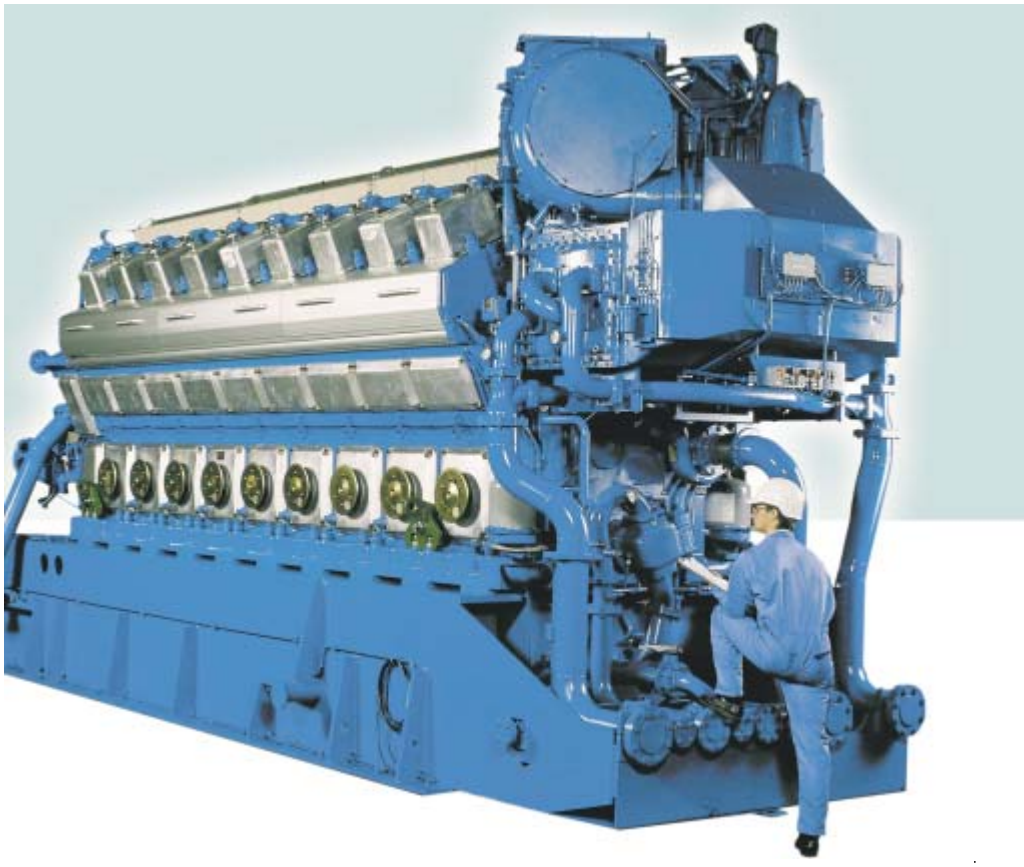
Gas engines – an increasingly attractive alternative

By Pilot Global Communications



When pulp and paper mills decide to produce their own power and heat on-site, they soon discover that they have a wealth of technology and equipment to choose from. Until recently, gas turbines were the obvious choice for industrial power plants. The current generation of gas engines, however, now makes engines a viable choice.

Industrial gas turbines for power generation have been around for a long time. Due to the increased availability of natural gas and its use in power plants, gas turbines have taken market share from large fossil fuel power plants. The rapid development of the gas engine has, however, created a new and competitive situation.

Compared with gas turbines, gas engines are more efficient and provide better flexibility in conditions of frequent starting, stopping and load changes, especially in the power range up to 50 MW.

The electrical efficiency of gas engines is clearly higher, making it possible to produce more power, which is more valuable compared to heat. Since investment costs are lower the gas engine now competes well with gas turbines in the global market.

Gas engines have an electrical efficiency 40-44%, which is not exceeded by gas turbines at the smaller end of the power class. If your plant requirements are in the 50 MW size bracket, turbines and gas engines probably show the same economic advantages. However, this is still very much dependent on what kind of heat recovery is applicable.

Papelera La Confianza mill, Spain

Papelera La Confianza, a privately owned paper mill in Spain, awarded a contract to Wärtsilä in early 1999 to supply a 5.5 MW power plant and control system based on the Wärtsilä 34SG gas engine. The plant was delivered to the site within six months from the order date and has been fully operational since August 1999.

