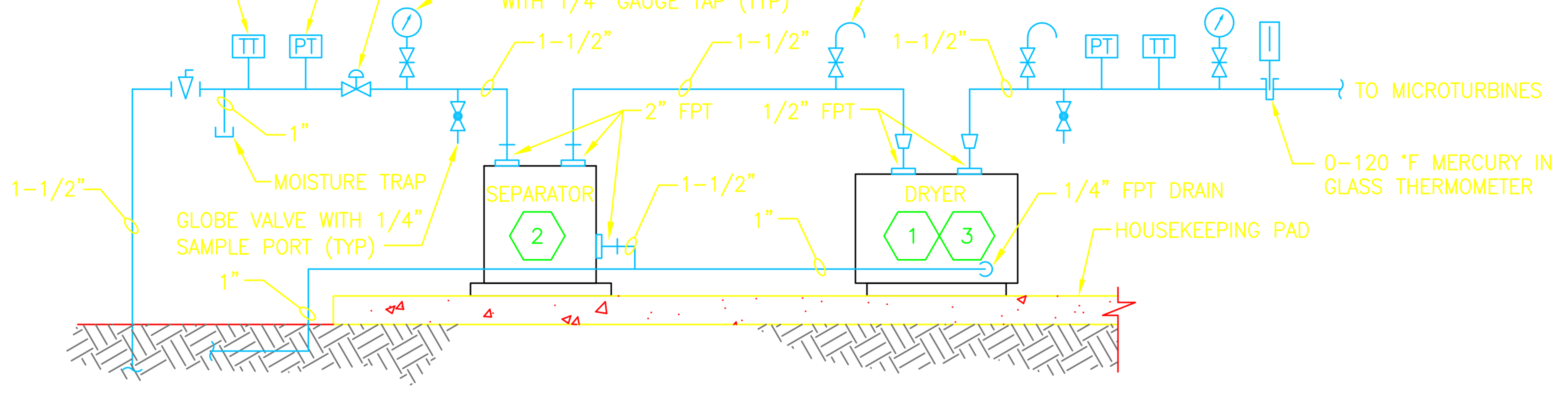
M 3.1

GENERAL NOTES:

1. SEE DRAWING M0.1 FOR ADDITIONAL NOTES.

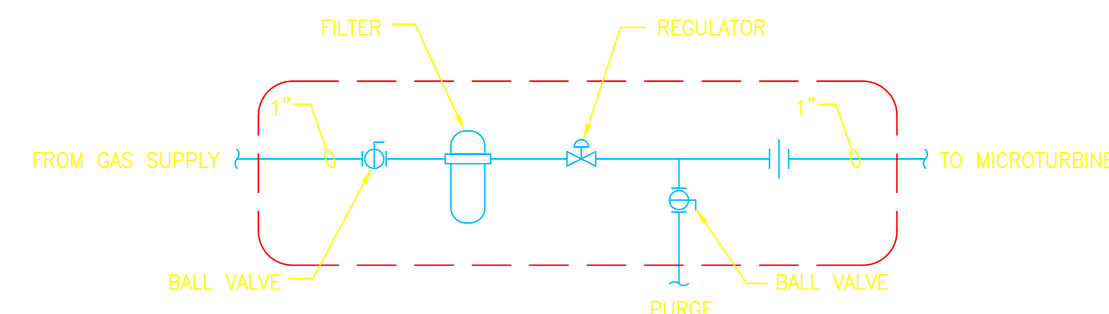
KEY NOTES:

1. NEW GATE REFRIGERATED AIR DRYER, MODEL NGT SS 30.
2. HANOVER VERTICAL 2 PHASE SEPARATOR, 24" O.D. x 7'-6" SS @ 125#.
3. PROVIDE REFRIGERATED DRYER UNIT BY-PASS LOOP WITH ISOLATION VALVES, REFER 2/M2.1.



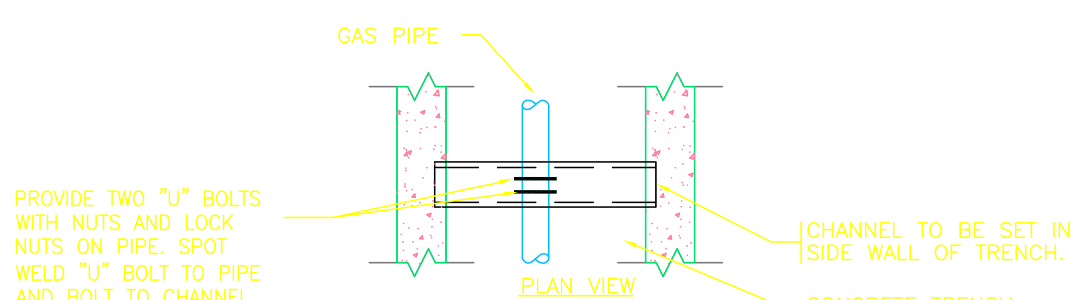
1 GAS CONDITIONING SCHEMATIC

NTS



2 FOK KIT SCHEMATIC

NTS



SCHEDULE		
SIZE OF PIPE	SIZE OF "U" BOLT	SIZE OF CHANNEL
1" TO 2"	3/8" DIA.	6" - 10 1/2#

SCHEDULE FOR 8 FT. SPAN OR LESS

3 PIPE TRENCH ANCHOR

NTS

TENG

TENG & ASSOCIATES, INC.
ENGINEERS/ARCHITECTS/PLANNERS
330 N. BRAND BLVD., GLENDALE, CA 91203
TELEPHONE: 818/539-1100

NO.	DATE	DESCRIPTION	BY
1	01-22-04	ISSUED FOR PERMIT	TDN

REVISIONS

DATE	DECEMBER 17, 2003
DRAWN	JSR
CHECKED	JCM
APPROVED	TDN
PROJECT NO.	00-9016-00

OFFGASES
MICRO TURBINES

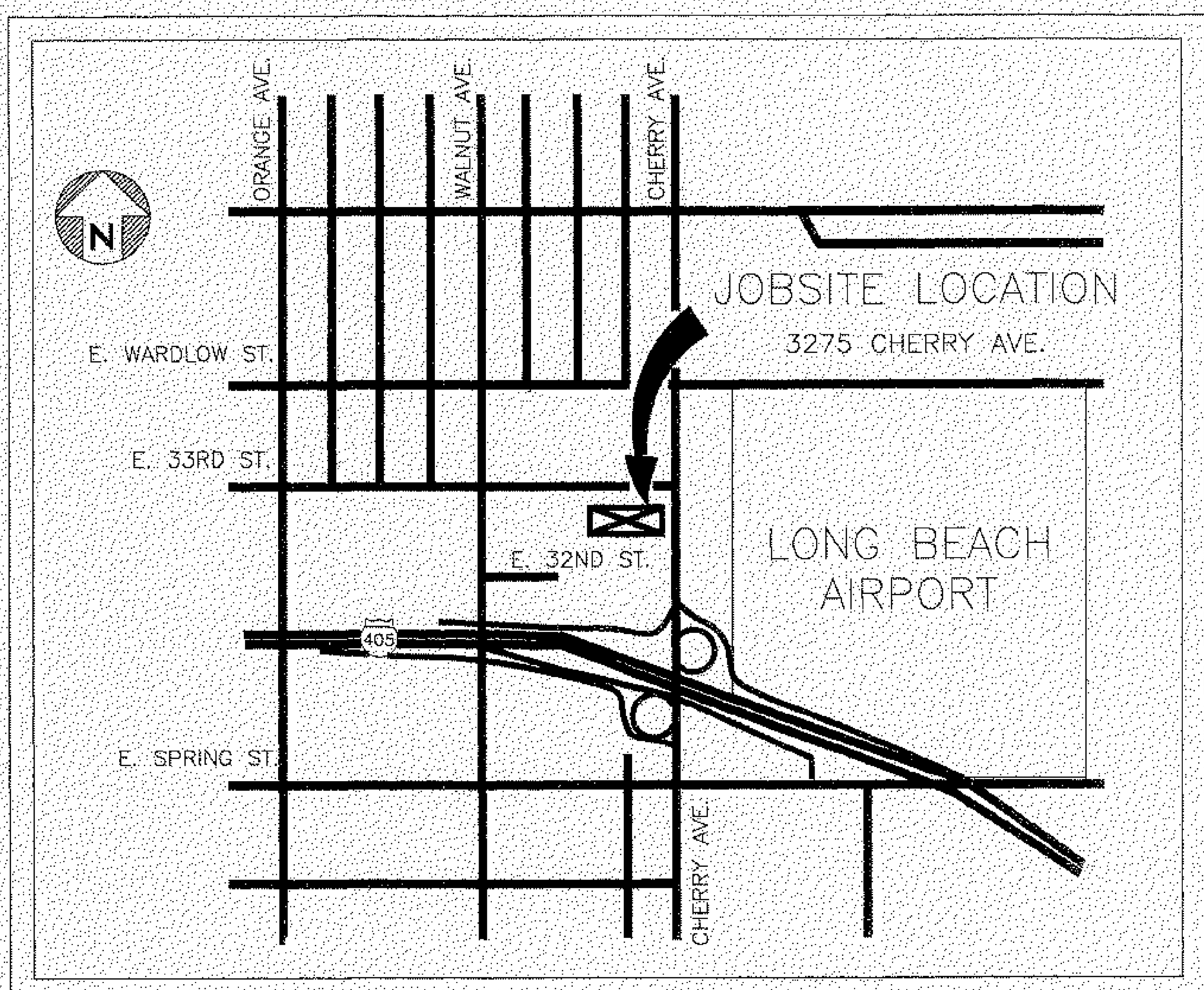
St. James Oil Field
814 WEST 23rd STREET
LOS ANGELES, CALIFORNIA 90018

MECHANICAL DETAILS AND SCHEMATICS

M3.1

PREPARED BY:
POWER ENGINEERING SERVICES, INC.
2703 SATURN STREET
BREA, CALIFORNIA 92821
714-524-9100
THOMAS M. HILL
LICENSE E8615

PREPARED FOR:
THE TERMO COMPANY
3275 CHERRY AVENUE
LONG BEACH, CA 90801



SITE MAP

DRAWING INDEX

DRAWING NUMBER	TITLES
3534-04-E100	TITLE, INDEX AND GENERAL NOTES
3534-04-E101	SINGLE LINE DIAGRAM
3534-04-E102	POWER PLAN
3534-04-E103	ENLARED PLAN, SECTIONS & DETAILS
3534-04-E104	GROUNDING DIAGRAM AND INTERLOCK DIAGRAMS

GENERAL NOTES

1. BIDDERS SHALL CAREFULLY EXAMINE THE ENTIRE SCOPE OF WORK. BIDDERS SHALL MAKE ALL INVESTIGATIONS NECESSARY TO BE THOROUGHLY INFORMED ABOUT THE WORK, REQUIRED SCHEDULING, PLACING AND USING THE NECESSARY EQUIPMENT AND MATERIALS, AND SPECIAL METHODS INVOLVED IN COMPLETION OF ALL WORK IN ACCORDANCE WITH THE PROJECT DRAWINGS, SPECIFICATIONS AND CONTRACT DOCUMENTS. FAILURE TO DO SO SHALL NOT RELIEVE CONTRACTOR OF CONTRACTUAL OBLIGATIONS NOR JUSTIFY ADDITIONAL COMPENSATION.
2. BEFORE STARTING ANY WORK, THE CONTRACTOR SHALL EXAMINE THE COMPLETE SET OF DRAWINGS FOR ALL TRADES. VERIFY ALL DIMENSIONS, SPACE REQUIREMENTS AND POINTS OF CONNECTION FOR ALL EQUIPMENT, MAKE MINOR ADJUSTMENTS NECESSARY TO AVOID CONFLICTS WITH EXISTING STRUCTURES AND THE WORK OF OTHER TRADES. CONTRACTOR SHALL VERIFY PURCHASED EQUIPMENT RATINGS AND DIMENSIONS MATCH DESIGN RATINGS AND DIMENSIONS PRIOR TO PURCHASE AND INSTALLATION. LAYOUT DIMENSIONS SHOWN ON THE DRAWINGS SHALL BE ADJUSTED BY CONTRACTOR TO ACCOMMODATE EQUIPMENT REQUIREMENTS OF INSTALLATION. CONTRACTOR SHALL OBTAIN MANUFACTURER'S SUBMITTALS FROM THE MANUFACTURER FOR CONTRACTOR PURCHASED EQUIPMENT AND FROM THE TERMO COMPANY FOR ALL OF THE TERMO COMPANY FURNISHED EQUIPMENT PRIOR TO LAYOUT AND INSTALLATION.
3. CONTRACTOR SHALL CONFINE SERVICE INTERRUPTION TO PERIODS SCHEDULED BY CONTRACTOR AND APPROVED BY THE CLIENT. ANY REQUIREMENTS FOR INTERRUPTION OR DISCONNECTION OF SERVICE SHALL BE REQUESTED IN WRITING FROM THE CLIENT PROJECT MANAGER AT LEAST 14 DAYS PRIOR TO SCHEDULED INTERRUPTION.
4. CONTRACTOR SHALL TAKE NECESSARY PRECAUTIONS TO PROTECT EXISTING AND NEW EQUIPMENT AND FACILITIES FROM DAMAGE DURING CONSTRUCTION.
5. CONTRACTOR SHALL SCHEDULE ALL REQUIRED INSPECTIONS. EACH INSPECTION SHALL BE COMPLETED BEFORE PROCEEDING WITH THE NEXT STAGE OF WORK. CONTRACTOR SHALL CORRECT, AT HIS OWN EXPENSE, ITEMS UNACCEPTABLE TO THE CLIENT OR CITY OF LONG BEACH.
6. ALL ELECTRICAL WORK SHALL BE IN ACCORDANCE WITH THE 2001 CALIFORNIA ELECTRICAL CODE (CEC), 2001 CALIFORNIA BUILDING CODE (CBC), ALL LOCAL CODES, ORDINANCES AND THE OCCUPATIONAL SAFETY HEALTH ACT (OSHA).
7. ALL ELECTRICAL MATERIALS SHALL BE NEW AND UNDERWRITERS LABORATORY (UL) LISTED AND RATED FOR THE INTENDED USE.
8. ALL LOW VOLTAGE CONDUCTORS SHALL BE STRANDED COPPER WITH 600V THHN/THWN INSULATION IN ACCORDANCE WITH DRAWINGS AND SPECIFICATIONS.
9. MINIMUM LOW VOLTAGE CONDUCTOR SIZE IS 12 AWG UNLESS OTHERWISE NOTED.
10. MINIMUM CONDUIT SIZE IS 3/4 INCH (1 INCH BELOW GRADE) UNLESS OTHERWISE NOTED.
11. THE DRAWINGS ARE DIAGRAMMATIC. CONDUIT ROUTING, CONDUIT BENDS, SUPPORT AND UNDEFINED DETAILS SHALL BE INSTALLED IN ACCORDANCE WITH CALIFORNIA ELECTRICAL CODE REQUIREMENTS AND SHALL BE DETERMINED BY CONTRACTOR AS A NECESSARY PART OF THE CONTRACTORS WORK.
12. INSTALLATION OF ELECTRICAL EQUIPMENT SHALL INCLUDE ALL MEASURES NECESSARY FOR SEISMIC ZONE 4 INCLUDING ANCHOR BOLTS AND CROSS BRACING WHERE REQUIRED. FOLLOW MANUFACTURER'S DETAILS AND INSTRUCTIONS FOR SEISMIC ZONE 4 INSTALLATION.
13. CONTRACTOR SHALL TEST ALL CIRCUIT ELEMENTS FOR INSULATION RESISTANCE PRIOR TO ENERGIZATION AND PERFORM ALL PRE-COMMISSION TESTING RECOMMENDED BY MANUFACTURERS. CONTRACTOR SHALL PROVIDE TEST RESULT DOCUMENTATION TO THE TERMO COMPANY.
14. MODIFICATIONS AND ADDITIONS TO EXISTING EQUIPMENT SHALL BE MADE IN A MANNER WHICH MAINTAINS THE ORIGINAL NRTL LISTING. WHERE LISTING IS COMPROMISED, THE CONTRACTOR SHALL PAY TO HAVE THE EQUIPMENT RE-CERTIFIED OR REPLACED.

REV.	DATE	DESCRIPTION	DR. / CH.
0	4/20/04	ISSUED FOR CONSTRUCTION	DR. LKC / CH. TMH
B	4/02/04	ISSUED FOR PLAN CHECK	DR. LKC / CH. TMH
A	3/22/04	ISSUED FOR CLIENT REVIEW	

THE TERMO COMPANY
3275 CHERRY AVENUE
LONG BEACH, CA 90801

PROJECT ENGR.	DATE	DESIGN BY	DATE	DRAWN BY	DATE
LKC	03/12/04	LKC	03/15/04	JPP	03/16/04

APPROVALS P.E. | CLIENT APPR.

MICROTURBINE GENERATOR ADDITION
TITLE, INDEX & GENERAL NOTES

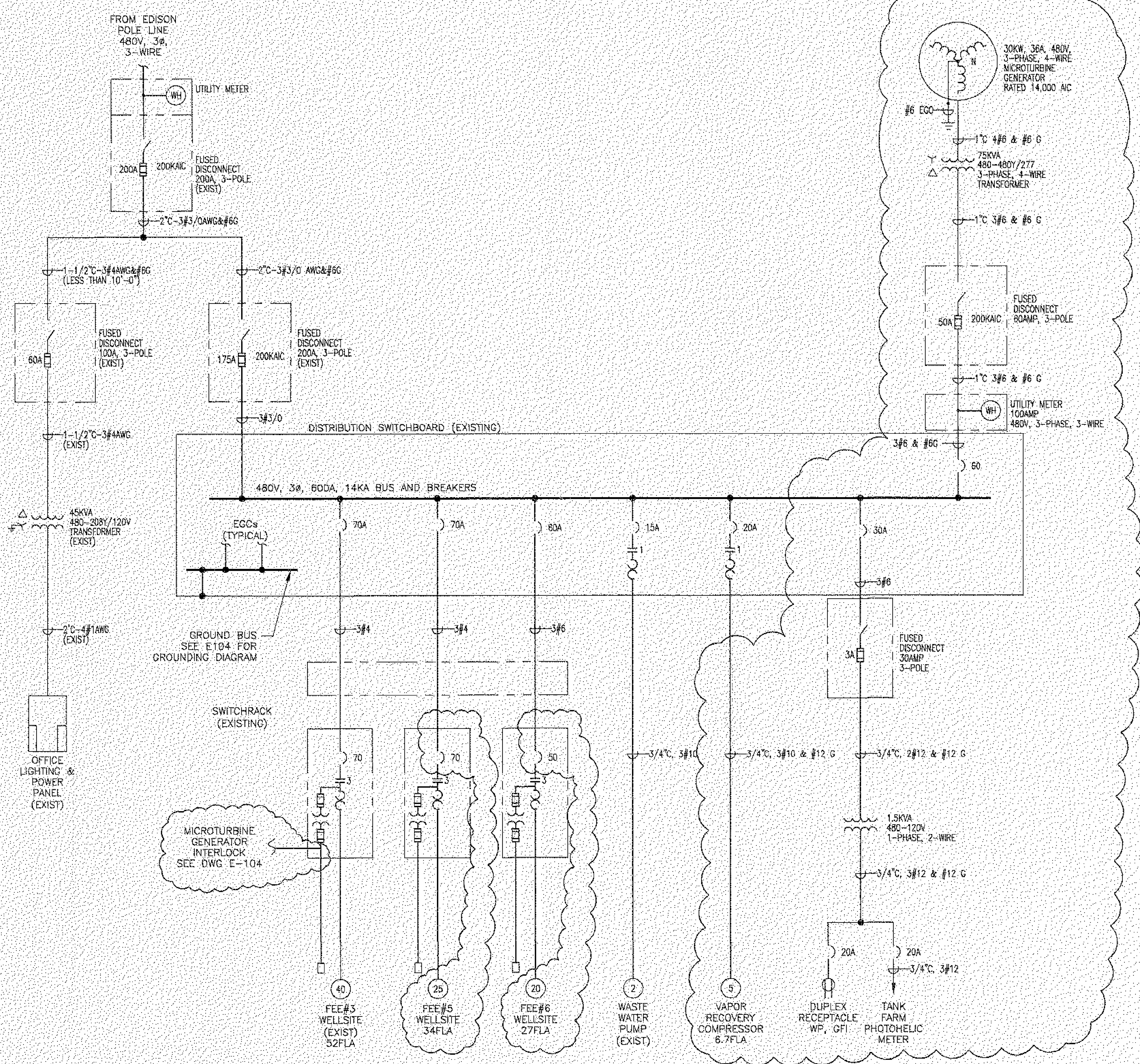
LONG BEACH CALIFORNIA

SCALE:	SIZE	PROJECT NUMBER	DRAWING NUMBER	REV.
NONE	D	3534-04	E100	0

DISCIP | TYPE | CODE | SEQ NO.

CADD DWG. NUMBER3534 E100.DWG

2703 SATURN STREET
BREA, CA 92821
TEL: (714) 524-9100



NEW WORK ON THIS CONTRACT IS SHOWN WITHIN THE CLOWDED AREA

LOAD CALCULATIONS

	AMPS
EXISTING LOAD (NOTE 1)	47.0 AMPS
VAPOR RECOVERY COMPRESSOR	6.7 AMPS
MICROTURBINE GENERATOR (NOTE 2)	0.0
RECEPTACLES (1.5 KVA TRANSFORMER)	3.0
FEE#5 PUMP (NOTE 3)	34 FLA
FEE#6 PUMP (NOTE 3)	27 FLA
FEE#3 PUMP (NOTE 4)	0
TOTAL (WITHOUT MICROTURBINE)	117.7 AMPS
MICROTURBINE OPERATING	-36 AMPS
FEE#3 PUMP (NOTE 4)	52 FLA
TOTAL (WITH MOCROTURBINE)	133.7 AMPS

NOTES:

1. NEC 220-35 ALTERNATE METHOD IS USED TO DETERMINE EXISTING LOAD. HIGHEST PEAK DEMAND FROM SOUTHERN CALIFORNIA EDISON FOR THE LAST TWELVE MONTHS IS 31KW AT 80% PF = 37-AMPS. THE EDISON PEAK DEMAND IS MULTIPLIED BY 125% TO OBTAIN THE EXISTING LOAD FIGURE OF 47-AMPS USED IN THE CALCULATION.
2. THE CAPSTONE MODEL 330 MICROTURBINE GENERATOR USES OUTPUT FROM THE VAPOR RECOVERY COMPRESSOR TO SUPPLY ELECTRIC POWER. THE MICROTURBINE WILL PRODUCE A MAXIMUM OF 36-AMPS AT 480 VOLTS TO THE ELECTRICAL SYSTEM. FOR THE BASE CALCULATION NO LOAD IS ASSIGNED TO THIS DEVICE.
3. WELL PUMPS WERE NOT IN OPERATION DURING THE PREVIOUS YEAR AND ARE NOT PART OF THE EXISTING LOAD. MOTORS ARE REPLACED. MOTORS FOR FEE#5 AND FEE#6 ARE REDUCED IN SIZE AND BREAKERS & OVERLOAD HEATERS IN THE MOTOR STARTERS SIZED ACCORDINGLY.
4. AN ELECTRICAL INTERLOCK IS PROVIDED IN THE FEE#3 PUMP STARTER TO PREVENT THE PUMP FROM RUNNING IF THE MICROTURBINE IS NOT IN OPERATION. ALSO, SHOULD THE MICROTURBINE FAIL, PUMP FEE#3 WOULD AUTOMATICALLY BE STOPPED.

REF. DWG. NO.	DESCRIPTION	REV.	DATE	DESCRIPTION		REV.	DATE	DESCRIPTION	
					DR. / CH.				DR. / CH.
					DR. / CH.	0	4/20/04	ISSUED FOR CONSTRUCTION	DR. LKC / CH. TMH
					DR. / CH.	B	4/02/04	ISSUED FOR PLAN CHECK	DR. LKC / CH. TMH
					DR. / CH.	A	3/22/04	ISSUED FOR CLIENT REVIEW	DR. / CH.

THE TERMO COMPANY
3275 CHERRY AVENUE
LONG BEACH, CA 90801

PROJECT ENGR.	DATE
LKC	03/12/04
DESIGN BY	DATE
LKC	03/15/04
DRAWN BY	DATE
JPP	03/16/04
APPROVALS P.E.	CLIENT APPR.

MICROTURBINE GENERATOR ADDITION SINGLE LINE DIAGRAM

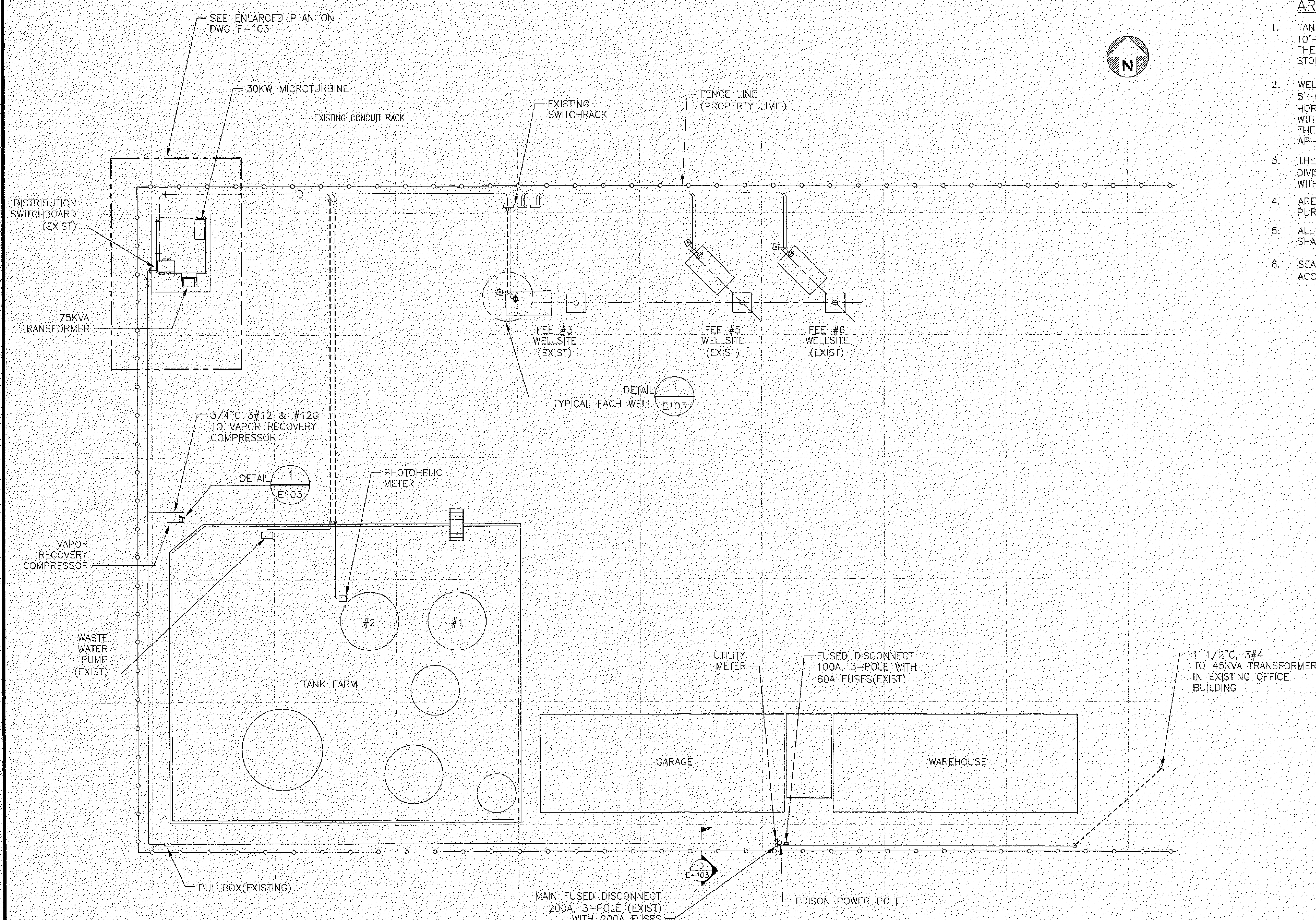
LONG BEACH CALIFORNIA

SCALE:	SIZE	PROJECT NUMBER	DRAWING NUMBER	REV.
NONE	D	3534-04	E101	0

DISCIP | TYPE | CODE | SEQ NO.

CADD DWG. NUMBER3534 E101.DWG

POWER ENGINEERING SERVICES INCORPORATED
P E S
2703 SATURN STREET
BREA, CA 92821
TEL: (714) 524-9100



AREA CLASSIFICATION NOTES

1. TANK FARM AREA IS CLASSIFIED AS CLASS 1, DIVISION 2, GROUP D, FOR 10'-0" FROM SHELL & ROOF OF TANKS AND SPACE INSIDE DIKE AREA TO THE TOP OF THE DIKE IN ACCORDANCE WITH CEC 515-2 FOR BULK STORAGE PLANTS.
2. WELLSITE AREAS ARE CLASSIFIED AS CLASS 1, DIVISION 2, GROUP D FOR 5'-0" AROUND THE WELLHEAD IN ALL DIRECTIONS AND 10'-0" HORIZONTALLY 1'-6" ABOVE GRADE. BELOW GRADE CELLARS LOCATED WITHIN THE CLASSIFIED AREA ARE CONSIDERED DIVISION 1 TO THE TOP OF THE CELLAR. WELLSITE AREA CLASSIFICATION IS IN ACCORDANCE WITH API-RP-500 SECTION 10.5.2.1 FOR BEAM PUMPING WELLS.
3. THE NEW VAPOR RECOVERY COMPRESSOR IS CLASSIFIED AS CLASS 1, DIVISION 2, GROUP D FOR 25' AROUND THE COMPRESSOR IN ACCORDANCE WITH API-RP-500 SECTION D.5.5.
4. AREAS NOT LISTED ABOVE ARE CONSIDERED AS UNCLASSIFIED FOR THE PURPOSE OF THIS PROJECT.
5. ALL WIRING AND EQUIPMENT IN CLASS 1, DIVISION 1 AND 2 LOCATIONS SHALL BE GROUNDED IN ACCORDANCE WITH CEC 501-16.
6. SEAL ALL CONDUITS CROSSING AREA CLASSIFICATION BOUNDARIES IN ACCORDANCE WITH CEC 501-5(b).

REF. DWG. NO.	DESCRIPTION	REV.	DATE	DESCRIPTION		REV.	DATE	DESCRIPTION	
					DR. / CH.				DR. / CH.
					DR. / CH.	0	4/20/04	ISSUED FOR CONSTRUCTION	DR. LKC / CH. TMH
					DR. / CH.	B	4/02/04	ISSUED FOR PLAN CHECK	DR. LKC / CH. TMH
					DR. / CH.	A	3/22/04	ISSUED FOR CLIENT REVIEW	DR. / CH.

THE TERMO COMPANY
3275 CHERRY AVENUE
LONG BEACH, CA 90801

PROJECT ENGR.	DATE
LKC	03/12/04
DESIGN BY	DATE
LKC	03/15/04
DRAWN BY	DATE
JPP	03/16/04
APPROVALS P.E.	CLIENT APPR.

MICROTURBINE GENERATOR ADDITION POWER PLAN

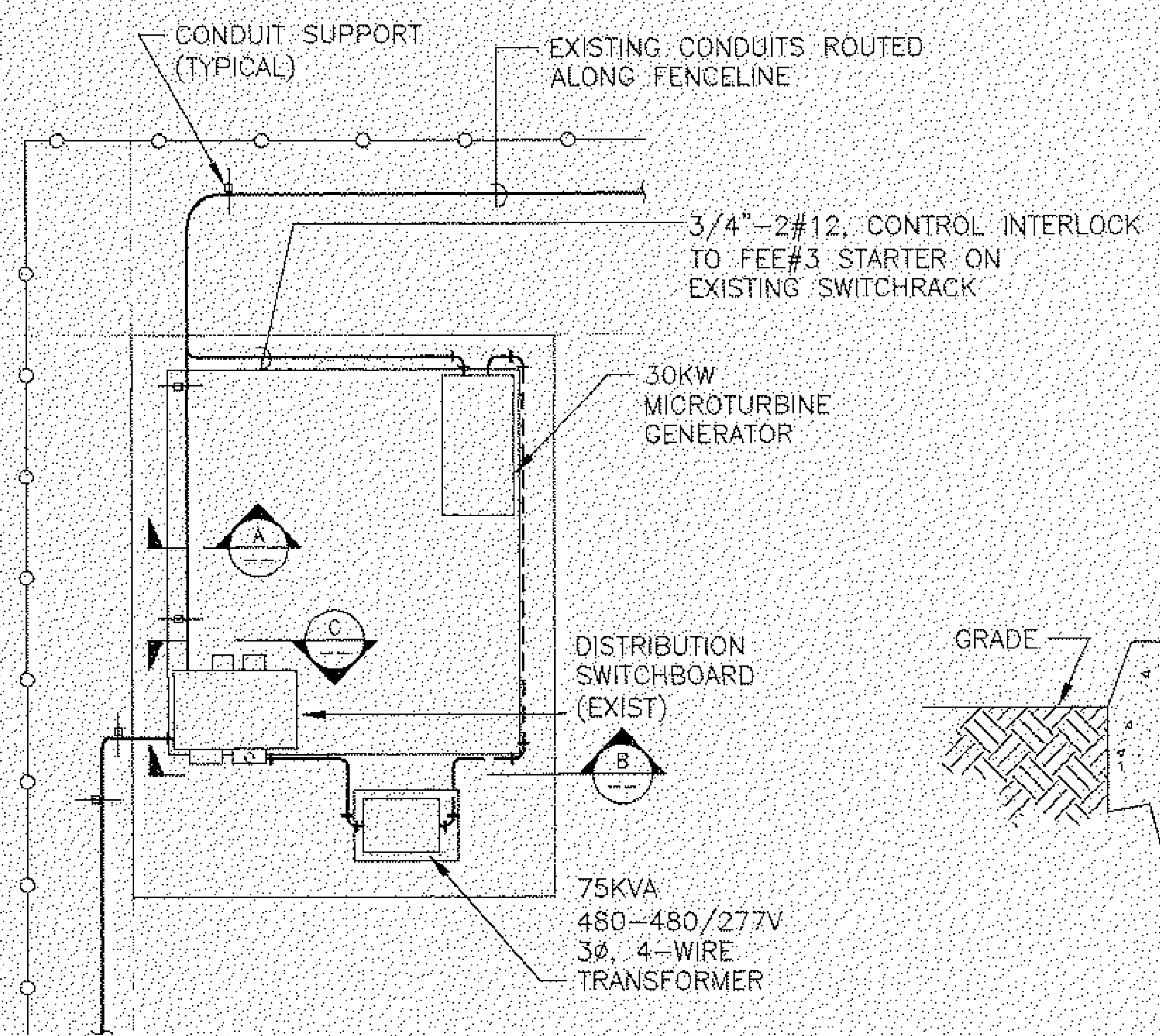
LONG BEACH CALIFORNIA

SCALE	SIZE	PROJECT NUMBER	DRAWING NUMBER	REV.
NONE	D	3534-04	E102	0

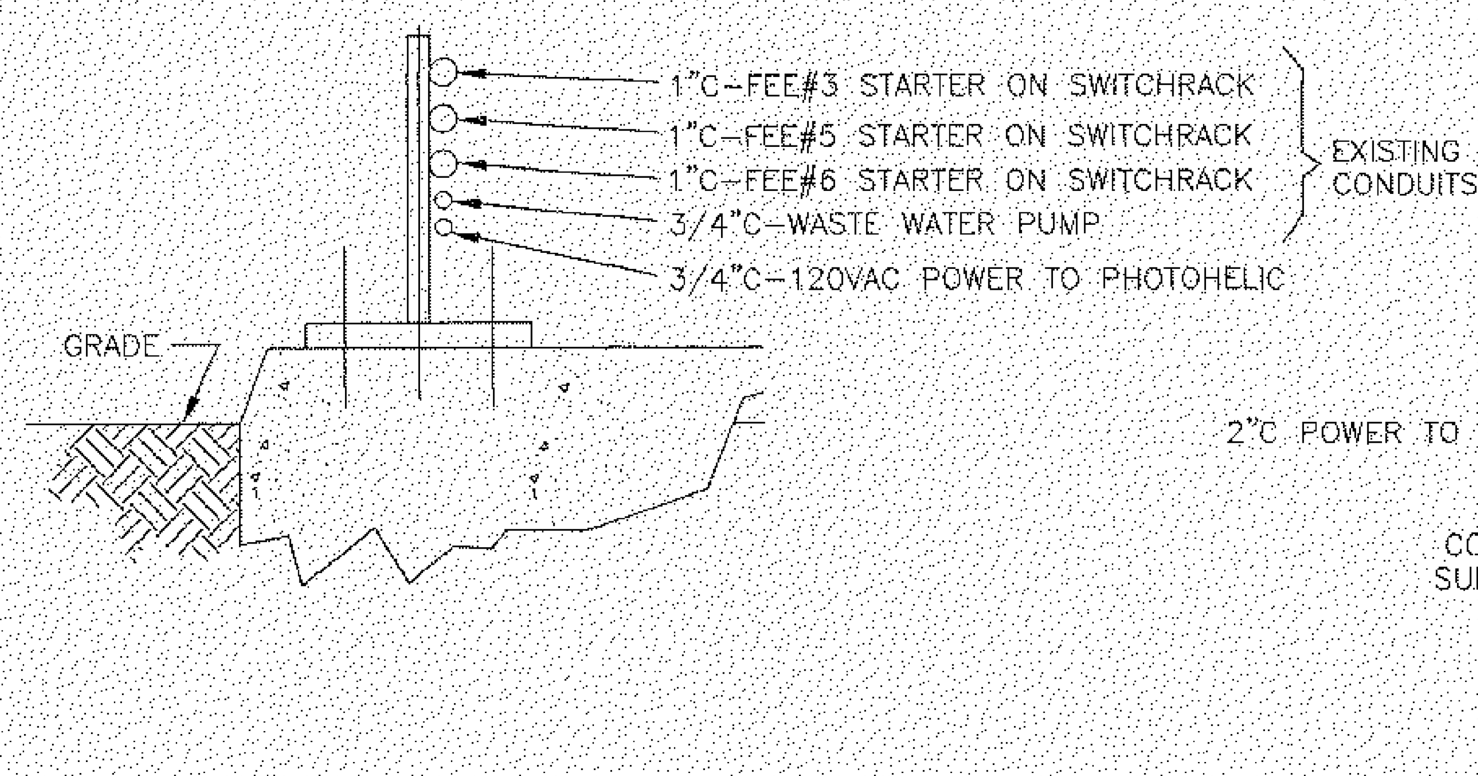
CADD DWG. NUMBER 3534 E102.DWG

DISCIP | TYPE | CODE | SEQ NO.

