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White Paper: How Lewis & Clark Regional Water System Provides Complete Reliability

Introduction

Lewis & Clark Regional Water System (LCRWS) of Sioux Falls, South Dakota is a consortium of 20 members—15 cities and five rural water districts in southeastern South Dakota, northwestern Iowa and southwestern Minnesota. Members will receive treated water from a network of well fields located near the Missouri River. The ambitious, $550-million program has been in the making for 20 years, and construction is well underway.

LCRWS is scheduled to begin operations in March 2012. When completed, the 337-mile project will serve more than 300,000 people and either replace or supplement their current water sources. One member of the system is the City of Sioux Falls, who will receive a needed secondary source of water from LCRWS. The city will be able to buy up to 28 MGD (million gallons of water per day) once they have been connected to the operational system.

LCRWS Executive director Troy Larson recently called on Congress to recognize the critical importance of improving water resources in rural America. “To help ensure the sustainability of rural America and remain competitive in the industrial market, access to quality, reliable water is job number one,” Larson said. He went on to explain that during this time of economic turmoil, “water truly is the oil that runs the engine of economic development.” He gave several examples of missed opportunities for development in rural communities, but also related examples of how providing water has indeed allowed for development in yet other communities within the region.

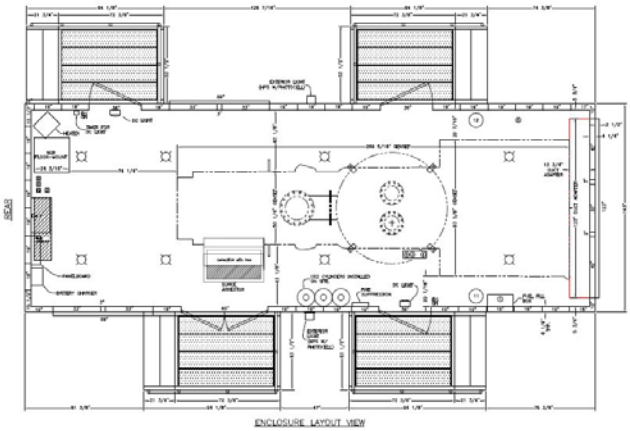
Challenge

As would be the case with any project of this scale, LCRWS is faced with challenges from every quarter. However, the focus of this particular study is Standby Power Generation—both at it’s Vermillion, SD Treatment Plant and eventually, for all of the pump stations in the system. The treatment plant, storage facilities and connecting network of pump stations each need a 100% reliable source of power and systems redundancy to provide an uninterrupted water supply to customers. Overall Engineering Project Manager Dave Odens, of LCRWS-contracted engineering firm Banner Associates explained, ”The main problem we wanted to address here is the need for standby power in the event of a complete utility power failure. We have to provide reliable standby power at the well sites that is basically capable of operating the system at near full capacity. Likewise, standby power generation is necessary at the water treatment plant that provides us with the capability to operate the plant essentially at full capacity.”

Furthermore, and significantly impacting the reliable operation of the equipment itself, was the need to ensure maximum protection of all standby power generation equipment via custom designed, robust, walk-in enclosures—required to provide an uncompromising level of protection from adverse convective weather conditions, as well as the occasionally hostile seasonal temperatures that exist in the north central United States.

Solution

HDR Engineering of Minneapolis was contracted to define specifications and requirements for LCRWS' facilities equipment, including standby power generation. Design and specifications called for total standby power capacity of 6,000 kW in three generator sets (gensets)—Diesel engines mated to generators and power controls and placed within weatherproof steel enclosures equipped with integral fuel tanks for storage of No. 2 Diesel fuel oil, to power the generators.



Technical Specifications

Butler Machinery Company of Sioux Falls was selected to supply Caterpillar equipment for standby power generation for LCRWS. The supplied gensets are CAT Model 3516C-HD TA Diesel engines, rated at 2000 kW, 2500 kVA, 60 Hz at 1800 rpm, and 12,500 Volts. They accept 100% rated load in one step per NFPA 110, and meet ISO 8528-5 transient response. The CAT HV generators are UL 1446 recognized with Class F insulation. Each genset includes a Surge arrestor that meets NEMA LA-1 and ANSI C62.11, and a UL 810-compliant Surge capacitor. Lectrus' South Dakota Operation (formerly D.T.S., Inc. of Tea, SD), was approached to design and build the modular steel enclosures for the gensets, completing the standby power supply packages.

Genset Enclosures

Lectrus sound attenuated generator enclosures are extremely robust, free-standing buildings. The units built for LCRWS each contain four full-height, hinged, lockable doors with NFPA crash hardware and bolt-on steps. Venting and motorized intake and exhaust louvers/dampers are also integral on each building.

