

World's Best Power Plants



The converted 51/60DF engine at the TMG SPE cogen plant. The newly installed gas supply lines are clearly visible in their mandatory yellow color coding.



The TMG SPE industrial cogeneration plant at Vila Nova de Famalicão in Portugal feeds electrical power to the grid and generates process steam for the adjacent textile works.

EMISSIONS COMPLIANCE AND FUEL FLEXIBILITY

MAN DIESEL

In 2008 MAN Diesel PrimeServ, the after-sales arm of the Augsburg, Germany-based engine builder, carried out the first retrofit of the company's latest, advanced dual-fuel gas engine technology on an existing diesel engine.

The retrofit involved a 12-cylinder Vee-configuration, type 48/60 engine (bore 480 x stroke 600 mm) burning heavy fuel oil (HFO) in an industrial cogeneration plant at Vila Nova de Famalicão in Portugal. The plant is owned by Têxtil Manuel Gonçalves, Sociedade de Producao de Electricidade e Calor S.A. (TMG SPE), which runs an adjacent textile works. The 50 Hz electrical output of the plant is fed to the local grid while the thermal output is used to raise steam for textile production processes.

The 51/60DF engine now produces considerably lower emissions of nitrogen oxides (NO_x) and particulate matter (PM) and, based on the ability to switch from gaseous to liquid fuel at any output, a 100% liquid fuel backup operating mode is now available. At this specific site, the conversion played a part in qualifying the plant as a high-efficiency, emissions-compliant cogeneration plant receiving preferential rates for the power it supplies to the local grid.

In over 11 years of operation at the TMG SPE plant, the 12V48/60 HFO engine had logged more than 88 000 hours in grid parallel base load mode. Since a major overhaul was due, the customer decided it was the perfect opportunity to convert to dual-fuel gas operation.

As well as the exchange of the original 480 mm bore cylinder liners and pistons to new 510 mm components, the conversion largely focused on the 51/60DF's common rail pilot

injection system. And while the turbocharging system of the 51/60DF engine is based on the later "B" version of the 48/60 engine platform, which features a single turbocharger, the 48/60 engine at TMG SPE is an "A" version with twin turbochargers. As a result, the retrofit involved the design of a new "Y" piece to distribute exhaust gases to the existing twin turbochargers. The turbochargers were overhauled and "rematched" to gas engine operation by fitting new nozzle rings as well as other exhaust system adaptations.

Upgrades beyond the fuel-related modifications were also carried out. In particular, the converted engine was equipped with a version of MAN Diesel's SaCoS (safety and control system) specifically for dual-fuel gas engines. Among the innovative functions of SaCoS DF are remote online monitoring capability, extensive redundancy and a sophisticated knock detection system based on acoustic sensors. In combination with its common rail pilot fuel injection system, SaCoS DF allows the output of the 51/60DF to be matched on a cylinder-to-cylinder basis and thus also allows response to knock signals on the individual cylinder or cylinders affected.

In the TMG SPE application, the output of the retrofitted 51/60DF is adapted to a local gas supply with a nominal methane number of 75, to the thermal and electrical energy requirements of the cogeneration application and the ambient air conditions. It equates to 950 kW/cyl under ISO conditions.

In terms of emissions, the 51/60DF is designed to readily achieve NO_x values of 500 mg/m_n^3 at 5% O_2 and, therefore, comfortably complies with Germany's TA Luft clean-air regulations and other legislation based on TA Luft. 