

UNLOCKING INDUSTRIAL EFFICIENCY WITH HIGH-TEMPERATURE HEAT PUMPS

Why industry should implement the HoegTemp



HoegTemp[®]
ENGINEERING BY ENERIN

Stirling cycle
High COP at high temperature lifts
Robust to varying operating conditions

R-704 Helium
Inert, non-toxic, zero ODP, zero GWP

Steam or hot water up to 200°C
Any source temperature

Simple integration:
Power, steam line and water circuit
Fast control response
Power control similar to boilers

Multinational corporations like GE and Pelagia are among the early adopters of High-Temperature Heat Pumps (HTHPs), demonstrating their commitment to de-carbonization targets. With a global increase in electrification, heat pumps are expected to be one of the dominant sources of heating in the 2050 energy mix.

CO2 emissions from heat intensive industrial processing could be eliminated by using heat pumps to recover and re-use energy from cooling, waste or ambient heat, as well as tap into stored renewables on-site, or source from renewable electricity grids at optimal times.

Replace fossil fuel boilers with heat pumps – save energy, emissions

European industry uses 500 TWh annually on process heating at temperatures between 100 °C and 200 °C. Much of this heat is used to produce food and beverages, animal feed, pharmaceuticals, chemicals, building materials and paper.

Fossil fuel boilers generate most of the heat (77%), while electric boilers make up the rest. Replacing the boilers with Enerin's HoegTemp HTHPs would reduce European energy consumption by 300 TWh, and eliminate 90 million tonnes of CO2 annually, using the average European electricity mix. Controlling the heat pumps to utilize a larger share of intermittent renewable electricity for non-time-dependent heating applications may reduce the emissions further.

Heat pump market expected to grow exponentially

Enerin believes that by using quality German automotive engineering components for its HTHP, coupled with an innovative heat pump design, the company could supply five per cent of the global energy market as the deployment of heat pumps increase. Bloomberg NEF estimated that the investment opportunity in the electrification of industrial and space heating over the next decade, also accounting for industrial heat

pumps, will become the next \$0.5 trillion market. Most industry players believe this market will experience exponential growth going forward.

HoegTemp is able to lift and recycle energy and convert it to very high temperatures, up to 250 °C, used in industrial drying, distillation or rapid heating, using recycled waste heat, or ambient heat sources and electricity. Compared to a traditional fossil fuel boiler, which usually has an efficiency of 80% to 90%, the heat pump will use two to three times less energy, depending on the working temperatures.

HoegTemp adapts swiftly to changing operating conditions

Industrial processes demand sufficient heating at the right quality, but the operating conditions are rarely constant. The heat demand may vary from minute to minute, follow a typical weekly or seasonal pattern, or be subject to change when new process equipment is installed, or the production volume changes. The available heat sources also may vary with production volume, product mix, or weather patterns. The HoegTemp has the ability to stop and restart in seconds, regaining full power in minutes, making it ideal for managing power loads within manufacturing environments and for electrical grid administrators.

The HoegTemp heat pump adapts well to changing conditions due to its single-phase thermodynamic process with low thermal inertia. The HoegTemp will work equally well at high temperature lifts, as at low temperature lifts, and will not require modifications if the plant's needs change in the future. The heating capacity follows the demand, regardless of other variations in operating conditions.

The design is based on more than 30 000 hours of real-world prototype testing, which makes HoegTemp among the most mature high-temperature industrial heat pumps on the market. Enerin's engineers have worked with several heat pump technologies since the turn of the century and have a broad experience with industrial energy efficiency projects.

Key takeaway for industry

The key takeaway is that the HoegTemp can be easily integrated, controlled and maintained which makes it much more flexible and suitable than a tailor-made solution for each factory application. Enerin's HoegTemp is connected to a power line and any heat source. It delivers high-pressure steam directly to an existing steam line, bypassing much of the detail engineering that is normally required. The HoegTemp's world-leading efficiency at high temperature lifts allows high-energy savings without re-designing the plant and processes.

For steam applications, HoegTemp heats a steam generator that boils water to produce steam, essentially replacing traditional boilers with sustainable thermal energy with less greenhouse gas emissions. In addition to electricity, the heat pump recycles heat from a cooling circuit, a waste heat stream, or directly from the ambient air, using fan coils.

HoegTemp can also deliver both heating and cooling simultaneously. At the IVAR biogas plant in Norway, the heat pump delivers steam to a CO₂ capture facility, while simultaneously cooling the amines for a new cycle. Enerin has previous experience with delivering both ice water and heat to a dairy plant, and the company has investigated similar applications in other food and beverage applications.

Oxygen-free feedwater to prevent corrosion

Any steam system is dependent on clean oxygen-free feedwater to prevent corrosion and mineral deposits in the system. Enerin has pioneered a chemical-free feedwater system utilizing the benefits of both vacuum and catalytic wet combustion of oxygen with hydrogen. Enerin's patent pending VacCat feedwater system

operates at lower temperatures than traditional feedwater systems, does not require the use of oxygen scavengers, and does not need to boil off steam to get rid of oxygen. That way, less minerals are added to the system, and the use of blow-down water is reduced too. Enerin has experience with oxygen removal in both steam turbine systems and food-grade water treatment, as well as standard steam systems. VacCat will extend the life of the steam system, while reducing day-to-day operating costs. This system is a good companion for the HoegTemp heat pump.

Thermonitor complete energy assessment

A successful implementation of a heat pump needs a complete energy assessment of a factory installation and set-up to establish the best way to integrate the HoegTemp. Thermonitor provides a detailed and necessary technical feasibility study to assess whether a HTHP can be implemented in a particular setting successfully.

Sustainable refrigerants

Concerning sustainable refrigerants, many traditional refrigerants used in heating and cooling are derived from fossil fuels, which contribute to global warming and ozone depletion. Enerin uses helium as the refrigerant in the HoegTemp. Helium has zero Global Warming Potential, zero Ozone Depletion Potential, no negative health and safety effects, and is completely inert. This contributes to making the HoegTemp fully sustainable and future-proof.

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ABOUT ENERIN AS

Enerin is an advanced and experienced engineering company specialising in the development of industrial High-Temperature Heat Pumps (HTHPs). Enerin's HoegTemp HTHP provides dependable, easy to integrate and control-based thermal energy for industry. The company pioneers HTHPs that can upgrade any heat source, such as waste heat or ambient heat to steam or hot water. With Enerin's Thermonitor energy monitoring and analysis service, an even higher operating efficiency can be achieved. Enerin's chemical free VacCat feedwater system can save additional operating expenses.