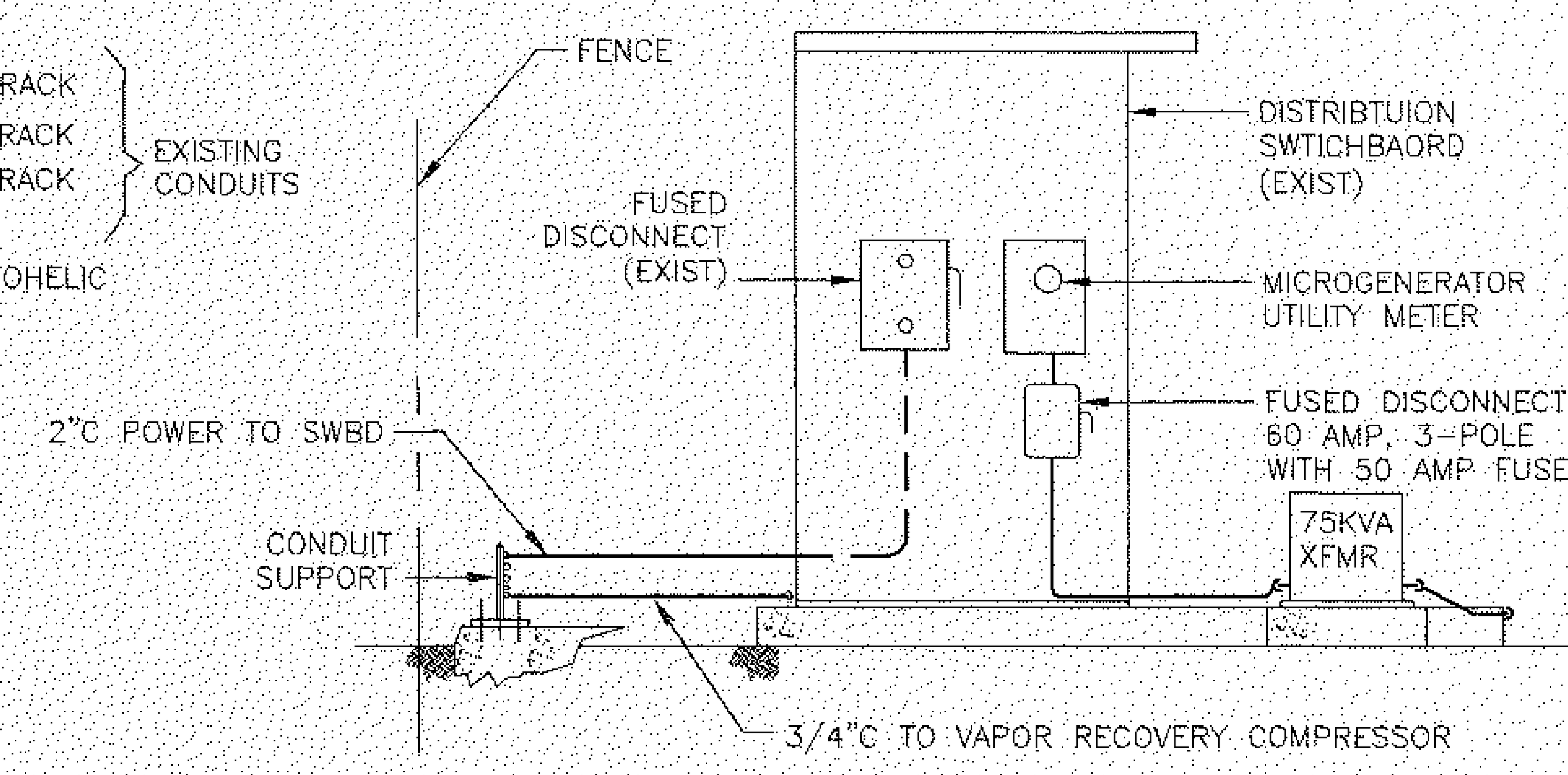
POWER ENGINEERING SERVICES INCORPORATED
2703 SATURN STREET
BREA, CA 92821
TEL: (714) 524-9100



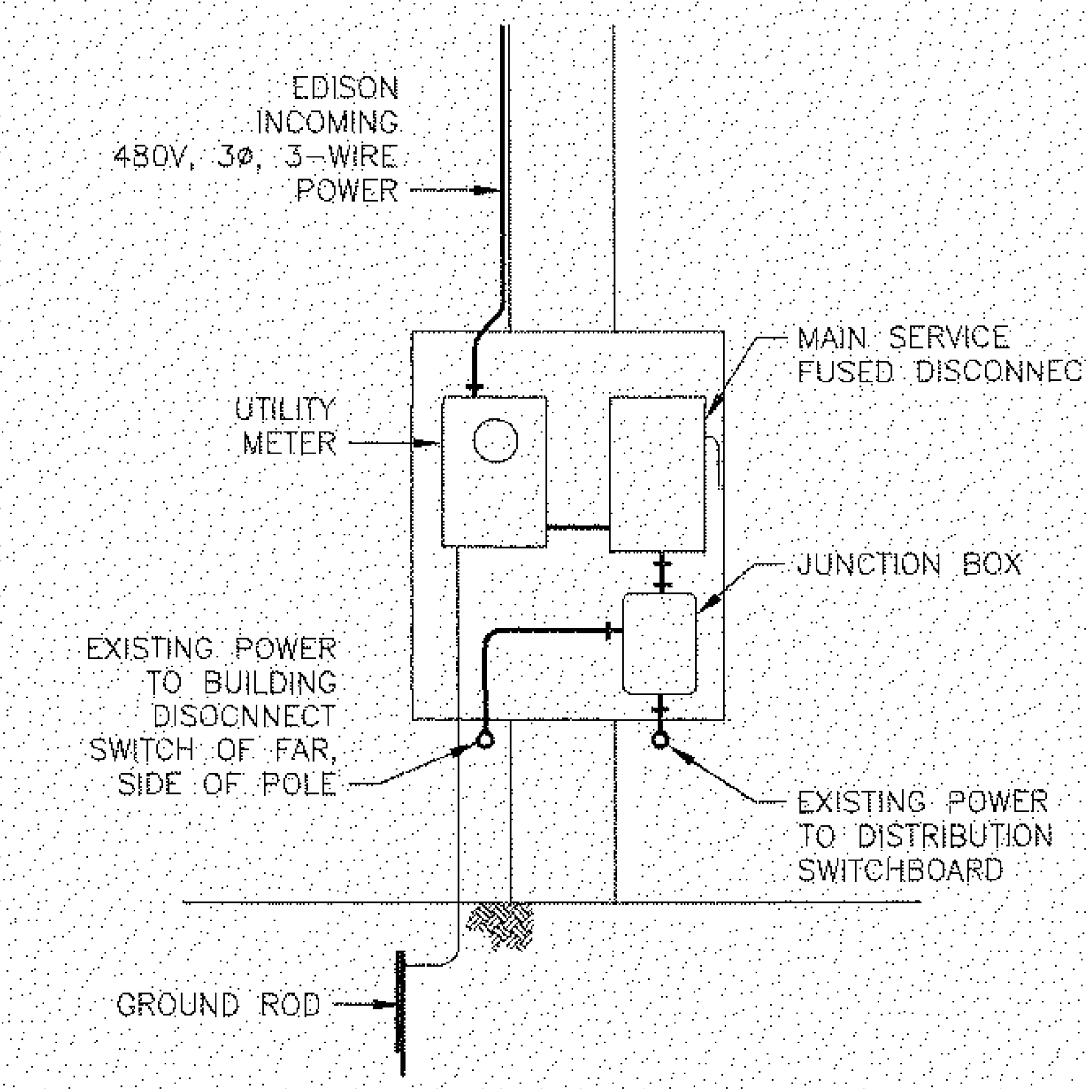
ENLARGED PLAN
SCALE:1/4"=1'-0"



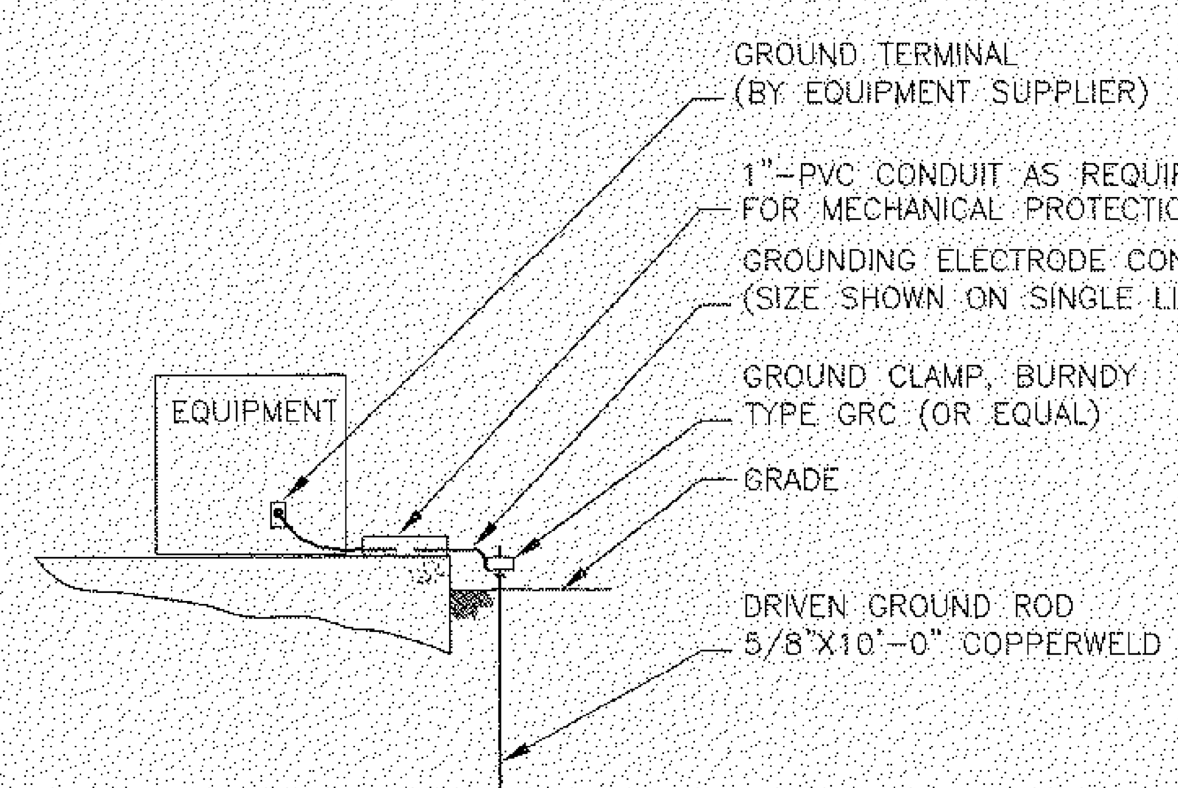
CONDUIT SUPPORT (A)
N.T.S.



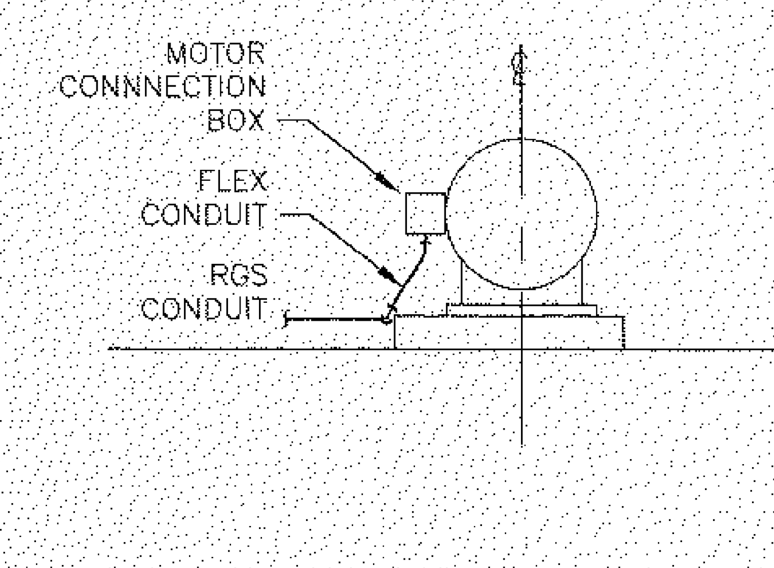
SECTION (B)



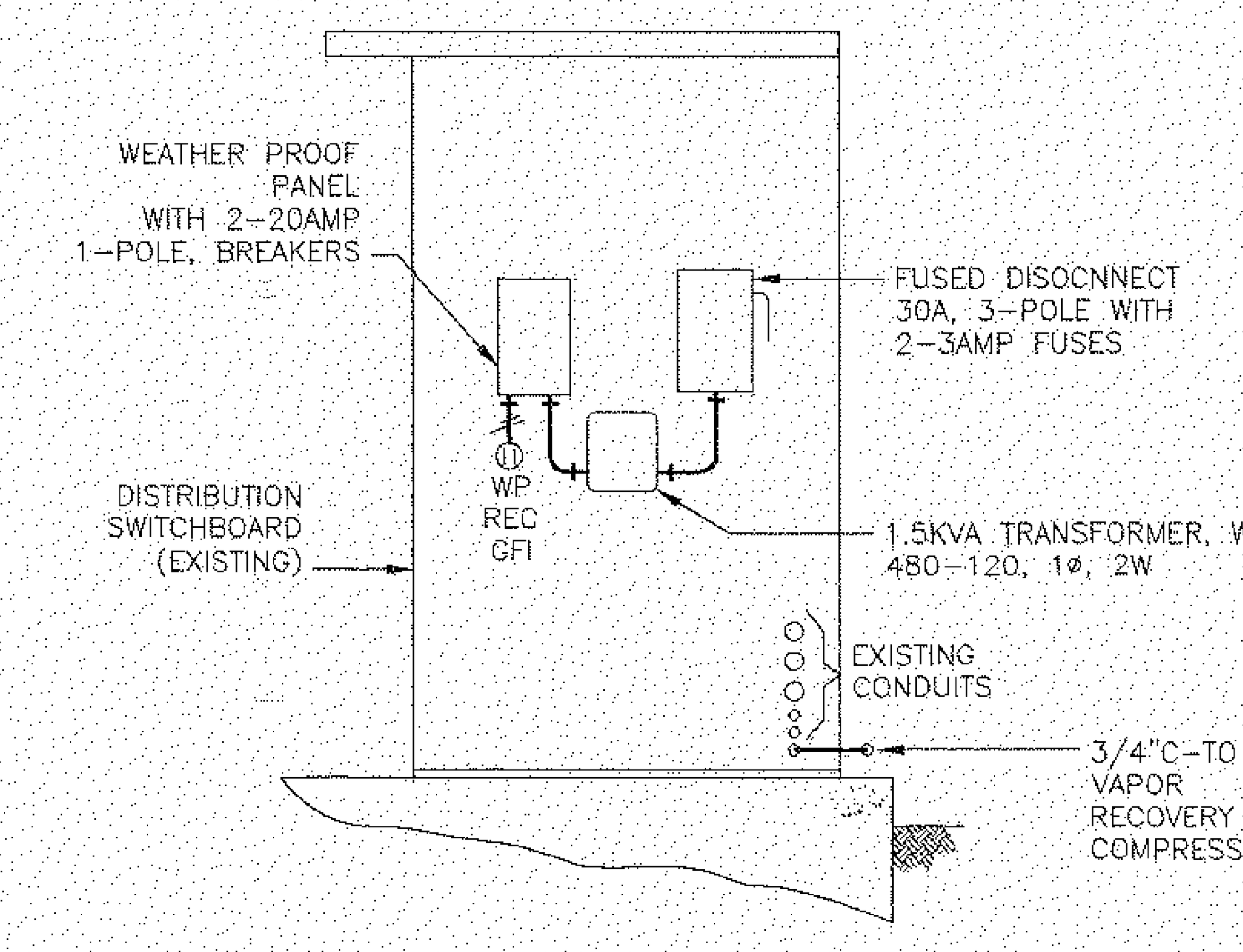
SECTION (D) E-102



GROUND ROD INSTALLATION DETAIL (2) E-104
N.T.S



MOTOR CONNECTION DETAIL (1) E-102
N.T.S



SECTION (C)

REF. DWG. NO. | DESCRIPTION | REV. | DATE | DESCRIPTION | REV. | DATE | DESCRIPTION

0 | 4/20/04 | ISSUED FOR CONSTRUCTION | DR. LKC | CH. TMH
B | 4/02/04 | ISSUED FOR PLAN CHECK | DR. LKC | CH. TMH
A | 3/22/04 | ISSUED FOR CLIENT REVIEW

THE TERMO COMPANY
3275 CHERRY AVENUE
LONG BEACH, CA 90801

PROJECT ENGR. LKC — DATE 03/12/04
DESIGN BY LKC — DATE 03/15/04
DRAWN BY JPP — DATE 03/16/04
APPROVALS P.E. — CLIENT APPR.

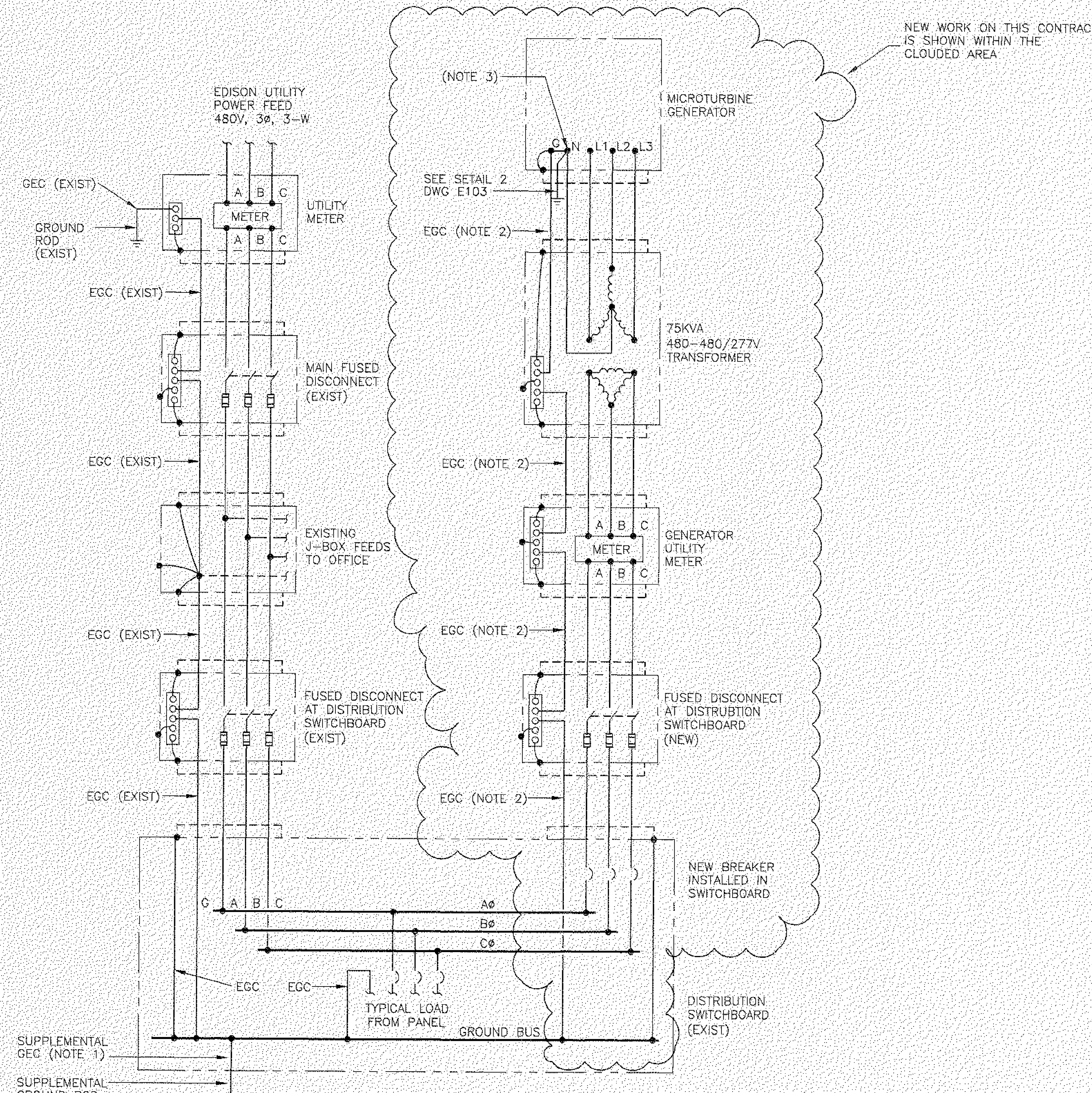
MICROTURBINE GENERATOR ADDITION
PLAN, SECTION & DETAILS

LONG BEACH — CALIFORNIA

SCALE: NONE | SIZE: D | PROJECT NUMBER: 3534-04 | DRAWING NUMBER: E103 | REV.: 0

CADD DWG. NUMBER3534 E103.DWG
DISCIP | TYPE | CODE | SEQ NO.

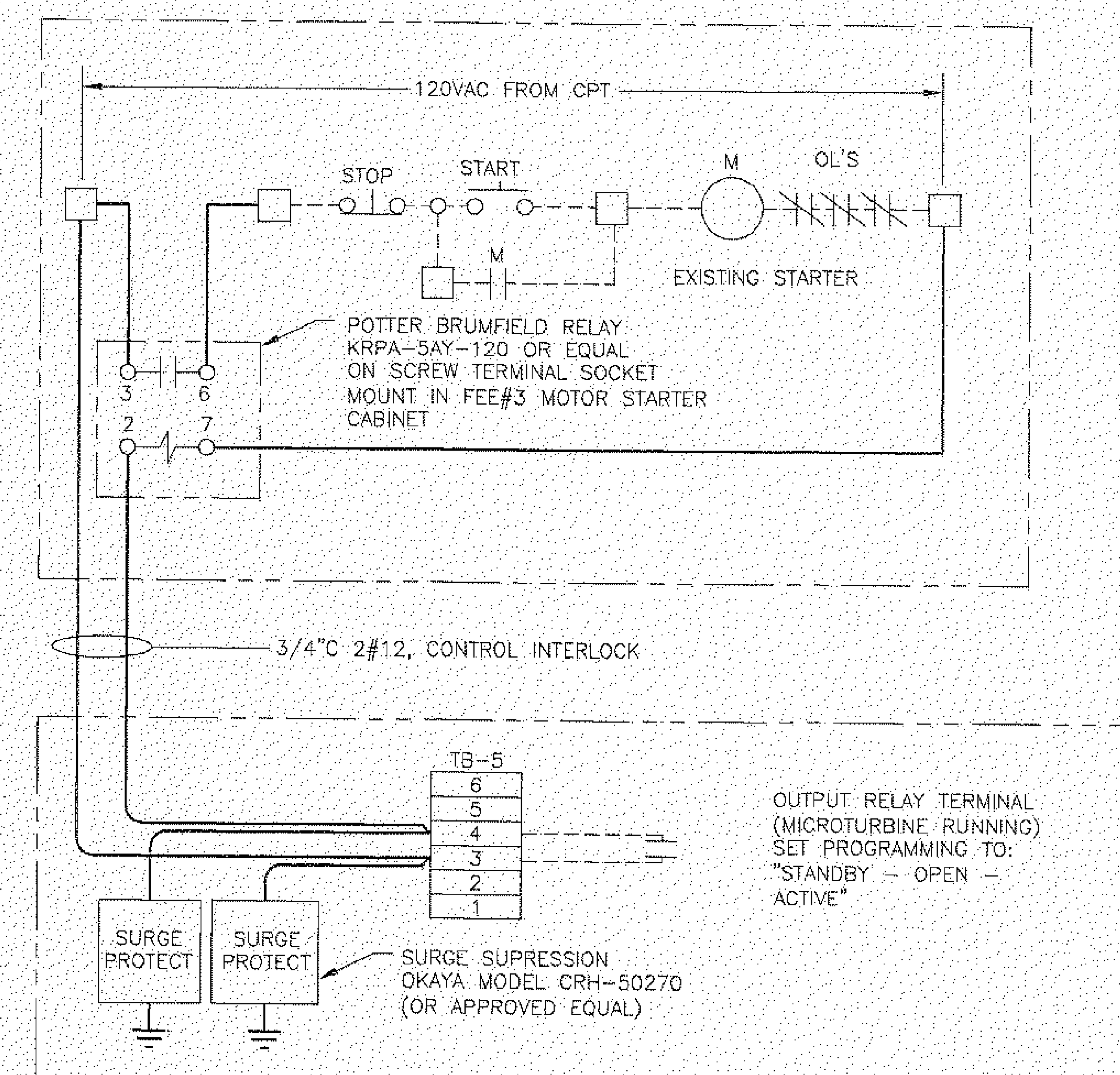
POWER ENGINEERING SERVICES INCORPORATED
2703 SATURN STREET
BREA, CA 92821
TEL: (714) 524-9100



GROUNDING DIAGRAM

GROUNDING NOTES

1. (GEC) GROUNDING ELECTRODE CONDUCTOR SIZED IN ACCORDANCE WITH CEC TABLE 250-66.
2. (EGC) EQUIPMENT GROUNDING CONDUCTOR SIZE IN ACCORDANCE WITH CEC TABLE 250-122. SEE DRAWING E101 FOR ESC SIZES.
3. THE MICROTURBINE IS DESIGNED FOR GROUND-REFERENCED, BALANCED PHASE-TO-NEUTRAL OPERATION AND MUST BE CONNECTED TO A 4-WIRE WYE CIRCUIT. THE 75 KVA TRANSFORMER IS PROVIDED FOR THIS PURPOSE. AN EARTH GROUND AT THE MICROTURBINE IS ALWAYS REQUIRED.



MICROTURBINE/WELL PUMP CONTROL INTERLOCK DIAGRAM
PREVENTS FEE#3 PUMP FROM RUNNING WHEN MICROTURBINE IS NOT OPERATING, AND STOPS FEE#3 PUMP ON LOSS OF MICROTURBINE GENERATOR

REV.	DATE	DESCRIPTION	DR.	CH.
0	4/20/04	ISSUED FOR CONSTRUCTION	LKC	TMH
B	4/02/04	ISSUED FOR PLAN CHECK	LKC	TMH
A	3/22/04	ISSUED FOR CLIENT REVIEW		

