What's Driving High-Performance Buildings

5 ELECTRIFIED HEATING TRENDS

TRANE TECHNOLOGIES

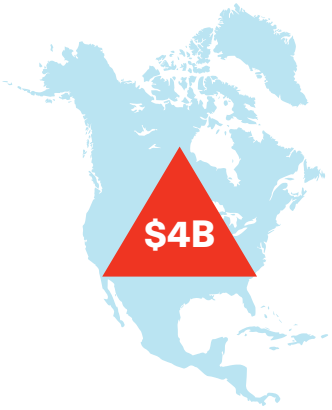
Electrified heating is a rapidly evolving market – **are you prepared?**

Executive Summary

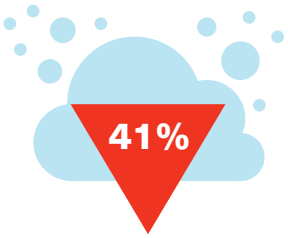
The push towards electrified heating is gaining momentum, driven by corporate sustainability goals, energy consumption concerns, emissions reduction mandates, and population growth. In addition, advancements in heat pump technology (lower ambient operation for all heat pumps, wider range of capacity, and higher hot water temperatures) allow them to be used in more places. This whitepaper explores these driving forces and introduces five key trends in electrified heating that are set to shape the industry.

Innovating today – for a fast evolving market tomorrow

Similar to the transition from gas to all-electric transportation, the building industry is transforming to electric heating and cooling systems through the use of heat pumps. The global commercial heat pump market is expected to experience an 8.6% CAGR from 2020-2029.



Potential opportunities are in the billions
Commercial heat pumps are estimated to be nearly **$4 billion** in North America (CAGR 7%) and are expected to double to **~$7 billion** from 2024-2033.[1]



Unstoppable momentum and so much, more
Electrification could decrease fossil fuel GHG emissions in the U.S. by **41%** below 2005 levels by 2050, even without policies that would decarbonize the grid.

Higher and higher energy efficiency
Heat pumps don't generate heat. They move heat around which makes then up to **3 times more efficient** than other forms of electric heating. Heat recovery can be even more efficient - **over 8 times more efficient**.

Catalysts for Change

Corporate Sustainability

Companies are increasingly committed to sustainability, with four-in-five including a commitment to Sustainable Development Goals. Despite economic uncertainty and shifting regulations, 84% of companies are doubling down on climate targets.[1]

Energy Consumption

The urgency for electrified heating is most pronounced where there is legislation to reduce emissions and increase efficiency. The residential and commercial sectors accounted for around 19.7% and 17.2% - 36.9% combined of the total national energy consumption respectively in 2023.[2]

Emissions

In 2022, the overall GHG emissions in the U.S. totaled about 6.3 million metric tons of CO2 equivalent, with the electric power end-use constituting around 25% of emissions.[3] Heating, ventilation, and air conditioning (HVAC) systems are among the largest energy-consuming components in buildings.[4]

Population Growth

The rapidly growing population and rise in multi-family apartments have increased hot water demand for various residential applications, including bathing, washing, cleaning, cooking, which is stimulating the residential heat pump water heater market.

