

Heat Pump Services for Hot Water Production in Industrial Processes

Replacing Fossil Fuels and
Reducing CO2 Emissions

Executive Summary

Industrial processes are significant contributors to global carbon dioxide (CO₂) emissions due to their heavy reliance on fossil fuels for heating and hot water production. The adoption of heat pump technology presents a sustainable solution to reduce emissions in these processes while improving energy efficiency and cost-effectiveness. The ease of installing and using heat pumps makes them a compelling tool to meet the challenge of decarbonizing industry. This white paper explores the utilization of heat pumps for hot water production in industrial settings as a means to replace fossil fuels, lower carbon footprints, and contribute to a more sustainable future. Under an Energy as a Service (EaaS) model, the use of heat pumps can be scaled quickly and combined with other offerings that maximize the technology's efficiency.

Introduction

The industrial sector accounts for a substantial portion of global energy consumption and CO₂ emissions: 24.2% of global greenhouse gas emissions come from energy use in industry. Integrating cleaner technologies and making energy use more efficient is therefore a pressing goal for the sector. A critical aspect of industrial energy consumption is the demand for hot water in various processes, including cleaning, sterilization, and space heating. Traditionally, this demand has been met primarily through the combustion of fossil fuels, such as natural gas or oil.

However, the environmental consequences of this approach are profound, with direct emissions of CO₂ and other pollutants contributing to climate change and air quality problems.

Heat pump technology offers an alternative and sustainable approach to meet the hot water needs of industrial processes while reducing reliance on fossil fuels. Heat pumps are highly efficient devices that can extract heat from the environment and deliver it at higher temperatures, making them an ideal choice for hot water production in industrial settings.

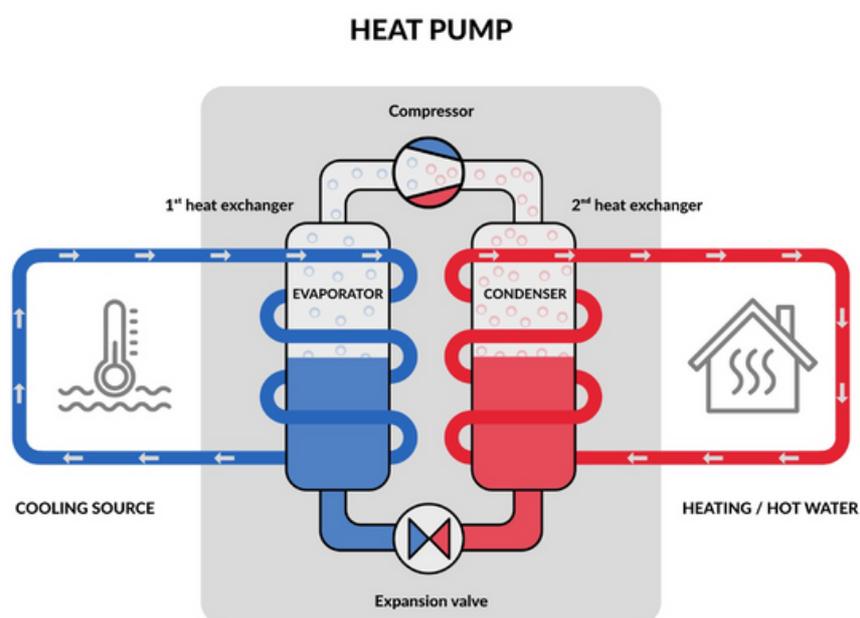
The Role of Heat Pumps in Industrial Hot Water Production

Heat pumps offer the opportunity to greatly reduce emissions and cut costs, while delivering comparable performance to traditional fossil fuel-based boilers. These benefits can be even more pronounced when the technology is offered on an EaaS basis. In the past, reaching sufficiently high temperatures was a barrier to wider heat pump adoption – but thanks to recent innovations, these benefits can now be applied to hot water production in a wider variety of industries, paving the way for a rapid adoption of the technology in the coming years.

1.

High Efficiency and Energy Savings

Heat pumps operate on the principle of thermodynamic cycles, allowing them to transfer heat from low-temperature sources (e.g., ambient air or water) to high-temperature destinations (e.g., hot water tanks). This process can achieve an impressive coefficient of performance (COP), typically exceeding 3.0, indicating that for every unit of electrical energy consumed, the heat pump can deliver three or more units of heat energy. Such high efficiency translates into significant energy savings and reduced operating costs for industrial processes.



2.

Renewable and Low-Carbon Heat Sources

Heat pumps can utilize renewable and low-carbon heat sources, including ambient air, ground heat, and waste heat from other equipment or wastewater as the primary heat input. This allows industries to tap into sustainable energy resources, thereby reducing their carbon footprint and dependence on fossil fuels. For example, waste heat from chillers can be used very effectively with heat pumps, making this a sustainable option for businesses that need both hot water and cooling services. With the use of waste heat, heat pumps can contribute to greater efficiency and circularity in the building's energy system. Utilizing these low-temperature heat sources also means reduced exposure to volatile fuel prices and supply disruptions.

3.

