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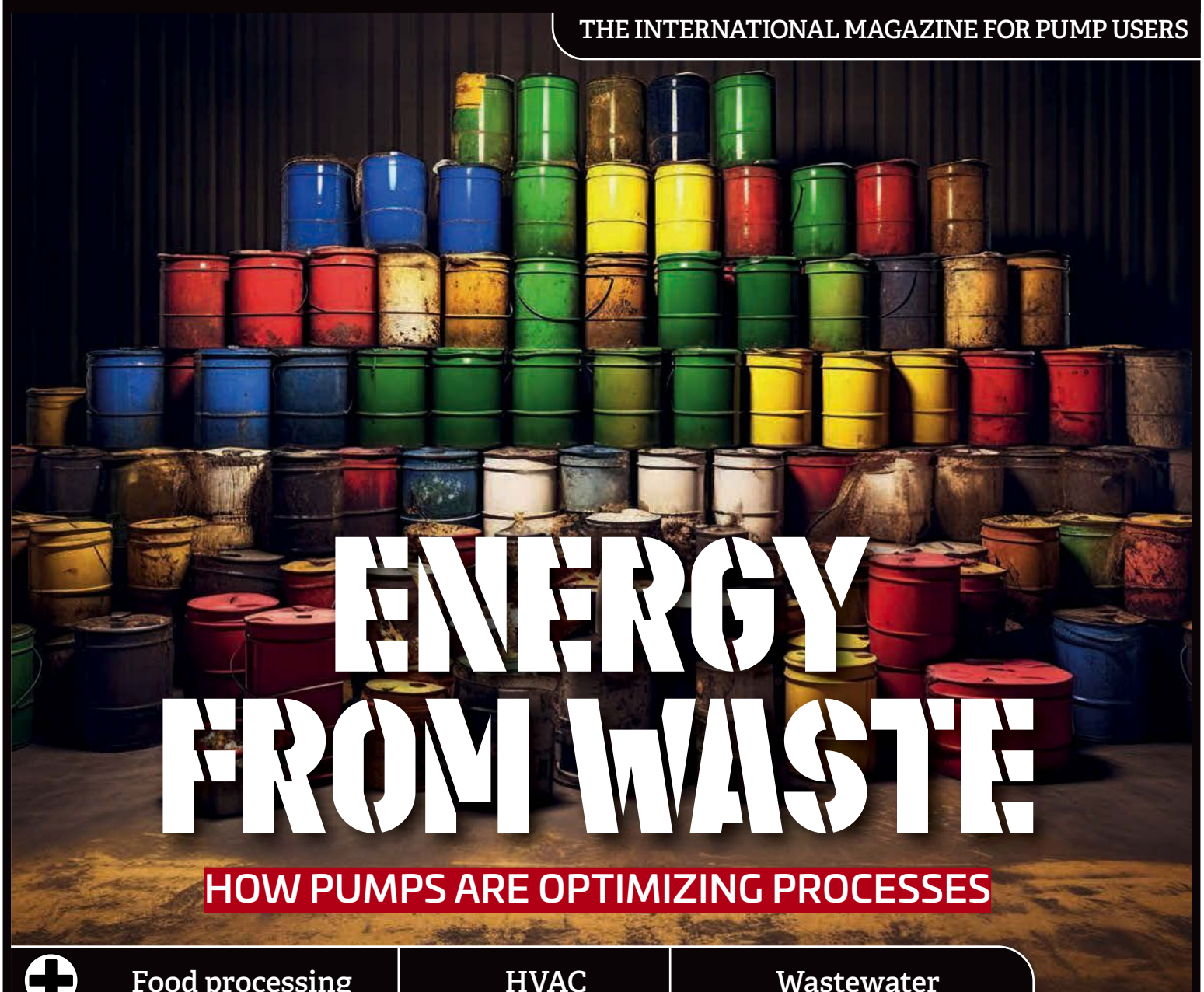

ENERGY FROM WASTE

HOW PUMPS ARE OPTIMIZING PROCESSES

Food processing | HVAC | Wastewater

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The power of waste

Energy from waste (EfW) is gaining strength in the UK and elsewhere. World Pumps finds out how processes could reduce global emissions by processing oil and gas waste.

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In June 2023 the UK government reported that it would include energy from waste (EfW) and waste incineration in the UK Emissions Trading Scheme from 2028, with plans to "consult later by the end of 2023 on the details of implementation".

This new inclusion "represents the most significant regulatory intervention to the UK waste industry in a generation," according to Charlotte Rule, a policy advisor at the Environmental Services Association (ESA). "It will fundamentally change the economics of the sector, and impact all stakeholders across the value chain, including local government, waste producers and the general public."