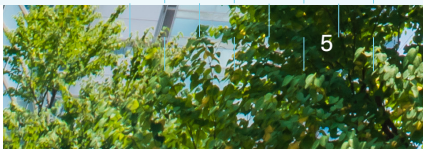
Heating is in our DNA

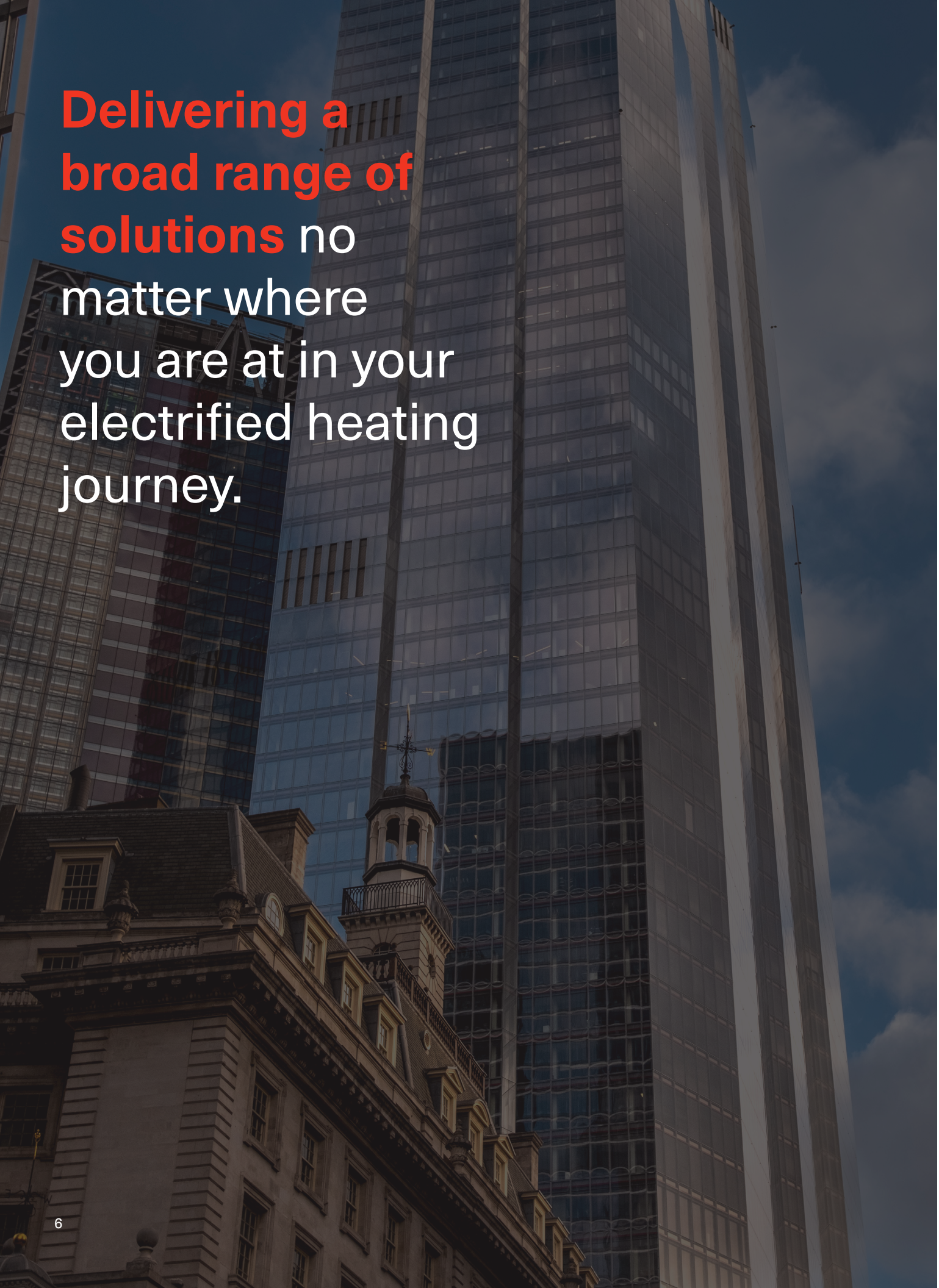
Did you know Trane started as a small heating business in La Crosse, Wisconsin in 1913? Over the past century, we've evolved into a global leader in thermal management transforming how the world shapes the built environment.

We found these **5 Key Trends** are moving electrified heating forward. Discover the possibilities to get started.

1. **Hybrid and Geothermal Heat Pumps**
2. **Efficient Cold Climate Heat Pumps**
3. **Simplified, Cost Effective Heat Pump Systems**
4. **High Temperature Hydronic Heat Pump Systems**
5. **Domestic Hot Water Heat Pumps**

Let's Talk. Explore electrified heating solutions today.
Visit **trane.com** or contact your local Trane account manager.





Delivering a broad range of solutions no matter where you are at in your electrified heating journey.

Electrified Heating Trends

As we look ahead, several key trends are emerging that will shape the future of electrified heating. These trends are driven by the need for sustainable, efficient, and cost-effective solutions that can be easily integrated into both new and existing building infrastructures. Below, we explore the top five electrified heating trends to consider when planning for the future.