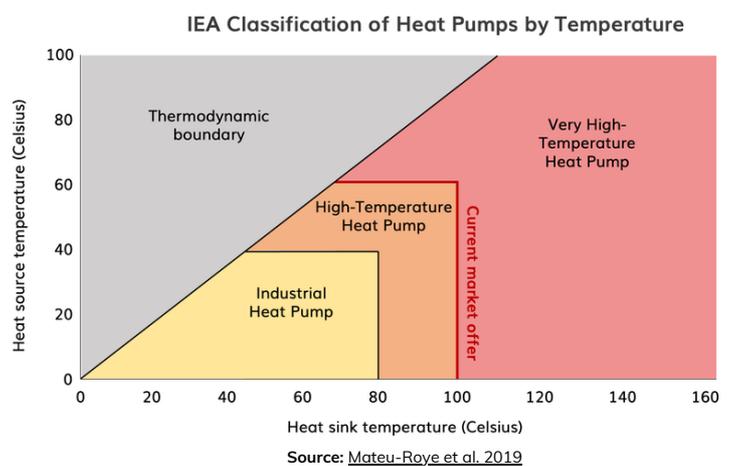
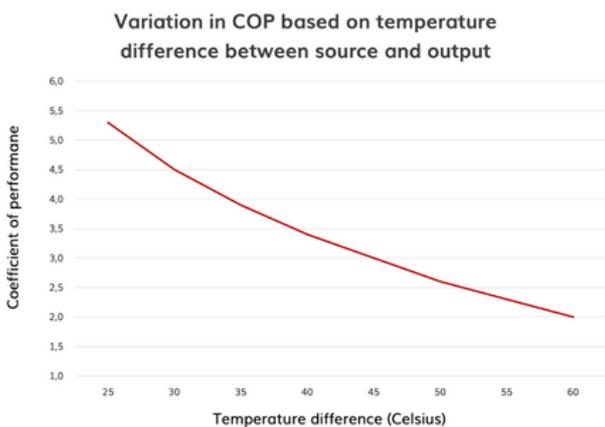
Reduced Emissions

The replacement of fossil fuel-based hot water production with heat pumps results in a direct reduction in CO2 emissions and can be brought to zero if the electricity to operate heat pumps comes from renewable energy sources. The electrification of industrial processes through heat pump technology enables industries to align with decarbonization goals and reduce their environmental impact. Furthermore, the utilization of heat pumps can contribute to meeting regulatory emissions targets.

4.

Scalability and Adaptability

Heat pump systems can be scaled to meet the diverse hot water demands of industrial processes, from small-scale operations to large manufacturing facilities. They are adaptable to various process temperatures and can provide hot water at the required specifications, making them versatile for a wide range of applications. As seen in Figure 2, heat pumps can deliver between 2 and 5 units of heat energy for every unit of electricity they consume, depending on the temperature difference between the original heat source and the hot water produced.



Examples by Sector

Several industrial sectors have already realized the benefits of heat pump technology for hot water production. They can provide a blueprint as to how the technology can be applied elsewhere, while also giving insights into the benefits that can be achieved. Here are some notable case studies:

1.

Food and Beverage Industry

Food processing plants require substantial quantities of hot water for cooking, cleaning, and sterilization. A heat pump system for a drinking water bottling facility in Southeast Asia has the potential to reduce CO₂ emissions and costs by over 50% while providing reliable hot water for the cleaning of bottles.

The global beverage packaging industry was valued at \$148 billion USD as of 2021, meaning a widescale shift to heat pumps could greatly cut costs and contribute to decarbonization targets for the players in this sector.

2.

Fast Moving Consumer Goods

At a rubber glove manufacturing plant in Vietnam, the replacement of an electrical boiler based hot water system with a heat pump solution results in a 75% cost and CO₂ emissions reduction due to the high COP of the heat pump.

The consumer goods sector is broad, and even a gradual shift to heat pumps in this sector would represent a significant step towards decarbonizing light manufacturing. With the wide variety of products represented by this sector, this shift could be undertaken by implementing heat pumps for the easiest use cases first, while continuing to develop the processes for more difficult use cases.

Energy as a Service (EaaS) and Heat Pumps

Energy-as-a-Service contracts provide a comprehensive solution, where a third-party service provider owns, installs, operates, and maintains the heat pump system. The industrial facility pays only for the energy delivered, shifting the financial and operational responsibilities to the service provider. This model provides a much higher level of flexibility for businesses, while also protecting them against incoming carbon taxes and other regulations.

1.

Benefits of Heat Pumps and EaaS Contracts



Capital Barrier Mitigation:

EaaS contracts alleviate the need for upfront investment, making heat pump adoption financially viable for industries with limited capital budgets.



Risk Transfer:

The service provider assumes operational risks and maintenance responsibilities, ensuring consistent system performance and reducing downtime.



Predictable Costs:

Industries pay a fixed fee for the energy consumed, enabling accurate budgeting and eliminating the volatility of fossil fuel prices.



Energy Efficiency:

Heat pumps, coupled with EaaS, provide industries with energy-efficient hot water production, leading to potential cost savings and reduced environmental impact.



Scalability:

EaaS contracts offer the flexibility to scale the system as needed to meet changing industrial demands.

2.

Implementation Strategy

1.

Service Provider Selection:

Choose a reputable EaaS provider like BECIS with experience in heat pump technology and a track record of successful industrial implementations.

2.

Assessment:

The service provider will help to identify the hot water demand, temperature profiles, and other process-specific requirements to determine the feasibility of heat pump integration.

3.

Monitoring and Reporting:

The service provider will implement a robust monitoring system to track energy consumption, system performance, and efficiency improvements over time.



Conclusion

The utilization of heat pumps for hot water production in industrial processes offers a sustainable alternative to fossil fuels, contributing to energy efficiency and emissions reduction. When combined with Energy-as-a-Service contracts, the barriers to adoption are lowered, enabling industries to realize the benefits of this transition without the burden of upfront costs and operational complexities. By embracing this approach, industries can advance their sustainability goals while optimizing operational performance.

That is precisely why BECIS is the perfect partner for heat pump solutions through EaaS, as our commitment to innovation, expertise in energy-efficient technologies, and a proven track record in delivering tailored EaaS solutions uniquely position us to support industries in their journey towards sustainability and operational excellence.

Value of Heating as a Service: Financial & emissions savings