THE TERMO COMPANY
3275 CHERRY AVENUE
LONG BEACH, CA 90801

PROJECT ENGR.	DATE
LKC	03/12/04
DESIGN BY	DATE
LKC	03/15/04
DRAWN BY	DATE
JPP	03/16/04

MICROTURBINE GENERATOR ADDITION GROUNDING AND INTERLOCK DIAGRAMS
LONG BEACH CALIFORNIA

SCALE	SIZE	PROJECT NUMBER	DRAWING NUMBER	REV.
NONE	D	3534-04	E104	0

POWER ENGINEERING SERVICES INCORPORATED
2703 SATURN STREET
BREA, CA 92821
TEL: (714) 524-9100

CADD DWG. NUMBER 3534 E104.DWG

IR 70 with Vertical Free Water Separator and CHP Heat Loop

Sulfa-Treat Vessels with Lead/Lag Piping for Continuous Use

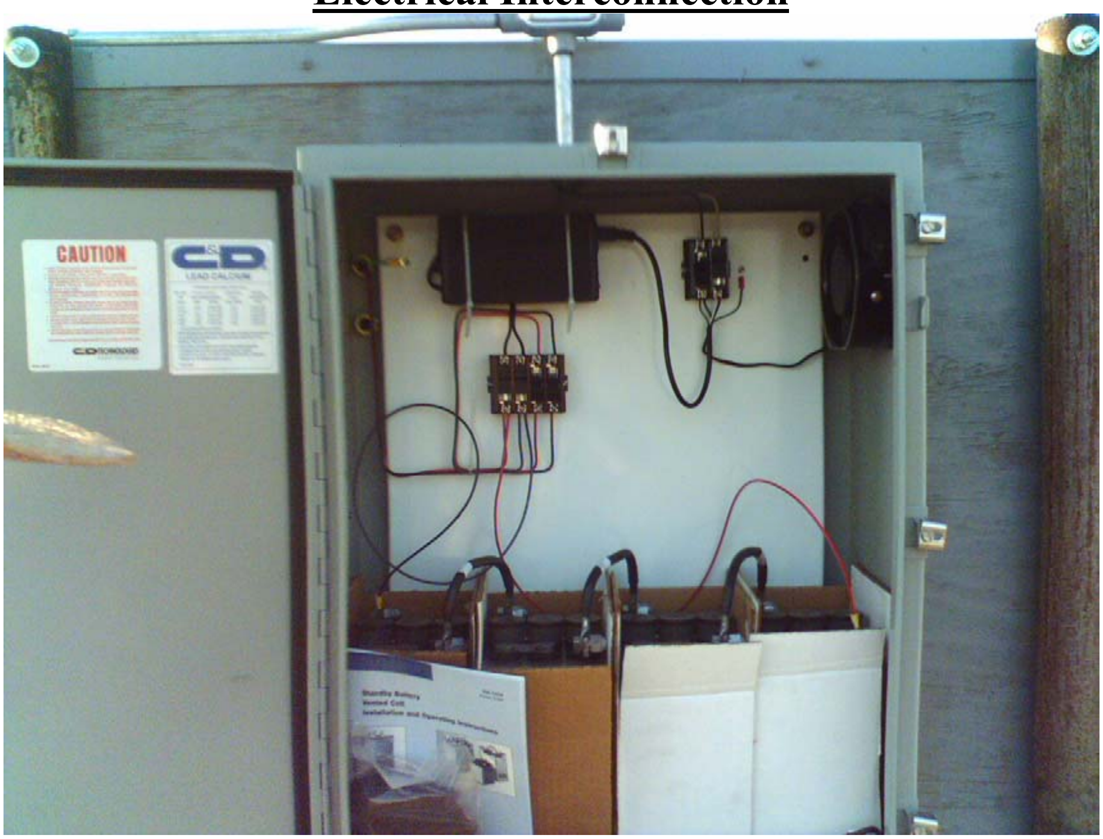
Electrical Meter

Double Redundant Beckwith Controller

IR 70 with CHP Heat Loop

Drilling & Production Process Falre

Electrical Interconnection

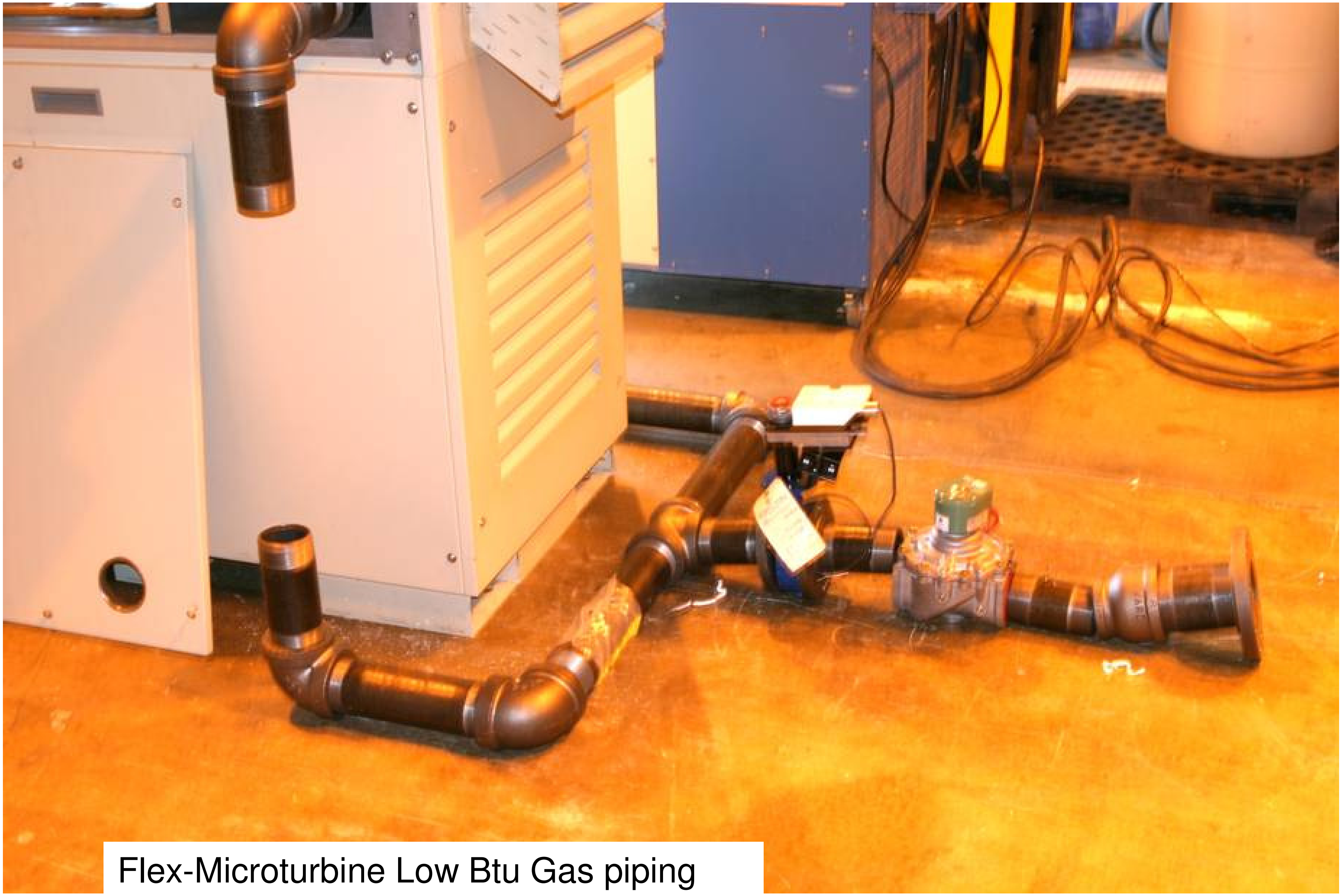


Battery Backup for Beckwith

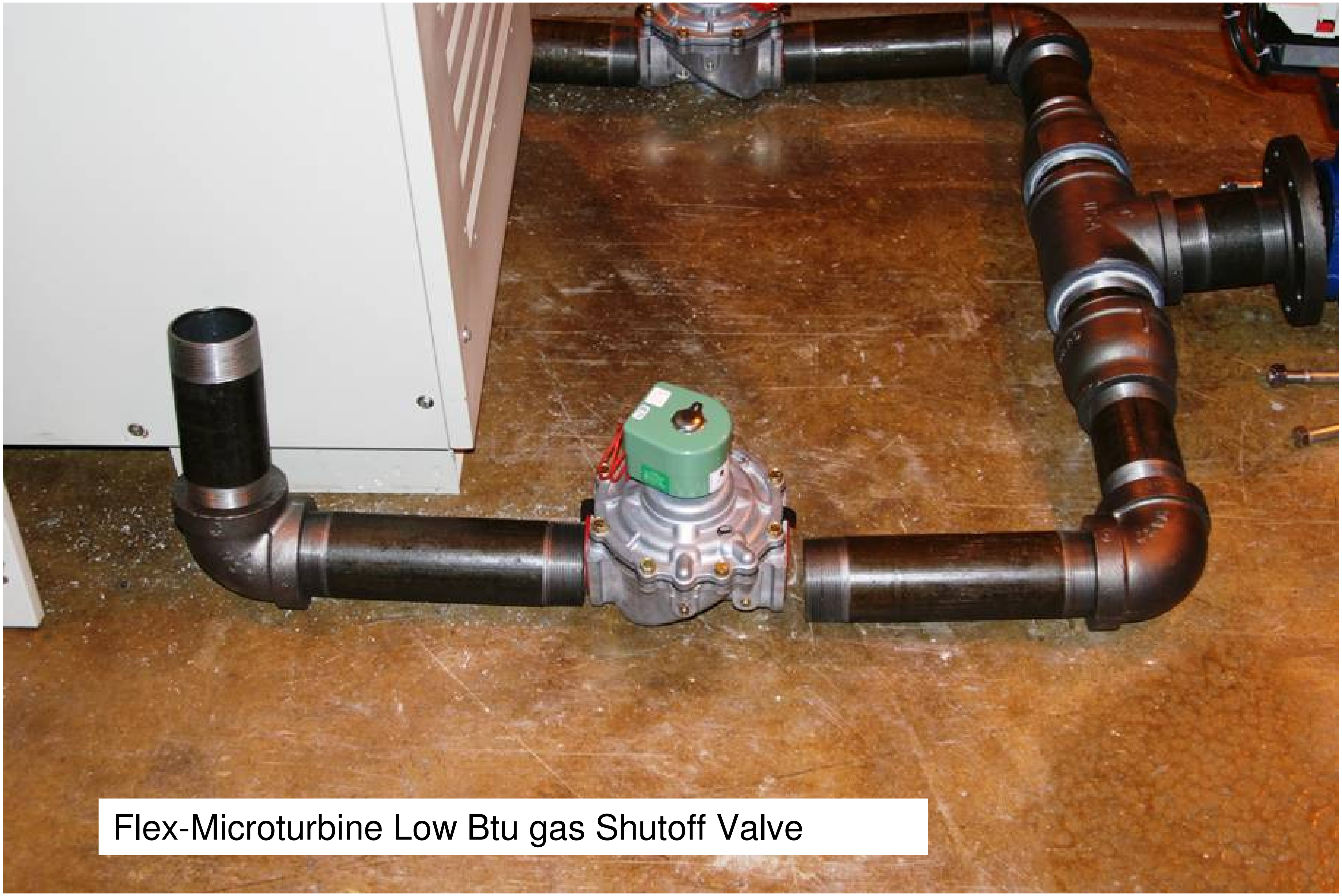
Power and Control Cable Trench

Turbine Pad Construction

Electrical Panel



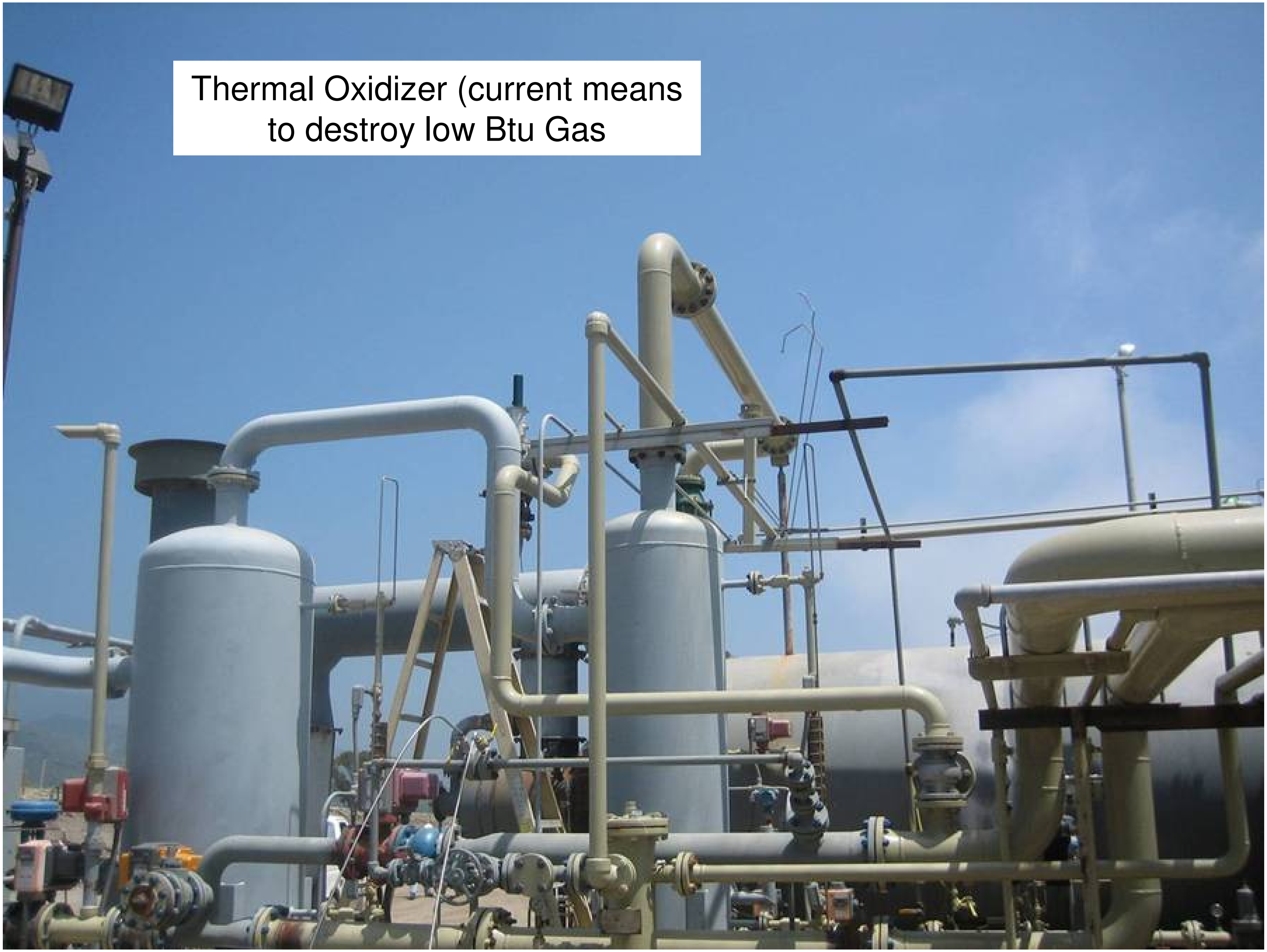
Flex-Microturbine Low Btu Gas piping



Flex-Microturbine Low Btu gas Shutoff Valve

Catalytic Combustor Dissembled

Flex-Microturbine on pad against Thermal Oxidizer background


Thermal Oxidizer (current means
to destroy low Btu Gas

St James site after over 3 years of no production.

Three Capstone C30 Microturbines installed

Vertical Free Water Separator with Refrigeration Dryer Unit

Electrical interconnection with Transformer

Rear Plumbing of C30 Units

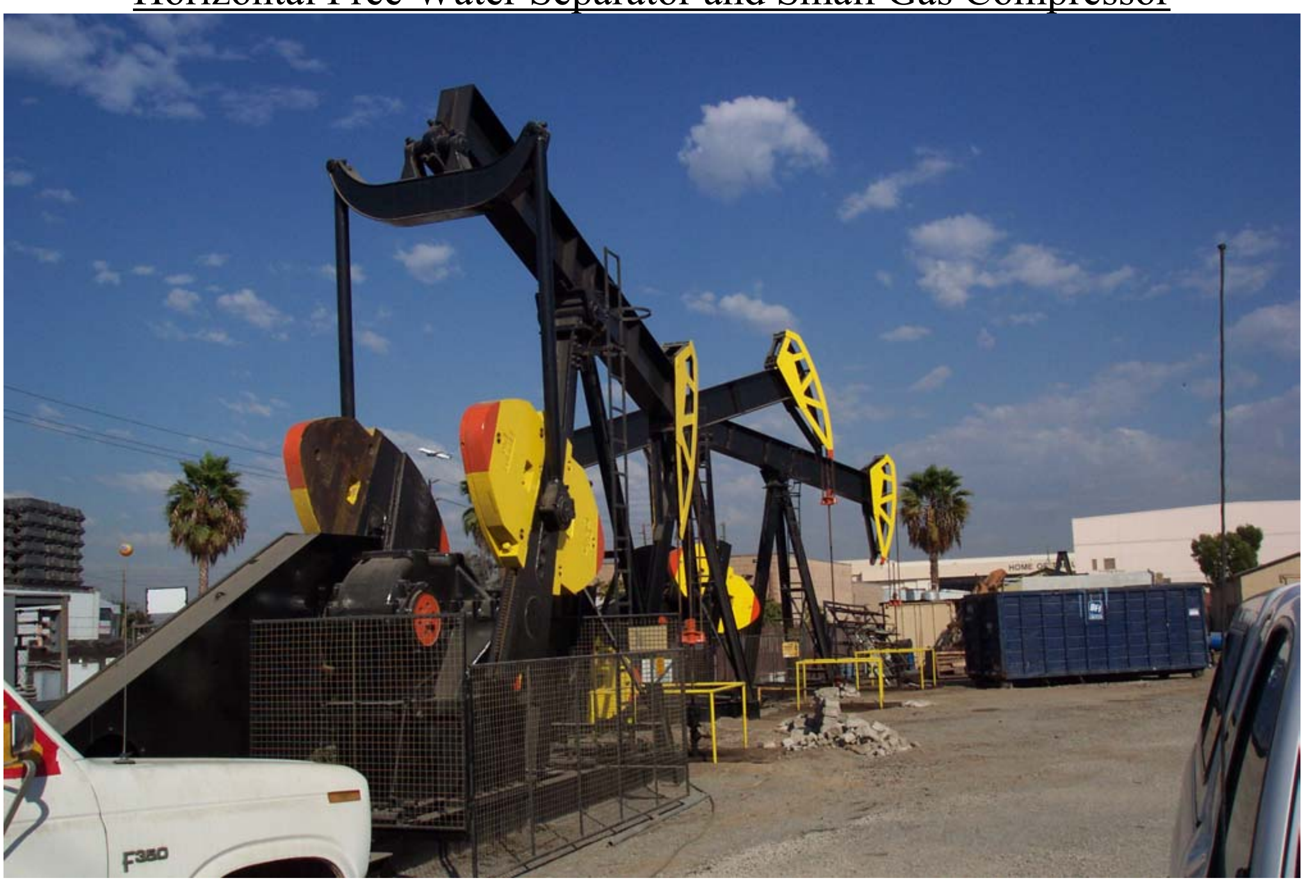
First Attempt at Soundproofing

Sound Proofing Blanket

Termo Site During Construction

Capstone C30 Turbine with Electrical Interconnection and Transformer

Horizontal Free Water Separator and Small Gas Compressor



Three Oil Wells Returned to Production after Several Years Idle

Interview with Chris Hall
General Manager of Drilling & Production's
Harsh gas site

- What was the biggest disappointment of the project?

    - Punitive rate structure. PG&E has levied stand by charges, departing load charges, reservation charges and a whole lot of other charges that make installing DG at my field an economic nightmare. If I go down for only 15 minutes once a billing period it triggers a whole lot of these charges and any savings that month are lost and in some cases my bill is larger than if I had not installed the DG

- In your view, what could be done to fix the problem?

    - I understand that there is a possibility of a tariff that would let me sell and wholesale market rates the surplus power that I generate. If I could sell the excess power or for that mater all the power produced then I would expect the project to be an economic success. I have an additional amount of gas going to boilers to make heat and to my flare that I could use to make electricity, 3 to 4 times what I am making now. If the production of electricity was a positive economic venture I would install extra generators to consume this stranded wasted gas. As a manager of a oilfield I have a responsibility to my royalty owners to run the field in the safest, environmentally prudent, and economically beneficial way. To be a prudent oil operator, I would need to install more DG if the economics justified it.

- What has been the reliability of the unit?

    - The turbine actually runs for long periods of time without any interruption. We have a total run time of about 92%. We have had several long stretches of run time, the longest being over 6 weeks. Change in our operation such as gas processing problems, changing out of the sulfa treat, can cause the DG to go down. The turbine can't run if we have a PG&E outage. This is a deliberate safety feature built into the unit. The big irony is that if PG&E has an outage for even a second, it trips off my turbine and then I go on to the draconian stand by rates. These PG&E caused trips happen frequently and every time they do the cash register at PG&E rings. I guess that they have a economic incentive to give me poor quality electricity. Add that to our limit on export where if we go over that limit it shuts down the unit I guess the fact that our run time is so high is quite an accomplishment for my operating staff.

- You mentioned not being allowed to export power to PG&E.

    - PG&E would like that I didn't export any power, and has not allowed me to export more than ½ the generators capacity. They really haven't given me a good reason for not accepting the excess power. They are not compensating me in any way for that power. I am sure that they sell that excess generation to another customer. We have a varying electrical load from turning on and off equipment during the day and if I find myself in a situation where I am exporting too much then we are shut in and back on stand by rates. I have installed electric heaters to dissipate the excess power and keep our export under control. It seems rather foolish to run electrical heaters when it is 110 degrees out side but we do it to keep the turbine on.

- What is your experience with the Sulfa-Treat.
    - We have had a hard time getting the H_2S out of our gas economically. The system works exceptionally well and stripping the H2S out but we are not getting the run time out of the medium that we would like. We looked at several different types of mediums and are looking into trying some different types
- Mechanically how has the turbine worked.
    - We had our share of startup problems but once they were worked out the turbine had worked very reliably. There seems to be a problem that I would think is a design issue with IR, with the main bearings. We have a master service agreement with IR which is a very good idea when purchasing DG no mater what the brand. Service has bee very good and the response of the service folks is also very good.

Interview with Dick Russel
General Manager of St James Oil
Medium BTU gas site

- What was the biggest disappointment of the project?

    - The economics. I seem to get little if no value for the power I produce. LADWP has the deck stacked against us. We do get what they call their "Avoided Cost" for the power we sell in excess, however the nickel and dime us with a laundry list of charges that negates any savings. I am paying about the same each month to LADWP even though I produce enough electricity to run my field.

- If economics are a problem, why did you do the project?

    - We get our value from the project from allowing us to operate the field. We take the high Btu gas from our field and run it through the turbines. That allows us to sell the good gas, 115-120 mcf/day to So Cal Gas, and to produce the wells at 80+ barrels of oil a day. From that standpoint it has been a very successful project.

- What has been the reliability of the unit?

    - Actually fairly high. 90%+/- We have had our share of mechanical problems but when the units are running they are fairly trouble free. When they do have a problem however it is fairly expensive to fix.

- Have you had further complaints from the neighborhood over the noise problem?

    - Not since we installed the sound blankets. They cut the sound down well below the legal limit. We had to have a professional sound engineer do a survey and then we had a blanket designed to eliminate the specific frequency the turbines were emitting. I think that part of the sound problem was that the field had been idle and very quiet for several years before we installed the turbines. The turbine puts out a very high pitched noise, sort of like a jet engine, that is not very high on t he decibels scale, but is offensive and therefore needed to meet a much lower DB rating. Late at night when the ambient noise level was low you could pick out the turbine noise from the neighborhood. Now with the blankets it is hard to tell if they are running or not.

- Do you have any plans to expand the project on your own.

    - We came by 9 extra units when we acquired an oil property. They had been leased and we bought the units from the leasing agency. We are using some of them for spare parts and plan to install 2 maybe 3 of the units when we get the time and if LADWP assures us that it will be economic to do so.

Interview with Dennis Conley
Project Manager of DECOR Oil
Low BTU gas site

- Why did you decide to participate in this project?

    - DÉCOR specializes in operating hard and expensive to operate oil properties. Much of our production is offshore. We look for technological solutions to make a property easier and more profitable to operate. The Flex turbine had and still has the potential to greatly reduce our operating costs. At the Rincon site we are taking tale gas, waste gas, from an Ammine process that strips out the CO_2 from our produced gas. This waste stream is almost all CO_2 with a small amount of methane that brings the total heating value up to between 15 and 45 Btu/scf. We know of no conventional method to dispose of this waste stream without adding good sales gas that we would be able to otherwise send down the pipeline and sell. The Flex turbine, if developed, has the potential of eliminating this waste stream without the addition of sales gas and to make electricity. Potentially a win, win situation for DÉCOR.

- What was the biggest disappointment of the project?

    - We didn't get to fully test the unit because of lack of funds. We knew fully well that this was an R&D project and that there were risks. We enjoyed working with the OFFGAS team and were pleased with the progress. We did have some equipment component failures that set us back and we ran out of budgeted money before we were able to achieve the successes that we feel were inevitable.

- What did you learn from the project?

    - A gas feed stream of 15-45 Btu/scf is so low and so far below what is normally required to sustain combustion, usually above 350 Btu/scf, that we had our doubts that any machine could operate in these conditions. The Flex did however prove that it could continue to run in these very weak gas streams. This gave us a great deal of hope for this technology. We look forward to completing the project if additional funding can be found.

- Do you have any plans to install other DG at your property?

    - We are in construction with 2 IR 250kW machines at one of our offshore platforms. We are very interested in CHP. We have a lot of need for heat in our processes and the CHP aspect of making electricity along with the needed heat is very attractive to us. We have looked at replacing our thermal oxidizer that we currently take a lot of waste heat from with turbines, but the economics though close don't pencil out at this time.

Interview with Trent Rosenlieb
Production Manager of The TERMO Co.
High Btu gas site

- Why did you participate in the OFFGASES project?
    - We had 3 wells that had been idle for 3-4 years because we lost a pipeline easement that would deliver the gas to a site where it could be blended with on-spec gas and used. We felt with the rising oil prices these 3 wells were economic, and the electricity could help keep the operating cost down. We could also use the extra electric produced to help power a building that we had nearby.

- What was the biggest challenge with the project?
    - We thought going in that permitting through AQMD and the electrical interconnection permit with SCE would be big challenges, but those processes went fairly smoothly. We had some maintenance problems in the early part of the turbine operation. We also didn't get the volume of gas we had before we shut in the wells for 3 years. Turn down of the Capstone Microtrubines to match the new smaller gas volume was a problem that we solved when we found an independent service company that were ex-Capstone employees and were able to set up the turbines to run at the lower rate.

- How is the reliability of the equipment?
    - Once we got the turbines set for the lower gas volume they have run just fine for over a year. The turbines need to run continuously. Shut downs are very hard on the equipment and shorten the useful life of the equipment. We had much more trouble calls when we were running the equipment intermittently. We would shut in the turbines every night when we went home and turn them on in the morning. This was very hard on the equipment

- Was the project an economic success?
    - Yes. We are very pleased with the economics at our lease. We have worked over the wells and increased the oil production from 10-15 bbls/day to 35-40 bbls/day. At today's oil prices this is a very economic operation.

- Would you consider installing turbines where you have more stranded gas?
    - Absolutely. We feel that we now have the expertise to operate these turbines and make a profit with them. This is an environmentally sensible solution to stranded gas.

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GLOBAL EXPLORATION & PRODUCTION NEWS • TECHNOLOGY UPDATES • ANALYSIS

Using stranded gas to revive production

Energy generated from waste gas restores marginal fields.

By Judy Maksoud, Senior Editor

A US Department of Energy (DOE) project is turning stranded natural gas at marginal or low-production oil fields into fuel for distributed electric power.

This breakthrough in using stranded gas is bringing previously idle oil fields back into production and could boost domestic oil production by 28 million bbl per year within 10 years of its inception, according to the DOE.

Typically, associated gas is vented or flared, re-injected, or left in the ground. A project called

A 30 kW flex microturbine is now generating electricity on a California oilfield by burning ultra-low-BTU gas.

Oil Field Flare Gas Electricity Systems (Offgases), which is managed by the Office of Fossil Energy's National Energy Technology Laboratory (NETL), has recently introduced another way to deal with stranded gas. This new solution is turning waste gas into fuel for distributed generation power units at marginal well sites in California.

Mature oil production sites are often heavy electricity consumers. According to the California Oil Producers Electric Cooperative, electricity accounts for 40% to 60% of the operating cost of oil production and delivery, and it represents one of the highest expenses in producing marginal oil wells. Pump jacks and other oilfield equipment are run by electricity, and in California, power to operate the equipment is purchased from the utility grid. As a result, the cost of energy figures heavily in the decision to produce or abandon a declining field.

By using microturbines to harness the stranded gas and generate low-cost electricity — which according to the DOE is usually 20% to 40% of the cost of utility grid electricity — the Offgases project is increasing oil production in fields that were previously cost prohibitive to produce. In electrical terms, the equivalent of about 45 MW of potential electrical generation has been identified as stranded gas.

The Offgases project demonstrates how associated gas of various heat content values and quality can be used to generate electricity. This research has been applied in four field installations: one using a high-British thermal unit (Btu) stranded gas with a value above 1,600 Btus per standard cubic foot (scf) of gas; one using a medium-Btu gas that does not meet the quality requirements for commercial pipelines in California; one using harshly contaminated fuel gas with high levels of nitrogen, carbon dioxide, and hydrogen sulfide; and one using ultra-low-Btu gas (below 300 Btu/scf).

The high-Btu gas project involves stranded gas containing more than 1,600 Btu/scf. The oilfield had been shut in for eight years because the operator had no means of handling the natural gas associated with the oil being produced from the field. Researchers chose a Capstone 30-kW microturbine for the project, coupled with a horizontal scrubber to remove produced water, and a small compressor to achieve the line pressure needed for the turbine. After the wells were reworked, production increased to 23 b/d. Production was estimated at about 9,000 scf/d of 1,650-Btu/scf gas.

As of June 2007, researchers were monitoring the project and collecting runtime and equipment reliability data as well as air emissions and operating maintenance figures.
A second application of the new technology took place in a well producing medium-Btu gas that did not meet the quality requirements for commercial pipelines in California. Three Capstone 30-kW microturbines were installed on site to generate power, and a large compressor was added to achieve the pressure needed for the microturbines. The solution also included a vertical scrubber to remove associated liquids and a small refrigeration dryer. The 19-well field that had been at risk for abandonment is now producing 150 b/d of oil, according to a report by the DOE.

The third field in the demonstration contained "harsh" gas — gas that contains naturally high levels of nitrogen, carbon dioxide and hydrogen sulfide (H2S). The unusable gas was being flared, but as of Sept. 6, 2006, enough H2S is being scrubbed from the gas to bring air emissions into compliance using a patented sulfur treating system.

Now, an IR 70-kW microturbine generates electricity through an interconnect permit with Pacific Gas & Electric. The system produces two segregated streams of gas, one containing about 6,000 parts per million H2S and the other containing no H2S. The separate streams allow researchers to test various concentrations of H2S. As of late 2007, researchers were in the maintenance and monitoring phase of the project, collecting runtime and equipment reliability data along with operating maintenance figures.

The fourth demonstration in the Offgases project addressed ultra-low-Btu gas, in this case, defined as gas containing as little as 15 Btu/scf. Because gas of this low quality is not flammable, the operators had been spiking the weak gas with purchased commercial natural gas so the gas could be flared.

As part of the NETL-funded project, operators on this field are now using a 30-kW Flex microturbine to generate electricity. This microturbine employs a new technology that uses catalytic combustors and runs on 15-Btu gas. While the microturbine is working, improvements are still needed to turn this field into a success, the DOE said.

Reservations aside, the present situation that has eliminated flaring along with the cost of adding commercial gas to make flaring possible is an obvious step in the right direction.

Publications
News Release

Release Date: July 24, 2007

Oil and Natural Gas Program Uses Stranded Gas to Revive Oil Production

Project Generates Energy from Waste Gas to Restore Marginal Fields

WASHINGTON, DC — A U.S. Department of Energy (DOE) project is turning "stranded" natural gas at marginal, or low-production, oil fields into fuel for distributed electric power. The breakthrough is bringing previously idle oil fields back into production and could boost domestic oil production by some 28 million barrels per year within the next 10 years, helping to reduce the Nation's dependence on foreign oil sources.

Stranded gas is natural gas that is uneconomic to produce for one or more reasons: the energy, or Btu content, may be too low; the gas may be too impure to use; or, the volume may be too small to warrant a pipeline connection to the gas infrastructure. Non-commercial gas is sometimes produced along with oil, becoming an environmental liability. This unwanted byproduct of oil production has become a major problem in California oil fields where producers have been forced to abandon sites early, leaving valuable reserves of domestic oil untapped.

Typically, there are three ways to deal with stranded gas: venting or flaring the gas contributes to air pollution without any beneficial offsets from the gas; using electrical energy to re-inject the gas incurs significant extra costs; and, shutting down oil production leaves valuable oil in the ground.

Researchers have recently found another, useful, way to solve the stranded gas problem. A project managed by the Office of Fossil Energy's National Energy Technology Laboratory (NETL) called the Oil Field Flare Gas Electricity Systems, or OFFGASES, project, is turning this waste gas into a valuable fuel for distributed generation power units at marginal well sites in California.

Oil production sites are heavy electricity consumers. According to the California Oil Producers Electric Cooperative, electricity accounts for 40 to 60 percent of the operating cost of oil production and delivery, and it represents one of the highest expenses in producing marginal oil wells. In California, equipment such as pump jacks are all run by electricity, and this power must be purchased from the utility grid. This figures heavily in deciding which sites remain economical to produce as oil production declines and which ones must be abandoned. By using microturbines to harness the stranded gas and generate low-cost electricity - usually at 20 to 40 percent of the costs of utility grid electricity - the Distributed Generation/OFFGASES project is increasing oil production in previously hopeless fields, making use of a fuel that was previously considered unusable and uneconomic to produce. In electrical terms, the equivalent of about 45 megawatts of potential electrical generation has been identified as stranded gas.

The project is conducting four field demonstrations with fuels of varying energy contents and quality. Three of the demonstrations have shown success so far:

A demonstration using high-Btu gas, which contains more than 1,600 Btu per standard cubic foot f gas, boosted oil production in its three-well marginal oil field from 10 barrels per day to 23 barrels per lay.

A demonstration with medium-Btu gas, which does not meet the quality requirements for ommercial pipelines in California, is now producing 150 barrels of oil per day in a 19-well field that had een at risk for abandonment.

A field containing "harsh" gas, which contains naturally high levels of nitrogen, carbon dioxide, nd hydrogen sulfide, has been brought into compliance with air emissions regulations by scrubbing ydrogen sulfide from the gas using a patented sulfur-treating system.

The fourth demonstration deals with ultralow-Btu gas, which has as little as 15 Btu per standard cubic foot of gas. This gas is of such low quality that it's not immediately flammable and therefore cannot even be flared; operators have been spiking the weak gas with purchased commercial natural gas just to flare it. As part of the NETL-funded project, operators are now using FlexEnergy's Flex-Microturbine, a new technology that uses catalytic combustors and actually runs on 15 Btu gas. While the microturbine is working, improvements are still needed, and researchers are testing the equipment needed to turn this field into another success.

NETL demonstration partners include FlexEnergy, the Interstate Oil and Gas Compact Commission, California Oil Producers Electrical Cooperative, California Energy Commission, and California South Coast Air Quality Management District.

The project was awarded under DOE's Office of Fossil Energy's Preferred Upstream Management Practices program, which aims to slow the decline in America's oil production by pairing "best practices" and solutions from new technologies to an active campaign of disseminating information to domestic producers.

Contact: Mike Jacobs, FE Office of Communications, 202-586-0507

Center for Cooperatives

Co-op Energy Symposium

University of California

PROCEEDINGS

Edited By
Shermain D. Hardesty
Director, Center for Cooperatives

May 14, 2002

Doubletree Hotel, Sacramento, CA

CO-OP ENERGY SYMPOSIUM

SPONSORS

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Kenneth R. Farrell, Center for Cooperatives

The Co-op Energy Symposium was funded by a USDA Rural Cooperative Development Grant.

CO-OP ENERGY SYMPOSIUM

PROCEEDINGS

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CO-OP ENERGY SYMPOSIUM

PROCEEDINGS

I. Setting the Stage

Bill Julian, Director of Office of Governmental Affairs, California Public Utilities Commission

Introduction

Disclaimer: These are personal views and do not represent view of President Lynch or PUC.

Indiana Rural Electric Cooperative Movement

Formed Hoosier energy cooperatives statewide with ethic of self-sufficiency and self supply

Deregulation in California

Integrated system of supply being dismantled in order to create market opportunities for sellers of energy

Opportunity for co-op principles and practices

Surprise Valley Electrification Corp., Plumas-Sierra Rural Electric Cooperative and DeAnza all good co-ops but don't represent large rural electric areas

Lee Ruth, David Thompson & Bob Marshall organized ag co-ops with electricity supply need

1997 Conference through Ag Council brought together CEC, NRECA, Northern California Power Agency in organizing co-ops

Creation of two aggregation co-ops

Co-ops

People - must recognize common needs, goals, opportunities; find each other and work together combining skills and insights

Resources - need time, money and investments

- California Electric Users Co-op most successful aggregation co-op

Make commitment over long period of time and stick with it - take out long term loans

Struggle

Enron "disaster"

How are vulnerable consumers to retain assets?

- Energy not like other commodities - energy "crucial"
- Where are resources going to come from?
  - Center for Cooperatives
  - CoBank

II. Where Co-ops Fit in This Picture

Bob Marshall, General Manager, Plumas-Sierra Rural Electric Cooperative

What is Plumas-Sierra Rural Electric Cooperative (PSREC)?

- Member-owned Electric Co-op
  - 6,500 Electric Meters
  - 6,400 Small Dish Customers
  - 500 Large Dish Customers
  - 2,700 Internet Customers

PLUMAS–SIERRA REC
Electricity • Satellite TV • Internet
Shaping the future together.

Where are we?

- Lassen, Plumas, & Sierra Counties, CA
- Washoe County, NV

PSREC's Business Philosophy

- Improve the Quality of Life of our Member Owners
- We are determined to prove that doing the correct thing can be a win–win–win situation for all three.
  - Environment
  - Members/Customers
  - Rural Utilities

Co-op energy programs

- GeoExchange Heat Pumps
- Solar Photovoltaic Program
- Energy Audits
- Water Heater Program
- Electric Thermal Storage

New Cooperative Development

- Launched in 1996
  - Protect under-served consumers.
  - Partners included Plumas-Sierra, Bill Julian &Associates, NRECA, CEC, CFC, UC Center for Cooperatives, and others.
- Started with Agricultural Cooperative and Green Cooperative

Why Cooperatives?

- Cooperative models allows aggregation to size necessary to participate in markets, and also allows size necessary to afford required expertise.
- Non-government structure allows statewide efforts.
- Negatives associated with government avoided while member control is kept.

National Rural Electric Cooperatives Association (NRECA)
- 855 Distribution Cooperatives, 64 Generation and Transmission Cooperatives
- One Director from each state with a Cooperative.
- Primary responsibilities are Legislative and Regulatory, Research, Education, Benefits, and Management Services.

National Rural Utilities Cooperatives Finance Cooperation (CFC)
- Self-financing for Electric Cooperatives.
- Established 1973 in response to changes in REA program.
- Access to cost-based capital is key to electric cooperative success.
- CFC currently has access to $21 Bil, with $3 Billion in equity investments by members

California Electric Users Cooperative
- 17 Agricultural Cooperatives throughout California
- 470 grower owners
- 2,500 Meters
- 55 Megawatts peak load
- 90% of all Agricultural Direct Access Customers

California Oil Producers Energy Cooperative
- 100 + Pumps
- 50 to 150 MW depending on the program.
- 85% Load Factor
- 1 to 1.75% discount off of tariff.
- Demand Bidding worth 10 times as much as aggregation effort.

Golden State Power Cooperative
- Three primary functions
  - Legislative and Regulatory
  - Cooperative Development
  - Power Purchasing coordination, Demand Bidding, Dist. Generation, etc
- Plumas-Sierra, CEUC, COPE, Anza, and Surprise Valley are members.

Clean Power Cooperative
- Energy Commission supporting green with $.01 per kWh.
- 10% of population willing to spend 10% more for "green" electricity. Power now a commodity.
- Cooperative model offers member control and cost control, two key elements of renewable energy.
- On hold due to changes in laws.

Lessons Learned
- Birds of a Feather Flock together.
- Leadership is key in organizing and producing long-term value.
- The value needs to be clear enough to get people to commit time and energy.
- The steps to success can not be overwhelming

III. NOTE: No Proceedings are available for the Session, Legal Processes & Issues

Nancy Montague, NRECA-moderator
Van Baldwin, CPA & Attorney, California Co-op Corporation Law
Dennis DeCuir, Attorney, Rural Electric Cooperatives/Municipals
Charles Wolfmann, Attorney, California Food & Agriculture Code

IV. Repowering California

Robert A. Laurie, Commissioner, California Energy Commission

Introduction
Market - driving force behind co-ops
Short-term forecast, energy policy & regulatory reform all important to market

Short-term forecast
2002 electricity summer outlook - not noteworthy
Future - in 2004, will not adequate reserves of power
May be tested as early as 2003
Voluntary conservation; rain weather in mid & southwest will help in short-run

Energy Policy
"Peaking" power - cut down on power during peak hours
Changed to energy efficiency and conservation statewide just recently this year
Relying on independent producers for future power
Imperative that administration make policy decision

1) retain competitive market,
2) 2) promote public power
3) 3) return of regulated marketplace and amend laws accordingly

Failure in leadership of executive branch - state overall energy policy non-existent and to extent that it does exist is contradictory; no one person in charge of energy policy

Regulatory Reform
Possible to effectuate legislative priorities that currently do not favor basic principles of co-ops (voluntary membership, democratic control, supplies to consumers, decisions based on common good for members)
Need immediate and aggressive action

V. TAX & FINANCE: PROCESSES & ISSUES

Lee Ruth, Lee Ruth & Associates, Moderator

Steve Piecara, Tax, Finance & Accounting Policy Director, NRECA
<u>Electric Co-op Tax Exemption</u>

Requirements for Electric Co-op Tax Exemption

Electric co-ops' tax status is addressed at **IRC §501(c)(12)** -

1. "**Like organization**" to telephone.
2. Apply **cooperative principles**.
3. Meet the **85/15 test**.

85% Member Income Test

85/15 test is **applied <u>annually</u>**; can flip-flop from tax-exempt to taxable status based on results of 85% test

On-going debate on use of **gross income *versus* gross receipts**

Instructions to the current Form 990 prescribe the use of **gross receipts**

Like Organizations

"**Like organizations**" are those that perform ***utility-type services***.

Also permitted are **ancillary services**, either-

1. ***Insubstantial***, or
2. ***Incident to and in furtherance of*** utility services.

Like Organization Activities **Qualifying**

Water/Wastewater
Natural Gas
Cable TV/DBS
Local Exchange Carrier (LEC)
Internet
Home Security, Medical Alert

Qualifying w/ Conditions

Paging w/LEC
Long Distance w/LEC

Cooperative Principles--Must operate under **key co-op principles** -

1. ***Subordination of capital***.
   Prohibits a co-op from operating for the purpose of **providing a *return on common equity***.
   Establishing **for-profit activities** in a **subsidiary** may pose problems.
   Tech Advice attributes activities of wholly owned subsidiary to parent co-op.
   Operation at Cost
2. ***Democratic control*** by the members

Qualification as a Member--In general, **member** must have right to -

1. ***Voice* in management**.
2. **Share in *patronage capital***.

3. ***Operation at cost*** by allocation of margins to members in proportion to business done.

Can charge ***different prices*** **for different products/levels of service**.
But, cannot sell product at **prices below cost** to ***cross-subsidize*** other products.

Unrelated Business Income Tax (IRC §511-514)

Income from ***trade or business***;
If ***regularly*** **carried on**; and,
Not substantially related to performance of **tax-exempt activity**.
Interest and rental income generally ***excludable*****, unless from** a controlled **subsidiary** or **debt-financed income**. (IRC §512(b)).

Form 990 Public Disclosure (IRC §6104(e))

Make ***application*** **for tax exemption** and past 3 years' ***Form 990s*** available for ***public inspection*** **during regular business hours**.
Provide ***copies*****, without charge** (other than nominal reproduction fee and postage) of ***application*** and ***returns*** when requested in person or in writing.