1 Hybrid and Geothermal Heat Pump Systems

Realistically, most buildings are not likely to go all-electric right away. A hybrid heat pump system is a practical strategy designed to integrate a clean energy source while providing the ability to transition over time. Here are some examples likely to take off this year:

Geothermal Systems

Geothermal heat pumps use the ground as a stable heat source, harnessing the Earth's constant temperatures to provide highly efficient, year-round operation. Some states, like Colorado, are pushing for more installations, awarding $14.4 million for geothermal systems.[1] At least 42 bills across 14 states are being considered to promote geothermal energy resource development.[2]

Hybrid Dual Fuel Systems

Commonly utilized for small to medium-sized buildings, these easy-to-install packaged rooftop units can also be integrated into larger applied systems. They feature electrified heat pumps for both heating and cooling, with an auxiliary gas heat option. This hybrid configuration provides an efficient upgrade from traditional gas heating units by supplementing heat pump operation with gas heat during colder temperatures.

Replacing a Trane gas heat rooftop unit with a Precedent® Hybrid Dual Fuel unit is as easy as replacing it with a new gas unit. With the same gas and electrical connections and no need to upgrade the electrical supply, you can save on installation costs.

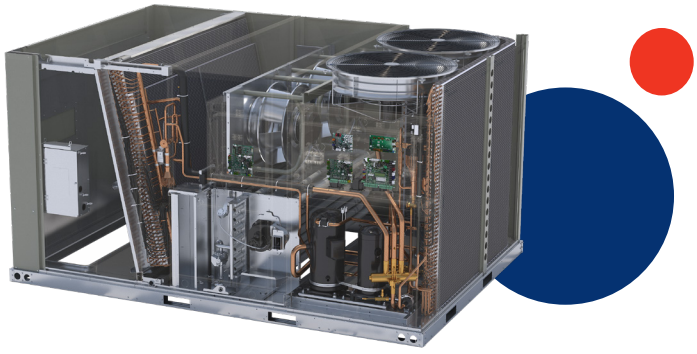
Heat Recovery Systems

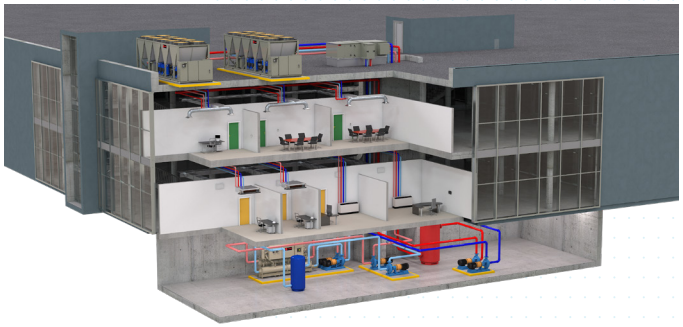
Heat recovery systems in commercial buildings are designed to capture and reuse waste heat from various sources, improving energy efficiency and reducing operational costs. They are a proven, extremely efficient solution for larger buildings above 25,000 sq. ft., ideal when there is an available heat source such as cooling load, condenser water, exhaust air coil, thermal energy storage, wastewater, or geothermal source.

