Permitting Procedures and Challenges of CHP Implementation

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ABSTRACT

The objective of this research is to determine appropriate procedures required to apply for air permitting and interconnection agreements with all necessary agencies to assist an oilfield service company in Louisiana implementing a combined heat and power (CHP) system for their day-to-day operations. The main reasons for the facility to implement CHP are twofold. The management wants to provide a climate controlled work environment for the facility personnel to ensure that a high level of productivity is achieved. The use of CHP will also reduce the greenhouse gases that are emitted into the atmosphere. The procedures required for air permitting and utility permitting are developed, followed by discussions on the challenges of implementing CHP in Louisiana. The development of a how-to guide on CHP implementation using a case study will provide insight on the procedures for potential CHP adopters in Louisiana.

INTRODUCTION

The implementation of a combined heat and power (CHP) system allows manufacturing industries to decrease their energy expenses while benefiting the environment. The payback period of a CHP system can range from less than one year to about ten years depending on the square footage of the facility, electric rates, natural gas rates, and size of the system. Despite the availability of CHP technology, Louisiana has not seen a steady increase in the number of systems implemented throughout the state in recent years [1]. Research has indicated that the difficulty in CHP implementation is due to the lengthy air permitting

procedures required by the Louisiana Department of Environmental Quality (DEQ) and the U.S. Environmental Protection Agency (EPA). In addition, the regulated utility companies also pose a significant barrier to CHP implementation because of the lack of regulation from the Federal and State governments [2].

The objective of this research is to determine appropriate procedures required to apply for air permitting and interconnection agreements with all necessary agencies to assist an oilfield service company in Louisiana implementing a CHP system for their day-to-day operations. The company is a manufacturing facility that repairs large compressor machines for oil and gas industries. The facility owner had previously acquired the CHP equipment after the design review was finalized. The utility company providing power is Cleco Power, LLC (Cleco) whose operations are based in central Louisiana. They are a regulated electric utility business with about 265,000 customers and about 1,360 MW of generating capacity.

The CHP system was designed by Blue Point Energy in California. The estimated electrical output generation is 315 kWe. The generator selected is a Waukesha VHP 3521 GSI model that will be run at 100% capacity. The Waukesha is a gas engine that will operate using natural gas as the fuel source. Blue Point Energy has calculated the total energy that will be recovered to be 90.16%.

The management has worked closely with California-based Blue Point Energy to design the system to meet the thermal heat requirements that will provide air conditioning for summer, heating for winter, and all facility hot water. The estimated simple payback for the facility's CHP system is approximately 2.86 years. The management wants to provide a climate controlled work environment for the facility personnel to ensure that a high level of productivity is achieved. The use of CHP will also reduce the greenhouse gases that are emitted into the atmosphere. Development of a how-to guide on CHP implementation using a case study will provide insight on the procedures to potential CHP adopters in Louisiana.

AIR PERMITTING PROCEDURE

The air permitting will be done through the Louisiana Department of Environmental Quality (DEQ) located in Baton Rouge, Louisiana. The

DEQ has many divisions, some of which include air, water, surveillance, and compliance monitoring. The DEQ air permitting process is outdated and manual, thereby increasing the processing time. While researching the air permitting process in Louisiana, only a small portion of the information required to complete the forms is available on the internet. The correct procedures were gathered through interviews with DEQ personnel. The air permitting process needs to be completed before purchasing any long lead time equipment. A flowchart is provided in Figure 1 to help clarify the air permit process.

The air permit process is initiated by completing the application form and the emission inventory questionnaire (EIQ) form. Both forms are required to be completed by a Louisiana certified engineer. The

