Accelerating Industrial Electrification

Renewable Thermal Collaborative

October 16, 2023

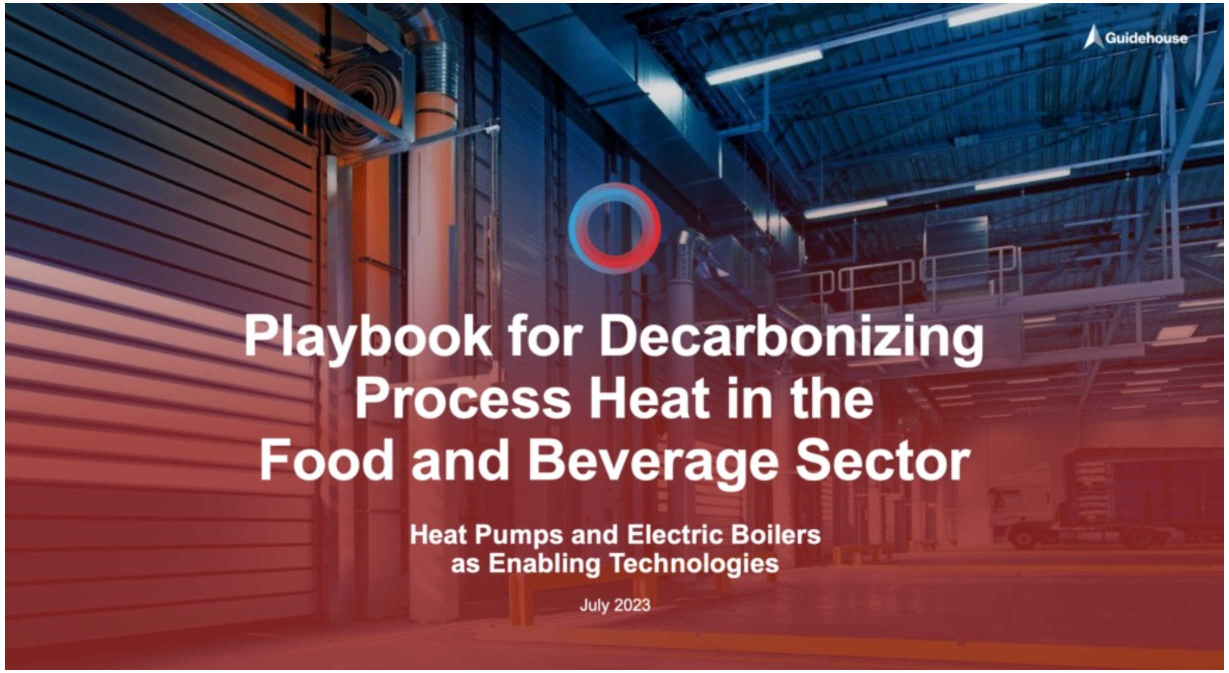
What is the RTC?

The RTC is the only global, buyer-led coalition focused on decarbonizing thermal energy with renewables.

We focus our work across the intersecting issues of **technology**, **market development**, and **policy**.

RTC Members (buy-side) and Sponsors (solutions-side) are invited to participate in RTC workstreams to:

- Identify and address barriers
- Accelerate solutions
- Implement projects and policies



Heat Pump Decision Support Tools

Tool 1: Initial screening

Identifies heat pump opportunities

Tool 2: High-level feasibility

Initial technical and commercial viability assessment

Tool 3: Supplier database

Provides details of relevant suppliers

Access the tools: https://www.renewablethermal.org/heat-pump-decision-support-tools/