More steam was needed for the mill's paper making processes. To meet this need and to provide power, the company decided to install a cogeneration power plant. The mill consumes around 1 MW of the electricity being produced by the cogeneration plant. The remainder is sold and exported to Spain's public grid. Heat from the plant's exhaust gas is recovered in two steam generators, with a capacity of 6000 kg/h, and then piped to the mill for its process needs.

The company's aim was to reduce the paper mill's energy costs, increase profits and raise the overall competitiveness of the company. The Wärtsilä 34SG power package has a high electrical efficiency of around 42%, which means lower operating costs for the mill.

Energy News spoke to Mr Juan Vila, General Manager and proprietor of the mill.

EN: Where exactly is the mill located?

Mr Vila: The paper mill is located at Besalu town, in the province of Girona. It is in the North Eastern corner of Spain, near Barcelona and very close to the border with France and the Mediterranean coast.

EN: How long has the mill been there?

Mr Vila: The mill was originally founded in 1880, so it is now 122 years old.

EN: What does it manufacture?

The Confirel power plant of Papelera La Confianza.

Mr Vila: New recycled paper grades manufactured from waste paper, in the range of 30 to 80 g/m², for copy paper, paper tablecloths and packaging.

EN: What was the mill's energy source before the Wärtsilä power plant was commissioned?

Mr Vila: Electricity from the grid and steam from a boiler burning heavy fuel oil (HFO).

EN: What was the Wärtsilä solution and why was it better than what you had before?

Mr Vila: Wartsilä supplied a complete CHP plant with a total capacity of 12 MW. In Phase I we installed one 6.5 MW Wärtsilä 18V32 generating set. Phase II consisted of a 5.5 MW Wärtsilä 18V34SG generating set. We now have a much better energy-efficient, fully independent power plant and our energy costs have decreased a lot.

EN: Why the Wärtsilä solution?

Mr Vila: Because we were very satisfied with our first Wärtsilä diesel engine, a Vasa 18V32-type, and we were involved in the first successful CHP project with a Wärtsilä 18V34SG engine at the DOGI textile mill.

EN: Has the Wärtsilä power plant lived up to expectations?

Mr Vila: Absolutely yes.

Flexible load capabilities

The power and heat demands of a paper mill can vary considerably depending on production requirements. This requires an excellent 'load following' capacity on an hourly basis, which means controlling power and heat production to correspond with the mill's immediate demands. These power fluctuations can cause difficulties in the case of large plants, which are typically planned to run at baseload and can be controlled only on a daily basis. Part load can also cause large energy losses.

Small power plants, based on gas engines, have flexible load following capabilities. They can be started up within minutes and their output level can be changed quickly according to the needs of the mill. Thus they can be used to maximize power generation profitability. This can be done by selling the maximum amount of electricity to the network in those periods when the price of electric energy is higher than the variable generation costs of the power plant.

Gas turbines are especially sensitive to rapid load changes. They are therefore typically used in constant power applications and the possibilities for power control and flexibility are relatively limited. The compressor in most modern compact turbines runs at a constant speed and the same amount of air flows through the turbine in the whole power range from zero to full load. This is why there is rapid deterioration in efficiency at partial loads.

Gas engines are more flexible, so if power demand/electric load deviates, it is easier to follow the load using gas engines because their efficiency curves are fairly flat. This means electrical efficiency does not decrease when running these power plants part load. Response time to load changes is also quicker than with gas turbines and the changes in load do not affect the service period for the engines.

Operating profits

Small plants are better suited to modern deregulated energy markets, which require shorter planning periods and more flexible operation. They can be operated on a short-time basis to maximize operating profit. Moreover, with smaller plants it is easier to adapt to the required power capacity on site. It is still necessary for the rated efficiency per unit to be high; with very small engines, efficiency will ultimately suffer. With multiple units in parallel, the availability of electricity can be maximized, which is very important for the economics of modern process industries. The units can also serve to provide electricity in case of blackouts and grid problems. In addition, maintenance of generators driven by reciprocating engines is carried out on site in a very short time. Unwanted downtime for a process industry has a very negative impact on profitability.

Sound reasons for decentralized power generation

Decentralized energy is becoming one of the main sources of power and heat in many countries. Small plants are now the norm rather than the exception in the power industry.

This trend is driven by the many benefits that decentralized power generation offers. One main benefit is cogeneration, where the power plant owners can use or sell the plant's waste heat or surplus electricity to third parties.

In addition to lowering costs, NO_X emissions from the Wärtsilä 34SG are extremely low, complying with the most stringent existing NO_X legislation. ■