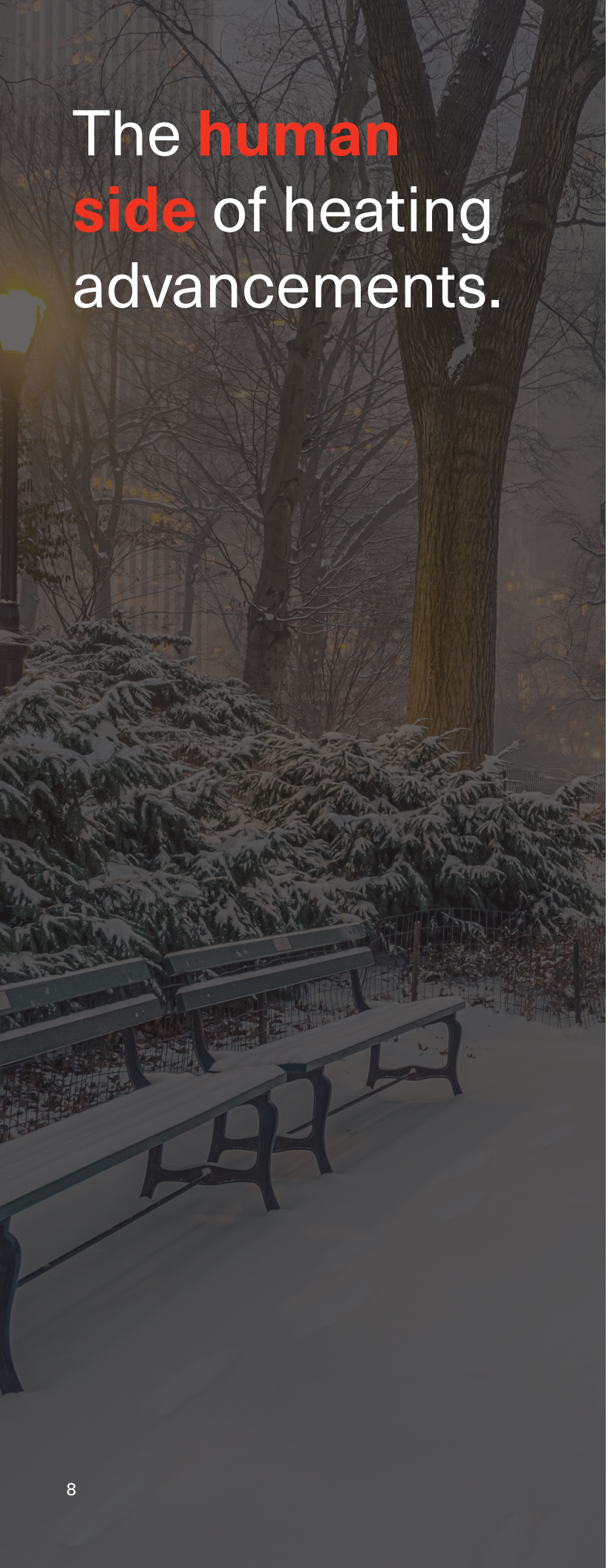
See an example of a successful heat recovery system implementation.

Heat Pump Chiller Systems

Advances in hydronic heat pump chillers and controls can be coupled with backup heat sources to provide a resilient heating system to cover space and water heating needs throughout the year. Incorporating thermal energy storage into hydronic heat pump chiller systems enhances efficiency and sustainability by boosting heat recovery potential in buildings and offers greater operational flexibility, allowing heat pumps to run during periods of abundant renewable energy.







The **human side** of heating advancements.

The consequences of poor heating system performance are potentially more significant than a cooling system failure, making reliable heating critical to well-being and productivity.
Today's solutions can provide heating capacity well below 0°F even in the dead of winter.

2 Efficient Cold Climate Heat Pumps

Innovations for cold climate heat pumps are making it possible to increase efficient electrified heating and cooling even in cold climates.

VRF Technology

Variable Refrigerant Flow (VRF) technology is an efficient, proven, and versatile heat pump solution for a wide range of buildings that consolidates heating and cooling into an electrified, multizone system. VRF systems can deliver a guaranteed heating capacity at ambient temperatures as low as -22°F (-30°C) and will continue to provide heating even below this threshold.

Thermal Energy Storage

Thermal energy storage enables building owners to leverage local utility rate structures and reduce demand on the grid. Paired with heat pump chillers, thermal energy storage extends its battery-like capabilities to heat, making it well-equipped for cold climates due to its ability to capture waste heat from cooling loads and use it when temperatures plummet.

