The Industrial Heat Pump (IHP) Opportunity and Electrification Momentum

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Breakout 1B: Push & Pull Toward Clean Heat





About ACEEE:

The American Council for an Energy-Efficient Economy (ACEEE), is a nonprofit research organization that develops policies to reduce energy waste and combat climate change. Its independent analysis advances investments, programs, and behaviors that use energy more effectively and help build an equitable clean energy future.

Learn more at aceee.org



Presentation Overview

- 1. Heat Pump and Industrial Process Heating Overview
- 2. Industrial Heat Pump (IHP) Barriers
- 3. IHP Alliance
- 4. Building Toward IHP Pilot Demonstrations
- 5. Southeast IHP Opportunities
- 6. Utility & State Initiatives
- 7. Available Incentives
- 8. Available Resources
- 9. Suggested Action Steps



Under the right climate (above 10 degrees F) residential heat pumps are a very efficient heating technology

Typical Coefficient of Performance, COP = 3

<u>Three</u> units of heat are delivered for <u>one</u> unit of electricity required to run the heat pump

Air Source Heat Pumps

Heating Cycle



Typical Industrial Process Heating System – Steam Boiler



Electric Industrial Heat Pump



Reference: de Boer, Robert, TNO, Strengthening Industrial Heat Pump Innovation Decarbonizing Industrial Heat; July 2020



Food & Beverage Plants in the Southeast

State	# Food & Beverage Plants
Alabama	120
Arkansas	173
Florida	1237
Georgia	581
Kentucky	233
Mississippi	101
North Carolina	772
South Carolina	128
Tennessee	224
Virginia	337

<u>One</u> typical Food & Beverage plant consumes the equivalent of <u>418</u> typical US households

Energy efficiency and decarbonization of manufacturing brings opportunities for cost savings, improved productivity and sustainability



IHP Supply	IHP Demand	Utility Regulators and Program Designers
Limited domestic workforce	Limited domestic IHP product and vendor support available,	Large-scale industrial electrification not considered in current grid planning
IHP suppliers not manufacturing product at scale domestically	Lack of proven energy, GHG, and cost savings demonstrated	Few programs currently exist to incentivize IHP implementation
Codes and regulatory inconsistencies restrict importing		
	Economic constraints for end-users, especially in retrofits and for early- adopters	Regulatory restrictions on fuel switching in some states
Perceived risk from suppliers and implementers		
	Need for engineering and IA	Lack of demonstrations: Need to find interested candidate sites for pilots

What Other Challenges do Some Sites Face?

Current IHP deployment is limited in some cases by temperature and cost

- Certain fuels limit economics of replacement e.g., hog fuel for lumber drying
- Current technology, best applications for temps <250°F
- Some retrofits can drive up installation costs to even exceed IHP equipment capex costs
- Spark gap is a barrier, some states face uphill electrification battle (ideally ≤3)

BUT policy, effective mobilization of capital can overcome these challenges



IHP ALLIANCE

Industrial Heat Pump Alliance





National Electrical Manufacturers Association



Seeking to enable a robust, transformative IHP marketplace

- Four goals underpin vision:
 - 1. Accelerate IHP deployment
 - 2. Increase domestic IHP manufacturing & market implementation capacity
 - 3. Raise awareness & knowledge of IHP implementation
 - 4. Identify & advocate for supportive policies & funding.

https://industrialheatpumpalliance.org/



IHP Alliance Suppliers List:

- Airthium
- Armstrong International
- AtmosZero, Inc.
- Echogen
- Frick / Johnson Controls
- GEA
- Karman Industries
- Nyle Thermal
- Piller TSC Blower Corporation

- Schneider Electric
- Siemens Energy, Inc.
- Skyven Technologies
- Spirax Sarco
- Thermal Energy International Inc.
- Trane Technologies
- Turboden S.p.A.
- Vilter by Copeland



Example Early IHP Pilot Best-Fits

- Spark spread electric to fuel price ratio < 3 or 4
- Dual process heating and cooling systems
- Co-located, waste heat recovery opportunities (e.g., Data center and Food Processing plant)
- Process heating operations > 4,000 hours per year
- Water heating for pasteurization, drying
- Preheat (especially at food processing, meat processing, dairy)
- Hot water for "Cleaning in Place"

What Makes a Site a Good Fit?