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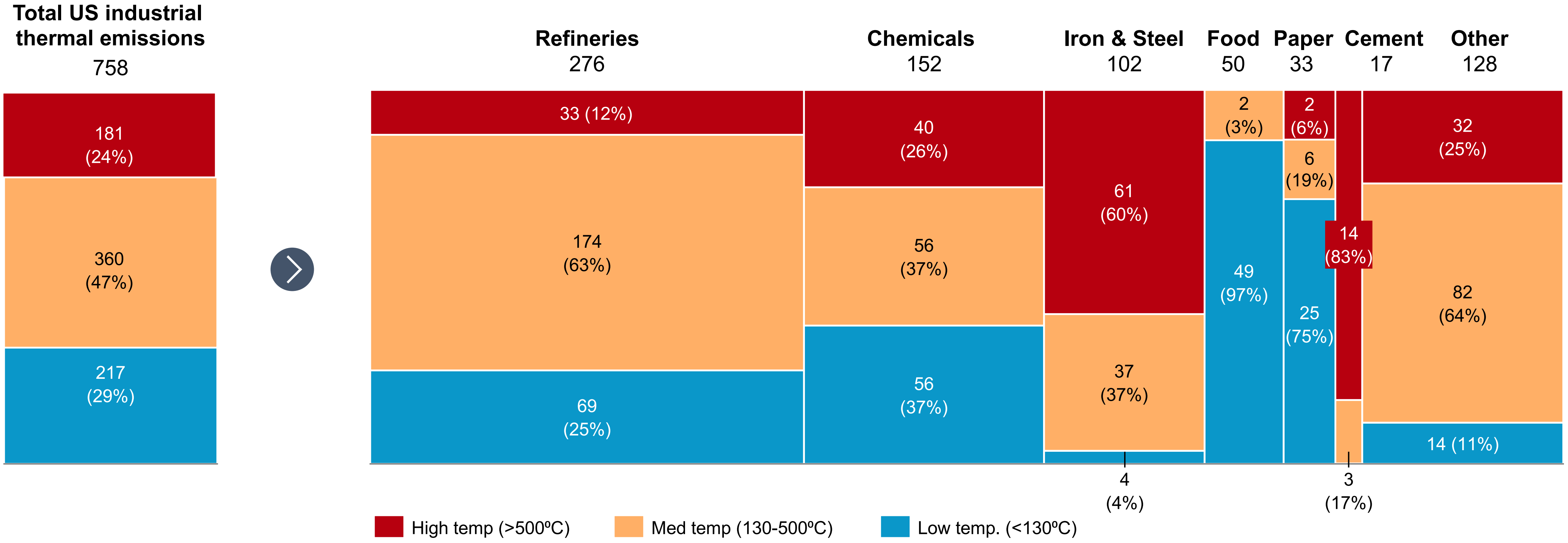
Low & medium heat processes dominate industrial thermal emissions and account for ~76% of total

