

Bioenergy is a precious resource for the benefit of climate change and the creation of a circular economy, says Turboden, part of Mitsubishi Heavy Industries Group

Wood residues for increased energy security

Representing 57% of the renewable energy consumed, bioenergy is the main source of renewable energy used in Europe.

The sector plays an important role in contributing to Europe's excellence in renewable energy adoption. It is committed to championing reductions in greenhouse gas emissions, enabling a sustainable circular economy, improving air quality, and in so doing, contributing to a sustainable European economy. However, despite the progress made, fossil fuels remain the largest source of power generation.

Unprecedented rises in the price of natural gas are increasing the cost of electricity for industry and consumers, pushing energy security up to political agendas across the EU. In this context, investment in alternative sources of energy, such as wood biomass residues, can offer stable prices and improved resilience to the energy market. As a substitute for traditional fuels, residues from wood biomass are reliable baseload energy sources that have added cost-saving benefits.

Wood biomass residues are the fuel source of Turboden's Organic Rankine Cycle (ORC) systems. These systems are a viable alternative, producing green power and heat that can save gas, reduce electricity costs and improve energy efficiency. Combining market competitiveness with environmental sustainability, Turboden's ORC technology

enables industries to reduce their CO₂ emissions and activate a circular economy of benefit to all.

Case study: ORC integration in the wood products industry

Kastamonu Entegre, a leading Turkish company in the wood products and panelling industry, recently decided to install two 13 MWe ORC systems, integrating them into its new investments in medium-density fibreboard and particleboard production. Currently under construction, these systems will allow the new plants to produce their own electricity and improve their carbon footprint.

The wood products industry is a high value-added heavy industry that employs a large number of resources, including forest-derived biomass or second-hand wood-based waste; capital for the fleet biomass boilers, refiners and presses needed to transform the wood

into panels ready for the construction and furniture industries, and energy – both electricity and thermal – to power production.

In the context of energy security concerns and increased attention on sustainability, the application of ORC technology will enable Kastamonu Entegre to adapt to these trends and improve its competitiveness in the future.

Particleboard: how is it made?

Particleboard consists of glued wood flakes of different sizes that form a multi-layer structure. In a typical process, the first step in production sees the bark, which is not suitable for board production, separated from the inner material. The bark by-product is used to fire large biomass boilers that supply the plant with the thermal energy needed to power the dryers (hot water) and presses (hot thermal oil).

ORC: how is it integrated into the process?

Turboden's ORC system uses thermal power (hot thermal oil) to produce electricity and lower-temperature heat. In this case, the ORC will be fed by hot thermal oil (heated in the waste-wood boiler) and will transform this heat into electric power and hot water. The 13 MW of electric power produced will be used either by the plant for its own consumption or exported to the grid through biomass-incentivised feed-in-tariffs. Meanwhile, the 55 MW of thermal power (as hot water at 100°C) will feed the belt dryer used for panel board production.

Addressing energy security with biomass

The two ORC systems will be installed at Kastamonu Entegre's plants in Kastamonu City and Balıkesir and will each have a capacity of 13 MW electricity. In addition,



Varna biomass plant, Italy

the two units will be able to work in 'island mode', meaning that should there be an interruption of electricity supply, or an increase in the price of electricity, the wood producer will be able to supply more than 50% of its electrical plant need. This will contribute to protecting the company from price shocks and energy price volatility that could impact production, as seen in Turkey in January on the back of high prices for natural gas linked to international turmoil.

Not only wood panels

In Europe, there are already more than 300 ORC units in operation coupled with biomass or waste boilers. Just like the systems at Kastamonu Entegre's plants, they are transforming the energy of biomass residuals into clean electric power (about 20% of energy input) and



ORC turbogenerator

hot water at 70-120°C (about 80%). Industries benefiting from this technology include district heating plants, sawmills, agri-processing and food processing plants through to pellet and charcoal producers.

All applications are united by a string of common features, including the use of renewable fuel inputs such as biomass and/or solid waste, which is burned in a boiler to generate heat to feed the ORC

module; the production of both electricity and hot water, known as 'co-generation'; and very high co-generation efficiency across the whole process from the theoretical heat value of the fuel about 85% is turned into useful electric or thermal power.

While most of these plants are small and medium-sized power plants with electric power rates between 300 kW and 5 MW, their impact should

not be underplayed. The contribution of ORC systems and those like it across Europe is an important step in diversifying our sources of energy, enabling industries to meet their net-zero goals, and in so doing, contributing to a more sustainable future for us all. ●

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