June 2013

Diesel & Gas Turbine WORLDWIDE

DEDICATED TO ENGINE ROOM PRODUCTS, TECHNOLOGIES & NEWS

GREEN POWER TECHNOLOGY

ALSO:

Nontraditional Fuel

Noise & Heat Reduction

LNG For Rail Traction

Mechanical Drive Order Survey

www.dieselgasturbine.com

A Continental Controls GSS installed on a Detroit Diesel 60 series.

Cutting Fuel Costs On Oil Field Diesels

New bi-fuel system from Continental Controls

Between the Alberta Oil Sands and the Bakken, Marcellus and Monterey formations, North America has plenty of proven oil and gas reserves to fully meet its own needs for decades or centuries to come and still become a major net energy exporter. The question is how to most efficiently extract those reserves and move them to market.

Given the abundance of natural gas in these fields, the relatively low market price per Btu, and the added costs of trucking diesel fuel to remote locations and storing it there, producers have achieved cost savings by running bi-fuel engines: using natural gas to supplement diesel.

Continental Controls Corp. said it has released a patent-pending control technology for this application that allows for low-cost retrofits of diesels, providing stable control that rapidly adjusts to changing conditions without risk of damage to the equipment. These systems have about a 30-day payback time, considering the cost of diesel fuel and transport, without adding in costs related to proposed CO_2 taxes, the company said.

Bi-fuel engines use a gas substitution system (GSS) where a portion of the diesel is replaced with natural gas. The allowable ratio of gas flow to total fuel flow (gas substitution ratio or

continued on page 12

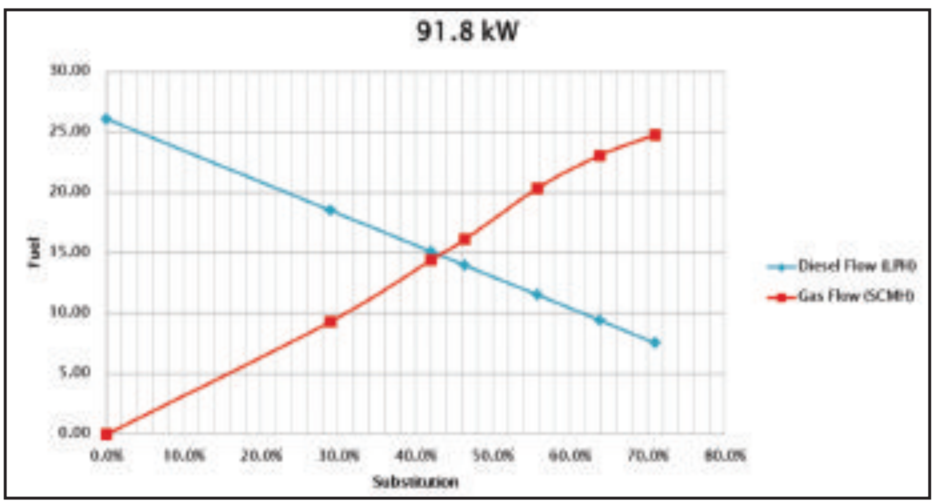
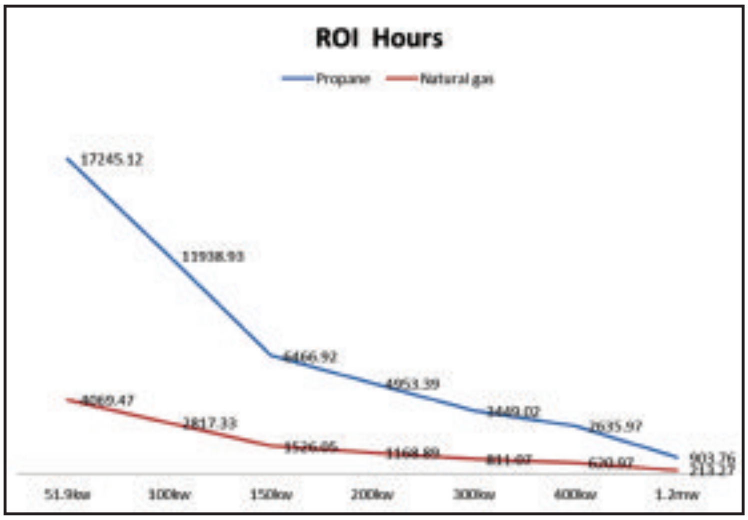


Figure 1. Gas substitution rate (GSR) for a 91.8 kW engine. The graph shows diesel usage dropping from approximately 27 L/hr to 8 L/hr while the natural gas flow rises to 25 m³/hr.