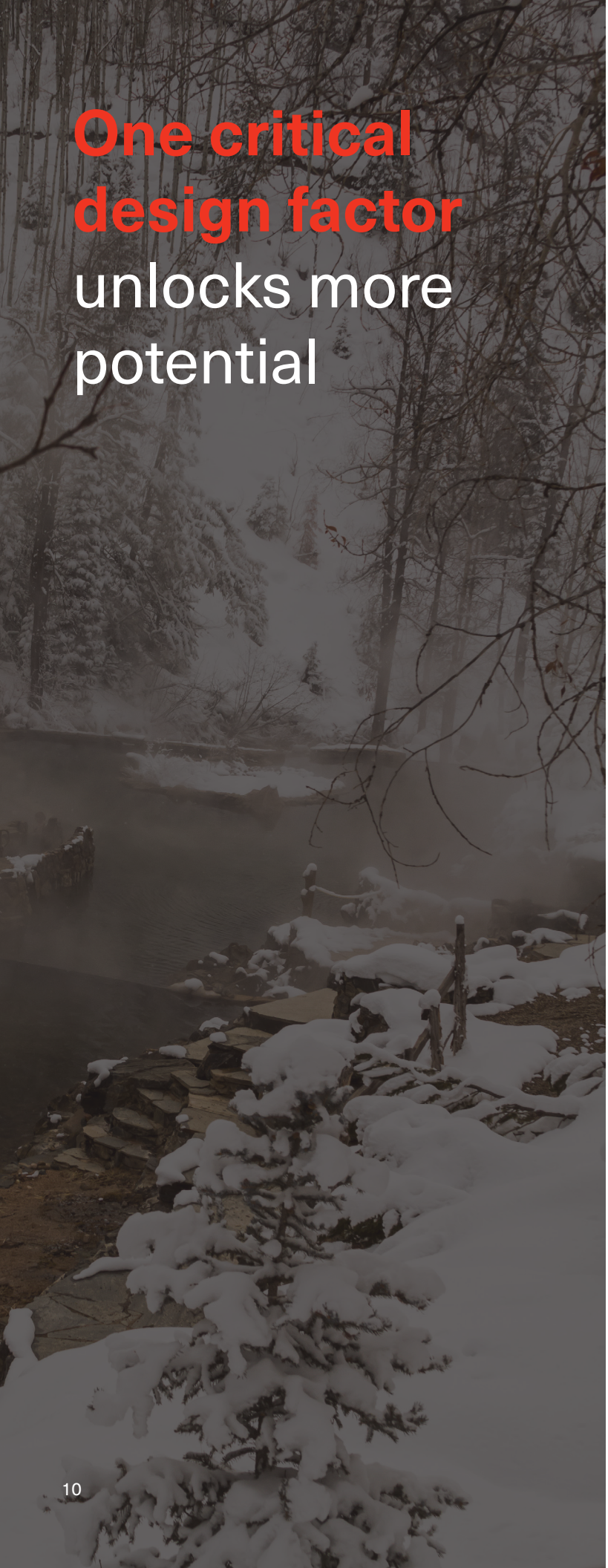
RECOVER AND STORE HEAT ENERGY

Trane Customer Experience Center (La Crosse, WI)

Here our experts utilized pragmatic, innovative solutions and cutting-edge efficient technology to extend the operating range for electrified heating beyond the limits of conventional heat pump systems.

See the first-ever Thermal Battery Storage-Source Heat Pump System.

- **COP of 3** on cold mornings, even when its below 0°F (-18°C)
- **3 times higher COP** than conventional chiller/boiler systems on a typical winter day



One critical design factor unlocks more potential

160°F (71°C) hot water requires **55%** more power than 105°F (41°C) hot water.

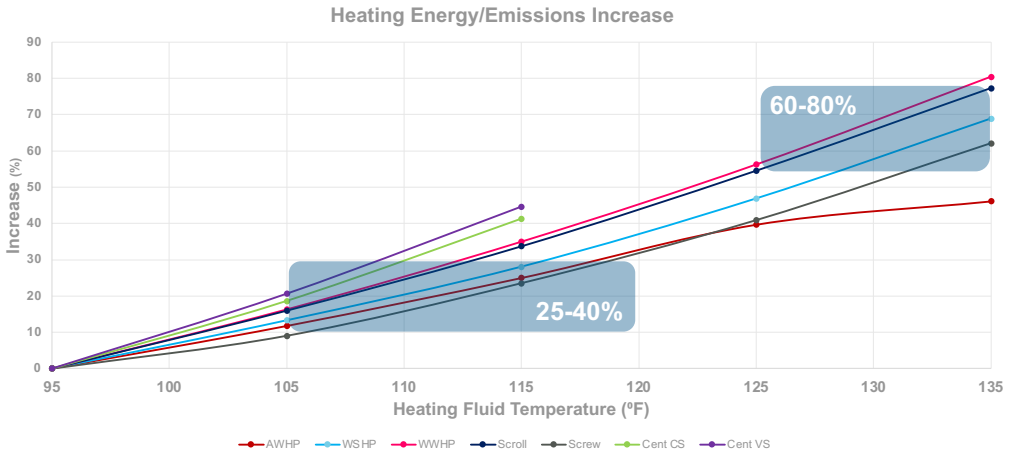
3 Simplified, Cost-Effective Electrified Heating

Higher project costs and complexity often become barriers to progress when implementing electric heat pump systems in new and existing buildings. Advances in simplified, cost-effective, innovative solutions reduce disruption by reducing installation costs and complexity.

