CASE STUDY

City of Drammen, Norway

Copeland heat pump technology heats a city using frigid North Sea water with zero global warming impact

Result

- High coefficient of performance heat pump
- Non-ozone depleting refrigerant with zero global warming impact
- Vilter single screw compressor with ammonia refrigerant achieves increased performance

Application

Industrial heat pump for district heating system

Customer

City of Drammen near Oslo, Norway

Challenge

Winters in Norway can be bitterly cold, with average air temperatures below freezing throughout much of the season and the waters of the North Sea dipping as low as 43°F. Despite these frosty conditions, when the city of Drammen, a community of 60,000 people located on the Drammen Fjord near the capital city of Oslo, needed hot water at 194°F for a new district heating system serving local residents and businesses, it turned to the frigid North Sea as a renewable energy source – and Copeland heat pump technology helped make it possible.

Installing heat pumps to extract heat from water or air is increasingly popular in Europe, largely because the heat they deliver far exceeds the energy they consume, greatly reducing the reliance on fossil fuels and the need for additional renewable energy sources. In fact, the European Commission has designated heat pumps as a renewable technology for heating and cooling. But, Drammen had several additional goals in mind for this project. It wanted the highest coefficient of performance (COP) possible for the ratio of heat extracted compared

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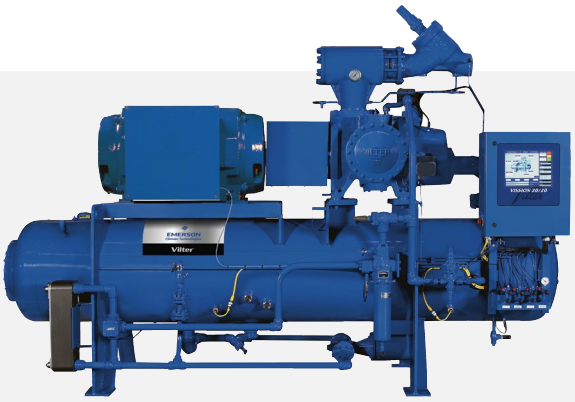

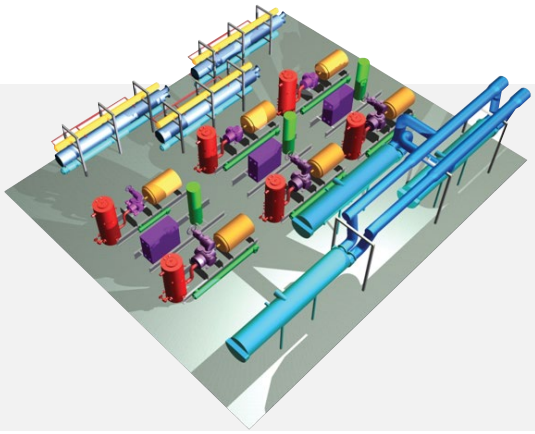

to energy consumed. It also wanted a technology solution with low annual operating and maintenance costs. Drammen ideally wanted the system to use a non-ozone depleting refrigerant with zero global warming impact.

When Copeland and project partner Star Refrigeration got involved, Drammen's requirements seemed an unachievable task. This is because most industrial heat pumps in Europe use R-134A, a refrigerant with a very high global warming potential (more than 1,400 times that of carbon dioxide emissions).

One of the few refrigerants that could meet all of Drammen's efficiency and environmental requirements was ammonia, an efficient refrigerant (designated as R-717) most commonly used by the food and beverage industry for process cooling and refrigeration. Ammonia does not contribute to ozone depletion or global warming, but it also had never been used in a high temperature industrial heat pump application of this design. In fact, not long ago, the application was deemed impossible by the International Energy Agency's (IEA) Heat Pump Centre, which said there were no suitable high-pressure compressors available to make using ammonia a reality for high-temperature industrial heat pumps.

Solution

Copeland engineers, collaborating with Star Refrigeration, took on the challenge by utilizing one of Copeland's industrial refrigeration compressors – the Vilter single screw compressor. By using ammonia, Copeland's compressor technology solution offered Star Refrigeration and its project partners in Norway – Norsk Kulde and Drammen Fjernevarme – a refrigerant that has a good environmental profile (non-ozone depleting and zero global warming impact), delivers higher temperatures and provides superior performance benefits from its consumed resources than competing technologies. In fact, the new ammonia-based industrial heat pump has a performance improvement estimated to be more than 15 percent higher than a heat pump using R-134A refrigerant.

In addition, the balanced radial and axial force design of the single screw compressor reduces stress on the unit's bearings, resulting in very low operating and maintenance costs while delivering a performance unachievable with any other type of compressor.

The Vilter single screw compressor technology is proving extremely adaptable in meeting the needs of other customers seeking increased performance efficiency. For example, a candy manufacturer in Europe is using a Vilter single screw compressor in a refrigeration application to cool chocolate while capturing the extracted heat to warm water to 140°F to separate the chocolate from the shaping molds. It's just another way Copeland technology is helping customers around the world operate their businesses in a more energy efficient and environmentally sound manner.

To learn more, visit copeland.com/vilter

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