Now, then, would seem a good time for pump manufacturers in the UK and worldwide to focus on the EfW sector which, according to market analyst company Tolvik Consulting, is growing. A 2022 report suggested that in that year a total of 15.32Mt of waste was combusted in UK EfWs, an increase of 2.6% when compared with 2021.

Generating process

While EfW often refers to food or solid waste, the term can be used for any kind of process whereby industrial and domestic waste products are used to generate energy or heat.

These include anaerobic digestion, which uses bacteria to break down organic material such as leftover food, waste food, and manures (mixed with liquid manure to make it easier to pump) in order to make biogas. Besides anaerobic digestion, EfW processes can be used in combustion, where water is boiled to make steam which in turn drives a turbine coupled to a generator that produces electricity.

Gasification is another combustion process that burns waste to create a synthetic gas used as a fuel within a gas turbine, while pyrolysis produces the same gas as well as biofuels. A biochemical process makes use of microscopic organisms to speed up the decomposition of biodegradable substances to create energy, while fermentation involves placing organic material into a tank containing acid, hydrogen or alcohol.

The wide variety of EfW processes can be matched by the types of pumps involved: including centrifugal, circulating, sludge pumps, dewatering pumps, chopper pumps, dosing pumps, cooling pumps and condensate pumps.

EfW has a number of benefits for countries aiming at improving sustainability and reaching net zero targets, as the process not only generates

1. A radial outflow turbine for a biomass plant.

2 & 3. The interior and exterior of a EfW plant installed in Pontcharra, France by Exergy Srl.

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energy, but can also limit the amount of landfill waste producing unwanted methane.

One specific EfW process, organic rankine cycle (ORC) technology, works by recovering heat from the furnace fumes of waste incineration plants or sludge incinerators in water treatment plants and converting it into energy.

Heat resources

Exergy International srl is a company based in Italy which designs, manufactures and maintains ORC systems which use radial outflow turbine (ROT) technology to produce electricity from waste heat resources from geothermal, biomass, waste heat from several industrial processes and concentrated solar power. Exergy was established in 2009 and in 2012 the company installed the world's first ROT in a geothermal site in Tuscany, Italy. It now runs a portfolio of 62 power plants with a total capacity of more than 500 Mwe. It is reportedly the second largest geothermal ORC provider worldwide. Among its operations, Exergy processes waste from oil and gas operations – one of the world's biggest contributors of greenhouse gas emissions, according to the company.

"ORCs are a perfect fit for circular reuse of waste byproducts from industrial processes and oil and gas operations, specifically waste heat energy," the company's website says. "They are employed to produce clean, zero emission energy exploiting waste heat potential, thus reducing the energy intensity and the emissions of the processes."

World Pumps spoke to Paolo Danesi, Exergy's commercial director, about the company's EfW technology and the role of pumps in making it efficient.

According to Danesi, Exergy's proprietary technology, the ROT, can convert the energy contained in fluid into mechanical power with higher efficiency than the competing technologies such as axial and radial inflow turbines. "The ROT has a simpler design which allows compact solutions and higher flexibility for customizations in addition to a quicker and easier construction," he said. What is the role of pumps in Exergy's processes? "Pumps are more than just an auxiliary. They are a crucial component of any ORC system," Danesi said. "Pumps in fact close the organic thermodynamic cycle for power production by delivering the low-pressure organic working fluid back to the high-pressure evaporator and then to the turbo-expander.

"Moreover, high reliability pumps ensure a more reliable ORC plant and are associated with reduced maintenance downtime, meaning higher revenues for clients."

According to Danesi, the hydraulic efficiency of pumps, both in on-design and partial load operations, is a crucial parameter in ORC systems, since pump electrical consumption accounts for a significant share of turbine gross power output: from around 4–10% of the total.

World Pumps asked how important EfW processes could be to improve sustainability. "Leveraging waste resources and reusing them in a circular economy model is one of the first and key measures to reduce energy consumption and carbon emission in the atmosphere," he said. "These technologies can contribute to start decarbonizing processes by now as they are already proven and have a reasonably quick time to market."

Growing field

Danesi feels that pump engineers can help develop new applications for ORC technology. "We believe that there is a large area of possible improvement in terms of new applications for ORC technology in all process industries," he said. "Engineers should play a big role in promoting these new applications with open mind and a bit of ingenuity."

Where does he see the energy from waste/biomass industry developing over the next 20 years?

"The waste management industry will continue to grow despite the huge effort of the industry to reduce waste with circular economy solutions," Danesi said. "Waste to energy will continue to grow, especially in developing countries."

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