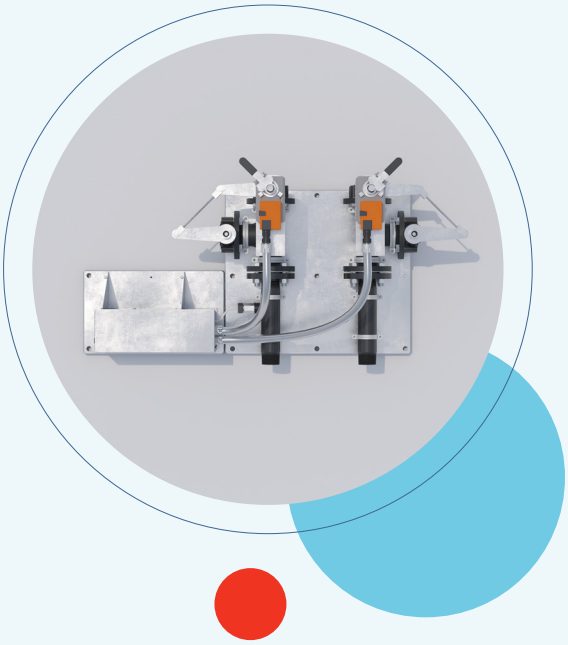
Low Temperature Hot Water Systems

A sustainable choice for medium-to-large sized buildings, these systems are three times more efficient than other forms of electric heating. Simple air-to-water heat pump systems perform most effectively and efficiently when generating milder hot water temperatures, which are considerably lower than those produced by traditional boiler systems.

Learn about the **one critical design factor** that greatly impacts system efficiency, fluid design temperatures.



As we increase hot water temperatures in hydronic heat pump systems, there are associated increases in energy usage, operating costs, and carbon emissions.



Hydronic Branch Conductors

The Hydronic Branch Conductor is a practical device that utilizes a four-pipe central plant in conjunction with an existing two-pipe branch distribution infrastructure. It repurposes the zone-level cooling coil or changeover coil as a dual-purpose coil, enabling efficient and uninterrupted year-round heating and cooling.

This ingenious solution allows for lower hot water supply temperatures, increasing heating efficiency by up to 400%, when compared to traditional heating systems, while also improving comfort. Unlike two-pipe changeover systems that switch from hot water to cold water seasonally for the entire building, causing major discomfort, the Hydronic Branch Conductor can adapt seamlessly to changing heating and cooling loads, area by area, multiple times during the same day.

In addition, this truly flexible solution can be applied to many different systems while reducing complexity and costs.

Explore the **Hydronic Branch Conductor**.

Solving unsolvable challenges with innovative solutions

Engineers rank **infrastructure building limitations** as one of the greatest barriers for implementation of heat pumps.

They also report that **design time** is significantly longer.