Operating as a Tax-Exempt Co-op

Confine diversified businesses to those qualifying as "***like organization***" activities.
Operate businesses on a ***cooperative basis***.
Derive 85% or more of ***income from members.***

Operating as a TaxableElectric Co-op

Electric co-ops **failing the 85/15 test** are **taxable**.
Taxable electric co-ops are governed by ***pre-1962 case law*** or ***Subchapter T***, depending on whether or not they are **rural**.
If capital credits are assigned, taxable electric co-ops generally **pay income tax only on** ***non-patronage-sourced income***.

Advantages of Taxable versus Tax-Exempt Status

Taxable

Far fewer restrictions on business activities.
Consolidated tax return is permissible.
Form 1120 not subject to disclosure.
Receive tax incentives offered to for-profit businesses.

Tax-Exempt

Activities limited to utility and ancillary.
No consolidated tax return.
Form 990 disclosure rules apply.
Most tax incentives not available to tax-exempt organizations.

Pre-1962 Co-op Law vs. Subchapter T (IRC §1381-1388)

Subchapter T

Patronage dividend deduction.
20% of patronage dividend must be paid in cash.
Patronage dividends taxable to recipient on assignment.

Pre-1962

Patronage dividend exclusion.
No cash requirement for patronage dividends.
Patronage dividends taxable to recipient on retirement.

Kathy Gordon, CPA, Aldrich, Kilbridge & Tatone LLP
Tax Filing Requirements

Check what type of coop you formed to determine what type of tax return to file
5 categories

- 501(c)(12)—tax exempt cooperatives
  - If pass 85% Member Revenue Test
    - Form 990, due 5/15
  - Fail 85% test
    - Pre-1962 cooperative case law
    - Form 1120, due 3/15
    - Patronage exclusion
  - Unrelated Business Activity
    - Federal Form 990T
    - All State activity is reported on Form 100
- Nonprofit mutual benefit corps—Other IRC Section 501 (c)s (like rural electrics)
  - Federal-Form 990 due 5/15
  - State of California-Form 199 due 5/15
  - Unrelated Business Activity
- Farmer or ag coops
  - Federal Form 990C due 9/15
  - 521 EXEMPT can deduct stock dividends, nonpatronage allocations & patronage dividends
  - non521 cooperatives must have 20% cash payment, deduct patronage allocation
  - State of California Form 100 due 9/15
- Other cooperatives—non ag, nonexempt
  - Subchapter T—1381, 1382 and 1383
  - treated like corporation for taxes
  - patronage dividend paid within 8 ½ months-=deductible
  - eg Golden State, Clean Power Coop
  - Federal Form 1120 due 3/15
  - State of California Form 100 due 3/15
- Regular corporation
  - Federal-Fully taxed on all income, due 3/15
  - State of California Form 100 due 3/15

Other Concerns
- Information reporting (1099s) to members for allocations and payments
- Other taxes
  - Payroll
  - Sales & local taxes

Karen Spatz, Business & Cooperative Specialist, USDA-Rural Development
Funding Opportunities for Rural Businesses

Divisions of USDA Rural Development
- Business And Cooperative Programs
- Rural Utility
- Rural Housing

Business and Cooperative Programs
- Rural Business Enterprise Grants
  - Eligible applicants:
    - Public Bodies
    - Private non-profit corporations
    - Federally-recognized Indian Tribes
  - Purpose is to assist in creation of new jobs and new businesses
  - Eligible Areas
    - Unincorporated rural areas and incorporated communities of less than 50,000 populations that are not becoming urbanized
  - Activities funded include:
    - Technical assistance for small business development
    - Revolving Loan funds to provide financing to small businesses
    - Capital expenditures to assist in development of small businesses
- Rural Cooperative Development Grant
  - Supports Centers to assist Cooperatives
  - Eligible areas are outside the urbanized edge of cities of <50,000 population
  - Center for Cooperatives, University of California has received grant money to develop new cooperatives and support educational programs
- Loans
  - B&I Guaranteed Loan Program
  - Federal Guarantee for lenders on their Rural Business
  - Purpose is to create and save rural jobs
  - Projects have to be rural areas
- Cooperative Development Assistance

John Rogers, National Rural Utilities Finance Corporation
An Introduction to CFC

MISSION STATEMENT

CFC is a not-for-profit cooperative whose mission is to provide its member utility systems — through their unified, collective strength — with an assured source of low-cost private capital and state-of-the-art financial services

INTRODUCTION

Formed in l969, CFC is a multi-billion dollar cooperative financial institution established and owned by more than l,000 member rural electric systems and related organizations nationwide

CFC meets the financing needs of its members through a variety of loans and specialized financing programs, investment opportunities and member services

The cooperative serves as a conduit to the private capital markets, providing competitively-priced financing for virtually all rural electric systems needs

CORPORATE OVERVIEW

CFC Has:

33 years experience in financing the RECs
More than 1,000 members nationwide
Governing Board serving limited terms elected from rural electrics by district nationwide
$23 billion in loans, commitments and guarantees
175 total employees, including 13 regional representatives
Total commitment and dedication to the rural electric program

In addition to providing financing programs and services, CFC also actively supports and provides assistance on may rural electric program issues, such as:

Rural development
Territory protection
Cooperative education

CFC, RECs AND WALL STREET

By acting through one national organization, rural electric systems can present themselves to the capital markets as a unified industry

They can engage the resources and trust of these markets much better than if each system were to present itself either separately

CFC deals primarily with Wall Street's premier first tier banking firms:

Lehman Brothers Goldman Sachs Merrill Lynch

CFC also maintains relationships with more than 50 regional and international banks to assure ready capital

CFC's Sources of Funds
- Members' equity
- Collateral trust bonds
- CFC Commercial Paper
- CFC Medium Term Notes

CFC – THE LENDER
- CFC provides a variety of loan programs to meet the broad spectrum of capital needs of its member rural electric systems. These include the following:
  - Long-term loans to finance land and equipment acquisitions, construction of facilities, and the purchase of materials and equipment
  - Lines of credit to meet the day-to-day cash requirements and operating expenses
  - Intermediate-term loans for interim project financing and for financing projects that may require a firm credit commitment
  - Specialized financing for qualifying projects
- CFC offers price incentives, including volume discounts, performance discounts and collateral discounts

CFC – MORE THAN A LENDER
- CFC offers a variety of financial service programs to help ensure that member cooperatives maintain optimum financial health

Access to Capital: Electric Cooperatives vs. Others—A World of Difference!
- The Banking Environment
- Collapse of Confidence
- Bankruptcies and Losses for Banks
- Huge Declines in Market Cap Values
- Costs of Raising Money is Higher Relative to Treasuries

Types of Credit Tightening
1.) Rejection
2.) Increasing Fees
3.) More Restrictive Terms
4.) More Equity

The Co-op Advantage
- Co-op Foresight is paying off
- Co-ops have long recognized that assured Capital access is essential
- Electric Co-ops do a wonderful job of protecting funding sources (RUS) creating funding sources (CFC)

CFC Financing
- Must be CFC member or (not for profit electric co-op), or Substantially owned or operated by CFC member co-op
- Need to have good reason for requesting financing, be financially ready, size & scope must be realistic, does it fit

CUEC

Partnered with Plumuas Sierra REC

CEUC member put up cash (by investing in CFC commercial paper as security for line of credit

New CFC Publication—Starting Smart-A Guide to Convergent Business Planning

Includes outline for a business plan

Budgeting, etc

COEF (Consumer Owned Energy Foundation)

Provides grants, loans and equity funding to eligible recipients

Funding may be used for new energy co-op development by new or existing cooperatives primarily for costs associated with:

Developing business plans

Initial feasibility studies

Legal or business costs of organizing the new energy cooperative; and/or

Providing equity funding to facilitate outside lending

Try to raise $ when refunding patronage capital

VI. NEW WAVE ENERGY CO-OPS

Linda Kelly, California Energy Commission, Moderator

Eric Larson, San Diego County Farm Bureau & San Diego County Agricultural Energy Cooperative

The Ag Experience

Formation

County felt deregulation electricity price increases quickly

Began Research in December 2000

Incorporated in March 2001; Farm Bureau "loaned" Eric to form cooperative

Got some financial incorporation fee support from County

Served solely by San Diego Gas & Electric

Farms are interspersed with urban developed

Ag coops don't serve San Diego farmers

Hit many dead ends being idealistic, including diesel

Sought Self-Sufficiency for Growers

Polling of Prospective Members

Energy Sources

Electricity–Efforts Stifled by Legislation and Administration

Diesel–No Advantage Available

Propane

Working Through Delivery and Tank Ownership

SD G&E doesn't service propane & many growers use it

Natural Gas

- 1st proven success area
- 5 fold increase, use to heat greenhouses
- Programs
  - 2001-02
    - retained consultant
    - had to post large bond to divorce themselves from SDG&E
    - consultant said to stay with SDG&E
    - offered advice to growers to stay with SDG&E
    - got hedging strategy to protect from price spikes (didn't happen)
  - 2002-2003
    - unbundle delivery and gas
    - establishing requirements for Letters of Credit
  - 2003-2004
    - core aggregation
    - use SDG&E for transportation, be independent on purchasing

Member Expectations

- Advice-needed someone to help them make decisions
- Co-op hired consultants, shared info, became watchdog of SDG&E
- Price Certainty and Reasonableness
- Fluctuating Market Makes Planning Difficult
- Self Sufficiency
- Hope to Avoid Victim Status

Cooperative Challenges

- Graduating from Volunteer Status, enthusiasm has its limits
- Keeping Members Informed
- Maintaining Interest Among Members
- Crisis Peaks and Valleys
- Funding --Professional Help Is Expensive
- No Product to Sell
- Institutional Barriers
  - CPUC Rulings
  - Legislation
- Most important things they have done is to form a co-op
  - have bylaws & a board
  - ready to move when opportunity comes

Steve Moss, San Francisco Community Power Cooperative

<u>The Inner City Experience</u>

Cooperative Team and Partners

- Cooperative Team
  - M. Cubed
  - San Francisco Department of the Environment,
  - Three 8 Creative Group,
  - Housing Conservation & Development Corporation,
  - Center for Neighborhood Technology,
  - National Association of Rural Electric Cooperatives
- Community Partners
  - Bayview Hunters Point Health and Environmental Resource Center
  - Potrero Hill Neighborhood House

Structure

- 10 month old coop
- Are energy constrained—energy distributed from a wire
- Neighborhood has 2 old power plants, highly polluting
- Mixed use, industrial, retail, residential, small businesses
- Have about 260 members
- Got 1.5 million grant from PG&E due to pollution issues
  - Developing small programs for specific needs
  - Energy efficiency coop
- Aggregating environmental "bads" (e.g., community-based emission trading)
- Managing demand-response programs

Business Benefits--Business members may receive:

- Five compact fluorescent light bulbs.
- A $500 rebate on any Energy Star appliance upgrade.
- Free lighting audit and up to 20 percent off of lighting retrofit with the City of San Francisco's Power Savers program.
- Up to 50% off of the Vending Miser
- Discounts, information, and technical assistance on energy efficiency and alternative generation such as solar energy.

Current Residential Benefits--Residential members receive:

- Energy savings kit, including two energy efficient bulbs
- A chance to win a free Energy Star refrigerator
- Discounts, information and technical assistance on energy efficiency and alternative generation such as solar energy
- In addition, eligible low income members may receive:
- Free refrigerator trade-in, light bulbs, and home weatherization
- Reduced electricity rates
- Access to vehicle repair assistance under the smog program

Upcoming Residential Programs

Discounted compact fluorescent light bulbs
Home energy audits performed by certified neighborhood residents
Rebates and financing assistance for home heating upgrades
Rebates on Energy Star refrigerator replacement
Bulk purchasing of energy efficiency products
Brokering renewable distributed generation
Serving as a research and development platform
Helping to manage the local distribution system
Purchasing power

Co-op can redevelop community through relationships, restore trust & won't cost as much

Bob Fickes, California Oil Producer Electric Cooperative (COPE)

The Industry Experience

Cooperative of Oil companies—big & small
1 member 1 vote
Represent 87% of pumping oil wells in CA
Started as a trade organization to buy power directly
Provides value to members by reducing electricity costs, about 60% of production costs
Have no control over their product prices
Demand response
Demand side management
Starting redistributive generation—put flared gas back into system
Legislative advocacy—got standby charges for redistributive generation repealed
32 year history of keeping prices down

David Dehnert, Southern California Tribal Chairmen Association (SCTCA)

The Tribal Experience

INTRODUCTION

SCTCA-19 Tribes primarily in San Diego County
Represents 19 so Cal tribes SCTCA, very diverse, some with casinos while others have barely any development
  mainly in San Diego Co
  1 tribe has no electricity
  provides welfare programs to tribes
History of over quarter century of services

WHY A COOPERATIVE?
- Explored 3 energy development options
  - energy cooperative
  - joint powers authority
  - WAPA Power Contract
- Consumer ownership
- SCTCA functions similar to a cooperative with member ownership
- Democratic control
  - SCTCA has a board of directors
  - Each tribe has 1 board member
- Opportunity in combining diverse profiles (business, commercial, residential)
- Multiple services
- Providing energy services at cost

WAPA Power Contract
- Southern California Tribes in Desert Southwest Region
- Parker-Davis Project has 242 megawatts of capacity from Parker Dam and Davis Dam
- Southern California tribes, as preference customers, will receive power allocations from Parker-Davis when existing contracts expire in 2008
- SCATA will enter power allocation contracts in 2004 or 2005
- Need facilities to deliver power from WAPA to tribes
- Unclear whether tribes may aggregate preference power as a cooperative

SCTCA Business Plan
- 4 Focus Areas
  - Load aggregation/direct access
  - Low income programs
  - Energy efficiency—biomass, wind, conservation measures
  - Electricification
- Other Areas
  - Need
  - Organization & structure
  - Financing
  - Education Plan
- Grants For Developing Business Plan
  - UC Davis Center for Cooperatives and USDA
  - CEC Energy Cooperative Development Program
  - Plumas Sierra Rural Energy Co-op

Tribal expectations
- Cheaper electricity
- Reliable electricity
- Improved services
- Self-determination

Challenges facing SCTA

- Location
- Jurisdiction
- Corporate structure
- Facilities
- Taking the "next step"

California Oil Producers Electricity Cooperative

Oil-Field Flare Gas Electricity Systems (OFFGASES) Project

Critical Project Review Meeting

October 28, 2004

California Oil Producers
Electricity Cooperative

OFFGASES WILL

- ***Bridge the Gap Between Distributed Generation Technologies and Oil Field Stranded Gases.***
- ***Provide Gas Conditioning Solutions in the Volumes Required for Small Distributed Generation.***
- ***Provide an Environmentally Friendly & Economically Viable Alternative to Flaring, Recompressing and Reinjection of Stranded Gas.***
- ***Provide Solutions for a Wide Range of Gas Qualities from Below 100 Btu/Scf to Over 2,000Btu/Scf.***
- ***Provide Solutions for Liquid Problems and High H_2S and Harsh Gas Environments.***
- ***Prove to the Oil Production Industry that Distributed Generation is viable Technology for Oil Production Fields.***

California Oil Producers Electricity Cooperative

Reasons Why Oil Producers Should Install D G!

- *High Electrical Energy Costs for Oil Producers*
  - *40% - 60% of Variable O&M is Electricity*
  - *Nearly 100% Load Factor Works for Base Loaded DG*
- *Stranded Gas = Free Fuel*
- *Most Oil Producers Have a Need for Heat*
- *Flaring, Shutting-in, and Re-injection Cost Dollars*
  - *Maintenance*
  - *Environmental Offsets*
  - *Shut-in Production*
  - *Re-compression Energy Cost*
- *Lowering Energy Cost Increases Oil Production!*

California Oil Producers Electricity Cooperative

Reasons Why Oil Producers Don’t Install DG

- *Technology is Unproven in the Oil Field*
  - *Manufactures Claims to Handle Oil Field Conditions Unproven*
  - *Actual Field Instillations Unsuccessful*
- *Small Operators have the Greatest Need but the Smallest Budget*
  - *Small Operations have the Fewest Options to Deal with Stranded Gas*
  - *With Small Capitol Budgets Small Producers Can’t Afford Failed Projects*
- *No Success Stories*
  - *Many attempts with Few if any Successes*
  - *Not Even and Attempt to Tackle Oil Field Gas Conditioning at a DG Volume*
- *UDC Issues*
  - *Interconnect challenges and delays*
  - *Utility Split Personality about DG support*

California Oil Producers Electricity Cooperative

Project Schedule

Task Number	Task/Description	Start Date Planned /	Start Date Actual	Due Date Planned/	Due Date Actual	Status (%)
1.1	Attend Kick-off Meeting	4/14/2003	4/14/2003	4/26/2003	4/14/2003	100
1.2	CPR Meetings	1/17/2004		2/17/2004		
1.3	Final Meeting	3/7/2005		3/31/2005		
1.4	Monthly Progress Reports	4/26/2003	4/26/2003	3/6/2005		66
1.5	Test Plans, Technical Reports and Interim Deliverables	10/20/2003	2/2004	2/16/2004		20
1.6	Final Report	2/15/2005		3/6/2005		
1.7	Identify and Obtain Matching Funds	4/14/2003	4/14/2003	4/26/2003	4/26/2003	100

California Oil Producers Electricity Cooperative

Project Schedule

Task Number	Task/Description	Start Date Planned /	Start Date Actual	Due Date Planned/	Due Date Actual	Status (%)
1.8	Identify and Obtain Required Permits	4/14/2003	4/14/2003	10/6/2003		40
1.9	Electronic File Format	4/14/2003	4/14/2003	4/14/2003	4/14/2003	100
1.10	Establish the PAC	5/5/2003	5/5/2003	7/14/2003	5/21/2003	100
1.11	Conduct PAC Meetings	7/21/2003	10/09/03	1/15/2005		
2.0	Site Selection	6/2/2003	5/12/2003	10/16/2003	10/21/2003	75
3.0	Specify Equipment	6/23/2003	5/12/2003	10/20/2003		80
4.0	High BTU Installation & Testing	10/20/2003	10/03/03	2/16/2004		75
5.0	Medium BTU Installation & Testing	10/20/2003	5/20/2003	2/16/2004		100
6.0	Low BTU Installation & Testing	10/20/2003	9/15/2003	2/16/2004		5
7.0	Harsh Gas Installation & Testing	10/20/2003	9/15/2003	2/16/2004		20
8.0	CPR	1/17/2004		2/17/2004		
9.0	High BTU Gas System Maintenance & Monitoring	2/24/2004		2/24/2005		5
10.0	Medium BTU Gas System Maintenance & Monitoring	2/24/2004	7/13/04	2/24/2005		
11.0	Low BTU Gas System Maintenance & Monitoring	2/24/2004		2/24/2005		
12.0	Harsh Gas System Maintenance & Monitoring	2/24/2004		2/24/2005		
13.0	Technology Transfer Activities	2/15/2005		3/6/2005		

California Oil Producers Electricity Cooperative

Project Budget Performance CEC

COPE				
Offgases Project : Contract #500-02-016				
Project Name: Offgasses				
Budget Summary				
		Spent Thru June 30, 2004	Pier Budget	Balance
Task 1	Administration Activities	41,882	80,300	38,418
Task 2	Site Selection	67,125	60,900	-6,225
Task 3	Specifiy Equipment	43,660	48,000	4,340
Task 4	High BTU Installation & Testing	82,147	140,575	58,428
Task 5	Medium BTU Installation & Testing	160,483	140,575	-19,908
Task 6	Low BTU Installation & Testing	26,744	139,670	112,926
Task 7	Harsh Gas Installation & Testing	41,207	137,340	96,133
Task 9	High BTU Gas System Maint & Monitor	0	57,910	57,910
Task 10	Medium BTU Gas Sys Maint & Monitor	35,413	57,910	22,497
Task 11	Low BTU Gas System Maint & Monitor	0	57,910	57,910
Task 12	Harsh Gas Sys Maint & Monitor	0	57,910	57,910
Task 13	Technology Transfer Activities	1,683	21,000	19,317
		$500,344	$1,000,000	$499,656

California Oil Producers Electricity Cooperative

Project Budget Performance DOE and Others

COPE

Offgases Project : Contract #500-02-016

Project Name: Offgasses

Budget Summary

		DOE Match Thru June 30, 2004	DOE & Other Match Budget	Match Funds Other Thru June 30, 2004
Task 1	Administration Activities	13,678	84,030	
Task 2	Site Selection	29,132	64,420	
Task 3	Specifiy Equipment	18,949	27,150	
Task 4	High BTU Installation & Testing	32,678	172,340	
Task 5	Medium BTU Installation & Testing	168,850	172,340	64,456
Task 6	Low BTU Installation & Testing	11,607	172,340	
Task 7	Harsh Gas Installation & Testing	22,468	172,575	
Task 9	High BTU Gas System Maint & Monitor		40,340	
Task 10	Medium BTU Gas Sys Maint & Monitor	15,369	40,340	
Task 11	Low BTU Gas System Maint & Monitor		41,245	
Task 12	Harsh Gas Sys Maint & Monitor		43,340	
Task 13	Technology Transfer Activities	730	274,400	
		$313,462	$1,304,860	$64,456

California Oil Producers
Electricity Cooperative

HI BTU SITE

California Oil Producers Electricity Cooperative

High Btu Gas

Project Status:

- ***The TERMO Co, 3275 Cherry Av. Long Beach CA***
- ***Turbine Installed and Running Since July 2004***
- ***Trouble Confirming Consistently High BTU Gas***
- ***Working on Stabilizing Production to Deliver Stable Gas Volume and Quality***

California Oil Producers Electricity Cooperative

High Btu

Gas Analysis

Strata-Analysts GROUP

California Oil Producers Electric
301 E Ocean Ave #300
Long Beach, CA 90801

Date Sampled: August 26, 2004
Date Reported: August 26, 2004

Lab ID: 040676
File ID: 08-26-04 Cherry #6

Attention: Bob Fickes
CC: Orlando Toledo
CC:

Pressure: psig
Temperature: Deg F.

Sample ID: Termo Cherry #6

GC/TCD (ASTM D1945, GPA 2261)

Analysis Results: (Detection Limit = 0.01)	**Mole %**		**G/MCF**	
OXYGEN	0.58			
NITROGEN	2.38			
CARBON DIOXIDE	2.63			
TOTAL INERTS:	*5.59*	(sum)		(sum)
METHANE	58.73			
ETHANE	6.05			
PROPANE	7.52		2.08	
iso-BUTANE	2.08	22.11	0.68	7.98
n-BUTANE	6.04		1.91	
iso-PENTANE	3.34	13.99	1.22	5.39
n-PENTANE	4.24		1.54	
HEXANE+	6.41		2.63	
Total	100.00			

Specific Gravity*	1.114		Dew Point:		Deg F.
Hydrogen Sulfide:		ppm(vol)	Water Content:		lbs/MMCF
Mercaptan Sulfur: (GPA 2194)		ppm(vol)	HHV:	1763	
			LHV:	1613	
Gross BTU/ft^3*	1763	(dry gas)			
	1732	(Water Vapor Saturated)			

*=Calculated Result (ASTM D3588-91)

Reviewed by:

Bruce Barron

1842 East 29th St., Signal Hill, CA 90755
Tel: 562-426-0199 Fax: 562-426-5664
www.strata-analysts.com


480 VOLTS


BPCI


CAUTION
THIS EQUIPMENT
STARTS AND STOPS
AUTOMATICALLY
blackmer


HOME OF

California Oil Producers
Electricity Cooperative

Key Technical Issues

- Maintaining Gas Supply Quality and Quantity
- Dehydration of Gas Supply
- Producing Well Problems

California Oil Producers Electricity Cooperative

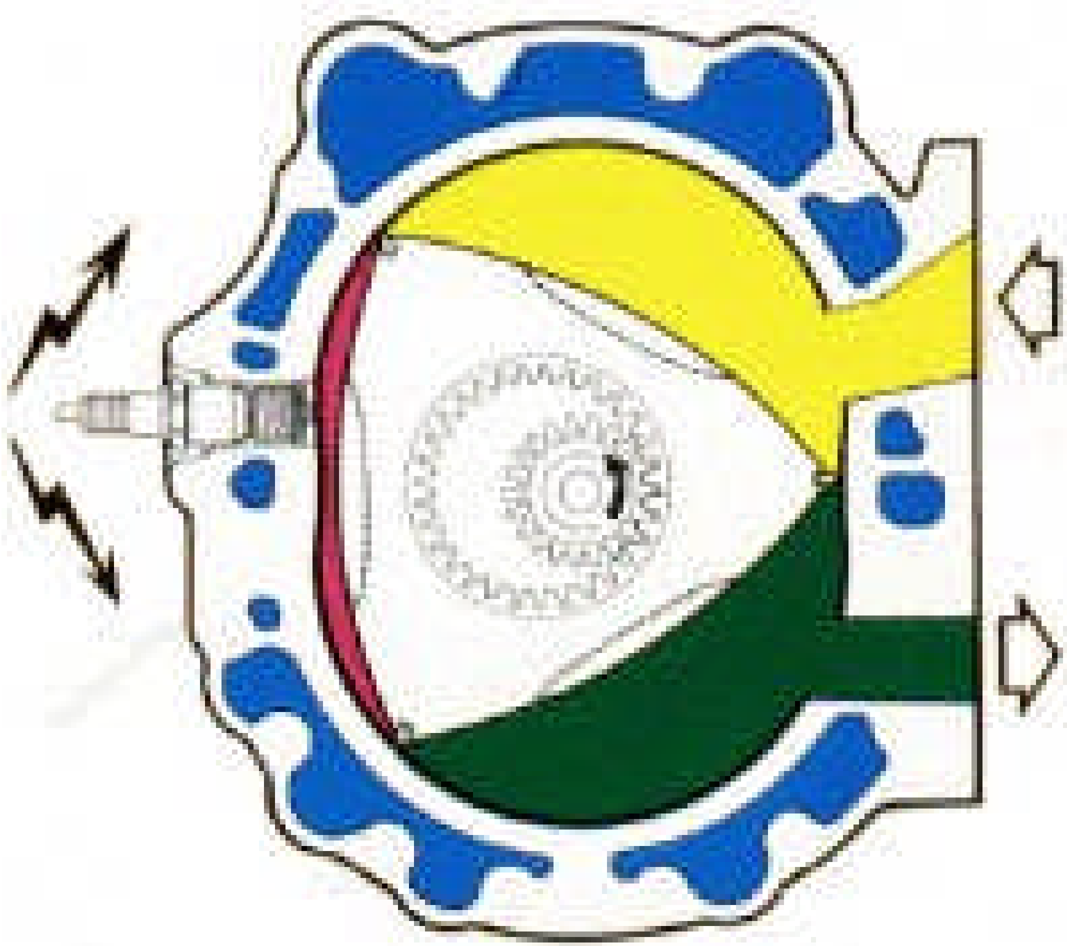
Performance to Date

- Turbine has Produced a Total of 120 Days.
- Turbine has Produced a Total of 45,000 kWh.
- Turbine has run Capacity Factor of about 60%.
- Low Capacity Due to Unstable Gas Supply.

California Oil Producers Electricity Cooperative

Budget Permitting

- ***Add a test of a Wankel in High BTU Gas application***
  - ***Low Cost***
  - ***Small Footprint***
  - ***Designed for CHP***
  - ***Lower Maintenance***
  - ***Scalability 30 – 600 kW***



CEC Presentation October 28, 2004

California Oil Producers
Electricity Cooperative

MEDIUM BTU SITE

California Oil Producers Electricity Cooperative

Medium Btu Site

Project Status:

- ***St James Oil Co, 814 W 23rd St. Los Angeles CA***
- ***Turbines installed Mid July 2004***
- ***Project in the Maintenance and Monitoring stage***

California Oil Producers Electricity Cooperative

Medium Btu Gas Analysis

Strata-Analysts GROUP

St. James Oil Company
1235 South Broadway
Los Angeles, CA 90015

Date Sampled: May 24, 2004
Date Reported: May 24, 2004

Lab ID: 040421
File ID: 05-24-04 Incoming Wells 1 & 4

Attention: Charles Sudderth, Victor Lopez

CC:

Pressure: psig
Temperature: Deg F.

Sample ID: St James Incoming Wells 1 & 4

GC/TCD (ASTM D1945, GPA 2261)

Analysis Results: (Detection Limit = 0.01)	Mole %		G/MCF	
OXYGEN	0.00			
NITROGEN	0.00			
CARBON DIOXIDE	0.78			
TOTAL INERTS:	*0.78*	(sum)		(sum)
METHANE	72.80			
ETHANE	13.42			
PROPANE	7.49		2.07	
iso-BUTANE	1.25	5.51	0.41	1.90
n-BUTANE	2.17		0.69	
iso-PENTANE	0.63	2.09	0.23	0.80
n-PENTANE	0.53		0.19	
HEXANE+	0.93		0.38	
Total	100.00			

Specific Gravity*	0.794		Dew Point:	Deg F.
Hydrogen Sulfide:		ppm(vol)	Water Content:	lbs/MMCF
Mercaptan Sulfur: (GPA 2194)		ppm(vol)	HHV:	1363
			LHV:	1239
Gross BTU/ft^{3*}	1363	(dry gas)		
	1340	(Water Vapor Saturated)		

*=Calculated Result (ASTM D3588-91)

Reviewed by:

Bruce Barron

1842 East 29th St., Signal Hill, CA 90755
Tel: 562-426-0199 Fax: 562-426-5664
www.strata-analysts.com

COPE
California Oil Producers Electricity Cooperative

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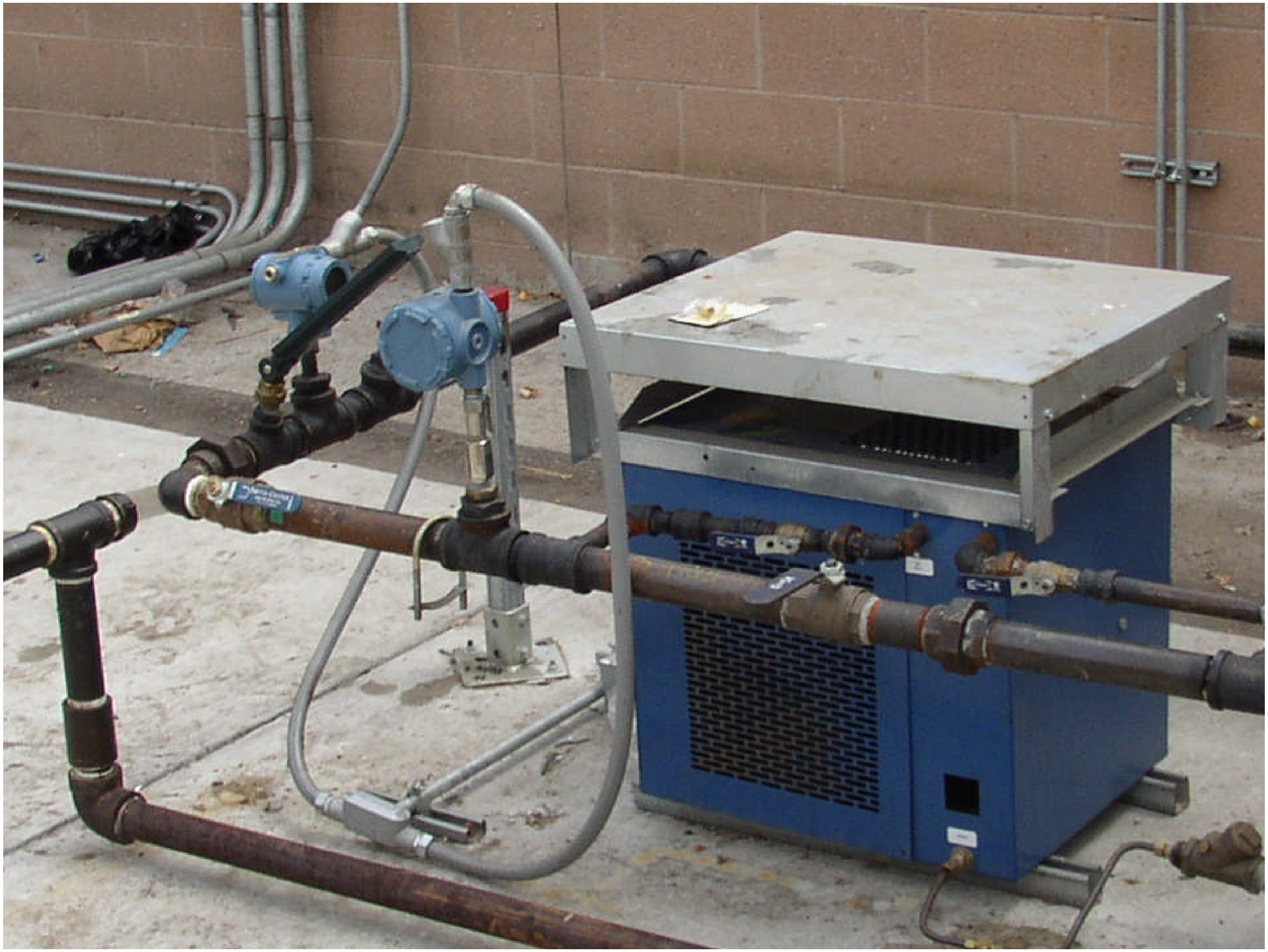
California Oil Producers Electricity Cooperative

Gas Conditioning

CEC Presentation October 28, 2004

California Oil Producers Electricity Cooperative



CEC Presentation October 28, 2004

California Oil Producers Electricity Cooperative

Key Technical Issues

- ***Maintaining Gas Supply***
- ***Dehydration of Gas Supply***
- ***So-Cal Gas Ability to Take Excess Gas***
- ***Noise Complaints From Neighborhood***
- ***Completing Final Check List of Warranty Issues***
- ***Complete Training for St James Field Personnel***
- ***Utility Rate Issues***

California Oil Producers
Electricity Cooperative

Performance to Date

- ***Turbines have produced a total of over 167,000 kWh since 7/13/04***
- ***Turbines have run capacity factor of:***
  - ***94.6% for Turbine #1***
  - ***70.7% for Turbine #2***
  - ***95.2% for Turbine #3***
- ***Noise Problem Successfully Mitigated Through Shrouding of Turbines on Top and at Air Intake***
- ***Utility Rate Issue Resolved through Negotiations with LADWP***

California Oil Producers Electricity Cooperative

HARSH SITE

California Oil Producers Electricity Cooperative

Harsh Btu Site

Progress to Date:

- Drilling & Production 100 Poso St. Maricopa CA
- PG&E Interconnection and Air Quality Permitting in progress.
- RFP for Engineering and Construction issued
- 3-Responses Received October 25
- Evaluating Proposals with Award Scheduled the week of November 8th 2004

California Oil Producers
Electricity Cooperative

Harsh Site

Gas Analysis

Midway Laboratory Inc.
Petroleum-Industrial-Environmental
315 Main Street P.O. Box 1151
Taft California 93268

State Certificate # 1396
Phone # (661) 765-2364
Fax # (661) 765-6920
E-Mail midlab@gte.net

NATURAL GAS ANALYSIS

Rev 1/23/03

Customer: Drilling and Production
Attention: Darin Holden

Log #: 6963-3
Date Received: 9/9/2003
Date Completed: 9/9/2003
Report Date: 9/11/2003

Sample Description: Boiler Gas W/O Sweet

Analytical Parameter: Natural Gas Analysis

Constituent	Mole %	Wt. %	Lv. %
Oxygen	1.292	1.292	0.575
Nitrogen	4.675	4.093	2.251
Carbon Dioxide	52.622	72.386	61.882
Methane	40.066	20.091	34.062
Ethane	0.094	0.088	0.118
Propane	0.138	0.190	0.191
Iso-Butane	0.045	0.082	0.074
N-Butane	0.056	0.101	0.088
Iso-Pentane	0.068	0.153	0.125
N-Pentane	0.042	0.094	0.076
Hexanes Plus	0.259	0.744	0.559
Hydrogen Sulfide	0.644	0.686	0.463
Total	100.000	100.000	100.000

Hydrogen Sulfide, ppm 6439
Total Sulfur, as H2S ppm Not Requested

Physical Data

	dry	wet
BTU cu.ft. Ideal	434.68	427.11
BTU cu.ft. real	435.93	428.35
BTU/lb. Ideal	5156.15	5066.43
Sp. Gr. Ideal	1.0971	
Sp. Gr. Real	1.0998	

GPM	0.2212
z..factor	0.9971
F..factor	9795
Sp. Vol.	11.79

CHONS

	% by Wt.
% Carbon	36.010
% Hydrogen	5.289
% Oxygen	53.923
% Nitrogen	4.093
% Sulfur	0.686
Total	100.000

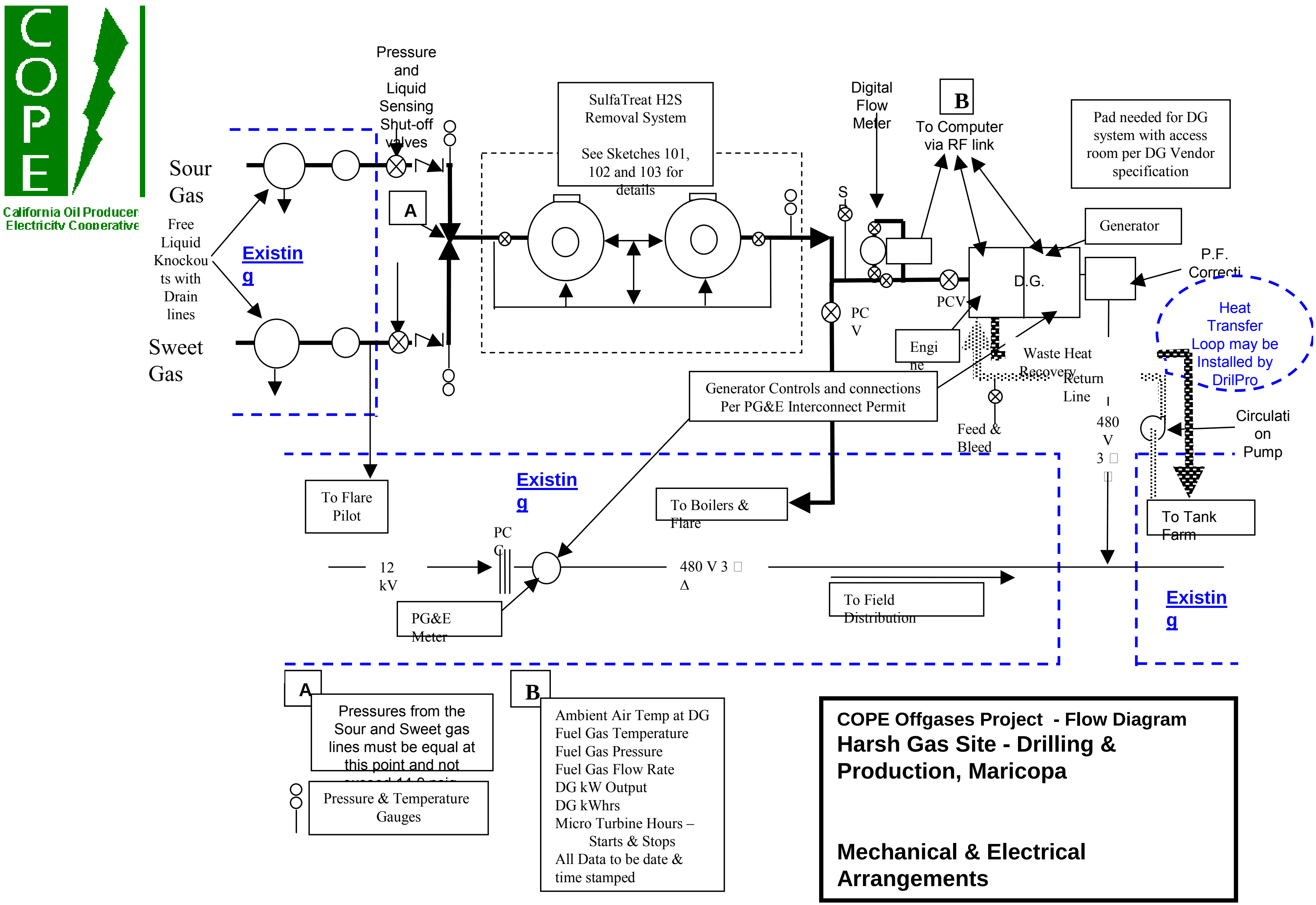
References
ASTM D 6228-98
ASTM D 1945-96
ASTM D 1946-94
ASTM D 3588-91
GPA 2145-00

Michael E. Mayfield
Laboratory Director
Midway Laboratory Inc.