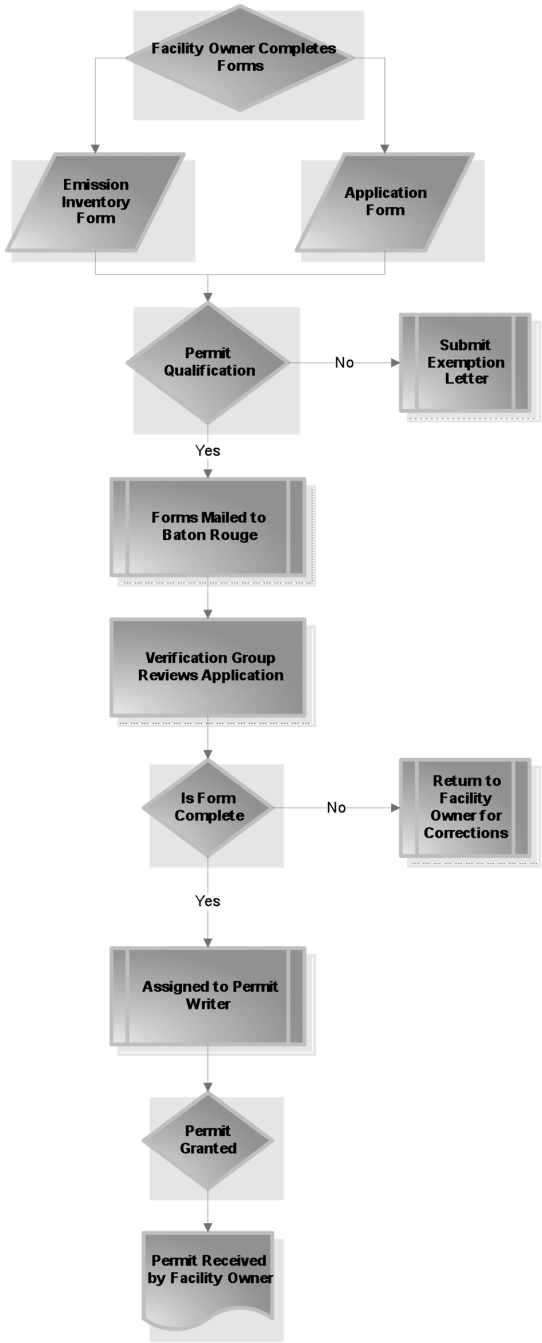

Figure 1. Air Permit Process

application form contains the facility information as well as a list of each emission point. The emission listing needs to have the following information for each emission point: an emission point number, description, operating rate and operating schedule. The emission totals need to also be calculated for each emission point. There is a section on the application that allows the applicant to indicate how compliance with the program will be achieved. The application form is 13 pages in its entirety and contains detailed data that needs to be accurately listed to ensure the application is correct.

The other forms required for submission are the EIQ and the single source point forms. The EIQ needs to be completed for each emission from the entire plant site. The information gathered on the EIQ is the organization activities such as days of the week not operating, days per year of operation, peak production season, daily operating schedule, and number of employees. The summary section of the EIQ provides a tabulation of all emissions in pounds per year and tons per year for the total. The single point/area/volume section of the EIQ form characterizes each emission point at the facility. The emission point listed in the application is again listed on the form along with the equipment services. The location of the stack or vent is listed on the form as well as the measurements, gas exit temperature, gas flow, and gas exit velocity.

After the forms are completed and the emissions are calculated for tons per year, the facility may either qualify for a minor source permitting or may be exempted. Exemption is determined by Act No. 918, which was passed in 2003. Act No. 918 states that if any regulated emission is calculated below 5 tons per year and the total emitted pollutants are less than 15 tons per year, the facility may submit a letter of exemption to the Baton Rouge office.

If the facility does not meet the exemption criteria, the completed forms are mailed to the Baton Rouge office to be verified for accuracy and completeness. The original form and two photocopies are required. The verification department will verify the forms. If forms are complete, the air permit will be assigned to a permit writer. If forms are not complete or verified, they will be returned to the facility owner for correction.

The permit writer will either approve or deny the permit. Once the permit is approved, a permit will be issued to the facility owner. The permit will contain reporting information and system modification

stipulations. In 2003, the EPA issued a fee schedule listing for a pricing structure for the permits. The fee schedule is based upon the capital cost of the system. There are fee schedules for new permit applications, annual maintenance, and modification fees. The permit writer will calculate the fee for the facility owner.

If the facility does qualify for an exemption from an air permit, the facility must send a letter to the EPA. The letter must state that the facility qualifies for exemption under Act No. 918. The exemption qualification requires that the facility owner maintain record keeping annually. The information that needs to be maintained includes the measurements of exhaust constituents and the names of the exhaust constituents for review by EPA inspectors. The record keeping will enable the facility owner to produce the information that will prove to an EPA inspector that the facility is still eligible for exemption under Act No. 918.

The record keeping is more stringent for those facilities that will require a minor source permit. The air permit received by the facility owner will indicate how often exhaust measurements and other significant data are necessary to maintain the air permit. Most air permit holders are required to submit a report semi-annually that contains regulated pollutants listing and their calculated emission totals.

The regulated pollutants based upon the AP 42, Compilation of Air Pollutant Emission Factors, Volume 1 book from the EPA for external combustion sources for natural gas include: nitrogen oxides (NO_x), carbon monoxide (CO), carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), volatile organic compounds (VOCs), trace amounts of sulfur dioxide (SO_2), and particulate matter (PM) [3, 8]. The emission data from the equipment that is generally provided by the manufacturer are acceptable for emission calculations. However, if there are no data available from the manufacturer, the AP 42 handbook contains an emissions database that can be used for calculations.

