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INCORPORATED
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Remote Power Generation

by: Kenneth H. Nelson, P.E.

Hurricane Katrina hit New Orleans on August 29, 2005 and shut down the electric grid, the water supply, and the communications grid, and flooded approximately 80% of New Orleans due to failures of levees and pumping systems. The Nelson office building was up and running on generator power eight days later on September 6, 2005 despite the devastation. In an interview shortly after Katrina, a reporter asked how we had been able to accomplish this feat. Our answer was "We do this for a living." Indeed, the senior staff members who came into town to hook up the generator were very experienced in designing standalone power systems for our industrial clients. In fact, we're usually doing it on an oil platform many miles offshore, and the only way to get there is by boat or helicopter. Other than negotiating the flooded roads and checkpoints that were in place after Katrina, the ability to drive to the installation site was comparatively easy access compared to what we normally have to do.

Hooking up temporary power for our building after Hurricane Katrina

From the beginning of the company in 1945, we have worked in locations so remote that we have had to create the infrastructure to support the project, including all the elements that Katrina knocked out of use: electricity, potable water, and communications. Our founder Waldemar Nelson had an often repeated saying that "Engineering is the foundation of civilization". He had grown up in a time where this was very apparent in everyday life and not taken for granted. The comforts and conveniences of civilized life we use every day without a second thought were not universal when he was born, and he took great pride in being able to bring them to more people.

This issue will concentrate on the topic of electric power generation because we have frequently been involved in projects requiring the knowledge to bring electricity to remote sites. Most of the United States is served by transmission lines that bring utility power to users. However, this is a big country, and there are still places where a large demand for power cannot always be reliably met by simply "plugging in" to the system. One example is pipeline compressor stations that may be located in very remote areas due to the need to boost pressure at certain intervals along the pipeline. They may have access to fuel, either natural gas from the pipeline or trucked in liquid fuel such as diesel, but there may not be utility lines anywhere near the location of the station. In these instances, we have worked with engine and turbine manufacturers to

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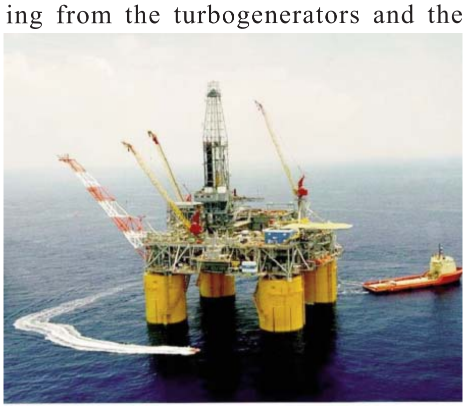
design standalone power generation facilities to service the load. Another example is oil production sets in remote areas, such as the Permian Basin in West Texas where the power supply is limited, or non-existent as in the Amazon Jungle, dictating a need for remote and/or supplemental power generation.

Our experience in remote power generation goes back many years to cogeneration systems for industrial clients that needed both electricity and steam to run their facilities. We designed power plants for them that used steam generated in natural gas fired boilers to turn turbines connected to generators. The steam generated in the boilers was also used for the industrial process. The steam exhausting from the turbogenerators and the flue gas exhausting from the boilers still contained usable heat, so we designed heat reclaiming processes to capture and recycle it back into the process. In a remote location such as an offshore platform out of sight of land, you need something to power the startup of such a complex system of boilers and turbogenerators with their associated feedwater pumps and lubricating oil systems. Therefore, we included in our design a small natural gas fired turbine / generator that could produce enough electricity to get the ancillary equipment and control systems running before firing up the main units. In turn, it took some electricity to get the control systems and lubrication for the small gas turbine up and running before you could fire it up, and you needed some power just to have lighting to orchestrate such a complex process. To accommodate this need, we also included a small diesel engine / generator set started by batteries to be able to “cold start” the entire process to get the platform running. Remember, all this was happening on an artificial steel island out of sight of land, so if you had to perform a cold start at night, you would have to use a flashlight to even find the start switch on the diesel engine! I remember looking at the drawings for the power plant of this offshore facility and realizing that this small diesel engine was the “jumper cables” to get the whole operation going when you had to start up after a shutdown caused by an event such as a hurricane.



Remote operations such as offshore oil platforms require total self sufficiency in power generation

Turbines fired with natural gas can provide high horsepower for electrical generation when space is limited

We have worked on electrical generation facilities in the jungles of South America, the Pacific islands, the deserts of North America, in arctic regions, on Caribbean islands, remote facilities in Africa and Asia, and on both fixed and floating offshore platforms in both state and federal waters of the United States as well as overseas. Some of our electrical engineers have even participated on committees of the technical societies that write the standards governing the electrical design of offshore facilities. We have worked on standalone industrial power plants in marsh locations and onshore chemical plants, and have worked for public utility scale power plants in remote but more conventional applications, such as independent power producers tying into the grid with small but efficient generating plants that take advantage of some market niche. We have participated in numerous recent projects to design small to medium size power generation facilities for industrial clients, electric cooperatives and municipalities. Such plants are designed to efficiently startup individual or multiple engine generator units to service peak demand loads and provide power when alternative energy sources such as wind and solar are not producing power.

