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Bi-Fuel in Generators

The intricacies of diesel fuel versus natural gas and generator monitoring in a bi-fuel situation

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In the Electrical Power Generation (EPG) Markets, there is always a decision to be made about whether to fuel a generator using ***Diesel Fuel or Natural Gas.*** The advantage of Diesel Fuel is that it produces maximum Horsepower for a specific engine displacement and the engine handles transient loads very well. The downsides include emissions and the cost of fuel. The advantages of Natural Gas fueled gensets are that an engine burns much cleaner and the fuel is much cheaper at this point in time. The disadvantage of larger required displacement is significant. For example, you need to buy a G3516 to produce the same amount of horsepower as a 3512 diesel which is 30-40% more engine to develop the same horsepower. In addition, the Natural Gas engines do not handle transient loads as well and are more complicated to operate. The increased operational complexity is due to requirements for spark ignition on each cylinder. Depending on the application, what fuels are available, the specific load requirements, and operational hours a customer will have to determine which type of engine is better suited for their application.

Bi-Fuel is a term used to describe a process by which you inject Natural Gas into the intake manifold of a Diesel engine to try and obtain the advantages of Natural Gas without giving up the advantages of a diesel engine. Theoretically, you only need 1-5% of diesel fuel to provide the ignition source to allow operation without spark plugs. There are some Natural Gas Marine engines that advertise this type of diesel substitution rate. However, many onshore drilling rigs with bi-fuel systems in operation today are achieving between 50-70% diesel substitution rate. At lower load factors, you simply substitute natural gas for diesel fuel and you get the advantages of cheaper fuel and lower harmful emissions. When you have high transient loads or higher constant load factors, you reduce the percentage of natural gas and burn more diesel fuel to produce the higher horsepower and torque requirements.

Current estimates show that natural gas fuel costs are so low, that even considering the equipment and installation costs of the Bi-Fuel system, payback is about 60 days. Therefore, bi-fuel systems are being installed by the hundreds on drilling rigs all over North America.

Unfortunately, there are no specific EPA rules to govern bi-fuel installations. The Good news is that when you introduce Natural Gas into the air stream at about 50% substitution rate, the NOx is reduced by about 30-50%, the SOx is almost eliminated, and the formaldehyde is drastically reduced. These are all gases that are currently regulated and are known to be harmful, so these are excellent results. However, the combustion temperature is higher with bi-fuel which leads to increased CO production. The only thing you can economically do to CO is to oxidize it to CO2 using a catalyst bed. CO2 is considered to be a green house gas and is the subject of much study, but no current regulatory limits. At this time, there are not any EPA certified aftermarket bi-fuel systems, so approvals needed have to be applied for on a location-by-location basis which in turn means higher regulatory costs for the project. Bi-fuel is a great example of a Win-Win situation where the emissions are drastically reduced and the cost savings will pay for the equipment and installation in a matter of a couple of months, but regulatory agencies are way behind the curve on figuring out how to allow for the benefits of bi-fuel systems.

Even though the most popular bi-fuel applications are in Prime Power applications such as drilling rigs, there are many other applications that are becoming more popular. Many emergency backup generators would be well suited for bi-fuel. A good example is a generator used for backup power at a water plant in preparation for prolonged outages. One local Water district added a bi-fuel system to their diesel genset and had the local gas utility install the appropriate gas line to feed the generator. Before the bi-fuel system the district had a 1000-gallon day tank and was constantly struggling to keep the fuel treated to be ready to burn at any time. The 1000-gallon day tank would last 2-3 days in full power outage situation. In the case of a major hurricane, power could be out for significantly longer periods of time with no additional diesel fuel available for purchase (ask anyone whose tried to buy diesel after a major catastrophe such as a powerful hurricane). By adding a bi-fuel system, they can substitute about 50-60% of the diesel fuel for natural gas and extend their run time from 2-3 days to 1-2 weeks without requiring refueling of the diesel tanks. Hospitals, data centers and other critical infrastructure locations can now consider installing bi-fuel systems at relatively low cost. In these cases it is not the low cost of the fuel but the critical availability of the fuel during emergency situations that is critical.

The reason Monico Gateways are used in these applications is that monitoring becomes even more critical with bi-fuel installations. It is critical to monitor the bi-fuel system to determine how long it is running and what % fuel is being substituted. When you can report this information routinely, you can manage your logistics to make sure you always have enough fuel on hand. In addition, there are maintenance considerations that are easily monitored using Monico Gateways.

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