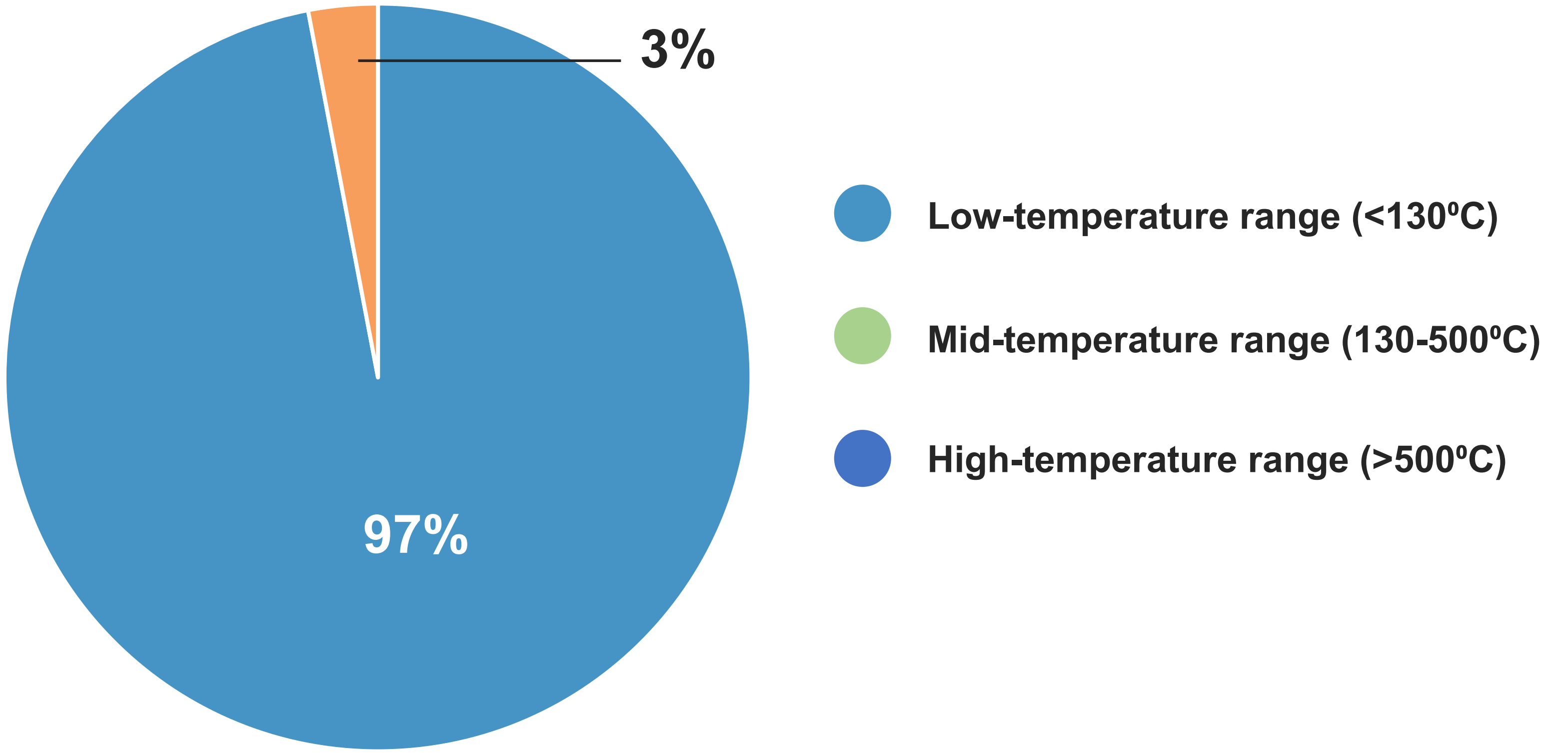
Estimated share of 2018 thermal emissions by temperature range (million tonnes of CO_2e)



Notes: Energy usage by temperature range was used as a proxy for thermal emissions by temperature range, most of industrial heat is fueled by natural gas across low, medium, and high temperature processes; certain sector emissions (e.g. Iron & Steel, Cement) may skew more towards the higher temperature range as these sectors combust fuels with higher carbon intensity for high temperature processes (e.g. coal in steel making) Source: NREL Manufacturing Thermal Energy Use in 2014 (provides thermal energy use by temperature); EIA Outlook 2019 (provides 2018 energy consumption by fuel); EPA emissions intensity by fuel

97% of industrial heat needs in the Food and Beverage sector are for applications in the low temperature range (<130^{0}C)

Thermal energy consumption (TBtu) by heat temperature range (ºC)[1]