With the current interest in wind generated electrical power, we have been investigating how our long experience in the offshore operating arena can be adapted to serve this potential market in the waters of the United States. We have also used solar powered generation on remote or unattended platforms for small power needs such as navigation lights.

There are many instances where the ability to generate power independent of public utilities is useful, even if the location is not remote. You can imagine the catastrophic consequences of losing power in a hospital, hotel, high rise office building, airport, or the communication and control center for any critical public agency. Industrial clients often require back-up power generation to safely operate or shut down their facilities. Standby generators for such critical functions are very common, and anywhere that public safety is at stake, we have the ability to provide standalone engine / generators with automatic transfer switches that will self-start and keep facilities functioning within seconds of losing utility power. Computer networks need instantaneous backup power to maintain their function, so they frequently will have uninterruptable power systems (UPS) in the form of DC batteries inverted to AC power, that are in turn backed up by standby generators.

The type of engine used to turn the electrical generator will vary depending on the use and the available fuel supply. We have designed facilities using high speed reciprocating engines powered by diesel or natural gas when the need for a quick start up is important. For larger stationary loads, we have used big slow speed reciprocating engines powered by diesel, crude oil, natural gas, and liquefied natural gas. Such installations may be dual fuel, normally operating on natural gas from a pipeline, and with diesel or LNG as a back-up fuel source. Many of these engine generator units are specifically designed for power plant use, but others are adapted from marine applications like ship or submarine engines. In the realm of gas turbines, when space and weight is critical, such as on an offshore platform, we have used small, relatively lightweight but powerful turbine driven generators adapted from aircraft engines. If more space is available, such as at a land based power plant, larger gas turbines have been used.

It is amazing how dependent on electricity our society has become. When the lights go off, it initially creates concern over physical safety issues, such as being able to safely exit a building or shut down a facility. We have also become so interconnected in terms of communication that most people's next concern is the ability to power their cellphones or computers, so they can keep up with what is going on in the rest of the world. We have served many clients' needs over the years to keep their facilities running and their communications with the world open. This is a multidiscipline task involving virtually all disciplines of engineering and architecture. Civil/Structural engineers prepare the site and design the foundations and supporting structures. Mechanical engineers select the engines and ancillary equipment and provide piping interconnects. Electrical engineers select the generators, transformers, switchgear, and utility interface, and design their interconnection, operation, and protection. Control systems engineers provide the instrumentation to monitor and control all aspects of the facility. Chemical engineers design the process systems for fuel supply, emissions controls, and lubrication. Architects design the building to house the equipment. Environmental engineers handle pollution prevention plans and compliance with environmental regulations. Over the years, we have provided all of these services in whole or in part as dictated by the client's needs and working in concert with various equipment manufacturers. Wherever there has been a need to "keep the lights on", no matter what the circumstances or how remote, Nelson has designed innovative solutions. We all take for granted that electrical devices will perform their function when the switch is turned on, but it takes a tremendous design effort to make sure it happens, especially in remote locations.

2018 SERVICE RECOGNITION DINNER

40 Year
Lyle Kuhlmann, Charles Nelson, Ken Nelson and Penny Larsen

35 Year
Steve Ducatel

30 Year
Steve Prados

25 Year
Tommy Deharde, Mark Milhet, Pat McCurdy and Derrick Millet

20 Year
Steve Hebert and Dave Wilkinson

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"THE CONSULTANT" CELEBRATES SIXTY YEARS OF PUBLISHING

The very first issue of The Consultant came out in September of 1958, so with this third quarter 2018 issue, we are celebrating sixty years of continuous publishing of our company newsletter! The stories that have been told in its pages showcased the technical innovations that we came up with to help develop the economies of the Gulf Coast, the nation, and the globe. We are very thankful for the opportunities we have had to participate in many world-class projects, and we are grateful to the many brilliant and dedicated staff members who have kept this enterprise going.

Congratulations to all who have taken part in our legacy, and we look forward to continuing the story into the future.

2018 Saints Kick-Off Run

Front l to r; Jessica Ramirez, Luan Tran, Rachel Delatte, Martin Patterson, Tonya Coleman, Roy Phelps, Jared Nunez, Carol Hutchinson, Michelle Maggiore, Derrick Millet, Louis Randazzo, Sarah Todd, Holly Beaulieau, Justin Bertheaud, Junius Nixon Michelle Jones and Mike Delatte (not pictured; Marie Vonderheide and Jack Neelis)

Gabriel & Natalia Varona

Yolanda & Maria Azpilcueta