- Public, Replicable Demonstrations are Critical

- High COPs
- Other technologies
- Simultaneous heating and cooling, WHR
- Energy **Economics** Savings Corporate **Thermal Re-Responsibilities** design
- Favorable spark-spread
- Opportunity to leverage financing
- Opportunity to save costs through other co-benefits

- Opportunity to redesign process
- Opportunity to offset carbon lock-in (boiler replacement/retirement)

- ESG targets
- Air quality regulations



Southeast States – Spark Gap by State

Southeast State	Spark Gap – Electric to Fuel Price Ratio
Alabama	2.98
Arkansas	2.15
Florida	2.97
Georgia	2.92
Kentucky	2.88
Mississippi	2.44
North Carolina	2.15
South Carolina	2.43
Tennessee	2.49
Virginia	3.23

Southeast States have favorable spark gaps!

Source: DOE EIA 2022 state energy prices



Good IHP Decarbonization Potential

Food and Beverage opportunities by subsector

- Fruit & Vegetable canning FL, TN
- Animal Slaughter and Meat Processing NC, MS, AR, AL, VA, KY, AL
- Fluid Milk Manufacturing FL
- Breweries GA, FL, VA
- Bakeries FL, NC, VA, GA

*States listed in descending order of carbon reduction potential

Source: EPRI "Opportunities for Demonstrating Industrial Heat Pumps in the U.S.", November 2024



Important State Activities on IHPs

CA: CalNEXT report on Industrial electrification

CO: Clean heat standard encourages – gas utilities to support beneficial electrification MN: Planning to include IHPs in their climate action plan, grants NY State climate plan:

- Heat recovery program and upcoming challenge
- NYSERDA IHP webinar, waste heat recovery incentive program

MA: Clean heat standard encourages gas utilities to support electrification, specific mention of heat pumps

PA: Planning to include IHPs in climate pollution reduction implementation grants



Utility Programs are Gaining Steam

- Utilities are increasingly realizing the opportunities created by IHPs and are seeking clarity on product availability.
- We anticipate a <u>timeline</u> for utilities that includes IHP pilots and incentive programs by 2025
- Existing Utility Programs and Engagement on IHPs and Industrial Electrification:
 - Southern Company:
 - Technical Application Center customer engagement
 - Focusing on emerging EV and CHIPS industries
 - TVA:
 - Launching industrial electrification program (custom incentives, HVAC incentive that includes dual fuel heat pumps)
 - Exploring customer demonstrations
 - BPA: Exploring dairy industry electrification opportunities
 - SCE: Exploring food industry applications
 - Xcel Energy: Planning IHP support and incentive program
 - Rocky Mountain Power: Planning IHP support and incentive program

Near-term Phased Pilot Approach

Technology agnostic feasibility studies

- Assess process heat decarbonization options
- Pinch analysis for process optimization
- Determination of electric load increase required

IHP Alliance Procurement Toolkit

- Sites use information from assessment(s) to fill out procurement toolkit
- Information sent to list of up to 17 IHP suppliers
- Connect and determine supplier options with quotes and estimated lead times.

Joint application(s) to funding sources

- Sites and supplier(s) jointly submit for available funding opportunities
- Potential to stack funding from state, utility, and federal government
- Create holistic electrification, systematic integration plan, and community benefits plan

Near-term Phased Pilot Approach

Technology agnostic feasibility studies

- DOE Programs:
 - Industrial Assessment Centers
 - Onsite Energy Technical Assistance Partnerships
- Third-party engineering firms perform the same function

IHP Alliance Procurement Toolkit

 End users, Utilities, ITACs/Onsite TAPs and Engineering Firms collaborate to find best IHP supplier Joint application(s) to funding sources

• DOE, State, Utility funding



Available Resources to Leverage

Existing:

- IHP Alliance <u>Website</u> & <u>Procurement Toolkit</u>
- IHP Alliance is supporting and reviewing applications to funding sources
- <u>IAC</u> and <u>TAPs</u> networks
- RTC IHP decision making support <u>tool</u>
- ACEEE publications on <u>co-</u> <u>benefits</u> and <u>thermal redesign</u>

Upcoming:

- IHP Alliance step-by-step guide to procuring an IHP
- IHP Alliance buyers bootcamps (to be announced)
- RTC IHP decision making support tool 2.0



Long Term Priorities for the Market

- Further funding opportunities beyond existing programs for groups of pilots, mobilization of capital
- Close collaboration between assessment sites, technical assistance. Cohort model
- Collection of public facing data from interested/implementing endusers, participation in international annexes
- Clearinghouse/repository of available product, performance specs
- Quantification and emphasis of co-benefits



Suggested Action Steps

- Check out the Industrial Heat Pump Alliance website
- Download the IHP Procurement Tool Kit
- Reach out to the most promising IHP applications Food and beverage, pulp & paper and chemicals sectors
- Contact the IHP Alliance for support with identifying feasibility study partners and funding opportunities