The time frame for the air permitting process will vary greatly depending on the number of air permit forms that the permit writer is assigned at the time. The air permitting process generally takes between one to two years. Furthermore, it is important for the facility owner to keep abreast and informed of any air permitting information that is mailed to him. If any semi-annually or other required report is not submitted within the designated time frame, the facility will be in violation.

UTILITY PERMITTING PROCEDURE

The process of the interconnection between the facility and Cleco's grid begins with researching the website and contacting a sales representative. The steps required for connecting a small generator with Cleco are illustrated below in Figure 2.

The first step is to determine if the system designed in the preliminary design phase of the project is a qualifying facility. The Public Utilities Regulator Policy Act of 1978 (PURPA) describes what constitutes a qualifying facility. If the preliminary design CHP system qualifies as a qualifying facility, then the next step for Cleco is to file a standard interconnection evaluation form. Customer information, generation facility information, and intended use of the facility are required. The generation facility information includes the type of generator that will be used in the system, the generator rating, voltage requested, daily running time of the generator, and weekly running time of the generator. The intended use of the facility is one of three possible uses: (1) self-supply load, (2) sell excess energy to Cleco, and (3) sell excess energy to third party.

The next step in the interconnection process is the determination of jurisdiction. Cleco indicated that the case study would fall under state jurisdiction rather than federal jurisdiction because the facility owner intended to self supply his own electrical load. Once jurisdiction is determined, Cleco submits the appropriate interconnection application to the facility owner. The facility owner is required to complete the application and submit a detailed engineer-

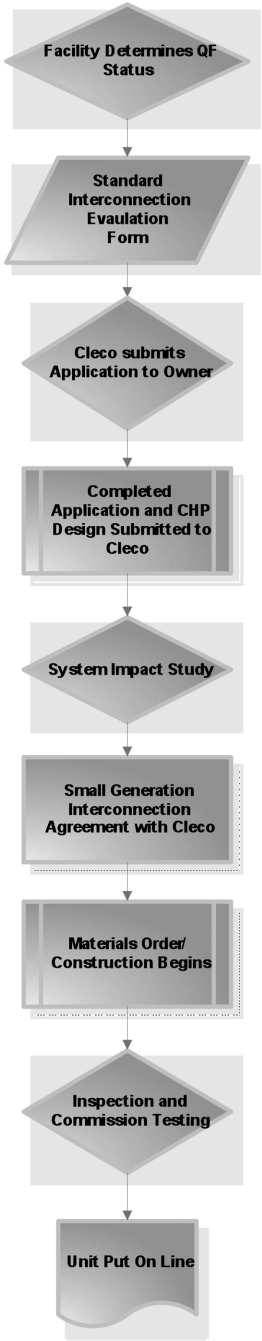

Figure 2. Interconnection Data Flow

ing drawing of the proposed generation system. Cleco stipulates that the drawing must be compliant to Cleco's customer owned generation (COG) specifications.

Cleco's COG specification contains the company policy on customer generation, the general operating requirements, metering requirements, and communication requirements. The document lists six sample CHP installations developed in CAD to illustrate acceptable interconnection methods. The document further indicates that all equipment needed to establish and maintain power quality standards, harmonics standards, and synchronization will be purchased by the facility owner.

All maintenance and replacement of such equipment will also be the expense of the facility owner. The specification also details the communication requirements that include having a phone line and data line at the facility to maintain communications between Cleco and the facility. The purpose of the communication is to transmit system information such as paralleling or separation, scheduled and unscheduled shutdowns, equipment clearances, and hourly and daily loaded schedules and reports. The metering equipment will also be paid for and maintained by the facility owner.

The completed application and Cleco COG appropriate drawing are returned to Cleco. If the application and proposed generation system drawing are accepted, then Cleco will conduct a system impact study. The purpose of the study is to determine what additional equipment is needed to comply with Cleco's safety regulations and power quality standards. The results of the system impact study include the equipment and cost responsibility of the facility owner that must be incurred to interconnect the CHP system to the grid.

If the facility owner accepts the system impact study, a small-generation interconnection request will be executed with Cleco. The facility owner will also provide payment for all necessary system improvements that need to be made to ensure that Cleco's electrical system can provide adequate power in cases where the customer's CHP system is non-operational.

The ordering of all materials and construction is initiated after the agreement is completed by Cleco and the facility owner. Once construction is complete and all required equipment is installed, Cleco will inspect the facilities. The inspection will entail inspecting the facility equipment and the electric utility equipment to ensure that everything operates correctly to ensure the safety requirements are met. The sys-

tem will be allowed to begin operation after all tests are successfully passed.

The fees that a facility owner will be required to pay during and after the interconnection is on-line and operational are stand-by fees. The stand-by fees are also referred to as avoided cost. The avoided cost is determined by the peak demand rate the customer would incur if the customer were using the electrical power. The facility owner will also have to pay a fee when the interconnection agreement is initiated, and will have to pay for all equipment Cleco requires. The fees associated with the interconnection process may severely impact the system payback, making it unfeasible.