The generator enclosure dimensions are 12 feet wide x 14 feet long x 14.3 feet high. The structures are certified to meet IBC standards including wind and snow loading. The outer wall of each enclosure is constructed using a 14-gauge, 4-inch deep steel welded and bolted design. All fabricated steel parts conform to ASTM 569, specification C-1018, and all structural steel meets ASTM A36 requirements. The inner wall consists of fiberglass insulation and a perforated, galvanized steel liner. Every enclosure is painted with durable, long-lasting weather-resistant coatings.

Electrical and power components include three-phase panelboard; Engine Control Panel with neutral grounding reactor; 208V single-phase connection to tank heater, plus critical power and fuel level warning alarms and indicators. Lighting includes three 24 V inside lights on timers and two outside lights on photocells. Enclosures also include battery charger and two, 5 kW room heaters each. For fire suppression, every enclosure incorporates its own automatic CO_2 extinguisher system tied directly into the main building's fire alarm system.

The genset enclosures' integral, low-profile 3500-gallon sub-base fuel tanks are made from structural steel, baffled and interior coated with durable rustproof coating to create a leak-proof, long-lasting reserve. As shown in photos accompanying this article, the tanks present a compact footprint. They are also UL 142-listed and designed to meet UL 2085 fire requirements.

There is also a unique, significant benefit with LCRWS' standby power. In the case of the standby generators at the water treatment plant, they have an agreement in place with the power utility that allows them to do "load-shedding" and reduce their electric rate by dropping the electrical load of the plant off the grid during certain high-demand periods. This agreement also allows them to sell power back to the utility, benefiting the other communities and reducing water service cost to customers. It's an innovative arrangement that positively impacts economic development.

Dave Odens further elaborated, "What we're providing here is the power to allow us to continue to operate the treatment process. It's a lime softening process and it's optimal if it's allowed to run. Interruptions to power can be more frequent in a rural area like ours and would be of longer duration. The other point about that particular site is that there are eight 1250-hp pumps used to pump water (60 miles) out to Tea—and when we are at a time of year that we need to do load-shedding, we can pick the load of the pumps up on those standby power generators. We wouldn't run all eight pumps at once—some of them are standby pumps. But those three generators will allow us to run at least five pumps and there's no interruption of water service or concern to our customers."

The greatest peak periods for load-shedding are mid-summer, when there is extensive use of water for irrigation and the need for power to run air conditioning equipment—and in January, as many of the area homes use electric heat and power needs are at their peak during that time of year.

"We also experience ice storms," Dave added. "Two years ago we had one that knocked out power for about four weeks—not at Vermillion, but 30 miles west of there. We work with a lot of utilities that

were without power in parts of their system for four weeks, so a standby generator becomes pretty important. And having one in a Lectrus enclosure is even more critically important because you can operate and maintain that generator in adverse weather conditions."

"We've used Lectrus enclosures in quite a few projects over the years. It's more or less a standard of how we design and operate standby power systems."

LCRWS' Water Plant Superintendent Jim Auen agrees, "We're ordering another generator and building...a life safety generator that's just for the main building and water treatment plant to provide emergency lighting and backup for the control systems. There are additional well field generators going in and they will need Lectrus enclosures as well. Those will be coming within the next year, and there's a 2250 kW-rated standby generator going in at the Tea pump station also."

Conclusion

Water and power are crucial needs in every area. LCRWS is addressing both in tangible, efficient ways. Jim Auen underscored the significance of the program, "It's a unique approach that Lewis & Clark has taken and it's a regional approach. We're going to be providing water to parts of three states, which has never been done before to our knowledge. We're addressing critical water needs for our members: each system presently has unique challenges with their current water sources—they either aren't adequate or they are of such low quality that it's difficult for them to fully utilize that source without expensive treatment options. We will be producing high quality, reasonable cost water that in some cases will be the sole source of supply for some of our members. And we're doing it in a manner that would've been financially impossible for the members to undertake on their own."

"Water in this part of the country is like gold as far as economic development goes. And the development in this region would have been curtailed without abundant water resources—abundant both from a quality side and the quantity side."

No matter what the weather or power conditions, it is absolutely critical that water be available 24/7/365 at 100%, to users. Butler Machinery and Lectrus have solved the power challenge, and Lewis & Clark has even gone the extra mile with load sharing via load-shedding agreements. Only the standby power generation equipment in place at their facilities makes that possible.

Whether or not a similar level of criticality exists in every other industry, a main issue remains: if power is interrupted, process safety, life safety, deliverability of product/service and business viability all suffer. The risk for that eventuality can be completely mitigated with reliable standby power systems placed within robust, weatherproof enclosures.