California Oil Producers
Electricity Cooperative

Harsh Gases: Key Technical Issues

- ***Scrubbing High Concentrations H_2S with Low Mass Flows.***
- ***Excess Power for Import***
- ***Interconnection Agreement With PG&E***
- ***Medium to Low BTU content of Gas***



Oct 04 **cwz** **Sketch 100 rev 9**

California Oil Producers Electricity Cooperative

LOW BTU SITE

California Oil Producers Electricity Cooperative

Low Btu Site

Progress to Date - - Discussion with the following COPE Members:

- ***Chevron/Texaco***
  - ***Good Quality and Quantity for project***
  - ***Entire Engineering Staff Transferred Out-Of-State***
  - ***Replacement Engineering Staff Not Willing to Consider R&D Project Until they Became Familiar with their New Assignment***
- ***E&B Resources***
  - ***Gas was marginally low 350+ and not consistently below the standard***
  - ***Lack of Management Buy-in***
- ***Seneca Resources***
  - ***Gas was marginally low 350+ and not consistently below the standard***
  - ***Lack of Management Buy-in***
- ***Berry Petroleum***
  - ***Good Quality and Quantity for project***
  - ***Shakeup in Upper Management Made Engineering Staff Unwilling to Recommend anything New and Innovative.***
- ***Chevron/Texaco***
  - ***Replacement Engineering Staff Now Familiar with New Assignment and Willing to Take another Look At Project***

California Oil Producers Electricity Cooperative

Low BTU Candidates

Low BTU

6	5	4	26	31	25	35	36	37	24	11	29
9/16/2002	8/8/2002	2/14/2001	2/26/2003		9/10/2002	9/5/2003	9/5/2003	9/5/2003	5/1/2002	5/23/2000	
				6 million cf/day		72mcf/day	70mcf/dar	5mcf/day			
92.3	107.9	158.1	282.6	366.50	374	434	538	793	796.6	807	940
%	%	%	%		%				%	%	
0.607	3.988	4.606	1.371	0.92	2.567	1.292	0.554	1.076	0.227	0.7	4.285
2.559	15.606	18.879	13.854	19.40	14.631	4.675	1.984	3.945	1.327	2.55	23.288
89.845	73.355	62.781	57.979	49.15	57.757	52.622	45.124	16.901	23.007	17.24	6.414
6.423	6.071	13.224	26.356	27.00	21.699	40.066	51.505	77.881	73.768	79.4	50.834
0	0	0	0	1.44	0.079	0.094	0.214	0.097	0.648	0.097	3.242
0	0	0	0.078	1.19	0	0.138	0.082	0	0.25	0	5.61
0	0	0	0	0.11	0.01	0.045	0	0	0.169	0	1.292
0	0.031	0.2	0.136	0.13	0.057	0.056	0	0	0.133	--	2.934
0	0	0	0.119	0.07	0.215	0.068	0	0	0.093	--	0.958
0	0	0	0.107	0.04	0.122	0.042	0	0	0	--	0.56
0.566	0.949	0.492	0	0.55	2.863	0.259	0.203	0.099	0.379	--	0
--	--	--	--						--	--	
--	--	--	--						--	--	
--	--	--	--						--	--	
520 ppm	120 ppm	91 ppm	660 ppm	14300.00	480 ppm	6439	3343	0	--	--	0

California Oil Producers Electricity Cooperative

Low Btu

Gas Analysis

Strata-Analysts GROUP

California Oil Producers Electric
301 E Ocean Ave #300
Long Beach, CA 90801

Date Sampled: August 20, 2004
Date Reported: August 20, 2004

Lab ID: 0465177
File ID: Kern River

Attention: Bob Fickes
CC: Rolando Tolido
CC:

Pressure: psig
Temperature: Deg F.

Sample ID: Arco Fee C Casing Gas

GC/TCD (ASTM D1945, GPA 2261)

Analysis Results:	Mole %		G/MCF	
(Detection Limit = 0.01)				
OXYGEN	1.76			
NITROGEN	7.27			
CARBON DIOXIDE	82.10			
TOTAL INERTS:	91.13	(sum)		(sum)
METHANE	8.32			
ETHANE	0.05			
PROPANE	0.00			
iso-BUTANE	0.00			
n-BUTANE	0.00			
iso-PENTANE	0.00			
n-PENTANE	0.00			
HEXANE+	0.50			
Total	100.00			

Specific Gravity*	1.399		Dew Point:		Deg F.
Hydrogen Sulfide:	881.00	ppm(vol)	Water Content:		lbs/MMCF
Mercaptan Sulfur: (GPA 2194)		ppm(vol)	HHV:	109	
			LHV:	102	
Gross BTU/ft^{3*}	109.6	(dry gas)			
	107.2	(Water Vapor Saturated)			

*=Calculated Result (ASTM D3588-91)

Reviewed by:

Bruce Barron

1842 East 29th St., Signal Hill, CA 90755
Tel: 562-426-0199 Fax: 562-426-5664
www.strata-analysts.com

California Oil Producers Electricity Cooperative

Low Btu Site Status with Chevron/Texaco

- ***Completed Technical Review with Engineering Staff***
- ***Chevron/Texaco Legal Reviewing CEC & DOE Contracts***
- ***Chevron/Texaco Legal Reviewing Member Participation Contract***
- ***Anticipate Decision by Mid November 2004***

California Oil Producers Electricity Cooperative

Reasons COPE Membership Hasn’t Responded

- *High oil prices*
  - *Limited physical resources.*
  - *Focus on oil production.*
- *Volatility in member staffing and property ownership.*
  - *Key decision makers transferred or changing jobs.*
  - *High oil prices are good times to sell properties.*
- *Education and fear of technology.*
  - *Pre-OFFGASES project failures still haunt us.*

The Flex-Microturbine® for Oilfield Gases

A Presentation to the IOGCC* Annual Meeting

Oklahoma City, October 18, 2004

22922 Tiagua, Mission Viejo CA 92692-1433

Phone: 949 380 489; FAX: 949 380 8407 email: edanprabhu@cox.net

* Logoless

FlexEnergy

Gas Comes with Oil

- Oilfields (and gas wells, and even coal mines) release gas
- Some of the gas is pipeline quality, some is not
- Gas quality is different from well to well, from time to time
- Some gas is so weak that it is not combustible
- Often, unless the gas is consumed, oil production will suffer
- Even flares are becoming harder to permit
- In the Bakersfield area of California, there is 200 million Btu of low Btu gas at below 100 Btu/scf available
- As part of the OFFGASES Project, COPE and FlexEnergy plan to run a Flex-Microturbine on the low Btu gas without any other fuel

What is the Flex?

- The Flex-Microturbine runs on waste gases or gasified solids and liquids
- Very low concentrations of gas are acceptable. A mixture with only 1.3 to 1.5% methane, or 13 to 15 Btu per scf will generate full power
- The Flex is adapted from the Capstone C30 microturbine. It uses a catalytic combustor and generates no NOx or CO; it is the cleanest means of power production
- It is highly fuel-flexible
- Each Flex generates 30 KW; multiple Flex-Microturbines can be laid out like machines in a laundromat

FlexEnergy

Projects and Progress

- Endurance Shop Tests of the Prototype have been completed; over 1,500 hours have been logged
- A Flex-Demonstration is running on 250 Btu gas from a digester in the Los Angeles area
- Another Demo is running on 120 Btu gas from wood
- A unit will soon run on 60 Btu gas (6% methane) from an oilfield near Bakersfield, CA
- Flex-turbine NOx emissions are extremely low, about 20 to 30 PPB; CO emissions are 5 to 30 ppm

A Primer on the Flex-Microturbine

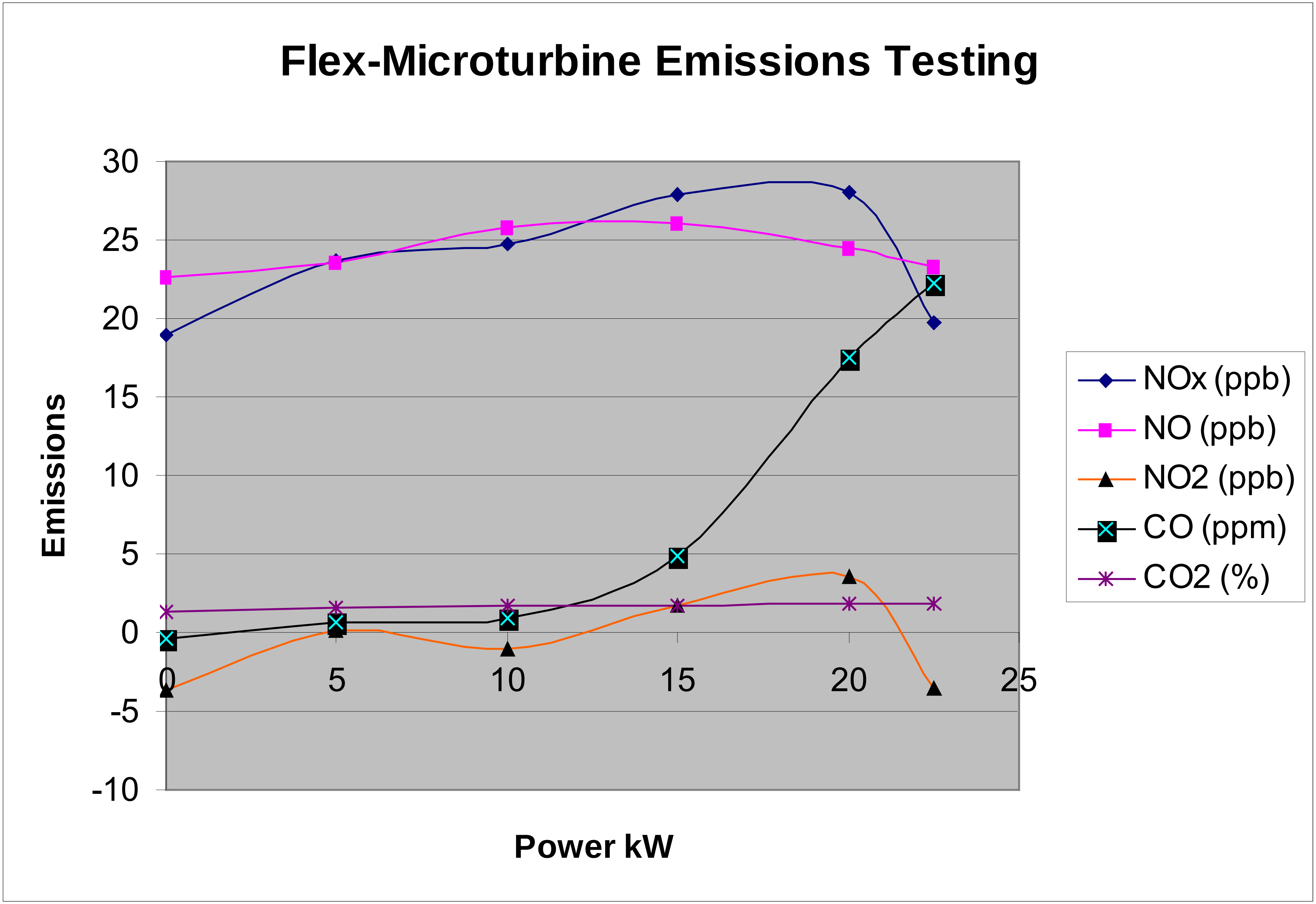
- The Flex-Microturbine *first mixes air and fuel*, then compresses the two together
- The mixture is so weak that traditional combustion will not work, the Flex-Microturbine uses a catalytic combustor, derived from automotive catalytic converter technology
- Gas may be delivered at atmospheric pressure. No separate fuel compressor is required

Why the Flex?

- Most turbines, fuel cells, IC engines, require at least 400 Btu gas, preferably higher
- The traditional Capstone microturbine is limited to fuels above 350 btu/cubic foot; others require much higher Btu fuel
- The Flex accepts any fuel, high or low Btu, dilutes it to 13 Btu, and consumes it to generate power…one size fits all

Potential Flex Applications

- Petroleum and gas drilling sites, coal mine vent gas, such as the OFFGASES Project
- Oilfield off-gases from production and refining operations
- Water treatment, landfills, sewage treatment
- Manure digesters from cattle, poultry, swine, farms (poultry litter can also be thermally gasified)
- Nutshells, orchard trimmings, wood waste, grain stalks, grain hulls, olive and cherry pits
- Gas from Compost Operations if it can be collected
- Low Energy Industrial vent gases: isopropyl alcohol vapor, hydrogen etc.


Flex-Microturbine Emissions Testing
Emissions
30
25
20
15
10
5
0
-5
-10
0
5
10
15
20
25
Power kW
NOx (ppb)
NO (ppb)
NO2 (ppb)
CO (ppm)
CO2 (%)

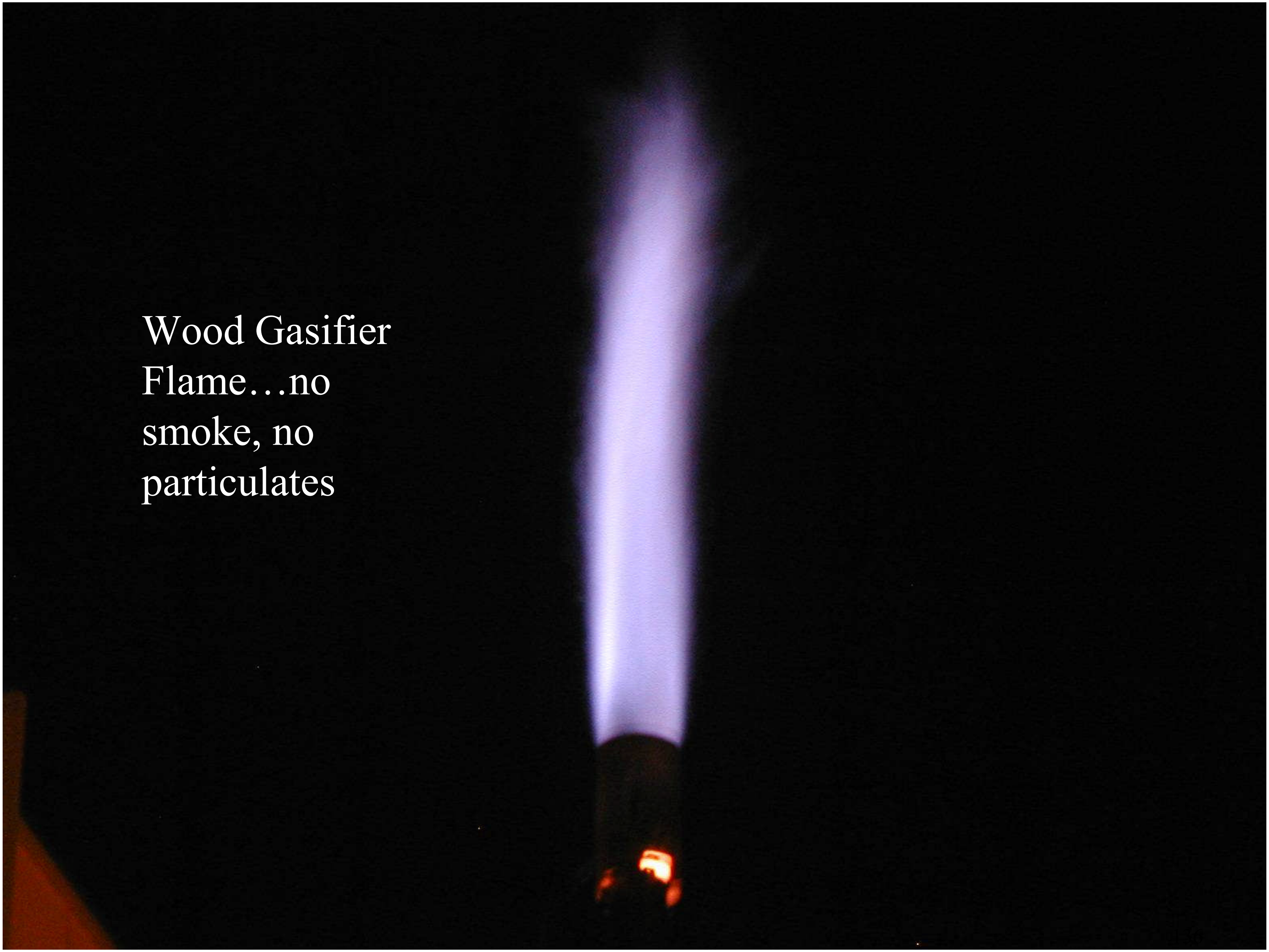
Clean Energy for the Planet

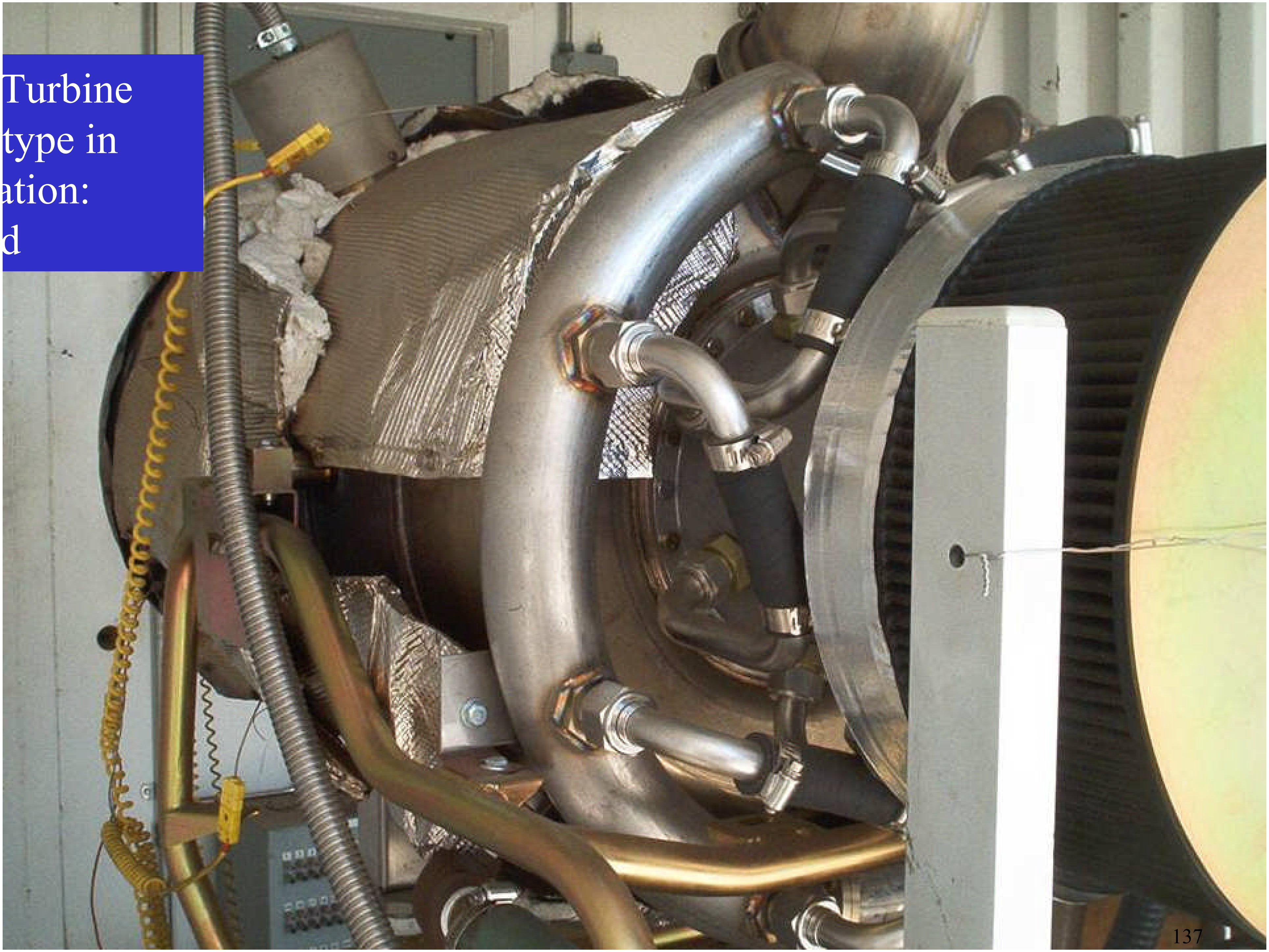
FlexEnergy

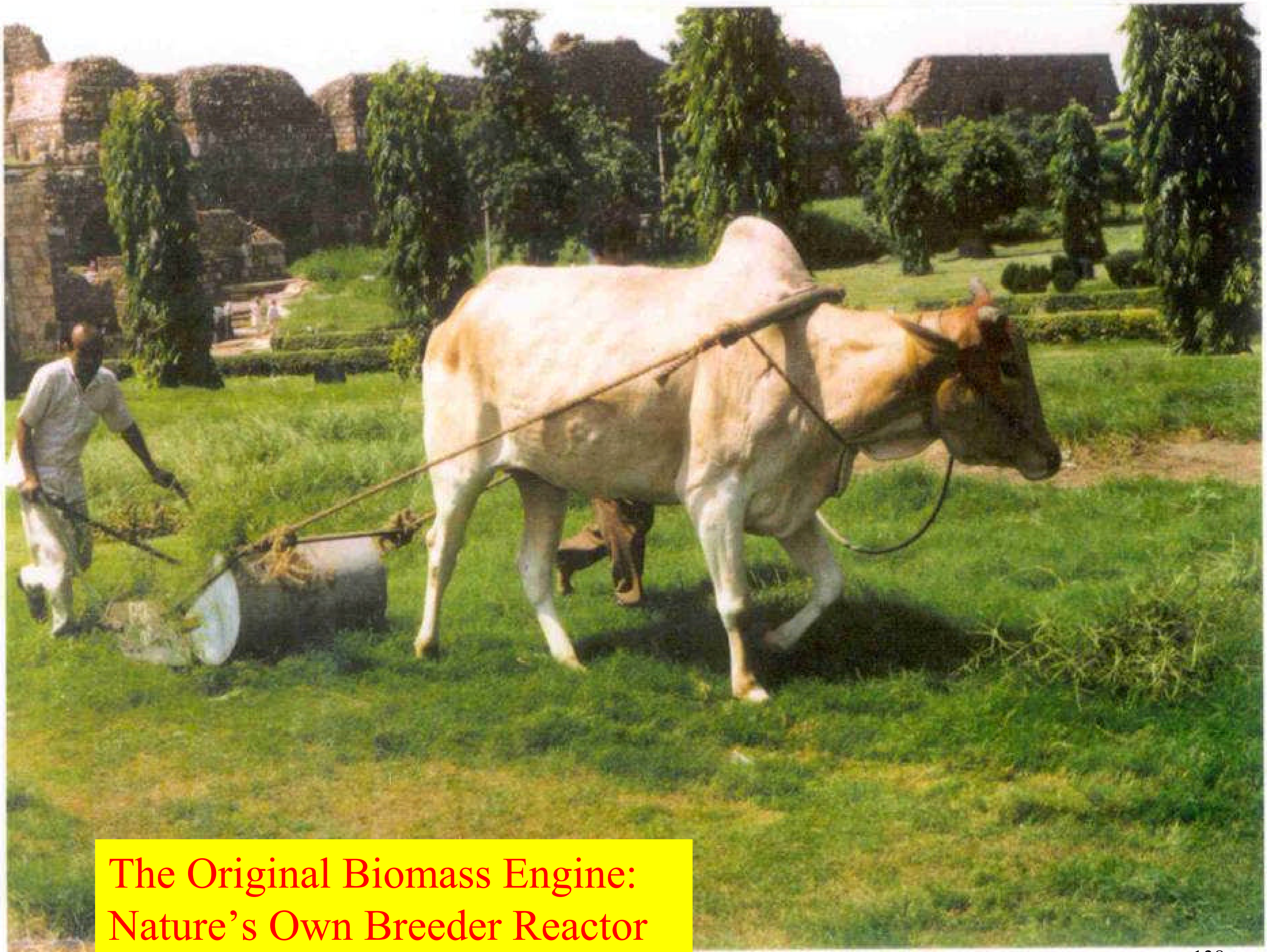
Where will the Flex make a Difference?

- If you have a site where low Btu gas is emitted or production is suppressed to prevent emission
- Credits for greenhouse gas reduction (Methane has a Global Warming Potential (GWP) of 23 (CO2 has a GWP of 1)


Wood Gasifier in
Operation
Mobile Renewable Energy Power Park
EERC


Wood Gasifier
Flame…no
smoke, no
particulates


Turbine
type in
ation:
d



The Original Biomass Engine:
Nature's Own Breeder Reactor

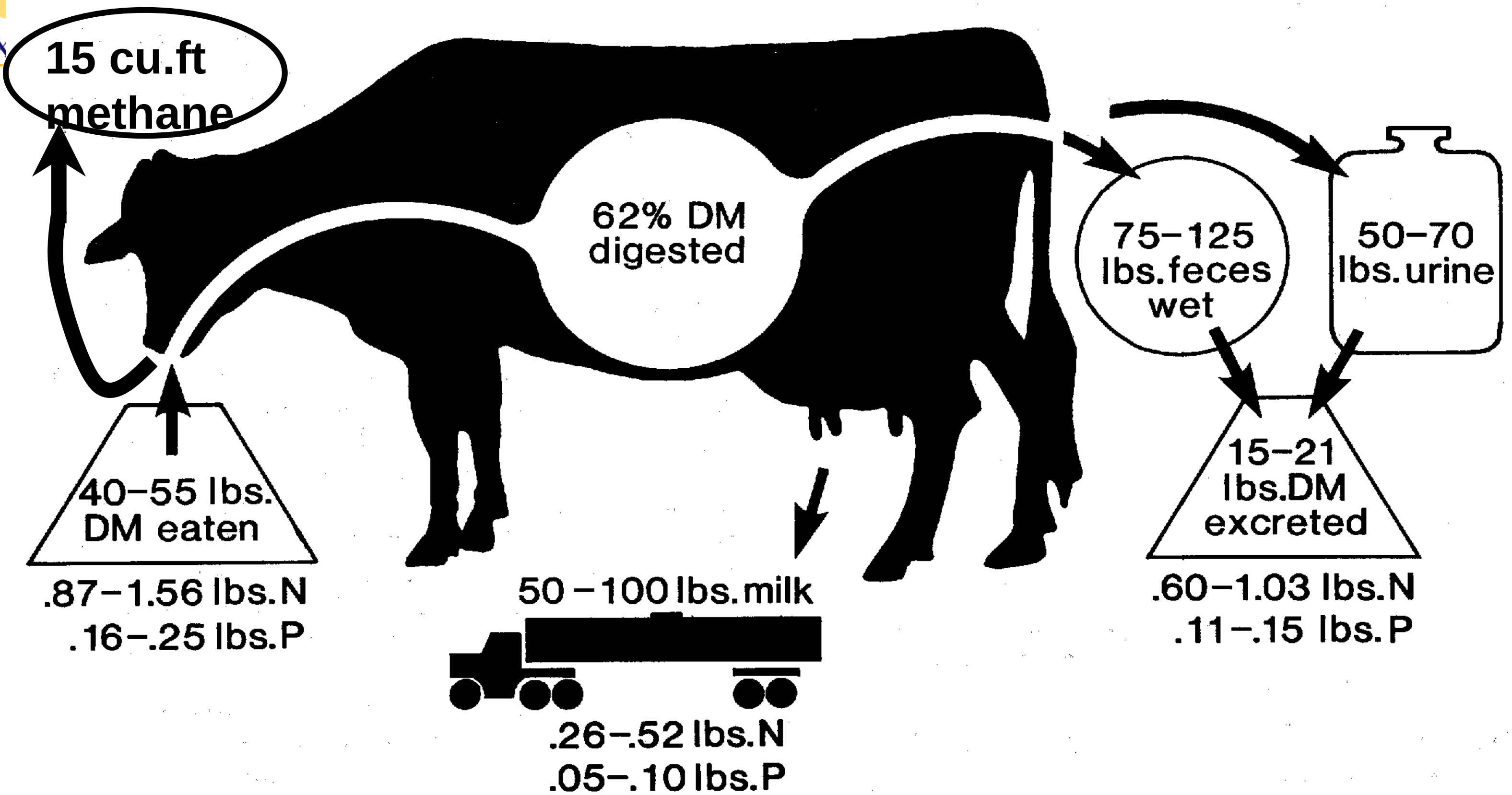
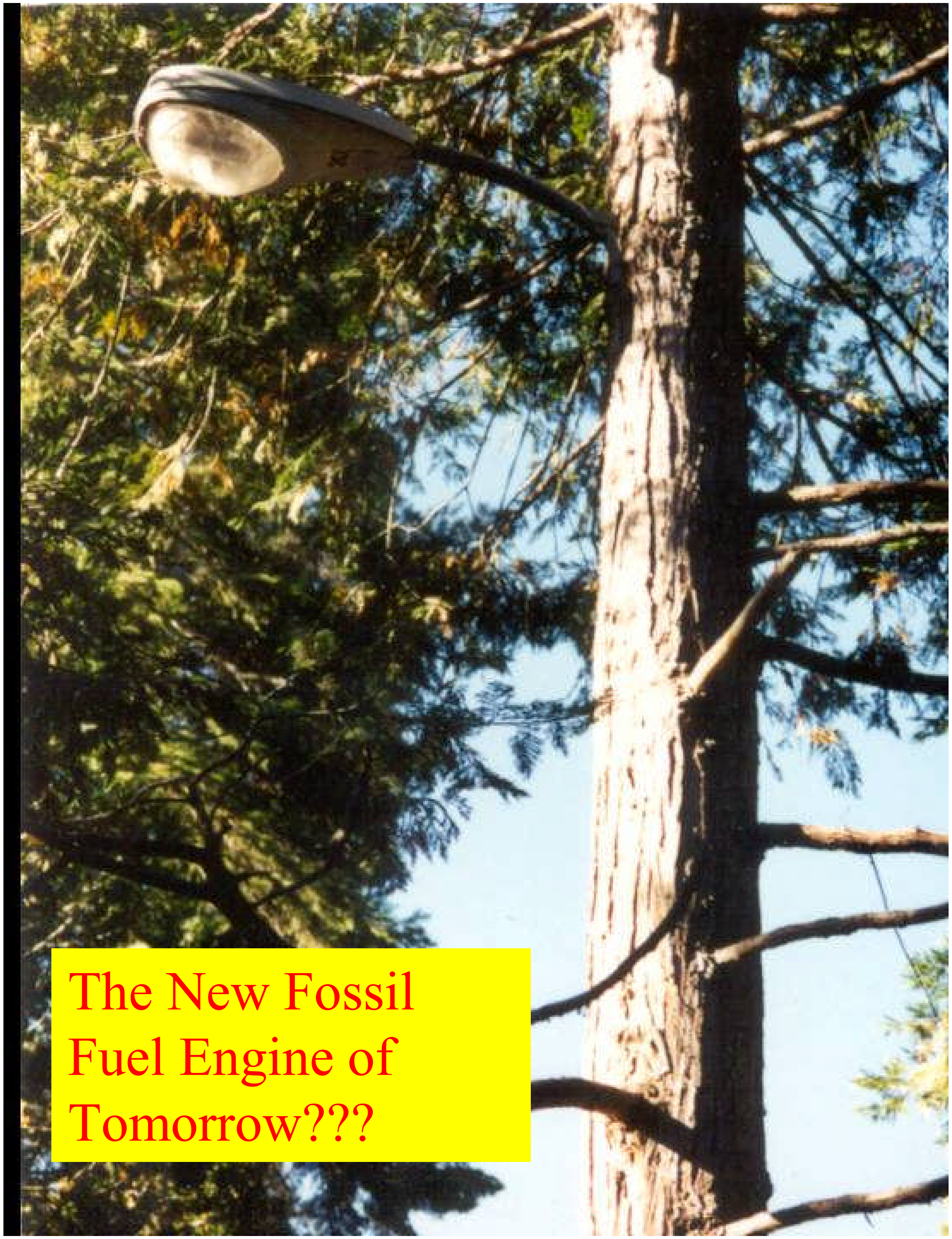


Figure 1. Daily input-output of dry matter (DM), nitrogen (N), and phosphorus (P) for a lactating cow producing 50 to 100 lbs of milk per day. Data from Table 1.

Could it be possible to capture enteric methane for power?


The New Fossil
Fuel Engine of
Tomorrow???

PTTC TECHNOLOGY CONNECTIONS

THOSE WHO KNOW, SHARING WHAT THEY KNOW, FOR MUTUAL BENEFIT

News NETWORK

Technology—The Engine That Drives Oil And Gas Production

Petroleum Technology Transfer Council WWW.PTTC.ORG

Notes From The Director

2007 has been an interesting year—in Oklahoma where I live it is late July and average rainfall is 25% above normal and still not a single day above 100 °F. That doesn't mean the heat is not on. PTTC continues to adapt and make progress towards an industry-funded model that will ensure we're here for the long term. Two key elements to our transition are (1) the receipt of some DOE funding to assist with the transition and (2) the move towards an AAPG-managed PTTC. The latter would bring a lot of resources to the table that PTTC on its own could likely never develop. It's not a done deal, but AAPG and PTTC are working diligently to bring it to pass, with DOE's full support and hope for some continued federal involvement in the long term. So the message is— have faith and stick with us. It will be good.