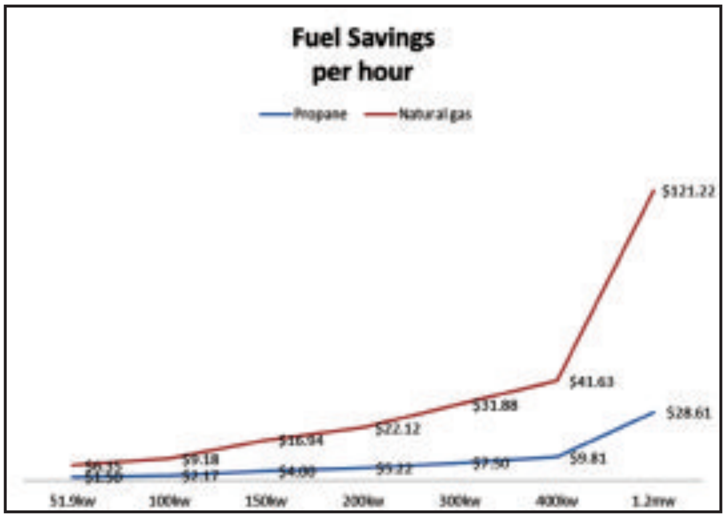


Figure 2 (left). Return on investment (ROI) in hours on diesel — assuming a cost of US$4.21 per 3.78 L for diesel and US$5.00 per 28.31 m³ for gas. Figure 3 (right). Hourly fuel savings from using GSS.

GSR) is largely a function of engine load. When operating at low loads — with a low diesel flow and low combustion temperatures — the gas flow is kept at zero to prevent misfiring.

However, as the load increases, the GSR can be increased to approximately 70% at 100% engine load. The GSS needs to be able to sense what is happening with the engine at any given moment and supply the proper GSR, allowing the maximum fuel cost savings without risk of misfiring or damage to the equipment (Figure 1).

The savings can be dramatic, especially given the current high diesel and low gas prices. According to Energy Information Administration (EIA) statistics, 3.78 L of diesel has 138 700 Btu — the same heating value as 3.96 m^3 of natural gas. At US$5.00 per 28.31 m^3 for gas, 3.96 m^3 of gas costs just US$0.70. This can replace 3.78 L of diesel, which costs more than US$1.05/L.

Figures 2 and 3 show the savings for engines using GSS based on US$4.21 per 3.78 L for diesel and US$5.00 per 28.31 m^3 for gas. Given these hourly rates, an engine with a 100 kW load running around the clock can save about US$340/day when using a 50% GSR. At 400 kW and 70% GSR, the savings rises to about US$1000/day.

Direct fuel costs are not the only consideration. There is also the cost of shipping diesel to a remote location and storing it on-site. Burning natural gas also produces far less CO_2 than diesel, which is increasingly important in an era of carbon taxes and cap and trade legislation. Finally, natural gas is already readily available on drilling sites and is frequently flared off. A far better choice is to use that gas to run the equipment.

Bi-fuel systems have traditionally relied on using instruments to measure the load and turning the gas on or off rather than proportionally metering the gas to the engine. This can cause sudden changes to the horsepower output.

Synchronizing generators, controlling the flow of pumps, and load sharing can be problematic during these transitions. Continental Controls said its GSS is based on fuel usage rather than load. The GSR uses the diesel fuel flow measurement from the electronic control unit (ECU) and proportionally controls the substitution of natural gas to bring the diesel fuel usage down to the desired level. Since the natural gas is proportionally controlled, there is no sudden transition.

Diesel engines have no ignition system, so a minimum amount of diesel is required for ignition. Above that, natural gas can be substituted as fuel.

To begin, the engine is first calibrated

Figure 4. Components of the Continental Controls GSS system.

Figure 5. GSS Interface.

to map actual diesel to provide the diesel consumption for all engine loads without substitution. Thereafter, during normal operations the diesel fuel flow rate is monitored and the gas flow to the engine is then adjusted to produce the desired GSR. The gas flow rate is then continually adjusted as needed to maintain that GSR. During acceleration, the gas flow rate is momentarily reduced to avoid engine misfire. An added feature in this system is the absolute shutoff of gas flow whenever diesel flow drops below the minimum idle flow setting, the company said.

Continental Controls' GSS is based on existing components (Figure 4). The VM350 and the new FMV6 mixing venturis are designed to provide a multitude of fuel inlet vanes and passages, which are evenly dispersed throughout the low-pressure region of the venturi so the fuel is more evenly distributed, providing a more homogenous mixture to the engine.

The GV1 gas valve is an electronic valve designed to operate as a variable pressure regulator to vary the gas pressure to the carburetor or mixing venturi. The gas valve uses closed-loop control logic to accurately command gas pressures in order to meet substitution requirements. A feedback signal, based on the desired substitution rate and the actual performance of the engine, is used to operate the valve, the company said.

On applications above 1 MW, the company recommends using the larger ECV5 valve in conjunction with the GSS system. The ECV5 is a fuel control with a balanced poppet design that can operate a higher supply pressure (up to5.5 bar).

The EGC4 electronic gas carburetor is for smaller engines in the range of up to 110 kW. This reduces the overall cost of the system, making the GSS affordable even on small engines, the company said.

The system interface (Figure 5) shows the load in kW, diesel fuel flow, gas fuel flow (optional), substitution rate, exhaust temperature, r/min and alarms.