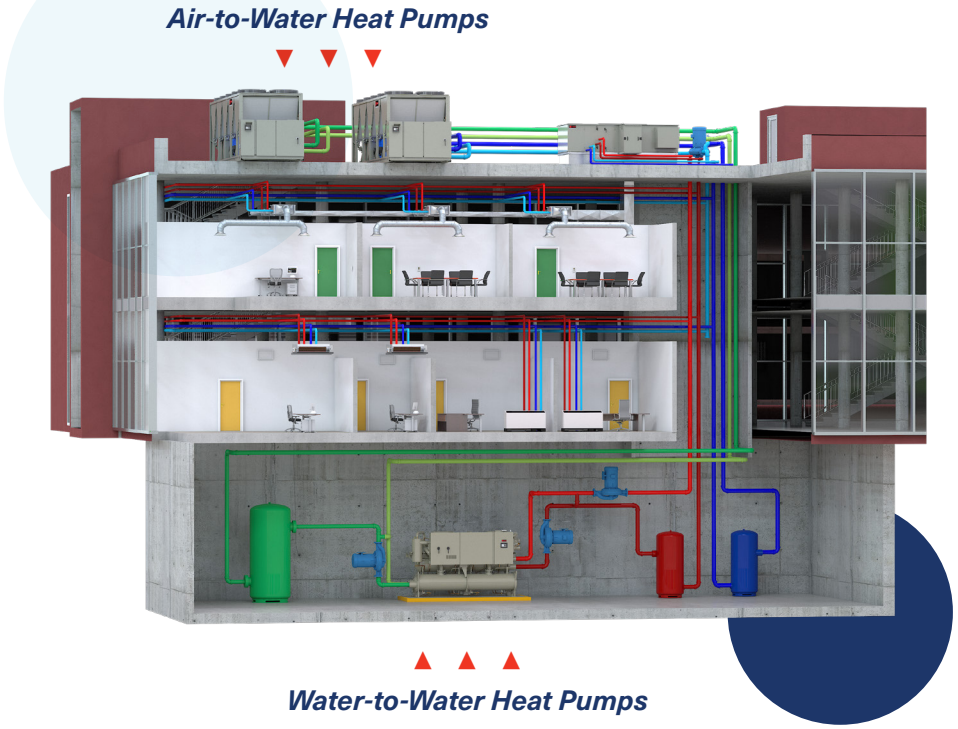
4 High Temperature Hydronic Heating Systems

Efficiency codes are driving more efficient solutions for boiler replacements. The next generation of heat pump systems delivers high temperatures and high lift while using a third of the energy of non-condensing boilers.

Cascade Systems

A sustainable choice for medium-to-large sized buildings, these systems are up to three times more efficient than traditional boiler systems. By pairing an air-to-water heat pump with a water-to-water heat pump, this cascaded system not only delivers up to 165°F (74°C) hot water but also expands the effective operating range of the air-to-water heat pump below 0°F (-18°C).

Learn more about **Cascade Systems**.



5 Sustainable Water Heating Increasing Popularity

Domestic Hot Water Heat Pumps

Until recently, the building industry lacked an energy-efficient solution for providing high-volume domestic hot water (DHW) for commercial spaces. Domestic Hot Water Heat Pumps (DHWHPs) have become increasingly popular, offering a cleaner, more sustainable solution. DHWHPs are about 150% more efficient than electric water heating systems, revolutionizing sustainable water heating.

With a design heating coefficient of performance (COP) ranging between two and four, domestic hot water heat pumps offer significantly higher efficiency compared to electric resistance heating. When installed in buildings where they also provide useful cooling, the combined heating and cooling COP can exceed six.

Learn more about **Trane Domestic Hot Water**.

Why Trane?

At the heart of our “why” lies a relentless commitment to progress and innovation. We believe in pushing boundaries and striving for excellence in everything we do, never stopping our effort to make a difference. But it's not just about never stopping. And its not just about making the highest quality, most reliable, most innovative HVAC equipment. It's about more – so much, more. It's about having a vision for a more sustainable world and the know-how to achieve it.

The Trane Advantage

Systems + People

- INNOVATIVE SOLUTIONS FOR EVEN THE MOST COMPLEX CHALLENGES
- ADVANCED TECHNOLOGY ENABLED BY PRECISE INTELLIGENT CONTROLS
- HIGHLY TRAINED, KNOWLEDGEABLE EXPERTS
- 24/7 NATIONWIDE SERVICE NETWORK

Commitment to Progress

Our systems push boundaries to improve building performance, reduce environmental impact and enhance efficiency. By combining our relentless commitment to always move forward and revolutionize, again and again, not only the way we manage thermal energy, but by the way we are propelled by an unstoppable momentum and insatiable desire to solve the unsolvable. When confronted with the seemingly impossible, we boldly respond “challenge excepted”.

Sources

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1. Colorado Energy Office. April 3, 2025
2. National Caucus of Environmental Legislators

Get started.
Visit trane.com.

Trane – by Trane Technologies (NYSE: TT), a global climate innovator – creates comfortable, energy efficient indoor environments through a broad portfolio of heating, ventilating and air conditioning systems and controls, services, parts and supply. For more information, please visit *trane.com or tranetechnologies.com.*

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