One element that we're examining for the future is "**Knowledge Centers**." Read about them on page 2, then give us your feedback on priorities by completing the **Online Survey**. I promise that doing it online will be painless. If not online, do it through fax. Either way, it is your input that we need.

In This Issue

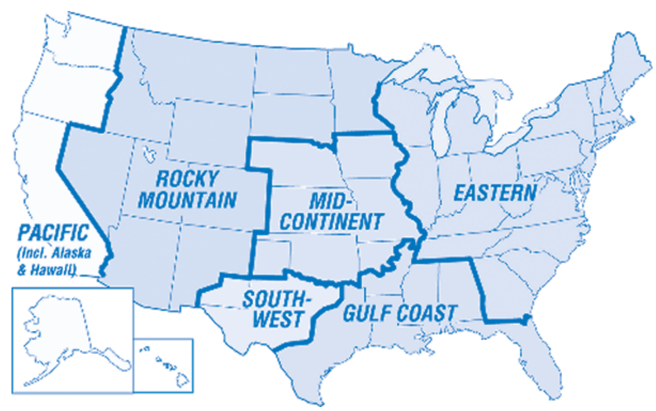
Vol. 13, No. 2 July 2007

AAPG, PTTC Sign Letter of Intent

PRESS RELEASE JULY 2007

The American Association of Petroleum Geologists and the Petroleum Technology Transfer Council in early July signed a Letter of Intent for AAPG to assume management of PTTC activities.

AAPG is a professional scientific organization with over 31,000 members in 115 countries. Since 1994, PTTC, funded primarily by the U.S. Department of Energy with funds matched by the states and industry, has been a recognized force for transferring exploration and production technology to domestic U.S. producers. Serving industry locally through Regional Lead Organizations, typically at universities or geological surveys, PTTC's primary focus has been serving independents.



One likely result of the transition is realignment with AAPG's sections to realize synergy with their active volunteers.

Last year, Congress declined to provide FY07 funding for many elements of the Department of Energy's natural gas and oil R&D program from which PTTC drew its federal funds. DOE ultimately provided $1 million of funding through September 2008 to help PTTC transition to a primarily industry-funded organization.

PTTC's primary tool for transferring E&P technology is regional workshops, which are supplemented with a strong web presence, newsletters and other personal outreach. Using these tools, PTTC connects producers, the service sector, consultants, researchers and others with the data and technology information needed to spur technology application.

Topics addressed by PTTC activities have covered the full spectrum of E&P operations, including exploration, unconventional resources, enhanced recovery processes, imaging technology, drilling and completion, hydraulic fracturing and many others.

The agreement provides for a due-diligence period of 60 days after which, presuming positive negotiations, the transition to an AAPG-managed PTTC would occur.

For further information contact:

Larry Nation
AAPG Communications Director
800.364.2274, ext. 648

E. Lance Cole
PTTC Executive Director
918.241.5801

News In General

Meeting Alerts

Colorado O&G Association
Rocky Mountain Natural Gas Strategy
Conference & Investment Forum
Aug. 13-15 Denver, CO
www.coga.org/pageinpage/conference.cfm

APTA/Midland College CO2 School
Aug. 21-24 Midland, TX
www.midland.edu/~ppdc/events

Summer NAPE
Aug. 23-24 Houston, TX
www.napeonline.com/home2.asp

AAPG Midcontinent
Section Annual Meeting
Sep. 9-11 Wichita, KS
www.aapg.org/sections/midcontinent.cfm

AAPG Eastern Section Annual Meeting
Sep. 16-18 Lexington, KY
www.uky.edu/KGS/esaapg07/

Stripper Well Consortium
Tech Transfer Meeting
Sep. 20 Roanoke, WV
www.energy.psu.edu/swc/

IOGCC Annual Meeting
Sep. 23-25 New Orleans, LA
www.iogcc.state.ok.us/events.html

SEG Annual Meeting
Sep. 23-28 San Antonio, TX
http://meeting.seg.org/

Louisiana O&G Association:
Gulf Coast Prospect Expo
Sep. 25-26 Lafayette, LA
www.lioga.com/Events/EventsDisplay.asp?p1=239&p2=Y&p9=E&E=N

GCAGS Annual Convention
Oct. 21-23 Corpus Christi, TX
www.gcags.org/

Stripper Well Consortium
Tech Transfer Meeting
Oct. 30 Wichita, KS
www.energy.psu.edu/swc/

Knowledge Centers—A Concept that PTTC Is Exploring

Just what is a knowledge center? The concept is simple. For a given topic, say hydraulic fracturing, PTTC would identify a few respected, unbiased individuals, universities or organizations that are recognized as leaders in the field. We listen to those experts, letting them help define what content needs to be captured within a knowledge center. We then retain them to develop the knowledge center and make information available through the Internet and workshops. It is not really research; it's gathering all that is relevant (as determined by experts). They are available only to those who "pay to play." Those willing to pay are a self-qualified audience—they are coming with a need and an application requiring services. This creates the incentive for vendors and service providers to provide funds to demonstrate their capabilities. Everybody wins: producers, vendors and service providers, PTTC and ultimately the country, as more domestic oil and gas is discovered and produced.

What would a knowledge center contain? Many elements are envisioned. To start, there would be a white paper that crisply summarizes the science, the remaining issues and the directions industry is pursuing to solve those issues. Hearing this from acknowledged experts will save days or weeks of digging for reliable information. There also would be case studies demonstrating how technology solved real world problems. Vendors and service providers would have a place to show how their solutions matched problems. A "links" section would enable users to quickly connect with those vendors. There would be an annotated bibliography directing individuals to the papers/articles publicly available that the experts considered to be seminal works. Active research consortia would be described along with their research thrusts and who to contact to get directly involved. A calendar would alert users to upcoming workshops across the country that were focused on the topic, or to proceedings from past workshops that might be available. Each year the experts would develop a top-notch workshop, which would be videotaped. Local workshops combining videotape and live presentations of regional case studies could be made available.

What will it take for the knowledge center concept to work?

- You the audience must prioritize the topics that PTTC pursues for knowledge centers. To that end, this article directs you to an online survey. In addition to the obvious prioritizing of topics, the number of people who actually respond to this survey will help PTTC assess the level of industry interest.
- Experts, those knowledgeable in the field, must agree to participate for compensation that a non-profit can afford. The reality is that participating experts will do so for reasons other than compensation.
- Vendors relevant to a topic must provide significant sponsorships. For this to happen, PTTC and the experts must present them with a "prospectus" of the knowledge center—a picture of what it will actually contain and what will happen within the knowledge center—and some indicator of industry interest and participation. Keep in mind that with a "self-qualified" audience it doesn't require thousands, but rather just a few hundred individuals, for sponsorship to be attractive for the service community.

Do PTTC A Favor—Complete this survey online at **www.pttc.org/knowledge_center_survey.htm**. It will save us time and money and allow us to analyze your input in real-time.

Survey - Your Priorities for Knowledge Center Topics

Industry's input needed: Help PTTC assess the feasibility of the Knowledge Center concept by identifying and prioritizing the topics you are interested in. Just a few minutes of thought in responding will deliver results to you. Thanks from PTTC.

Potential Knowledge Center Topics ***Why?*** Save days or weeks finding concisely organized technical information critical to performing your job. ***What is a knowledge center?*** A semi-virtual technology information resource center developed by those recognized as leaders in the field. Solutions are presented through the Internet and annual workshops.	**Ranking (from 1 to 5)** **Importance to You/Your Company?** **1=low interest - 5=critical topic** *(please circle your response for each item below)*				
Shale Gas Resource Development	1	2	3	4	5
Coalbed Methane Development & Operations	1	2	3	4	5
Recent Developments in Formation Evaluation and Logging	1	2	3	4	5
CO2 Flooding	1	2	3	4	5
Advances in Coiled Tubing or Microhole Drilling	1	2	3	4	5
Horizontal Drilling	1	2	3	4	5
Hydraulic Fracturing - Completion & Initial Stimulation	1	2	3	4	5
Wellbore Damage Removal and Well Restimulation	1	2	3	4	5
Wellbore Management (Extending Downhole Equipment Life)	1	2	3	4	5
Gas Well Deliquification	1	2	3	4	5
Affordable, Efficient Well & Field Automation	1	2	3	4	5
Produced Water Shut-off/Management	1	2	3	4	5

Is there a topic you'd like to see that is not listed? Suggest topics for PTTC.

____

____

____

____

Please fax response to PTTC (918.241.5728) *Thanks in advance for your input.*

Optional: Name: ____________________ Company: ____________________

Phone: ____________________ Email: ____________________

Tech Transfer Track

Proppant Flowback Treatments in Arkoma Basin Wells

XTO Energy Inc. (XTO) operates many conventional Arkoma Basin gas wells, typically completed in the late 1980s without fracture stimulation. In 2003 XTO began a fracture stimulation program, typically using a nitrified borate gel system to place proppant. Proppant flowback problems were common. Well cleanouts would restore production, but only temporarily. In 2006 XTO treated five wells with a proppant-flowback arresting (PFA) system.

The PFA service is a coiled-tubing deployed, single-trip, rigless intervention service that requires no isolation packers. Time and costs are lower than conventional workovers. The service treats the existing proppant in the near-wellbore region with a coating. After coating the grains, a consolidating agent forms a tacky film that creates bonds between grains that cure with time and temperature. Minimal conductivity loss is experienced. Curing of this one-component resin takes place slowly, which aids placement. The PFA service is implemented with pulsing technology, either fluidic oscillation or low-frequency pulsing, to enhance fluid flow and ensure penetration into the proppant pack.

The five wells in the 2006 program that XTO described had been requiring frequent wellbore cleanouts, costing $15,000 or more per cleanout. PFA treatments were performed in early 2006. Proppant flowback with associated production declines and down time has not been a problem since. Projected value added from reduced workover-cleanout expense and/or increased production varied from $210,000 to $400,000 per well per year.

Excerpted from "XTO Energy Extends Life of Arkansas Wells," Oil & Gas Journal, May 14, 2007, pp. 42-45.

IADC Planning Series of Books

Tackling the challenge of capturing the knowledge of experienced drillers that would be lost with the coming crew change in the O&G industry, the International Association of Drilling Contractors is planning a book series, as many as two dozen, spanning all aspects of drilling technology and operations. Plans are to publish five later this year or in early 2008. There are many books. What is different about this series? They will be peer-reviewed. The Book Committee, under the chairmanship of Leon Robinson, is looking for authors, co-authors, editors and reviewers. Interested? Contact Robinson at docleon@worldnet.att.net.

Excerpted from "IADC Book Committee Plans Legacy of Knowledge Before Greybeards Go Fishin'," Drilling/Contractor, January/ February 2007, p. 9.

Casing While Drilling (CWD) and Stage-Tool Cementing Combine to Resolve Piceance Basin Surface Casing Drilling Problems

The complex geology, dipping formation beds and fractured formations of the western Piceance Basin leads to "crooked hole" and "lost circulation" problems when drilling the surface hole. Surface casing is typically targeted at about 3,100 depth. Conventional drilling uses mud motors and low weight on bit. After drilling, hole conditions that can prevent getting surface casing to the desired depth can be encountered. Poor hole conditions also lead to poor cement jobs, requiring remedial workovers to achieve the cement return required by the Bureau of Land Management.

Sandridge Energy selected Weatherford's DwC (Drilling with Casing) service, combined with stage cementing of the surface casing. Results for a seven-well program were reported in this article, plus extended detail on some of the procedures involved. Bottom-line overall results were impressive compared to data evaluated for five wells that had been conventionally drilled. Documented improvements include:

- Reduced average overall drilling time by 2.72 days per well (21%),
- Reduced average surface-hole nonproductive time by three days per well (47%),
- Significantly reduced fluid loss with documented savings of $40,000 for one well,
- Reached desired surface casing depth in ALL WELLS,
- Achieved cement returns in ALL WELLS, and
- Reduced average deviation by 44%.

*Excerpted from "Casing While Drilling and Stage-Tool Cementing Combined to Mitigate Downhole Conditions," World Oil, March 2007, pp. 59-64 available online at **www.worldoil.com/magazine/MAGAZINE_DETAIL.asp?ART_ID=3141&MONTH_YEAR=Mar-2007.***

Deeper CT Drilling Growing in the U.S.

Coiled tubing (CT) drilling has been common in Canada, particularly at shallower depths. That experience is moving south to the U.S. Xtreme Coil Drilling Corp., with its Coil Over Top Drive rig, has been a driving force in the U.S. growth. Experience by multiple operators in multiple basins is building. Much of that experience is in deeper wells, which are made possible with Xtreme's rigs and the larger 3-1/2-inch CT developed for them by Tenaris Coiled Tubes. Further advancements may lead to even larger CT, which would further increase depths.

Following are some of the recent records with Xtreme rigs:

- Record depth: drilling for Encana in DJ Basin's Wattenberg field by XTC 200DT rig using 3-1/2-inch CT to depth of 8,125 ft
- Record drilling time: drilling for Anadarko in DJ Basin's Wattenberg Field by XTC 200DT rig—3.4 days spud to total depth; move to rig release 4.8 days
- Longest S Curve well: drilling for Encana in Piceance Basin reaching length of roughly 6,000 ft

Most recently, Xtreme delivered its first XTC 400 rig, operating for Encana in the Piceance Basin. This is a hybrid CT plus conventional drilling rig that has the same capabilities as a fit-for-purpose 14,000 ft conventional rig. CT can drill to near 10,000 feet, then one can use jointed drillpipe to approach 14,000.

Xtreme plans continued rapid growth, anticipating a fleet of 18 CT rigs by early 2008 with most scheduled for U.S. delivery.

*Excerpted from "Coil Over Top Drive Rigs Carry Canadian Contractor to Onshore Drilling Records in U.S. Rockies," New Technology Magazine, June 2007, pp. 34-35; "New Larger Bore CT Drilling Beyond 7,000 Ft," Oil & Gas Journal, June 25, 2007, pp. 45-49; "Xtreme Operations Update and 2007 First Quarter Results" available online at **www.xtremecoildrilling.com/news/releases/07-05-10xdcQ1.pdf.***

Developments in the Produced Water Arena

One element of DOE's produced water program focuses on produced water and the many issues associated with it. Several recent developments deserve notice.

Produced Water Management Information System (PWMIS) (http://web.evs.anl.gov/pwmis/). DOE's National Energy Technology Laboratory, in partnership with Argonne National Laboratory, has developed the web-based PWMIS. The new system offers critical information on current technologies and best practices, summaries of relevant state and Federal regulations and a decision tree for technology options to deal with produced water issues. PWMIS is an easily navigable web tool that consolidates all the required information in one location.

Desalination Unit. In a DOE-supported project Texas A&M University has developed a new technology to remove salts and minerals from brackish coproduced water, yielding safe drinking water. The project's mobile desalination unit can process as much as 238 bwpd. It enables one to re-use about 30 percent of a well's wastewater stream, reducing the volume and costs of salt water disposal. The technology has been licensed to GeoPure Water Technologies LLC to commercialize. *View further information in DOE's Techline online at **www.netl.doe.gov/publications/press/2007/070720-Oil_and_Gas_Produced-Water.html.***

Guide to Management of Produced Water. The Interstate Oil & Gas Compact Commission (IOGCC) in cooperation with ALL Consulting has completed a comprehensive new guidebook to the current best management practices for produced water from conventional gas and oil operations. The guidebook, entitled A Guide to Practical Management of Produced Water from Onshore Oil & Gas Operations in the United States, is available through IOGCC's website (**www.iogcc.state.ok.us/projects.aspx**). The project also developed an online geographic information system (GIS)-based analysis tool to help producers understand watershed-related regulations and permits and calculate the impacts of produced water in specific areas according to various oil and gas field development scenarios. The online guidebook and GIS tools will help regulatory agencies devise more effective regulations to make water management easier while still maintaining environmental protection.

DOE Receives AAPG's Corporate Award for Excellence in Environmental Stewardship

The American Association of Petroleum Geologists (AAPG) recently recognized DOE for its work in a network of regional carbon sequestration partnerships by selecting them for their "Corporate Award for Excellence in Environmental Stewardship." Nearly 350 organizations in 41 U.S. states, four Canadian provinces and three Indian nations are involved. A two-year characterization phase identified more than 3,500 billion tons of potential CO_2 storage capacity in geologic formations. The partnerships are currently working to implement 25 geologic sequestration tests.

*View further information in DOE's Techline online at **www.fe.doe.gov/news/techlines/2007/07026-DOE_Earns_Environmental_Award.html.***

Closed-Loop Drilling: One Operator's Experience in NM

Drilling pits are an issue in New Mexico. Although perceived as being more costly than traditional pits, that is not necessarily so. Cimarex Energy Co. described their experience using an engineered on-site drilling waste treatment system on nearly 40 wells in Lea and Eddy Counties, New Mexico. Cimarex found that the average cost of using a pit and hauling the waste elsewhere for disposal is about 45% more compared to following the same process without a reserve pit. When burying the waste on-site, costs are about 24% higher when using a reserve pit. Cuttings volumes are significantly less, some 60 to 70% less. To top it off, the footprint of the drilling operation is reduced.

*Excerpted from "Closed-Loop Drilling System: A Viable Alternative to Reserve Waste Pits," World Oil, December 2006, pp. 41-48 available online at **www.worldoil.com/magazine/MAGAZINE_DETAIL.asp?ART_ID=3053&MONTH_YEAR=Dec-2006.***

SEQURE™ Well Finding Technology

The SEQURE well finding technology, developed by NETL researchers in partnership with Apogee Scientific, Inc. (Englewood, Colo.), Fugro Airborne Surveys (Mississauga, Ontario, Canada) and LaSen, Inc. (Las Cruces, N.M.), employs magnetic and methane sensors deployed on helicopters to accurately locate abandoned and leaking wells. Finding these wells is valuable for secondary and tertiary recovery projects, but it is absolutely critical in future CO2 sequestration projects. SEQURE, along with two other technologies developed in DOE-supported R&D projects, received an R&D 100 Award from *R&D Magazine* for 2007.

*For more information, view DOE's TechLine at **www.fe.doe.gov/news/techlines/2007/07058-FE_Technologies_Win_Awards.html.***

Green Completions in Fort Worth Basin Attractive for Devon

During a May 2007 EPA Natural Gas STAR workshop, Devon Energy Corp. shared their experience with reduced-emission or "green" completion practices in their Fort Worth Basin operations. With conventional practices, a well is flowed back to frac tanks until clean up is completed. Tubing is then snubbed in the hole while venting gas to atmosphere. Gas during required open flow potential tests is also vented to atmosphere. With reduced-emission completions, a temporary flowline and meter run is on location during completion. The well is flowed back to frac tanks until gas is encountered, at which time the well is turned to sales and revenue realized during further cleanup, snubbing and testing. In their Fort Worth Basin operations Devon's incremental costs are about $6,000 per well—but the incremental revenue from sale of captured gas is more than 10 times that. The work environment is safer and wells can be cleaned up longer. Since starting the practice in March 2004 through 2006, Devon had captured and sold about 3.7 Bcf of natural gas, realizing about $20 million in profits.

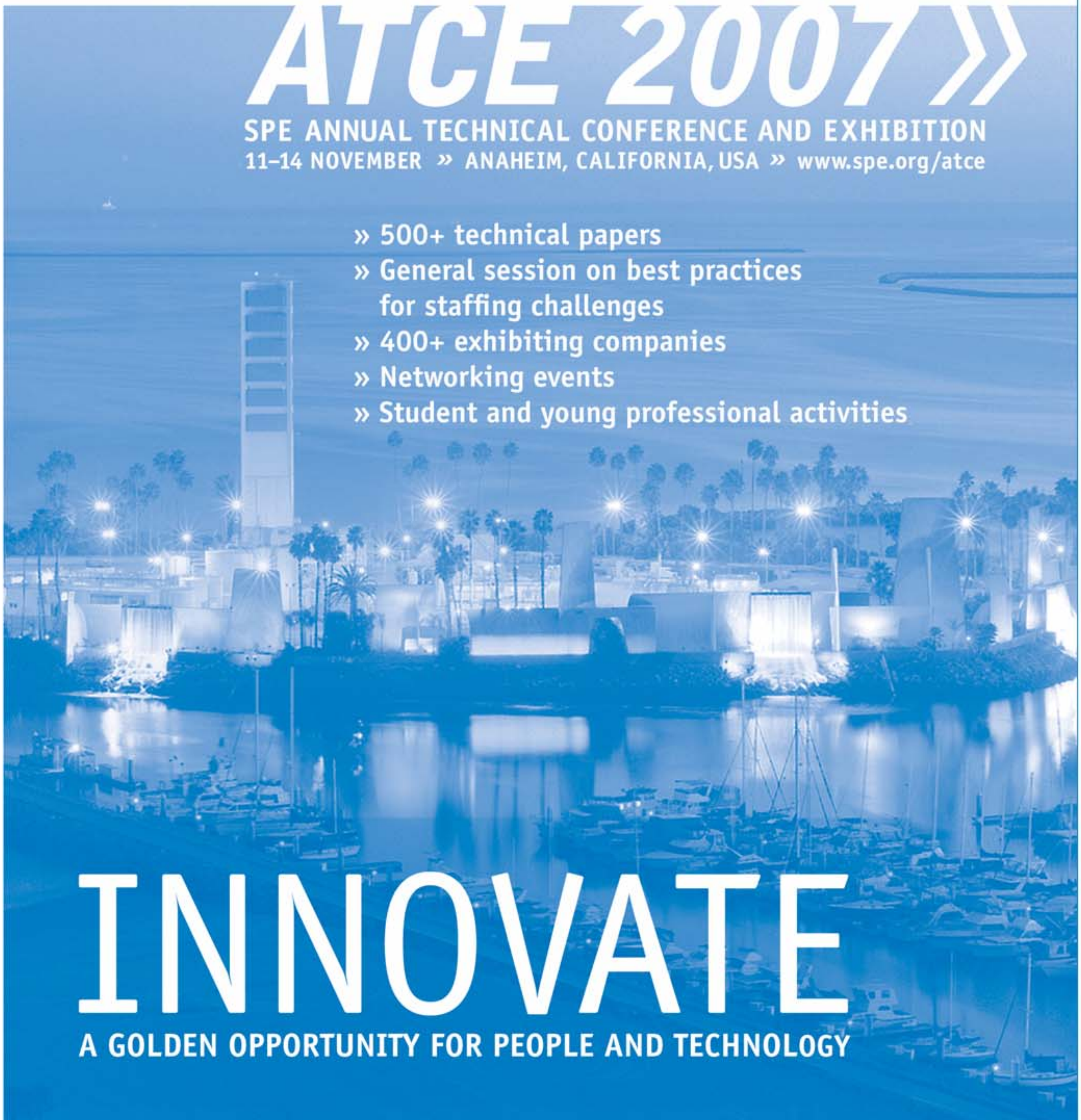
*For more information, view Devon's presentation online at **www.epa.gov/gasstar/workshops/collegestation-may2007/7-completions.pdf.***

EPA's Natural Gas STAR Program

Aug. 21-22	Long Beach, CA	Producer Tech Transfer Meeting
Sep. 11	Glenwood Springs, CO	Producer Tech Transfer Meeting
Sep. 13	Durango, CO	Producer Tech Transfer Meeting
Oct. 23-24	Houston, TX	Annual Implementation Meeting

Recommended Practices *Check them out - make or save $ and protect the environment*

www.epa.gov/gasstar/



THUMS production facilities in Long Beach, CA, designed to blend in with coastal community. Photo courtesy of Occidental Petroleum Corporation.

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12-CD Set of DOE's Unconventional Gas Research Data

During the 1980s and 1990s DOE invested about $225 million in unconventional gas research. This research, or advances spawned by it, contributed greatly to technologies widely employed today in unconventional gas development. The archive, prepared in response to increased requests from industry for reports stored at NETL, includes nearly 1,400 documents on twelve CDs: four related to eastern gas shales, three related to western gas sands and one each related to methane from coal seams, methane hydrates, deep source gas and secondary gas recovery. Reports and proceedings covering the unconventional gas R&D program in general are included on a final CD.

*To order the 12-CD set, please visit the NETL CD-DVD ordering system (**www.netl.doe.gov/publications/cdordering.html**) and request the Archive of Unconventional Gas Research Data.*

Pre-Drill Seismic Technology for Deep Wells

Conventional seismic imaging and attribute analysis becomes less reliable the deeper the target. Rock Solid Images has developed, in a DOE-supported project, an approach that improves pre-drill diagnostics for deep reservoirs using a set of independent indicators known as seismic attenuation attributes. Essentially, the degree of attenuation is used to track the amount of gas or oil in the reservoir, and combined with conventional seismic analysis techniques, these attenuation attributes can effectively confirm or disprove the presence of oil or gas at depth.

The modeling software was tested offshore Norway where conventional seismic attribute analysis indicated possible hydrocarbons beneath a well drilled to 14,000 feet. Through rigorous forward modeling, using available log and seismic data, Rock Solid Images found that the anomaly was caused by a marked change in rock type, rather than oil or gas in the reservoir. Drilling another well was avoided. The modeling software has also been successfully tested in the deep Gulf of Mexico and offshore West Africa. It is commercially available through Rock Solid Images' iMOSS software package and has been adopted and developed for internal use by several major oil companies.

*For further information, view DOE's Techline at **www.netl.doe.gov/publications/press/2007/07051-Seismic_Technology_Goes_Commercial.html**.*

Stripper Well Consortium Makes 10 Project Awards

Following its spring meeting in New York, the Stripper Well Consortium (SWC) evaluated the received proposals and has subsequently made awards for 10 projects, committing over $1.16 million of SWC funding for work to be performed between August 1, 2007 and July 31, 2008. Projects address needs for both stripper oil and natural gas wells. Some projects are follow-on work to earlier SWC projects, while many are new. Some of the new projects are:

- *Low Cost, Stripper Well Booster Compressor* by Combined Heat and Power, Inc.
- *Novel Low Rate, Electric Plunger Pump System* by Impact Technologies LLC
- *Hybrid Casing Plunger for Multiple Zone Stripper Wells* by PAAL LLC Casing Plungers
- *New Class of Novel Paraffin Inhibitors* by RTA Systems, Inc.
- *Low Cost, 2-Tower Micro Scale N_2 Rejection System* by University of Kansas Research Center

*Readers are encouraged to review details of all projects, which are available on the SWC's website (**www.energy.psu.edu/swc/projects.html**).*

New Approach Brings High-End Modeling Software to the PC

In a DOE-supported project, Texas A&M University has adapted sophisticated computer modeling to the PC, using "Generalized Travel Time Inversion" technology. Cost and time savings coupled with the streamlined model and accessible PC-based tools make the technology feasible for a much broader audience.

Reservoir characterization and subsequent simulation can identify unswept regions in mature fields. "History matching" to calibrate the model is essential and tracer tests provide key data that must be modeled during history matching. In the Texas A&M project, researchers developed a novel, computerized method for rapidly interpreting field tracer tests. The new method integrates computer simulations with history matching techniques, allowing scientists to design tracer tests and interpret the data using practical PC-based software—a process that is much faster than conventional history matching.

The developed technology has already been adopted by two companies. As a result of widespread interest in advancing this technology, A&M researchers have an ongoing industry research and development consortium funded by eight oil production and service companies and won a grant from the National Science Foundation.

*For more information, view DOE's Techline at **www.fe.doe.gov/news/techlines/2007/07035-PC_Tools_Boost_Oil_Recovery.html**.*

NPC Presents "Energy" Study to DOE Secretary Bodman

Culminating a 22-month study effort, the National Petroleum Council presented its report, Facing the Hard Truths About Energy, to DOE Secretary Bodman on July 18. More than 350 expert participants contributed. Risks and challenges to a secure and reliable energy future were identified and strategies and recommendations were made. The NPC study conveyed multiple recommendations regarding R&D, which provides both technology for application and training for the future workforce.

- For enhanced oil recovery (EOR), support regulatory streamlining and R&D programs for marginal wells and expedite permitting of EOR projects, pipelines and associated infrastructure.
- For O&G resources affected by access restrictions, conduct national and regional basin-oriented resource and market assessments and use technology and operational advancements to allow environmentally responsible development of high potential onshore and offshore areas currently restricted by moratoria or access limitations.
- For unconventional O&G production, accelerate oil shale and oil sands R&D and leasing and accelerate unconventional natural gas leasing and development
- To expand R&D opportunities to support long-term study goals, review the current DOE R&D portfolio to refocus spending on innovative, applied research in areas such as EOR, unconventional oil and natural gas, biofuels, nuclear energy, coal-to-fuels and carbon capture and sequestration.

*Excerpted from Executive Summary (available online at **www.fe.doe.gov/programs/oilgas/advisorycommittees/facing_hard_truths_execsumm.pdf**) of National Petroleum Council Report: Facing the Hard Truths About Energy, delivered to Secretary of Energy Bodman on July 18, 2007.*

Appalachian Region

The Digital Revolution: Archive, Organize and Deliver

Traditionally, public oil and gas databases in the Appalachian basin have contained various parameters associated with site specific well locations, including tops, thicknesses, treated intervals, initial well test and pressure and production histories. More recently, individual reservoir data were compiled on a field scale for oil (TORIS) and gas fields (Gas Atlas). Recent effort compiled a variety of other data types (stratigraphy, structure, seismic, petrology, geochemistry and gas production) for the Trenton-Black River trend.

Basin-wide databases created during recent research projects include: digital maps, cross sections and other illustrations that were either works in progress or finished versions in reports and slides used for presentations. References from the literature and lab data generated during the projects also are included in this "new generation-style" database, one that captures in digital form all aspects of previous work as well as this new information (as an example, see page 7—12-CD set of DOE's unconventional gas research data).

In a recent Appalachian Region workshop, those involved in developing and delivering data described the "digital" systems and resources available for their state. These offerings are dynamic, so an update like this has great value for those operating in the region.

Speakers representing the Pennsylvania Geologic Survey (PGS) described and demo'd (1) the WIS (Well Information System) and (2) PA*IRIS (Pennsylvania Internet Record Imaging System). WIS originally was for internal use only, but evolved into a system that can be used by visitors to the PGS offices. Survey personnel help the visitors log on to find information on individual wells. PA*IRIS was developed to enable industry to access well records from their offices. Essentially, the PGS scanned everything in their files and put it into this system. An expensive software system is required to view the information, so the PGS charges each subscriber a one-time $5,000 fee, plus $500 for annual maintenance.

Originally PA*IRIS included scanned location plats, the completion record (drillers' log) and perhaps a plugging affidavit, but it has evolved since '99 to link to WIS, so more detailed information on an individual well can be accessed. This includes interpreted information, such as log tops picked by staff geologists, plus lists of available logs, lists of "canned" reports with data in spreadsheets and a production module that allows the user to gather production data. ArcReader allows users to view tiff images of oil and gas base maps.

The PGS is planning several new products that will become part of PA*IRIS. This includes 7.5 minute topo maps with well locations, the ability to view several layers, download capability, interactive tools, etc. They plan 10-15 interactive layers that can be turned on or off, with print capability.

Staff from the Ohio Geologic Survey described and demo'd POGO, the Production of Oil & Gas in Ohio database that is updated annually; the digital map series; bedrock geology, on CD or online; and the interactive map series. Most of the time was spent describing the interactive map series, which includes the oil and gas maps in combination with topographic maps, aerial photos, roads and streams, etc. A print layout feature with scaling options allows you to create a PDF.

Searches can be made on many parameters, but most begin with the state permit number. Ohio has one file, one folder per well in their system, whereas Pennsylvania has separate files for the plats, well record, plugging record, etc. The Ohio system allows a user to cut and paste well data and create their own shape files. They also have a query string option, allowing a user multiple choices to add to the query string before the search is executed and the data are assembled in a table or on a map.

In New York there is ESOGIS (Empire State Oil & Gas Information System). Early punch card and tape systems eventually evolved into the online system of today. Their goal in NY was to make all subsurface data and information, including all of their reservoir studies, available online. This includes slides of numerous talks presenting results of research. To use the site, one first must create an account, then log in. Creating an account allows one to create different project files and then to add data to these files. There is no limit to the number of wells that you can download, but there is a one minute time limit on the downloads. A project manager feature allows one to create a project, add wells, tailor the data, display and download the data. Scanned images of well records, logs, etc. are available, as are production data. There is also a virtual core library, where one can look at core photos or core images. NYSERDA reports are also available there. Subscriptions range from $2,500 to $25,000, depending on which of five levels one chooses.

Staff from the West Virginia Geologic Survey (WVGS) described their (1) oil and gas database and (2) a current project to assemble from a variety of sources all data on five tight gas plays and deliver the data online. Current online services include "pipeline," a subscription service that allows users to access data on individual wells; production summaries, where queries can be made by well, by county or by years; e-logs, as scanned images in tiff files; focused datasets, mainly from project work, like Trenton-Black River, coal bed methane, etc; and the IMS site, which is hosted by the WVGS. The idea in the DOE-supported Log Scan project is to find every piece of data on five tight gas plays in two states, organize the data into a database and delivery it to users online. This data is currently widely scattered among offices and even within offices.

Demonstrating their commitment to the digital world, the Kentucky Geologic Survey has taken a bold step of closing their oil and gas record room (open by appointment only) and replaced it with a system that can display everything in that room on a user's computer. To do this, the user needs to download and install a free web browser plug in. No fees are required and no subscription service is necessary.

Those looking for data should not forget Google. Its searches not only lead one to the resources within geological surveys and state agencies, but there can be other sources. When one finds a resource of value, bookmark it and it's easy to go there again.

Appalachian Workshop

Core and Sample Analysis and Interpretation

September 2007 (TBD)
Pittsburgh, PA.

For information contact: 304.293.2867 x 5443, for date and details, watch the Appalachian Region calendar at: **www.pttc.org/appalachian/appalachian_calendar.htm.**

Basin Analysis and Petroleum System Characterization and Modeling, Interior Salt Basins, Central and Eastern Gulf of Mexico

By Ernie Mancini and Don Goddard, University of Alabama and Louisiana State University

The University of Alabama and Louisiana State University have undertaken a cooperative five-year, two-phase fundamental research project involving sedimentary basin analysis and petroleum system characterization and modeling of the North Louisiana Salt Basin and Mississippi Interior Salt Basin. According to the United States Geological Survey, the hydrocarbon volume of these basins ranks them in the top 8% of the most petroliferous basins of the world. Phase 1 work focused on data compilation, determination of the tectonic, depositional, burial and thermal maturation histories, basin modeling and petroleum system identification for the North Louisiana Salt Basin; comparison of the geohistory of the North Louisiana Salt Basin to that of the Mississippi Interior Salt Basin and assessment of the undiscovered and underdeveloped reservoirs of the North Louisiana Salt Basin. Phase 2 work focuses on characterization and modeling of the Upper Jurassic Smackover petroleum system, characterization and modeling of other Mesozoic petroleum systems and refinement of the assessment of the undiscovered and underdeveloped reservoirs of the North Louisiana Salt Basin.

Three active petroleum source rocks (Oxfordian, Albian and Cenomanian-Turonian) have been reported from the onshore north central and northeastern Gulf of Mexico area. Based on the assessment of potential petroleum source rocks in the North Louisiana Salt Basin, only the Upper Jurassic (Oxfordian) Smackover lime mudstone beds were determined to be an effective regional petroleum source rock in this basin. The components of the Smackover petroleum system in the North Louisiana Salt Basin include the following: (1) the underburden and overburden strata include pre-rift, syn-rift and postrift deposits, which are a result of their rift-related geohistory; (2) organic rich and laminated Smackover lime mudstone beds are the petroleum source rocks; (3) petroleum reservoir rocks include

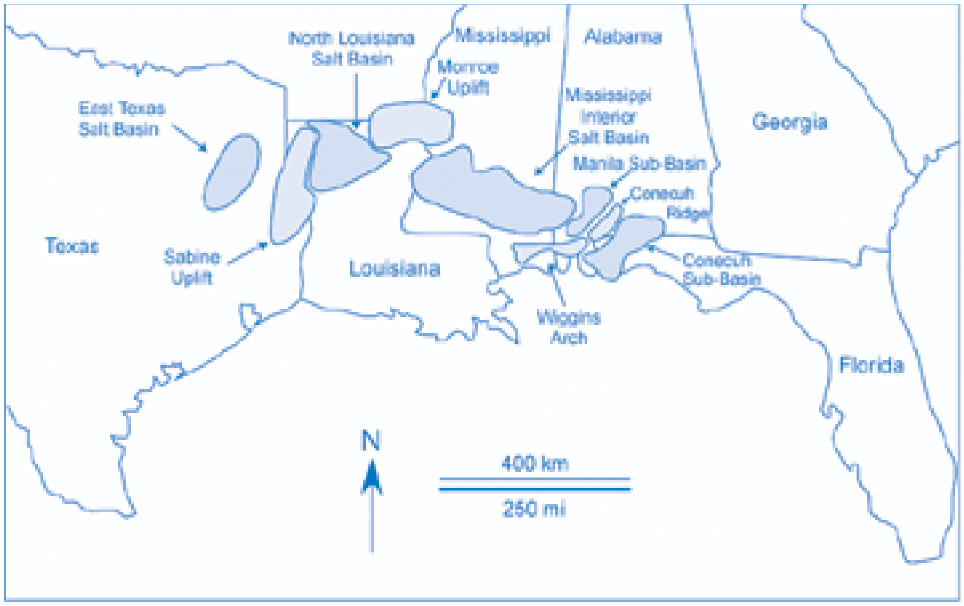


Figure 1. Location map of interior salt basins and subbasins in the north central and northeastern Gulf of Mexico area.