IMPLEMENTATION CHALLENGES

In spite of the many benefits that a CHP system provides the environment, the facility, and electric utility companies, it can be seen from our case study that it remains a difficult and confusing task to successfully get a CHP system permitted and connected to the electric grid in Louisiana. The main challenges to successfully implementing a CHP system in Louisiana involve the resistance of many of our electric utility providers and the EPA/DEQ's air permitting process. Other challenges to implementing a CHP system are attributed to the country's government policies regarding energy efficiency, natural gas pricing structure, and the lengthy planning process for CHP adoption.

Electric Utility Provider Challenges

The electric utility provider challenges to successful implementation of CHP are related to lack of procedures, requirements, and additional costs. In Louisiana the electric utility companies are not deregulated. A deregulated utility company system would enable customers to have their choice of electricity providers. The electric utility companies in Louisiana are privately owned by multiple shareholders that enjoy no interference or regulation from state or local governments. The revenue of the electric companies is generated directly from the rate payers and is the product of the base rate multiplied by the quantity of energy used [4]. There is a monopoly of electric utility companies in Louisiana. This monopoly directly inhibits the benefits of rate reduction that are naturally found in other business environments in which multiple companies

compete for a customer's purchase.

Other barriers that an electric utility company uses to hinder the adoption of a CHP system are related to the utility's responsibility to maintain the reliability, safety, and power quality of the electrical power system. Studies have found that utility companies may have requirements for protective relays and transfer switches to prevent "islanding" even though the CHP equipment has the same safety features as part of the equipment [5]. "Islanding" occurs when a generating facility supplies power to a portion of the grid when the grid balance has been de-energized. The electric company is unable to control the equipment that is used at the facility site, and it is therefore important that the facility's equipment is certified and properly engineered when connected to the electric grid.

An electric company needs to ensure that it is able to generate enough electricity and distribute it through the distribution lines to provide power to the facility. Therefore, the utility provider charges the facility owner a stand-by fee that is calculated as a flat monthly demand rate per kW. The stand-by charge is the cost needed to recover the electric company's cost of providing enough electricity to the facility whether the electricity is used by the facility or not.

Air Permitting Challenges

Another challenge to the successful implementation of CHP systems is the extensive and confusing permitting process. Before a CHP system is operational, the owner must first determine what if any local, state, and federal permits are required to comply with environmental regulations, utility regulations, and building codes. Unfortunately, the required permitting information is not located in one central location. The permitting process can also be different in each town or city, thereby making it difficult for continuity of process throughout a state. To ensure that permitting is done correctly and all necessary permits have been applied for, the owner should employ an experienced environmental consultant [6].

Natural Gas Provider Pricing Challenges

The difference in contract prices that exist between an electric provider and an individual company is vast. The lack of bargaining power to secure lower natural gas prices that are given to the electric utility companies possesses another challenge to CHP implementers. Because

of the larger volume of natural gas purchases made by the electric utility company, they are able to negotiate lower rates than an individual company, whereas CHP adopters' pay retail price for their natural gas because they purchase a smaller volume [6]. This pricing difference between an electric company's purchasing power and a CHP adopter's retail price can be such a significant variation that implementation of CHP may not be cost effective.

The contract price of natural gas compared to the price of electric rates is of major concern to a potential CHP adopter. A CHP owner must attempt to negotiate fuel prices at reasonable rates without expertise in supply contract negotiation strategies. Therefore, to ensure that supply contracts are done correctly and with the best possible pricing, the facility owner must pay for the expertise of a fuel supply contract negotiator.

Not only is the fuel supply contract an expensive undertaking, but also the recent radical price changes in natural gas can make the project an unattractive undertaking. The ratio between low electricity prices and high natural gas prices is called "spark spread." In areas that have low spark spread, the desire to adopt CHP is not very cost-effective. However, in areas that have a high spark spread, the desire to adopt CHP is very desirable [7].

CONCLUSIONS

The barriers to implementation of CHP can be rather difficult and costly for a facility to overcome. The electric companies have been successful in over engineering a potential CHP adopter to the point that it makes the project unaffordable. The environmental polices passed by government agencies overlook incentives for potential CHP projects, thereby making CHP an unattractive undertaking. The lack of state and local policy continuity and easily accessible information makes it such a time consuming task to attempt to locate all appropriate permitting, certification, and interconnection agreements that most potential CHP adopters give up on the process. These barriers are especially prevalent in Louisiana. Development of a how-to guide on CHP implementation using a case study will provide insight on the procedures to potential CHP adopters in Louisiana.

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