1. NREL Manufacturing Thermal Energy Use in 2014

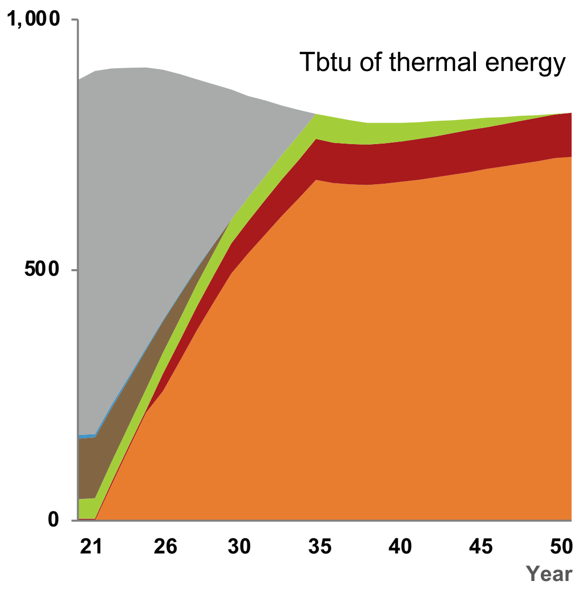
Thermal decarbonization pathways

97% of industrial heat needs are for applications in the low temperature range (<130ºC), which can be **decarbonized on an accelerated timeline** with electrification and heat pumps. Natural gas, which combusts at ~1,850ºC is not required for most heat needs in the sector.

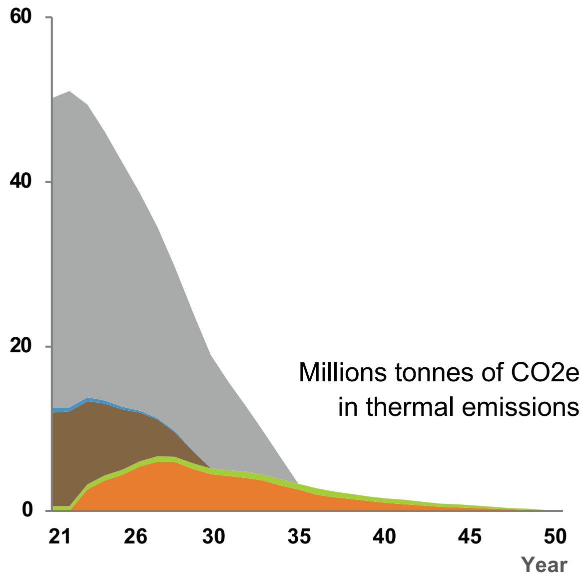
Use of fossil coal and petroleum is **phased out by 2030**, and natural gas **phased out by 2035** – replaced with electrification.

Solar thermal energy with battery storage should also be considered, particularly in the US Southwest, and/or when electric heat pumps have a higher cost to generate heat than fossil natural gas (e.g. California).

Thermal energy consumption[1]



Thermal emissions[2]



1. Total thermal energy consumption based on EIA 2022 Outlook; forecasted energy mix per BCG analysis 2. Thermal emissions calculated based on emissions intensity of individual fuels; RNG and clean hydrogen assumed to be net zero fuels, biomass assumed to have an emissions intensity of 15 kg CO2e per mmBtu, electricity modeled based on US electric grid emissions intensity assuming 80% and 100% renewables by 2030 and 2050 Source: EIA outlook; EIA emissions intensity; BCG analysis

Approach to Effective Heat Pump Deployment

There are three steps to deploy a heat pump on a processing site

1. **Energy optimization to reduce heat demand**
   - Ensures energy demand has been minimized
   - Includes setpoint optimization, de-steaming, waste heat recovery
2. **Thermal mapping to identify heat pump opportunities**
   - To establish baseline thermal energy balance and heat recovery opportunities
   - Includes identification of heat sources and sinks, pinch analysis
3. **Heat pump selection and deployment**
   - Selection of suitable heat pump technology (e.g., mechanical compression, absorption, mechanical vapor recompressions)

Additional Resource: The RTC has developed Heat Pump Decision Support Tools that can further support Energy Buyers with evaluation and selection.

There are detailed slides in the playbook on the aims, implementation considerations and success factors

Barriers and Recommendations to Adoption and Implementation

Barrier	Recommendation
1. Lack of Operational Track Record	Pilot Projects and Case Studies
2. Project Cost	Cost Share Programs
3. Insufficient Grid Infrastructure	Grid System Planning and Assessments
4. Utility Pricing Structures	Rate Structure Reforms

Get Involved

Register to attend the RTC 2023 Summit later this week:

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