Jurassic, Cretaceous and Tertiary siliciclastic and carbonate strata; (4) petroleum seal rocks are Jurassic, Cretaceous and Tertiary anhydrite and shale beds; and (5) structural or combination traps characterize the basin with movement of the Jurassic Louann Salt also producing a complex array of structures that serve as petroleum traps. These structures include peripheral salt ridges; low relief salt pillows, salt anticlines and turtle structures; and piercement domes. From burial history and thermal maturation history profiles for wells in the North Louisiana Salt Basin, hydrocarbon generation and maturation trends have been observed.

Initiation of oil and associated gas was at a vitrinite reflectance (Ro) level of 0.55% and the commencement of essentially only thermogenic secondary, non-associated gas generation was at a Ro level of 1.3%. Cessation of thermogenic gas generation was at a Ro level of 4.0%. The generation of hydrocarbons from Smackover lime mudstone beds was initiated at 6,000 to 8,500 feet during the Early Cretaceous and continued into the Tertiary. Hydrocarbon expulsion from Smackover source rocks began during the Early Cretaceous and continued into the Tertiary. Commencement of oil expulsion began first in the southern (downdip) portion of these basins in the Early Cretaceous and peaked in the late Early Cretaceous. Smackover lateral hydrocarbon migration was probably of an intermediate range (80 km or 50 mi). Hydrocarbon migration into overlying strata was probably facilitated by vertical migration along faults.

The Bossier Shale has been identified as a potential Mesozoic petroleum source rock in the North Louisiana Salt Basin. Phase 2 work on characterizing these shale beds using thermal maturation history has been initiated with completion expected in early 2008.

PTTC workshops transferring Phase I insights to industry were held in Tuscaloosa, Alabama and Shreveport, Louisiana in spring 2007. Contact Bennett Bearden, Alabama (email bbearden@geo.ua.edu) or Don Goddard, Louisiana (email dgodda1@lsu.edu) for further information about these workshops. There is other information about the research project and its reports online (link reports online to ***www.netl.doe.gov/technologies/oil-gas/Petroleum/projects/EP/Explor_Tech/15395UofAL.htm****). Future workshops on later findings and insights are anticipated.*

Shallow Gas in the Michigan Basin

By Dr. William B. Harrison, III, Professor Emeritus, Michigan Geological Repository for Research and Education, Department of Geosciences, Western Michigan University, Kalamazoo, MI.

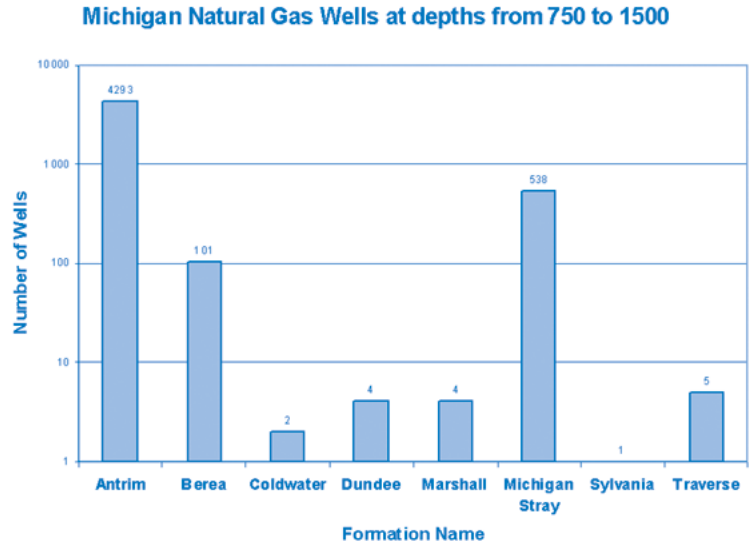


Figure 2. Distribution of Michigan natural gas wells by geologic formation. Data compiled from records of Michigan Geological Survey.

Shallow gas production is significant from the Michigan Basin. Approximately 40% of Michigan's gas production is shallow (<1500 feet). Total cumulative Michigan gas production exceeds 6.5 TCF, with Antrim Shale production at approximately 2.5 TCF. All other shallow formations have produced about 250 BCF.

Over 1200 wells have shown commercial production from less than 1000 feet deep and nearly 5200 wells produce gas from less than 1500 feet depth. About 91 percent of the shallow gas in Michigan is produced from the Upper Devonian Antrim Black Shale. Most of the 2.5 TCF of gas produced from the Antrim around the Basin's northern margin is biogenic in origin. The Antrim Shale in this area has seen low thermal maturation (Ro approximately 0.6). The presence of an extensive natural fracture network is the key to commercial production. Although there had been occasional Antrim producing wells since 1940, the recent development began in the late 1980s as a result of new technology, access to underutilized Silurian Niagaran Reef well infrastructure, and a federal non-conventional fuels tax credit (section 29). To date, the Antrim Shale in Northern Michigan, has produced over 2.5 TCF of gas from over 9000 wells. Production in 2006 was nearly 140 BCF. The Antrim Shale is a classic black shale that produces natural gas by desorption processes into a complex network of fractures. The distribution of high total organic carbon and natural fractures are keys to good productivity. This play, mainly in north-central Lower Michigan, has been developed through the use of vertical wells. The abundance of fractures in the primary development area makes vertical wells effective. Initial well spacing was on 40-acre units; unit size was increased to 80-acre units in 1995. Today some operators even use 160-acre units. Horizontal drilling has not become widely used in the Antrim Shale play. Few horizontal wells have performed significantly better than vertical wells.

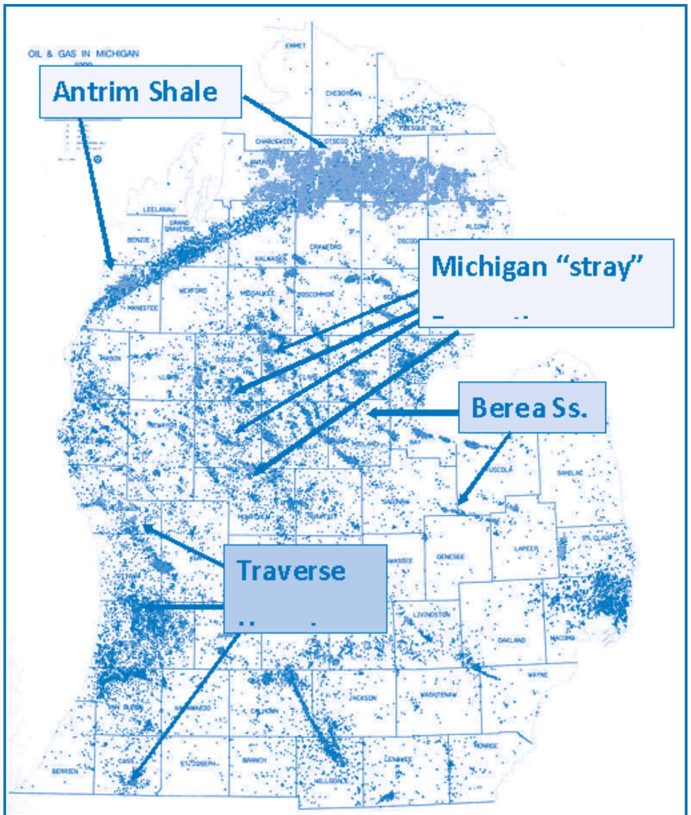


Figure 1. Modified from Michigan Geological Survey Map online **www.deq.state.mi.us/documents/deq-ogs-gimdl-GGMOG05.pdf**.

Shallow gas is produced from Devonian, Mississippian, Pennsylvanian and even sporadically from the Pleistocene Glacial Drift. Most other formations in the Michigan Basin have produced only small amounts of gas from shallow depths. Mississippian sandstones of the Michigan Formation and the Berea Sandstone have small amounts of commercial production. The Michigan Formation "Stray" Sandstone has been the most productive, with wells in seven different fields. The largest of these fields, Shaver Field in Gratiot County, produced over 11 BCF of gas before being converted to gas storage.

Middle Devonian carbonates of the Traverse Limestone have limited gas production from a few shallow conventional reservoirs, often associated with oil production. Gas-oil ratios are generally low (typically less than 5000). Historically much of the associated gas from these reservoirs was flared and accurate records of total gas production are poor.

Very limited gas production is also known from the Mississippian Marshall and Parma Sandstones, the Pennsylvanian Saginaw Formation and the Pleistocene Glacial Drift. Although the production of shallow gas from the Michigan Basin is dominated by the unconventional Upper Devonian Antrim Shale gas play, there are several other shallow conventional-type plays that should not be overlooked. If these other horizons were exploited with the intensity of the Antrim Shale development, other significant gas reserves may be found in the Michigan Basin.

Cellular geomodel for a giant gas field, Hugoton, Midcontinent, U.S.A.

Martin K. Dubois, Alan P. Byrnes, Saibal Bhattacharya, Geoffrey C. Bohling and John H. Doveton, Kansas Geological Survey

The Hugoton geomodel provides a comprehensive lithologic and petrophysical view of a mature giant Permian gas system, the 70-year-old Hugoton Field, which is the largest gas field in North America. Fine-scale cellular models are particularly important for modeling thin-layered, differentially depleted reservoir systems (Hugoton) and methods used in building the model demonstrate the construction of a cellular petrophysical model for a giant field. The study also illustrates the benefits of pooling proprietary geologic and engineering data in settings with multiple operators. Both the knowledge gained and the techniques and workflow employed have implications for understanding and modeling similar reservoir systems worldwide. As giant fields mature, high-resolution modeling at the full-field scale in data-rich environments will become increasingly important and the Hugoton model is a large-scale example for developing such models.

Building an accurate static model for the entire Hugoton field (Hugoton and Panoma in Kansas and Guymon-Hugoton in Oklahoma) was the primary objective of a 2-1/2 year collaborative project sponsored by ten industry partners and the State of Kansas through the Kansas Geological Survey. The goal was to develop a model with sufficient detail to represent vertical and lateral heterogeneity at the well, multi-well, and field scale, which could be used as a tool for reservoir management including accurate prediction of original and remaining gas-in-place. This required that the model be finely layered (169 layers, 3-foot (1 m) average thickness) and have relatively small XY cell dimensions (660x660 ft, 200x200m; 64 cells per mi2). These criteria resulted in development of a 108-million cell model for the 10,000-mi2 (26,000 km2) area modeled. Although lithofacies geobodies tend to be laterally extensive, covering multi-section to township scales, small XY cell dimensions were required to allow the extraction of portions of the model for local reservoir simulation. Water saturations needed for original gas-in-place (OGIP) determination were estimated using capillary pressure methods and not measurements from wireline logs because accurate determination of water saturations using conventional wireline logs is complicated by deep mud filtrate invasion for typical drilling programs. Material balance methods for estimating OGIP are equally problematic because the reservoir is layered and differentially depleted and wellhead shut-in pressures (WHSIP) are strongly influenced by high-permeability interval properties and do not accurately represent all interval pressures; and pressure data for individual layers are sparse. The Hugoton geomodel may be the largest model of its kind (lithofacies-controlled, property-based water saturations).

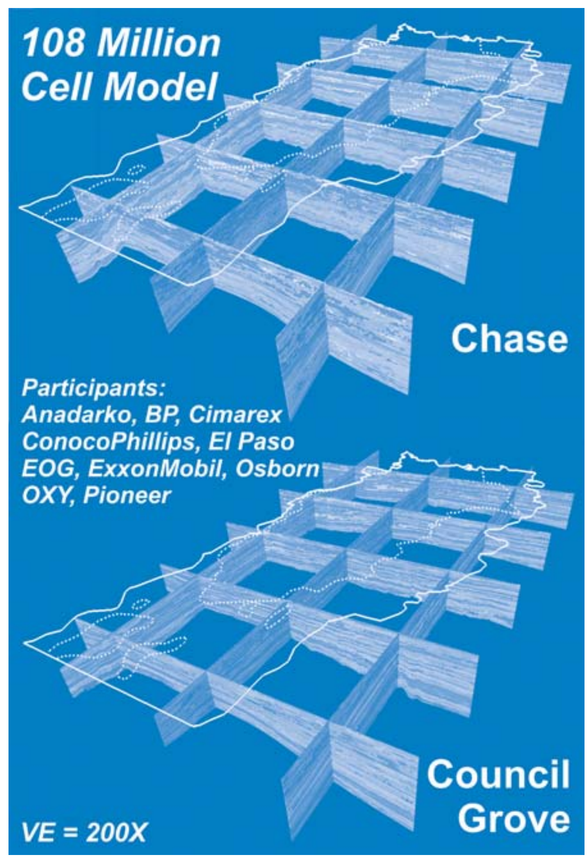
Core-based calibration of neural-net prediction of lithofacies using wireline-log signatures, coupled with geologically-constraining variables, provided lithofacies at wells. Stochastic methods were employed to estimate lithofacies between wells. Differences in petrophysical properties among lithofacies and within a lithofacies among different porosities illustrate the importance of integrated lithologic-petrophysical modeling and of the need for closely defining these properties and their relationships. An accurate lithofacies model, coupled with lithofacies-dependent petrophysical properties, allowed the construction of a 3-D geomodel that has been effective at the well, section (1mi2, 2.6 km2) and multi-section and field scales. Multi-well, multi-section simulations validate the property model and illustrate differential depletion relationship to layer property variability.

The model provides a detailed three-dimensional view of the 160-m reservoir comprised of thirteen shoaling-upward cycles vertically stacked in a low-relief shelf setting and is an analog for similar thin layered, stacked-cycle reservoir systems, including those in the Paradox and Permian basins and the Khuff Formation in Gwahar and North fields in the Arabian Gulf. Unprecedented 3-D views of shifting lithofacies patterns on a large stable shelf document sedimentary response to climate change during the transition from icehouse to greenhouse conditions in the Lower Permian. The model is a tool for predicting properties, water saturations and OGIP, is a quantitative basis for evaluating remaining gas--in-place, particularly in low-permeability intervals and has helped direct field management and field rules changes that could enhance ultimate recovery. The model and study also provides a "fast-forward" view of similar giant reservoir systems worldwide. Static model construction was completed in 2006. The consortium is now focused on the characterization of remaining gas-in-place and developing alternative drilling and completion practices for more efficient extraction of remaining reserves.

Key findings:

1. The Kansas-Oklahoma portion of the field has yielded 35-tcf gas (963-billion m3) over a 70-yr period from over 12,000 wells and an estimated 65% of the original gas-in-place in the central portion of the field.
2. Most remaining gas is in lower permeability pay zones of the differentially depleted, layered reservoir system.
3. The Chase (Hugoton) and Council Grove (Panoma) behave as a common reservoir.
4. Lithofacies bodies are laterally extensive and reservoir storage and flow units exhibit extensive lateral continuity.
5. The Hugoton reservoir free-water level (FWL) is sloped, ranging, west to east, from subsea depth of +1000 ft (+300 m) to +50 ft (+15 m).
6. Base on reservoir simulations, production is sustainable through 2050, provided the integrity of 40-70-yr old wells can be maintained.

For more information and references, see the full report online at the Kansas Geological Survey website ***www.kgs.ku.edu/PRS/publication/2007/OFR07_06/index.html***).



Fence diagram from the 108-million cell, 80 x 120 mi, model for the Chase Group (Hugoton field, solid outline) and the directly underlying Council Grove Group (Panoma field, dashed outline), flattened at the top of each interval. Production is from thirteen upward-shallowing marine carbonate intervals (cooler colors) separated by continental siliciclastics (warmer colors).

Rocky Mountain Region

The Next Generation of Oil and Gas Professionals: Futures in Energy 2007

Concerns have been raised over the past several years where the next crop of Oil and Gas Professionals will come from. PTTC is actively involved in answering the question with the Futures in Energy Program for high school teachers and students. With the help of 29 sponsors, PTTC's Rocky Mountain Region oil and gas industry outreach program continued successfully in 2007. A total of 15 high school students and 23 teachers were given an interactive training program focusing on oil and gas exploration technology—some at the Colorado School of Mines between June 18-22 and others in Pinedale, Wyoming between June 11-15. Participants were supplied with free room and board and instructional material. The courses for both the students and teachers included class room training, talks by local industry people on careers in the energy field, field visits to see actual oilfield operations and instruction at sites of geologic interest. After the course, nine students participated in a four week paid internship program with local energy companies in their community.

High school teachers received two semester hours of graduate-level re-licensing through the program and at the end of the training course were given a kit of instructional material so they could teach a six week module on oil and gas technology. This module addresses various aspects of petroleum exploration, integrating geography, mathematics and problem-solving skills with traditional geologic concepts. It is hoped that through the use of real data from the energy industry and federal agencies, including seismic profiles, electric logs, maps, and oil samples, that earth science and the study of natural resources will become relevant to students.

On the lighter side, everyone enjoyed the "Gushers and Dusters" simulation game in which players get to act out the risk and excitement enjoyed by members of the energy community. Overall, the program received great grades from all participants.

NOTE: High school students and teachers interested in joining next year's program, or companies interested in sponsoring through internships or money donations are encouraged to contact Mary Carr, mcarr@mines.edu, 303.273.3107.

Dr. Mary Carr, Director of PTTC Rockies, instructing at the Field Trip to Dinosaur Ridge

Animated Instruction on the Field Trip to the Duke Energy Natural Gas Processing Plant

Straightforward Approach for Reducing Electric Costs

By Naaman Gipson, EMS Electronics, LLC in cooperation with Bob Kiker, PTTC Texas Permian Basin

Electric power costs, which are often a major component of operating costs, do not necessarily require complex or expensive solutions to realize significant savings. This article focuses on one such solution that has application in several different oil- or gas-patch applications. Beyond just addressing reduced power consumption, the solution also provides transient surge protection and can reduce lost production due to equipment downtime, equipment replacement as well as repairs and associated labor hour reductions.

Although band-pass filters are not a new concept, Stems Electronics, LLC (STEMS), a four-year old company based out of Plainview, Texas, now offers a product that will provide line filter conditioning, enhanced power factor correction and top of the line surge and lightning protection, all in one device. Although a relatively new product, there are numerous U.S. applications serviced by a national sales organization. Products are also being sold in Canada, Mexico, Puerto Rico and Europe. Within the U.S., STEMS units are being applied by producers in different applications (artificial lift, injection pumps, compressors, etc.). Having realized positive results, several operators now purchase units on a regular basis.

Figure 1 illustrates why operators would do so. When applied in a 150-hp injection system in Wyoming, the units realized an 18% savings in daily electric cost. This system required eight STEMS units, costing approximately $28,000. With the demonstrated savings, considering purchased power only, this translates to a payout period of only 16 months. Long-term, there are other equipment/reliability savings that will be realized.

The unit is a highly sophisticated band-pass filter that blocks distortion in electrical power above and below normal signal range. It cleans up utility-supplied power to make power better fit the form of a 60-cycle sine wave, forcing current and voltage to form to the sine wave as well, which is the ideal design for AC motors. As a direct result, motors run smoother at lower temperatures, work more efficiently and require less power from the utility provider (KW). This creates an ideal operating environment for equipment, as well as increases power factor, reduces KVAR, amp draw and most importantly, KWH usage. If one compares the amount of electricity flowing to the site (KVA) with that performing work (KW), one sees a difference (KVAR). More current flows through the electrical system than is needed to do the required work. Excess current dissipates in the form of heat as reactive current (KVAR) flows through resistive components (motors, wires, switches and transformers).

Power Factor is the ratio between True Power (KW) and Apparent Power (KVA), known as Reactive Power (KVAR). Perfect unity of your power factor is 1.0, which means that there is no wasted energy. The voltage and current are in phase in the 60 cycle sine wave. Anything less than 1.0 (ex: 0.80, 0.65, 0.50) means there is energy being expended that is not being used. This often occurs in cyclic processes such as those using conveyers, compressors, grinders and pumping units where the motors are sized for the heaviest load. Losses caused by poor power factor are due to reactive current flowing in the system. These are watt-related charges and can be eliminated through power factor correction. When compared to the regular cost of power factor correction, load bank capacitors have a much longer payout than STEMS equipment. STEMS units are also very effective in reducing power factor penalties and demand charges. Keep this in mind! Whenever energy is expended, one pays for it whether it does useful work or is wasted as heat.

Before choosing a unit, one must first test the condition of the motor to determine which size unit is necessary to achieve satisfactory results. Going a step beyond that, STEMS doesn't "permanently" install units until initial performance demonstrates expected improvements. STEMS provides a three-year prorated warranty, a $2,000,000 product liability insurance policy (this means should a downstream protected motor be fried by lightning, the loss will be covered) and a 12-month money back guarantee that electrical consumption will be reduced by 5%. In actuality, savings average 10-12% with an average payout of 6-18 months (with all installations proving fewer than 24 months). Payouts are longer for smaller loads (less than 20 hp). STEMS offers a lease program to those who qualify and meet the criteria.

*For further information, visit STEMS website (**www.emselectronics.net**) or contact Winfrey A. Shipp, President / Sales Manager (phone 806.292.7995, email washipp@nts-online.net).*

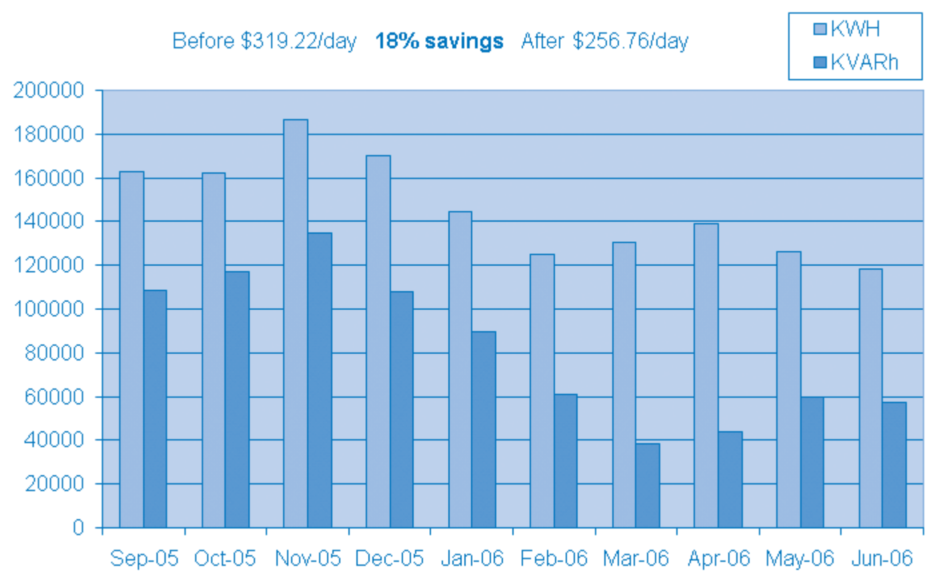


Figure 1. Power Cost Reduction in Wyoming 150hp, 5-Pump Injection System with STEMS Units

West Coast Region

New Life for an Aging California Field

Warren Resources Inc. has embarked on an active redevelopment program in the Wilmington Townlot Unit (WTU) and adjacent North Wilmington Unit (NWU) in the central part of supergiant Wilmington field. These properties were originally unitized in 1973 by majors and, like most of California's mature fields, are now in the hands of an independent. Plans are to drill more than 500 wells in the next few years, targeting development in several reservoirs. Drilling will be done from cellars, which places wellheads and facilities below ground level. Estimates are that the WTU has produced only 20% of the estimated 727 million bbl of original oil-in-place, leaving an average remaining recovery potential of 228,000 bbl/well. Warren Resources estimates that WTU could yield another 92 million bbl of oil if the company were able to attain a 32% recovery factor.

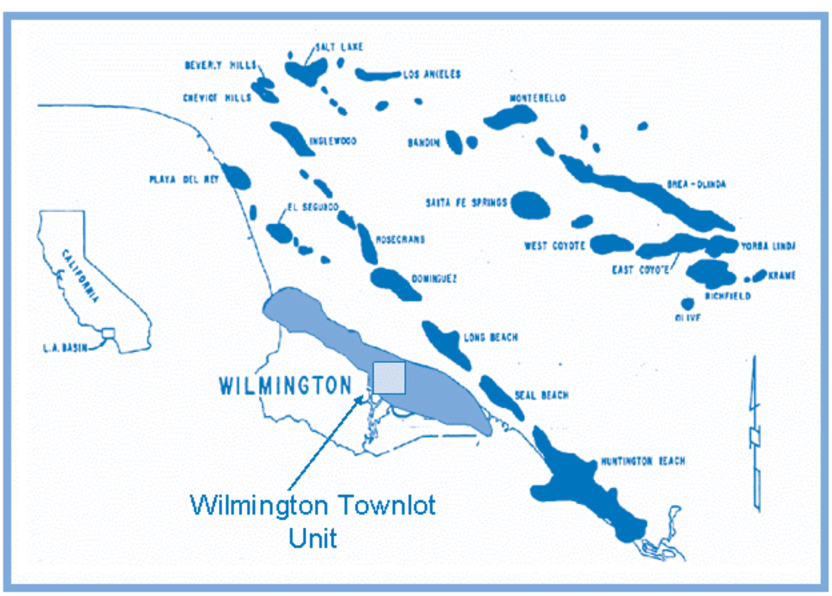
Warren Resources took over operation of WTU in March 2005 and NWU at the end of 2005. The units produce oil mainly from the Upper Terminal formation at 4,000 ft and the shallower Ranger and Tar formations, all Tertiary in age. Since acquisition, the company has hiked WTU production from 375 bopd to more than 2,100 bopd. This increase results from additional production from new wells drilled and completed in the Upper Terminal, Ranger and Tar formations. The strategy at WTU is to develop seven-spot waterflood patterns in the Ranger and Upper Terminal formations. NWU now produces close to 400 bopd. Warren Resources has budgeted $68 million (74% in WTU) in 2007 for drilling and infrastructure development. This includes 34 producing and injection wells at WTU, and 14 new wells and 12 recompletions at NWU. The company plans to construct as many as five doublewide drilling cellars at WTU that can each accommodate two rows of wells in open cement-lined trenches. A skid-mounted drilling rig allows for rapid rig moves, and all fluid production and clean water reinjection occurs at wellheads in the cellars.

Tar formation horizontal wells: As of early May, the company had drilled eight Tar formation horizontals. The Tar formation was not previously exploited with secondary recovery. The first horizontal completion, which occurred in August 2006, had a 1,200 foot lateral and initially produced some 150 bopd. Modern logs from waterflood development drilling in the Upper Terminal formation is helping Warren Resources identify additional Tar formation wells. As of early May, the eight horizontal wells were averaging 100 bopd with a water:oil ratio (WOR) of 2, without any pressure maintenance. There are another 10 horizontal drilling locations already identified. Once the initial group of horizontals is developed, the company will evaluate the potential for additional horizontals, including in other potentially productive sands.

Upper Terminal formation: As of May 2007, the new Upper Terminal wells are averaging about 25 bopd. Some Upper Terminal wells drilled in the north area of the field have been below average production with very low WORs. Effects of water injection support, which is not evident yet, are expected within the next 12 to 24 months.

Ranger formation: Warren Resources drilled and completed its third Ranger formation well in the 1st quarter of 2007. Currently, the Ranger wells are producing an average of 40 BOPD with a WOR of 20. There are plans for an additional 5-10 Ranger wells in 2007.

Excerpted from "Central Wilmington Oil Field Due for Denser Development," Oil & Gas Journal, Feb. 19, 2007, pp. 36-37; and press releases (dated 10/2/06, 12/14/06, 5/4/07) by Warren Resources.



Graphic courtesy of Warren Resources (**www.warrenresources.com**)

Power From Stranded Gas Saving California Leases

A DOE-supported project (Oil Field Flare Gas Electricity Systems or OFFGASES) is demonstrating how distributed power generation from stranded natural gas reduces power costs and is making a difference in saving marginal leases. Results from four field demos with fuels of varying energy content/quality are demonstrating the possibilities.

- High-Btu gas (1,600 Btu/scf): boosted oil production in its three-well marginal oil field from 10 to 23 bopd.
- Medium-Btu gas (not meeting pipeline quality requirements): now producing 150 bopd in a 19-well field that had been at risk for abandonment.
- "Harsh" (contains naturally high levels of N_2, CO_2, H_2S) gas: brought into compliance with air emissions regulations by scrubbing hydrogen sulfide from the gas using a patented sulfur-treating system.
- Ultralow-Btu (as little as 15 Btu/scf): Just to flare it, producers have to spike it with purchased natural gas. Tests using FlexEnergy's Flex-Microturbine, which uses catalytic combustors, are ongoing. While the microturbine is working, improvements are still needed and testing continues.

*View further information in DOE's Techline online at **www.fe.doe.gov/news/techlines/2007/07061-Creating_Energy_from_Waste_Gas.html.***

Upcoming Events

*PTTC's low-cost regional workshops connect independent oil and gas producers with information about various upstream solutions. For information on the following events, that are sponsored or co-sponsored by PTTC, call the direct contact listed below or 1.888.THE.PTTC. Information also is available at **www.pttc.org/national_calendar.htm**. Please note that topics, dates and locations listed are subject to change.*

September 2007

9/9-11 Midcontinent Region: *"Business" session @ AAPG Midcontinent meeting* - Wichita, KS. Contact: 785.864.7396

9/14-15 Rocky Mountain: *Structural Concepts and Applications in Rocky Mountain Hydrocarbon Plays* (Rocky Mountain Association of Geologists) - Denver, CO. Contact: 303.273.3194

9/TBD Appalachian: *Core and Sample Analysis and Interpretation* - Pittsburgh, PA. Contact: 304.293.2867 x 5443

October 2007

10/10 Central & Eastern Gulf Coast: *Technologies and Exploitation Strategies for Developing Naturally Fractured Reservoirs* - Shreveport, LA. Contact: 225.578.4538

10/18 Midwest: *Seizing Opportunities in a Mature Basin (Michigan O&G Association)* - Gaylord, MI. Contact: 269.387.8633

10/TBD Rocky Mountain: *Sequence Stratigraphy; Principles and Applications* - Golden, CO. Contact: 303.273.3194

10/TBD Texas: *Modern Methods Used To Capture Production Data and Implement Field Automation* - Midland, TX. Contact: 512.471.0320

November 2007

11/16 Rocky Mountain: *GeoGraphix Training, An Overview and Refresher Course* - Golden, CO. Contact: 303.273.3194

11/TBD Texas: *East Texas Field; Geology, Engineering, and Potential Future Exploration* - Kilgore, TX. Contact: 512.471.0320

11/TBD Texas: *Reservoir Engineering Symposium: Back To The Basics; Rocks, Oil and Gas* (Core Labs) - Houston, TX. Contact: 512.471.0320

December 2007

12/2 Central & Eastern Gulf Coast: *5th Annual Reservoir Symposium (Core Labs)* - Lafayette, LA. Contact: 225.578.4538

12/TBD Rocky Mountain: *GIS and GPS for Earth Scientist* - Denver, CO. Contact: 303.273.3194

12/TBD Texas: *Designing and Forecasting Waterflood Using "Reservoir Grail" - The Best Place to Find Oil is in the Oil Fields* - Dallas, TX. Contact: 512.471.0320

Check PTTC's online calendar frequently for changes. ***www.pttc.org/national_calendar.htm***

Knowledge Center Developments

PTTC Tech Info

- Tech Connections Column *The American Oil & Gas Reporter*
- Alerts via Email
- Workshop Summaries Solutions From The Field
- Tech Inquiries? Pose a question and we'll find a qualified connection

Regional Contacts

Appalachian
West Virginia University
Director: Doug Patchen
304.293.2667 ext 5443

Gulf Coast
University of Alabama
Director: Ernest Mancini
Coord.: Bennett Bearden
205.348.4319
205.348.1880
Louisiana State University
Director: Don Goddard
225.578.4538

Midwest
Illinois Geological Survey
Director: Beverly Seyler
217.244.2389
Western Michigan Univ.
Michael Grammer
269.387.8633

Midcontinent
University of Kansas Energy Research Center
Director: Rodney Reynolds
785.864.7398

Rocky Mountain
Colorado School of Mines
Director: Mary Carr
303.273.3107

Texas and SE New Mexico
Bureau of Economic Geology, UT Austin
Director-Scott Tinker
Coord.: Sigrid Clift
512.471.0209
512.471.0320
Permian Basin, UTPB CEED Bob Kiker
432.552.3432

West Coast
Univ. of Southern California
Director: Iraj Ershaghi
213.740.0321

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Kristi Lovendahl Editor

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PTTC Headquarters Staff:

E. Lance Cole Executive Director
Kathryn Chapman Director of Business Affairs

Phone: 918.241.5801
Fax: 918.241.5728
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Fax new information to 918.241.5728 or e-mail hq@pttc.org.

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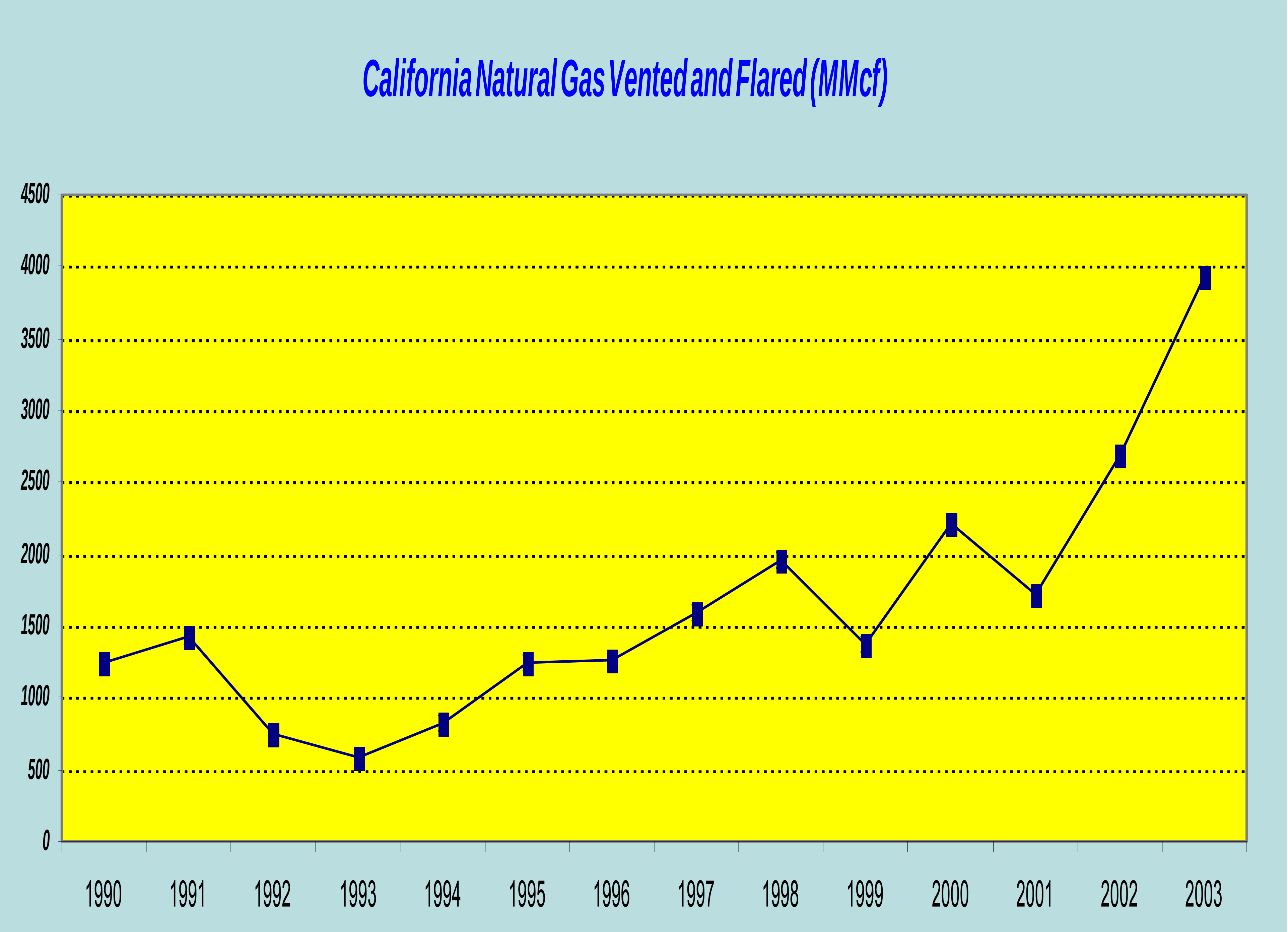
Overview of OFFGASES Project to Use Oil Field Stranded Gas to Generate Electrical Power

Bob Fickes

COPE

Why OFFGASES?

