

BERGEN B36: 45 AND B33: 45

# RELIABILITY AND FLEXIBILITY



## ROLLS-ROYCE IN A NUTSHELL

Rolls-Royce was born as an engines manufacturer and then split in two divisions in 1971: the one that preserves the features of a luxury icon, the car with the Spirit of Ecstasy on the bonnet, and the second related to turbines for aeronautical propulsion and the co- and tri-generation.

Following a series of operations to consolidate energy asset, the company took over part of the Norwegian group Bergen and Tognum, thus inheriting MTU, which is worldwide famous for its experience in commercial boating. As part of a series of financial transactions, Rolls-Royce sold the maritime division to the Norwegian group Kongsberg in a long-term perspective to focus on the strategic assets of the military and power generation sectors. L'Orange has also been sold, in this case to Woodward. The total value of the agreement, announced on 9th April 2018, is around 700 million euros.

Peter Headland, Head of Customer Business at Bergen Engines: «The Powergen market is a very important part of our business. We believe this new power plant platform will be in high demand, especially in the Asian market where many of our customers have access to LNG or natural gas. The B36:45V gas engines are perfect to support variable renewable energy sources in hybrid systems like micro grids».

Among the EU Member States, the Czech Republic has one of the highest rates of energy independence, thanks to a supply mix that provides a solid endowment of natural reserves, the national production of fossil fuels and the use of nuclear energy. The Czech Republic is a net exporter of electricity: it is no coincidence that Rolls-Royce will install the first two Bergen engines with V-architecture, **B36:45 and B33:45**, at the C-Energy plant in Tabòr/Sezimovo Ústí. The result is the extension of the installed capacity of the plant of additional 23 MWe. With 70 years of experience, Bergen perfected the V-configuration of B36:45 (Natural Gas) and B33:45 (Liquid Fuel: HFO, MDO) engines. Such operation involves a meticulous work of 'goniometer' (considering the sizes of this units) to minimize

Bergen showcased the V medium speed engines at the Power Gen Asia in September: the B33:45, powered by HFO or MDO, and the B36:45 by natural gas. Two ways, synthesis fuels and gas (including LNG), that are spreading from commercial boating into power generation sector

vibrations and accessory components, in view of available space, heat loss and power density, driver of engine engineering, which, from mobile applications, has involved stationary ones. Getting to the point, the 'ethical' balance of V-engines, in thermodynamics, can be prosaically translated into an increase in efficiency. The power per cylinder increases by 20 percent compared to the original versions of the previous series, thus achieving a full power output of **600 kilowatts per cylinder** (The biggest variant of this model, the V20, generates an output of 11,8MWe) managing to limit the levels of NOx, CO2, SOx and particulate emissions, in compliance with the en-force regulations about energy production, social acceptability and sustainability. There is also a practical, logistic and

organizational advantage for the plant. «Delivery of four Rolls-Royce engines among other investments helped to transform the old coal fired central heating plant into a modern plant in 2015» says Ivo Nejd, C-Energy Director and Co-Owner: the flexibility in using these engines was the key-fact to the Czech company's request for upgrading

itself to more competitive arenas both in terms of technology and TCO. The new engines in fact allow the recovery of heat and emissions and are equipped with a sophisticated software, in addition to the CPM, which allows the management of different operating modes such as the Baseload or Peak Saving.

All Bergen V and L Series engines are equipped with this device allowing a clear improvement of machine's operation performance (consumption/emissions) as well as having a greater power response. Power generation plants having start-up and rump-up times below 15 minutes are generally given preference by load dispatchers, therefore such

### V LINE EVOLUTION: 12, 16 AND 20 CYLINDERS

BERGEN V (50 HZ) *	B33:45V12A	B33:45V16A	B33:45V20A	B36:45V12A	B36:45V16A	B36:45V20A
N. cylinder	12	16	20	12	16	20
Stroke x Bore - S/B (mm)	330x450 - 1,36	330x450 - 1,36	330x450 - 1,36	360x450 - 1,25	360x450 - 1,25	360x450 - 1,25
Displacement dm <sup>3</sup>	461,627	615,503	769,379	549,374	732,499	915,624
Electrical power - rpm	6,380 - 750	8,520 - 750	10,650 - 750	7,090 - 750	9,470 - 750	11,830 - 750
Torque Nm	81,178	108,407	135,508	90,212	120,494	150,522
kW/m <sup>3</sup> (power density)	33,34	34,80	39,60	37,05	38,68	42,64
t/m <sup>3</sup> (total density)	0,52	0,61	0,63	0,52	0,61	0,61
dm <sup>3</sup> /m <sup>3</sup> (displacement/volume)	2,41	2,51	2,86	2,87	2,99	3,30
Electrical efficiency%	48	48,30	48,30	49	49,50	50

\* All the V-engines are also available @ 60 Hertz



## “FAST RAMP-UP MODE”

Massimiliano **Stefanini**, from Bergen Engines.

*«To stabilize grids featuring renewable energy sources, responsive back-up power that adapts quickly to changes in demand is critical. As load dispatchers give preference to power plants with short start-up and ramp-up times, players on the spot market must often guarantee power delivery no later than 15 minutes following the request. This system is already installed in the new engines produced by Rolls-Royce Bergen Engines, both for the V and L series.*

*The new engines reach full power output in less than eight minutes while maintaining high efficiency across the load profile. The Fast Ramp-up makes the system respond flexibly to any grid fluctuations and the resulting peaking, providing the required reserve capacity promptly and smoothly».*

Stefanini wraps his speech up: *«Pre-heating warms the circuit of oil and water so they are already hot at the start of the engine. This allows accelerating the loading up».*

peculiarity is almost essential for plants powered by renewable energy sources. The Cylinder Pressure Monitoring provides a sensor in each combustion chamber: a processor encodes information about the global ignition angle detecting high pressure, knocks and misfires.

A wide range of data is monitored continuously and analysed in real time, avoiding possible inefficiencies or shutdowns that would lead to unscheduled stops: the CPM controls the timing of each valve to automatically align the combustion pressure without modifying the global ignition angle. The system does not modify the profile of the cams but only the spark ignition speed in the combustion chamber: this reduces significantly stress and vibrations on the shaft. Further protection systems for

the engine and its performances are derating and, ultimately, engine shutdown. Derating foresees lowering loads by 5-15% as long as the system is re-established: a further compensation of

The ECC's software has been considerably upgraded to enable fast acceleration to reach the nominal load. The result is an increase in the engine's performance during start-up and parallel connection with the grid

the derating will follow the power grid needs.

The new 20 cylinder V-engine is conceptually based on the latest medium-speed Rolls-Royce 6, 8 and 9 cylinder in-line models. 12 and 16 cylinder V-engines will soon complete the range of the Group's products and confirm - as stated by Peter **Headland**, Head of Customer Business at Bergen Engines: *«Rolls-Royce's position as global provider of some of the world's most efficient power plants».*

For three years now, the company has been working to satisfy the Powergen market, an increasingly significant segment for the company that aims to meet the key requirements of the latest generation power plants such as low environmental impact, low maintenance costs and start-up speed. **Roberta Ronda**