

PRESS RELEASE

Turboden provides the first Direct Heat Exchange Organic Rankine Cycle solution from multiple heat sources

A Turboden 4 MW heat recovery Organic Rankine Cycle (ORC) system will be installed in the 80 MW power station of Gibraltar, designed and supplied by Bouygues Energies & Services. This solution improves the power plant efficiency and reduces the overall life-cycle costs.

Brescia, September 29, 2015 – Turboden, a group company of Mitsubishi Heavy Industries (MHI), leader in Organic Rankine Cycle (ORC) turbo-generators production for distributed power generation from renewable sources and waste heat, was selected to supply a **heat recovery system** for the 80 MW electric power plant that will be built by **Bouygues Energies & Services for the H.M. Government of Gibraltar**.

The **Turboden 40 HRS ORC unit exploits the heat of exhaust gases coming from three MAN 14V51/60G gas engines (14.3 MW each)**, to generate 4 MW of gross electric power, achieving an **overall combined cycle efficiency of 52%**. Turboden will supply the ORC system including the three primary heat recovery exchangers for the direct heat transfer between the engines exhaust fumes and the ORC working fluid.

The ORC system start-up is expected in the first quarter of 2017. Once in operation, the heat recovery plant will lead to an annual saving of 42 thousands of Barrel of Oil Equivalent (note 1) and will avoid the emission of 12 thousands of tons of CO₂ equivalent each year (note 2).

Turboden has been developing direct heat exchange solutions for medium temperature hot gases (e.g. 600 °C) since 2009, when the first 500 kW Direct Exchange ORC unit was installed downstream a 7 MW Diesel engine. In addition to the first unit, Turboden has supplied other 4 ORC units with direct exchange. The direct exchange solution allows avoiding the presence of intermediate circuits, leading to improved performances, lower investment cost and simpler schemes.

“These applications represent an important technological innovation and provide several benefits and advantages compared to other solutions, as well as enhancing environmental sustainability, emissions reduction, industrial process efficiency and business performance. Turboden is committed to successfully deliver its ORC solutions worldwide, providing maximum quality service from commissioning to aftersales to achieve the expected performance results throughout the life of the plant” says **Roberto Bini, Turboden Managing Director and R&D Manager**.

In heat recovery applications, Turboden ORC units can be employed in **combined cycles** with reciprocating engines, with a net output increase of 8÷12%, and with gas turbines, with a net output increase up to 25÷45%, depending on the primary mover efficiency and on the fuel used. Turboden ORC modules can find an efficient use in these dry

combined cycle projects, thanks to the good electrical efficiencies, minimum requests of operation and maintenance and simplicity of all start and stop procedures, which allow system management even by a non-licensed technician and permit operations in remote locations, with lack of water and extreme climates.

For medium temperature heat recovery (e.g. 300 °C), the ORC technology – compared to the traditional steam based solutions- leads to a relevant improvement of the net power output leveraging the perfect match between the heat source and the working fluid selected. Additionally, thanks to the characteristic of an organic compound as working fluid, the Direct Exchange ORC solution puts together the effectiveness of once-through type evaporators (high performances, fast response, low cost) to the ease of operation of the thermal media (no issue of corrosion, erosion, scaling, etc).

Turboden 35 years' experience in the construction of ORC turbogenerators made possible the design, implementation and delivery of **more than 300 power plants, with an overall power output of about 430 MWe**, of which 10 units recover waste heat from internal combustion engines and from gas turbines, with a total power capacity of 13.5 MWe. The power of Turboden ORC turbogenerators in this application typically ranges between 500 kW and 15 MW electric.

Note 1: considering 47.6% average efficiency of conversion in Europe-28 - source EEA 2012 – 5.4 GJ/BOE of oil low heating value and 95% plant availability.

Note 2: assuming an average emission factor of EU power generation plants of 400 tons CO₂ per GWh - source IEA 2013 - and 95% availability.

Turboden, a Mitsubishi Heavy Industries company, is an Italian company and a global leader in the design, manufacture, and supply of Organic Rankine Cycle (ORC) turbo-generators, which harness heat to generate electric and thermal power from renewable sources, including biomass, geothermal and solar energy and waste heat from industrial processes, waste incinerators, engines or gas turbines. Turboden has more than 300 plants in 32 countries and offers turbo-generators from 200 kWe to 15MWe. www.turboden.com

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