- Stranded gas has become a big problem for California Oil Producers
- CARB 80 rule change
- Increase in both gas prices and electricity prices
- Fewer options for gas disposal


California Natural Gas Vented and Flared (MMcf)
4500
4000
3500
3000
2500
2000
1500
1000
500
0
1990
1991
1992
1993
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003

Why OFFGASES?

- Stranded gas has become a big problem for California Oil Producers
- CARB 80 rule change
- Increase in both gas prices and electricity prices
- Fewer options for gas disposal

Why DG?

- Much more infrastructure for delivery of electricity than for gas
- Electricity costs one of the highest expenses in oil production

Why Turbines?

- **On the plus side**
  - Better air emissions, easier to permit
  - Less maintenance
- **On the minus side**
  - More equipment expense
  - Higher maintenance costs
  - Technically higher to maintain

St. James Medium BTU Site

Gas Conditioning

Termo
High BTU Site


F350


BPCI
CAUTION
blackmer


480 VOLTS
480 VOLTS

Lessons Learned

What we thought would be major challenges

- Air quality and permitting
- Equipment maintenance & reliability
- Utility interconnection
- Power export

Air Quality & Permitting

- The three air agencies we have worked with all have been reasonable
  - Do your homework
  - Know the regulations

Equipment Maintenance

- Long term service agreements
- 2nd party non-factory service providers

Utility Interconnection

Depending on the Utility, the easiest part of the project or your worst nightmare

- **LADWP signed agreement in 2 hours**
- **SCE 3-5 Months that ran Along With Construction No Delay In Startup**
- **PG&E 23 Months – Lots of Bloodshed**

Power Export

Export Without Compensation

Contract for
Power Purchase Agreement
Currently in negotiations

Questions ?

West Coast PTTC Workshop

Panel On

"Power Generation - Using Waste and Stranded Gas"

Tuesday, Nov. 22, 2005
Hyatt Valencia Conference Center,
24500 Town Center Drive, Valencia CA
Registration starts at 8:30 am

This workshop is intended to review opportunities and challenges in using distributed electric power generation from produced gas for reducing operating cost.

Co-Sponsored by: U.S. Department of Energy (DOE), University of Southern California (USC), California Independent Petroleum Association (CIPA), Western States Petroleum Association (WSPA), Independent Oil Producers' Agency (IOPA), State Lands Commission, Minerals Management Service (MMS), U.S. Department of Interior, Conservation Committee of California Oil & Gas Producers (CCCOGP), State of California, Department of Conservation, Division of Oil and Gas and Geothermal Resources (CADOGGR), Los Angeles Basin Section of SPE, San Joaquin Valley Section of SPE

<table>
<tr><td>8:30 AM</td><td>Registration</td></tr>
<tr><td>9:00</td><td>Workshop Moderator- Chris Hall, Drilling and Production Company
Invited Speakers:

Richard C. Russell,St. James Oil Company — Rod Headley, Central California Power
Egon Garthoffner , Oxy USA, Inc. — Peter Laehy, Pacific Energy Solutions
Cliff Simonson, BSI — John Swanson, Capstone
Trent Rosenlieb, The Termo Company — Rajesh Buch, Ingersoll Rand Energy Systems
Jeevan Anand, Pacific Energy Resources — Edan Prabhu, Flex Energy
Christopher Schmidt, Unico, Inc - Oil & Gas Division</td></tr>
<tr><td></td><td>Part I - Considerations for buying and/or not buying self generating equipment.
Payout expectations
Operational and maintenance issues
Self generation and selling power on the grid</td></tr>
<tr><td></td><td>Part II - General Background –
Speakers: Casper Zublin, Energy Options, Chris Hall, Drilling & Production Co., Bob Fickes, COPE
Associated gas availability, current uses, quantification, quality and conditioning hurdles.
Electrical power considerations and unique issues
Utility Tariffs and Non-bypassable Charges
Permits - Utility Interconnect , Air, and Construction
Equipment Selection – systems design
Types of prime movers available and selection reasons
Service/Maintenance Issues. Equipment reliability
Self Generating Incentive Program
Site requirements
Activity time line and cost outlines</td></tr>
<tr><td>12:00pm</td><td>LUNCH</td></tr>
<tr><td>1:00pm</td><td>Part III - Presentation by Vendors:
Internal Combustion
Micro turbine generator
External Combustion</td></tr>
<tr><td></td><td>Part IV - Case Histories by Producers/Operators
Examples of installations, lessons learned, how they are working</td></tr>
<tr><td></td><td>Part V - Resources Availability
Where to go for additional information and assistance</td></tr>
<tr><td></td><td>Part VI - Panel Discussion – Q and A</td></tr>
<tr><td>4:30 PM</td><td>ADJOURN</td></tr>
</table>

STANDARD OFFER
FOR SELF-GENERATION
INTERCONNECTION AGREEMENTS

St. James Oil Co. - LADWP
SELF-GENERATION INTERCONNECTION AGREEMENT

BETWEEN

St. James Oil Co.
(CUSTOMER)

AND

DEPARTMENT OF WATER AND POWER OF
THE CITY OF LOS ANGELES

DWP NO. ______

St. James Oil Co. – LADWP
SELF-GENERATION INTERCONNECTION AGREEMENT

TABLE OF CONTENTS

St. James Oil Co. – LADWP
SELF-GENERATION INTERCONNECTION AGREEMENT

St. James Oil Co. - LADWP
SELF-GENERATION INTERCONNECTION AGREEMENT

This Agreement is made and entered into by and between THE DEPARTMENT OF WATER AND POWER OF THE CITY OF LOS ANGELES (LADWP), Acting by and through the BOARD OF WATER AND POWER COMMISSIONERS (Board) and St. James Oil Co., an LADWP customer, (Customer), sometimes referred to singularly as "Party" and collectively as "Parties", who agree as follows:

1. RECITALS: This Agreement is made with reference to the following facts, among others:

1.1 Customer is currently purchasing Electric Service from LADWP at:

800 W. 23rd St.
Los Angeles, CA 90007
Acct. 1-63-95855-00800-00-9001-001

Electric Service at this location is being provided pursuant to the terms and conditions of the Electric Rate Ordinance.

1.2 Customer currently has, or intends to design, construct, own, operate, and maintain, at its sole risk and expense, a Self-Generation Facility in parallel with LADWP's electric system. The Self-Generation Facility has an installed nameplate rating of 90 - kW. The Self-Generation Facility is more fully described in Exhibit A of this Agreement.

1.3 If it is deemed necessary by LADWP to do so after evaluating Customer's Self-Generation Facility's plans, LADWP will design, construct, own, operate, and maintain an LADWP Facility and make any necessary modifications to LADWP's electric system for the safe parallel operation of the Self-Generation Facility with LADWP’s electric system. Customer agrees to reimburse LADWP for all actual costs (direct and indirect) incurred in performing such work. If the LADWP Facility is constructed a description of the LADWP Facility will be attached as Exhibit B of this Agreement after construction.

2. DEFINITIONS: The definitions, terms, conditions and requirements provided in the Electric Rate Ordinance, the Electric Service Requirements, and the Rules are incorporated in and made a part of this Agreement by reference. The following additional terms, when initially capitalized, whether in the singular or plural tense, shall mean:

2.1 Agreement: This St. James Oil Co. - LADWP Self-Generation Interconnection Agreement.

2.2 Authorized Representatives: The representative or designated alternate of a Party appointed in accordance with Section 14 of this Agreement.

2.3 Customer: California Oil Producers Electric Cooperative

2.4 Effective Date: As defined in Section 27 of this Agreement.

2.5 Electric Rate Ordinance: Ordinance No. 168436 effective on January 31, 1993, and all amendments, revisions, and replacements thereof, including the electric rate schedules adopted by ordinance of the City of Los Angeles approving the rates to be paid by Customer at the location of the Self-Generation Facility. The Electric Rate Ordinance in effect at the time of billing shall have precedence over any definitions, rate figures, numbers or calculations that may appear in this Agreement.

2.6 Electric Service: As defined in the Rules.

2.7 Electric Service Requirements: Requirements prescribed in writing by LADWP in effect at the time this Agreement is executed, and all revisions thereto or replacements thereof, which are necessary and proper for the regulation of any Electric Service installed, operated, and maintained within the City of Los Angeles. The Electric Service Requirements shall be in conformance with the Charter of the City of Los Angeles and the Rules.

2.8 Energy Credit: As defined in the Electric Rate Ordinance.

2.9 Excess Energy: Energy generated by the Self-Generation Facility beyond Customer's load requirements.

2.10 In-Service Date: The date of initial interconnection of the Self-Generation Facility to LADWP's electric system.

2.11 Interconnection Costs: All reasonable costs, as determined by Customer and LADWP in accordance with Prudent Utility Practices, including, but not limited to, planning, engineering, design, supervision, material procurement, construction, quality assurance and inspection, testing, metering, maintenance, negotiation, contract administration, protection, expediting, accounting, budgeting, and other activities reasonably necessary for the interconnection and safe parallel operation of the Self-Generation Facility to Department’s electric system.

2.12 LADWP Facility: Electrical and mechanical equipment required and installed, owned, operated and maintained by LADWP for the safe parallel operation of the Self-Generation Facility—This equipment is deemed by LADWP to be appurtenant and/or incidental to the Self-Generation Facility and will be located at the site of the Self-Generation Facility.

2.13 Prudent Utility Practices: Those practices, methods, and equipment, as changed from time to time, that are commonly used in prudent engineering and operations to design and operate electric equipment lawfully and with safety, dependability, efficiency, and economy.

2.14 Rules: The Rules Governing Electric Service in the City of Los Angeles adopted by the Board under Resolution No. 56, dated September 8, 1983, and all amendments, revisions, and replacements thereof. The latest revision at the time this Agreement is executed is dated November 1996.

2.15 Self-Generation Facility: All of Customer's electrical and mechanical equipment associated with the generation of electricity at Customer's location.

3. AGREEMENT: In consideration of the terms and conditions contained herein and the mutual benefit to be derived by this Agreement, the Parties further agree as follows:

3.1 Customer shall purchase Electric Service, as needed solely from LADWP, in accordance with the appropriate schedule in the Electric Rate Ordinance.

3.2 LADWP shall purchase Excess Energy produced by the Self-Generation Facility. Payments for Excess Energy shall be made as described in Subsection 9.2 of this Agreement.

3.3 Customer shall pay LADWP for all costs associated with the interconnection and safe parallel operation of the Self-Generation Facility in accordance with the terms and conditions contained herein.

4. RESPONSIBILITIES OF THE CUSTOMER:

4.1 Customer shall own, at its sole risk and expense, the Self-Generation Facility in compliance with all applicable codes, laws, Electric Service Requirements, Rules, and Prudent Utility Practices. A person or entity acting on Customer's behalf may operate and maintain the Self-Generation Facility in compliance with all applicable codes, laws, Electric Service Requirements, Rules, and Prudent Utility Practices. Meeting this requirement shall not relieve Customer of its obligations pursuant to the terms and conditions of this Agreement.

4.2 When Customer submits the executed Agreement to LADWP for execution, Customer shall also submit the following information:

4.2.1 Electrical plans including load schedules and single-line diagrams.

4.2.2 Plot and site development plans showing generator, disconnect, metering equipment locations and Department access to generator, disconnect and meter equipment locations.

4.2.3 Energy Source Information:
(1) Maximum kilowatt rating
(2) Nominal voltage output
(3) Voltage regulation
(4) Maximum fault current contribution

4.2.4 Protective system information:
(1) Protective system plan
(2) Manufacturer's data sheets and maintenance requirements for protective equipment
(3) Any additional information required by LADWP

4.3 Review by LADWP of Customer's specifications shall not be construed as confirming or endorsing the design, any warranty of safety or durability of the Self-Generation Facility.

4.4 LADWP shall not, by reason of review or failure to review, be responsible for strength, details of design, adequacy or capacity of the Self-Generation Facility or said equipment, nor shall LADWP's acceptance be deemed to be an endorsement of the Self-Generation Facility.

4.5 Within thirty (30) calendar days following the In-Service Date or at a date mutually agreed to between the Authorized Representatives, Customer shall submit in writing to LADWP’s Authorized Representative that the Self-Generation Facility meets the standards set forth in the applicable Electric Service Requirements.

4.6 Customer shall operate and maintain the Self-Generation Facility in accordance with the applicable Electric Service Requirements and Prudent Utility Practices.

4.7 Customer shall not energize, at any time, a de-energized portion of LADWP's electric system without express permission from LADWP’s Authorized Representative.

4.8 Customer shall obtain and maintain in full force and effect appropriate insurance coverages for the Self-Generation Facility with limits not less than those set forth in Section 12 of this Agreement.

4.9 The Parties recognize that, from time to time, certain improvements, additions, or other changes in the interconnection and protection equipment at the Self-Generation Facility may be required for the safe parallel operation of the Self-Generation Facility with LADWP's electric system. Such improvements, additions, or other changes shall be in accordance with Prudent

Utility Practices. LADWP shall have the right to require Customer to make those changes on the Self-Generation Facility upon reasonable advance written notice from LADWP's Authorized Representative.

4.10 Failure of Customer to comply with Section 4.9 within a reasonable period of time after receipt of such written notice may result in the Self-Generation Facility being disconnected from LADWP's electric system pursuant to Section 7.

5. RESPONSIBILITIES OF LADWP:

5.1 LADWP shall be the sole provider of Electric Service required by Customer at the location of the Self-Generation Facility subject to future amendments to the existing Rules. LADWP shall purchase Excess Energy from Customer.

5.2 If it is deemed necessary by LADWP to do so after evaluating Customer’s Self-Generation Facility’s plans, LADWP will design, construct, own, operate, and maintain an LADWP Facility and make any necessary modifications to LADWP's electric system for the safe operation of the Self-Generating Facility in parallel with LADWP’s electric system.

5.3 LADWP reserves the right to make measurements or other tests on the Self-Generation Facility, from time to time, as specified in the Electric Service Requirements. If the measurements or tests determine that the Self-Generation Facility does not meet the specifications, LADWP will require Customer to disconnect the Self-

Generation Facility from LADWP's electric system pursuant to Subsection 7.1. Customer shall make the appropriate changes to the Self-Generation Facility before reconnection to LADWP’s electric system.

5.4 The Parties recognize that, from time to time, certain improvements, additions, or other changes in LADWP's electric system may be required for the safe parallel operation of the Self-Generation Facility. Such improvements, additions, or other changes will be in accordance with Prudent Utility Practices. LADWP shall have the right to make those changes upon reasonable advance written notice from LADWP's Authorized Representative to Customer. LADWP shall bill Customer for such improvements, additions, or other changes in accordance with Subsection 8.1 of this Agreement.

5.5 LADWP shall have the right of ingress to and egress from Customer’s premises pursuant to Section 11 of this Agreement.

5.6 LADWP shall bill Customer for the Customer’s pro rata share of the costs incurred in the implementation of this Agreement pursuant to Section 8 of this Agreement.

6. METERING:

6.1 LADWP shall install, at no cost to LADWP, time-of-use metering equipment and recorders at the Service Point and at the output point of the Self-Generation Facility, to measure electric energy and other electric parameters deemed appropriate by LADWP.

6.2 For Self-Generation Facilities with nameplate ratings of at least 1,000 kW, Customer shall provide LADWP with the capability to remotely monitor Customer's Self-Generating Facility. LADWP shall install, at no cost to LADWP, telemetering equipment at the Service Point and at the output point of the Self-Generation Facility to monitor the electrical generation at LADWP's Energy Control Center.

6.3 On the In-Service Date, the Maximum Demand, as recorded by LADWP's revenue meters at the Service Point, shall be reset to zero for billing purposes. Any demand incurred after the In-Service Date shall be used to determine the Maximum Site Demand.

6.4 LADWP meters shall be sealed with Department seals only. The seals shall not be broken except when the meters are inspected, tested, or adjusted by LADWP. LADWP shall test the meters, at its own expense, in accordance with its routine practice and the Rules.

6.5 Customer may request testing of meters prior to their normally scheduled test dates, and LADWP shall test the meters upon request. Customer shall be given reasonable notice to have a representative present at the time of meter testing. Customer shall pay for the cost of the requested meter testing if the meters are found to be within the tolerances specified within the Rules.

6.7 Disputes concerning alleged meter discrepancies shall be resolved in accordance with the Rules.

7. <u>DISCONNECTION OF THE SELF-GENERATION FACILITY</u>:

7.1 LADWP shall require Customer to disconnect the Self-Generation Facility from LADWP's electric system if Customer does not comply with the covenants of this Agreement, the Electric Rate Schedules, the applicable Electric Service Requirements, or the Rules. LADWP's Authorized Representative shall provide Customer with twenty (20) calendar days' written notice of such intent. In the event Customer takes prompt action to comply, and pursue such action to completion, then LADWP will take no further action.

7.2 In accordance with procedures established in the Electric Service Requirements, LADWP shall require Customer to disconnect the Self-Generation Facility immediately from LADWP's electric system if LADWP determines in good faith that an emergency and hazardous condition exists and such action is necessary to protect persons, LADWP's electric system, or other customer facilities from damage or interference caused by Customer's electrical equipment, or to allow LADWP to repair, replace, or maintain any equipment associated with LADWP's electric system.

7.3 Each Party shall endeavor to correct the condition on its electric system that resulted in the separation and shall coordinate reconnection of the Self-Generation Facility for parallel operation.

7.4 LADWP shall provide for reconnection of the Self-Generation Facility to LADWP's electric system when reasonable to do so.

7.5 LADWP shall not be liable to Customer or any person or entity acting on Customer’s behalf including, but not limited to, any agent, designee, contractor, or lessee for damages resulting from the connection or disconnection of the Self-Generation Facility from LADWP's electric system.

8. INTERCONNECTION BILLING DETERMINANTS:

If LADWP determines after review of Customer’s Self-Generation Facility plans that an LADWP Facility must be constructed and modifications made to LADWP’s electric system for the safe parallel operation of the Self-Generation facility in parallel with LADWP’s electric system, then this Section 8 shall apply.

8.1 For each detailed cost estimate and detailed design for the LADWP Facility and modifications to LADWP’s electric system, LADWP shall bill Customer a nonrefundable amount equal to ten (10) percent of the preliminary cost estimate of the Interconnection Costs. The estimate made shall be based on Customer’s specifications, pursuant to Subsection 4.2. Upon receipt of the nonrefundable amount, LADWP shall prepare a detailed cost estimate and a detailed design in a timely manner.

8.2 LADWP shall bill Customer for the amount of the Interconnection Costs based on the detailed cost estimate, less the ten (10) percent previously advanced pursuant to Subsection 8.1.

8.3 Upon receipt of the necessary funds, LADWP shall proceed with the LADWP Facility and any necessary modifications to the electric system for the safe parallel operation of the Self-Generation Facility.

8.4 If it is determined, at the completion of the LADWP Facility, that Customer has advanced funds, which are greater or less than the actual Interconnection Costs; LADWP's Authorized Representative shall make the appropriate adjustment within ninety- (90) calendar days after the In-Service Date. Payment shall be made within thirty- (30) calendar days thereafter.

8.5 LADWP shall bill Customer monthly for maintenance service on the LADWP Facility pursuant to Exhibit C of this Agreement.

8.6 If it is determined, pursuant to Subsection 5.3 of this Agreement, that LADWP must make improvements, additions, or other changes to either the LADWP Facility or to LADWP's electric system, LADWP will bill Customer for all costs incurred for such improvements, additions, or other changes. The Maintenance Costs determined pursuant to Exhibit C shall be modified to reflect changes in the LADWP Facility.

9. ELECTRIC SERVICE BILLING DETERMINATIONS:

9.1 LADWP shall bill Customer for Electric Service after the end of each billing period. The bill shall be calculated using the applicable rates in the appropriate rate schedule in the Electric Rate Ordinance and recorded billing data that shall consist of metered values deemed required by LADWP. The recorded billing data shall be obtained from LADWP revenue meters and recorders. Customer shall send the payment to the address specified in Subsection 10.2.

9.2 For Excess Energy purchased by LADWP during the just-ended billing period, LADWP shall pay Customer a dollar amount equal to the recorded amount of Excess Energy times the Standard Energy Credit. For Administrative convenience, LADWP shall deduct the dollar amount owed Customer for Excess Energy from Customer's monthly bill for electric service at the location of the Self—Generating Facility.

10. BILLINGS AND PAYMENTS:

10.1 Billings and payments pursuant to Section 8, Interconnection Billing Determinants, shall be transmitted to the following addresses:

10.1.1 If to LADWP:

Department of Water and Power
of the City of Los Angeles
P. O. Box 30870, Room 434
Los Angeles, California 90030-0870
Attention: General Accounting

10.1.2 If to Customer:

__ St. James Oil Co.______________

____

____

Attention: _Dick Russell________

10.2 Billings and payments pursuant to Section 9, Electric Service Determinations, shall be transmitted to the following addresses:

10.2.1 If to LADWP:

Department of Water and Power
of the City of Los Angeles
P. O. Box 51111
Los Angeles, California 90051-0100
Attention: Accounts Receivable

10.2.2 If to Customer:

___ St. James Oil Co. ___________

____

____

Attention: __ Dick Russell____

10.3 Either Party may change, by written notice to the other Party, the name or address of the person to receive invoices or payments pursuant to this Agreement.

10.4 All bills, except as provided otherwise in this Agreement, are due and payable upon presentation. Payment shall be made in accordance with the Rules.

10.5 If the correctness of any bill for Electric Service, or any part thereof, or if the correctness of other charges or practices of LADWP is disputed by Customer, LADWP shall conduct an investigation in accordance with the Rules.

11. INGRESS AND EGRESS:

11.1 LADWP shall have, at all times, the right of ingress to and egress from Customer’s premises for the following reasons:

11.1.1 Any purpose related to furnishing or receiving electric energy under this Agreement.

11.1.2 In order to exercise any and all rights secured to LADWP by law, this Agreement, or the Rules.

11.2 While on Customer's premises, LADWP shall abide by Customer's safety rules and regulations.

12. INSURANCE:

12.1 Unless otherwise agreed to in writing by the Authorized Representatives, Customer or any person or entity acting on Customer's behalf including, but not limited to, any agent, designee, contractor, or lessee shall, at their own expense, maintain in effect at all times insurance coverage with limits not less than those set forth below. Such coverage may be on either an occurrence basis or a claims-made basis. Any insurance carried by LADWP, which may be applicable, shall be deemed to be excess insurance. Customer's insurance shall be deemed primary.

12.2 Coverages for Comprehensive General Liability Insurance, Premises and Operations, Contractual Liability, Products and Completed Operations, Broad Form Property Damage, Personal Injury, and, if applicable, Explosion Hazard, Collapse and Underground Hazard shall be furnished.

12.3 For Self-Generating Facilities with a total installed nameplate rating of 100 kW or less, Customer shall provide coverage for a combined single limit of not less than $500,000 for each occurrence or not less than $1,000,000 for each claim.

12.4 For Self-Generating Facilities with a total installed nameplate rating of greater than 100 kW, Customer shall provide coverage for a combined single limit of not less than $1,000,000 for each occurrence or not less than $2,000,000 for each claim.

12.5 Customer shall furnish LADWP's Risk Manager at the address shown in Subsection 12.6 with insurance endorsements on endorsement forms acceptable to LADWP's Risk Manager. The endorsements shall be evidence that policies providing the required coverages and limits of insurance are in full force and effect.

12.6 The insurance endorsements shall name the City of Los Angeles, the Board, LADWP, and their officers, agents, and employees, while acting within the scope of their employment, as additional insureds with the Customer. The endorsements shall also contain a provision that the policy cannot be canceled or reduced in coverage or amount without first giving thirty (30) calendar days' written notice by registered mail to LADWP at the following address:

Department of Water and Power
of the City of Los Angeles
P.O. Box 51111, Room 465
Los Angeles, California 90051-0100
Attention: Risk Management Section

12.7 The foregoing insurance requirements are not intended to and shall not in any manner limit or qualify the liabilities and obligations assumed by Customer under this Agreement.

12.8 Failure of Customer to maintain such insurance, or to provide such endorsements to LADWP when due, shall result in the disconnection of the Self-Generating Facility from LADWP’s electric system pursuant to Section 7.

12.9 LADWP shall not be liable to Customer or any person or entity acting on Customer’s behalf including, but not limited to, any agent, designee, contractor, or lessee for damages resulting from the disconnection of the Self-Generation Facility from LADWP's electric system.

13. INDEMNIFICATION:

13.1 In the performance of this Agreement, Customer shall indemnify, defend, and hold harmless the City of Los Angeles, the Board, LADWP, and their officers, agents, and employees from and against any and all liability, costs, losses, claims, demands, actions and causes of action, including reasonable attorneys' fees and expenses, for damages to the person or property of any person or entity, including the Parties to this Agreement, attributable to, in whole or in part, or resulting from the actions or omissions of Customer or any person or entity acting on Customer’s behalf including, but not limited to, any agent, designee, contractor, or lessee.

13.2 LADWP shall not be indemnified under this Section 13 for liability or loss resulting from its sole negligence or willful misconduct.

14. ADMINISTRATION:

14.1 Within thirty (30) calendar days after the effective date of this Agreement, Customer and LADWP’s Assistant General Manager – Power Transmission and Distribution or designee shall each designate, by written notice to the other, a representative who is authorized to act in each Party's behalf with respect to those matters delegated to the Authorized Representatives. Each Party may delegate an authorized alternate with full authority to act in the absence of the Authorized Representative. Each Party shall have the right to change its Authorized Representative or authorized alternate by written notice to the other Party.

14.2 The Authorized Representatives shall provide liaison between the Parties and a means of securing effective cooperation, interchange of information, and consultation on a prompt and orderly basis concerning the various matters that may arise, from time to time, in connection with this Agreement.

14.3 The Authorized Representatives shall review and attempt to resolve any disputes between the Parties under this Agreement. Should the Authorized Representatives be unable to resolve a dispute, the matter shall be referred to Customer and LADWP's Assistant General Manager – Power Transmission and Distribution who shall use their best efforts for resolution.

14.4 Prior to the In-Service Date, the Authorized Representatives shall agree on written procedures pertaining to the synchronization, operation, maintenance, administration, and other activities that may require coordination between the Parties.

14.5 All actions, agreements, resolutions, determinations, or reports made by the Authorized Representatives shall be made in writing and shall become effective when signed by the Authorized Representatives.

14.6 Any expenses incurred by an Authorized Representative or authorized alternate in connection with their duties shall be paid by the Party they represent unless otherwise agreed to in writing by Customer and LADWP's Assistant General Manager – Power Transmission and Distribution.

14.7 The Authorized Representatives shall have no authority to modify this Agreement.

15. DEFAULT:

15.1 Default by Customer: The occurrence of any of the following shall constitute a material breach and default of this Agreement by Customer:

15.1.1 Failure by Customer to make payment to LADWP of uncontested amounts within the time set forth in Section 10 herein; or

15.1.2 Failure by Customer to comply with requirements pertaining to the safety of persons or property set forth herein, in the Electric Rate Schedules, or in the applicable Electric Service Requirements; or

15.1.3 Failure by Customer to substantially observe and perform any other material provision of this Agreement where such failure continues for thirty (30) calendar days after receipt by Customer of written notice from LADWP. Provided, however, that if the nature of such default is curable, but that the same cannot with due diligence be cured within the thirty (30) calendar day period Customer shall not be deemed to be in default if it shall within the thirty (30) calendar day period commence to cure the default and, thereafter, diligently prosecute the same to completion.

15.2 Default by LADWP: The occurrence of any of the following shall constitute a material breach and default of this Agreement, if not cured by LADWP as provided below:

15.2.1 Failure by LADWP to substantially observe and perform any material provision required by this Agreement, where such failure continues for thirty (30) calendar days after receipt of written notice from Customer. Provided, however, that if the nature of such default is curable, but that the same cannot with due diligence be cured within the thirty (30) calendar day period LADWP shall not be deemed to be in default if it shall within the thirty (30) calendar day period commence to cure the default and, thereafter, diligently prosecute the same to completion.

16. REMEDIES UPON DEFAULT: Each party shall be entitled to money damages according to proof of actual damages resulting from default of the other and, in addition, each party shall have the right to terminate this Agreement upon the occurrence of any of the events of default described in Section 15. In no event shall incidental or consequential damages be payable.

17. FORCE MAJEURE: Neither Party shall be considered to be in default in the performance of any of its obligations under this Agreement (other than obligations of said Party to make payments due) if failure of performance shall be due to an uncontrollable force. The term “uncontrollable force” shall mean any cause beyond the control of the Party affected, including, but not limited to, failure of or threat of failure of facilities, flood, earthquake, storm, fire, lightning, epidemic, war, civil disturbance or disobedience, labor dispute, labor or material shortage, sabotage, restraint by court order or public authority, and action or nonaction by or inability to obtain authorizations or approvals from any governmental agency or authority, which by exercise of due diligence it shall be unable to overcome. Nothing contained herein shall be construed so as to require a Party to settle any strike or labor dispute in which it may be involved. Either Party rendered unable to fulfill any obligation under this agreement by reason of uncontrollable force shall give prompt notice of such fact to the other Party and shall exercise due diligence to remove any inability with all reasonable dispatch.

18. AUTHORIZATIONS AND APPROVALS:

18.1 Each Party shall obtain all the necessary authorizations, licenses, approvals, and permits from

Federal, State, or local agencies having jurisdiction.

18.2 This Agreement and all operations hereunder are subject to the applicable laws, ordinances, orders, rules, and regulations of local, State, and Federal governmental authority having jurisdiction.

19. EFFECT OF SECTION HEADINGS: Section headings appearing in this Agreement are inserted for convenience only and shall not be construed as interpretations of text.

20. NONWAIVER: None of the provisions of this Agreement shall be deemed waived unless expressly waived in writing. Any omission or failure of either Party to demand or enforce strict performance of provisions of the Agreement shall not be construed as a waiver or as a relinquishment of any rights. All provisions and rights shall continue and remain in full force and effect as if such omission or failure had not occurred.

21. NONDEDICATION OF FACILITIES: This Agreement shall not be construed as a dedication of any properties or facilities, or any portion thereon, by either Party to each other or the public.

22. NO THIRD-PARTY BENEFICIARIES: This Agreement is for the sole benefit of the Parties hereto and shall not be construed as granting rights to any person or entity other than the Parties or imposing on either Party obligations to any person other than a Party.

23. NOTICES:

23.1 Any written notice under this Agreement shall be deemed properly given if delivered in person or sent by registered or certified mail, postage prepaid, to the person specified below unless otherwise provided for in this Agreement:

23.1.1 If to LADWP:

Department of Water and Power
of the City of Los Angeles
P. O. Box 51111, Room 951
Los Angeles, California 90051-0100
Attention: Assistant General Manager
Power Transmission and Distribution

23.1.2 If to Customer:

_____ St. James Oil Co. ______________________

____

____

Attention: __ Dick Russell ________________

23.2 Either Party may, by written notice to the other Party, change the name or address of the person to receive notices pursuant to this Agreement.

24. TRANSFER OF INTEREST: Neither Party shall assign or transfer this Agreement, in whole or in part, without the prior written consent of the other Party. The consent to assign or transfer shall not be unreasonably withheld. LADWP’s Assistant General Manager –Power Transmission and Distribution or designee shall execute assignment or transfer of this Agreement or the consent to assign or transfer this Agreement.

25. SEVERAL OBLIGATIONS: The duties, obligations, and liabilities of the Parties are several and not joint or collective. Nothing contained in this Agreement shall be construed to create an association, trust, partner- ship, or joint venture or to impose a trust, partnership duty, obligation, or liability on or with regard to either Party. Each Party shall be individually and severally liable for its own obligations under this Agreement.

26. SEVERANCE: If any paragraph, sentence, clause, phrase, or word shall become without full effect due to any judicial decision, the balance of this Agreement shall remain in full force and effect provided that the purposes of this Agreement can still be fulfilled.

27. EFFECTIVE DATE AND TERM:

27.1 This Agreement shall become effective upon the date of execution by the Parties.

27.2 This Agreement terminates thirty-six (36) months from the Effective Date.

27.3 Upon the date of termination of this Agreement all rights to services provided hereunder shall cease and neither Party shall claim or assert any continuing right to such services hereunder. However, such termination shall not affect the rights and obligations to pay money for transactions occurring prior to termination.

28. GOVERNING LAW: This Agreement shall be interpreted in accordance with the Charter of the City of Los Angeles, as amended, the laws of the State of California, and all

applicable Federal laws, rules, and regulations. Any lawsuit relating to this Agreement shall be filed in the County of Los Angeles.

29. CHILD SUPPORT ASSIGNMENT ORDERS:

29.1 This Agreement is subject to Section 10.10, Article 1, Chapter 1, division 10 of the Los Angeles Administrative Code, Child Support Assignment Orders Ordinance. Customer is required to complete a Certificate of Compliance with Child Support Obligations, which is attached as Exhibit D and incorporated herein by this reference. Pursuant to this ordinance, Customer shall:

29.1.1 Fully comply with all State and Federal employment reporting requirements applicable to Child Support Assignment Orders;

29.1.2 Certify that the principal owner(s) of Customer are in compliance with any Wage and Earnings Assignment Orders and Notices of Assignment applicable to them personally;

29.1.3 Fully comply with all lawfully served Wage and Earnings Assignment Orders and Notices of Assignment in accordance with California Family code section 5230, et seq.; and

29.1.4 Maintain such compliance throughout the term of this Agreement.

29.2 Pursuant to Section 10.10b of the Los Angeles Administrative Code, failure of Customer to comply with all applicable reporting requirements or to implement lawfully served Wage and Earnings Assignment Orders and Notices of Assignment or the failure of any principal owner(s) of Customer to comply with any Wage and earnings Assignment Orders and Notices of Assignment applicable to them personally shall constitute a default by Customer under the terms of this Agreement, subjecting this Agreement to termination where such failure shall continue for more than ninety (90) calendar days after notice of such failure to Customer by City.

29.3 Any subcontract entered into by Customer relating to this Agreement, to the extent allowed hereunder, shall be subject to the provisions of this Section and shall incorporate the provisions of the Child Support Assignment Orders Ordinance. Failure of Customer to obtain compliance of its subcontractors shall constitute a default by Licensee under the terms of this Agreement, subjecting this Agreement to termination where such failure shall continue for more than ninety- (90) calendar days after notice of such failure to Customer by the City.

29.4 Customer shall comply with the Child Support Compliance Act of 1998 of the State of California Employment Development Department. Customer assures that to the best of its knowledge it is fully complying with the earnings assignment orders for all employees, and is providing the names of all new employees to the New Hire Registry maintained by the Employment Development Department as set forth in subdivision (1) of the Public Contract Code 7110.

30. UNDERSTANDING: This Agreement contains the entire understanding between the Parties with respect to the subject matter hereof; and there are no other promises, terms, conditions, obligations, understandings, or agreements between the Parties with respect thereto. This Agreement supersedes all previous communications, representations, understandings, and agreements, either oral or written, between the Parties with respect to the subject matter hereof.

31. REPRESENTATION: Each Party has been represented by legal counsel in the negotiation and execution of this Agreement.

32. EXHIBITS: Exhibits A through D attached hereto and are incorporated herein by this reference.

33. EXECUTION: IN WITNESS WHEREOF, the signatories hereto represent that they have been appropriately authorized to enter into this _ St. James Oil Co. _ - Department Self-Generation Interconnection Agreement on behalf of the Party for whom they sign. This Agreement is hereby executed on the day and year written below.

_____ St. James Oil Co. _____________

(Customer)

By:

Name (Signature): ______________________________

Name (Print): Dick Russell

Title: ______________________________

Date: ______________________________

DEPARTMENT OF WATER AND POWER OF THE CITY OF LOS ANGELES

By:

Name (Signature): ______________________________

Name (Print): ______________________________

Title: ______________________________

Date: ______________________________

Resolution No. 98-028
Date: July 15, 1997

National Energy Technology Laboratories

626 Cochrans Mill Road
P.O. Box 10940
Pittsburgh, PA 15236-0940

3610 Collins Ferry Road
P.O. Box 880
Morgantown, WV 26507-0880

One West Third Street, Suite 1400
Tulsa, OK 74103-3519

1450 Queen Avenue SW
Albany, OR 97321-2198

2175 University Ave. South
Suite 201
Fairbanks, AK 99709

Visit the NETL Website at:
www.netl.doe.gov

Customer Service:
1-800-553-7681