

## ORC CHP APPLICATION

### E-RATIONAL ORC 20FT – 2MW<sub>TH</sub> – 135kWe

**Crossfields Farm Penrith, UK** is a dairy farm in Cumbria using wood fired biomass boilers and ORC for cogeneration of heat & power.

On-site, two biomass boilers, 1000kW<sub>th</sub> each, are fired with wood to power an E-RATIONAL High Temperature 20ft ORC unit.

In addition to the green electricity produced, the condenser heat of the ORC installation is used to warm the air used for a drying process of wood chips. In this way almost 100% of the generated heat is valorised in the process. The project is implemented according to the RHI scheme supporting the use of renewable energy.



The biomass boilers produce 4000kW<sub>th</sub> to feed the ORC unit with pressurized water of 120°C. The return temperature to the boilers is 105°C. The cooling water circuit of the machine operates at 33°C inlet to 47°C outlet temperature at the condenser. Through a heat exchanger with modified ducting, the heat is converted into warm air blown by fans through two bays to dry 100 tonnes of woodchips per day, to decrease the moisture level from 50% to 10%. The ORC produces an average of 135kWe (peaking to 165kWe of power) which is used for local power consumption.



Richard Threlfel, owner of Crossfields Farm and co-owner of the project says: "Unlike it may be expected, the use of the low temperature isn't a real disadvantage for the drying process. The right air flow which blows the warm air through the 4ft packed woodchips is also important. The drying result is better than for many high temperature driers. Even wood shavings can easily be dried in this installation. The current set-up gives the best fit between power production and drying requirements."



Working temperature hot side	120°C → 105°C
Thermal load at hot side	± 2000kWth
Condenser	33°C → 47°C
Drying capacity	± 1800kWth
Cooling	Dry coolers for air heating
Installed generator capacity	220kWe
Average net power production	135kWe
In operation since	2016
Running hours per year	± 8.000h
Support scheme	RHI (Renewable Heat Incentive)
G59/3	Installed

*Machine definition Crossfields Farm Penrith*

E-RATIONAL is delivering a cost-effective solution to convert low temperature waste heat into clean energy without emissions. Our state-of-the-art **Organic Rankine Cycle (ORC)** technology, with in-house development of the expansion part and the use of industrial grade components, makes E-RATIONAL's ORCs user-friendly, robust and economically viable. The E-RATIONAL ORC has been designed to maximize uptime and efficiency with a minimized operational and maintenance cost. This results in a containerized modular machine, CE-compliant, with plug-and-play connections for easy installation.

The ORC machines can convert heat from various sources, such as:

- Industrial processes, e.g. cooling cycles at chemical plants, glass, steel or food industry, power plants, etc.
- District heating networks (unused excess heat)
- Biomass burners or biogas installations with CHP units
- Low temperature geothermal wells

E-RATIONAL's technology is suitable for heat recovery of feeding temperatures at maximum 170°C (338°F) and minimum 85°C (185°F) at the hot side. Typical temperature difference between inlet and outlet is 20°C. Cooling temperature sent to the machine can be maximum 60°C (140°F), depending on the temperatures at the hot side.

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