Industrial Heat Pump Market Transformation –

Presented at the first Industrial Heat Pumps Workshop

Andrew Hoffmeister
Neal Elliott
Paul Scheihting

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Agenda

10:00–10:30 AM Pre-workshop Networking (tea and coffee served)

10:30–10:55 AM Welcome and Introduction

10:55–11:15 AM Global IHP Experience (continued)
- Policy learnings from Denmark on IHP support, REPowerEU Initiative (Fabian Bühler – Danish Energy Agency)
- Q&A for Fabian and discussion

1:00–1:35 PM Global IHP Experience (continued)
- Announcement of U.S. Industrial Heat Pump Initiative and Partnerships (Nora Esram – ACEEE)
- Supply Chain Efforts (Initiative Partners)
  - Renewable Thermal Collaborative (RTC) and IHP user perspectives (Blaine Collison – David Gardner & Associates)
  - National Electrical Manufacturers Association (NEMA), and IHP manufacturer perspectives (Steve Griffith – NEMA)
  - Q&A for Blaine and Steve and discussion

1:45–2:35 PM Supply Chain Efforts (Initiative Partners)
- 1:45–2:00 CAM-I Day: Renewable Thermal Collaborative (RTC) and IHP user perspectives (Blaine Collison – David Gardner & Associates)
- 2:00–2:15 National Electrical Manufacturers Association (NEMA), and IHP manufacturer perspectives (Steve Griffith – NEMA)
- 2:15–2:35 Q&A for Blaine and Steve and discussion

2:35–3:00 PM Networking Break (coffee and cookies served)

3:00–3:15 PM Utility Perspectives
- Electric Power Research Institute perspective: challenges, district heating, drying applications. (Ammi Amarnath – EPR)
- Utility perspective: ongoing work, learnings from customers (Chase Cortner – Southern Company)
- Q&A for Ammi and Chase and discussion

3:15–3:30 PM Utility Perspectives
- Utility perspective: ongoing work, learnings from customers (Chase Cortner – Southern Company)

3:30–4:20 PM Policy Support and Federal Investment
- Department of Energy’s ongoing effort: IHP R&D, upcoming funding opportunities. Industrial Heat Shot, Electrified Processes for Industry without Carbon (EPX) Institute (Yaroslav Chudnovsky – DOE)
- Q&A for DOE and discussion

4:20–4:50 PM Energy Engineering perspectives
- Need for implementers, engineering, regionality, early pathways (Steve Koski – Cascade Energy)
- Q&A for Steve and discussion

4:50–5:00 PM Wrap up: summary, next steps, upcoming work products and events (Andrew Hoffmeister, Neal Elliott – ACEEE)

5:00 PM Adjourn

5:00–7:00 PM ACEEE Summer Study Welcome Reception for conference attendees
Process Heat Accounts for Most (~70%) Industrial Energy Use

U.S. Manufacturing Sector Process Energy Flow in 2010

*Process heat fuel consumption for key industries

LEGEND: Fuel, Steam, Electricity, Applied Energy, End Use Losses

U.S. Manufacturing Sector Process Energy Flow in 2010
Significant Industrial Process Heat is at or Below 150 °C

Data Source: McMillan 2019
Many States have Favorable Cost Parity for IHPs

- Blue states indicate areas where operating an industrial heat pump is likely more affordable than running a natural gas-powered equipment.
- Based on electricity/natural gas ratios.
- Assumes a COP of 4.0.

*Propane and RNG make IHP use even more cost-favorable.*
IHP Research Phase 1: Opportunity Scouting

• Process heat: 51% of industrial on-site energy use. The large, early, cross-cutting GHG reduction opportunity

• Three industry groups - good early focus for IHPs, as they have high amount of process heat < 200°C
  • Food & Beverage
  • Pulp & Paper
  • Chemicals

• IHPs research shows combined potential impact of;
  • Net energy savings 26-32% (427-518 TBtus/year)
  • CO₂ savings 30-43 million tons/year
  • Simultaneous cooling needs met
  • 5 GW-hour/year electricity needed

• Simple paybacks can be under 2 years, depending on electricity/natural gas price ratio

• Policy enablers can accelerate adoption

Report: https://www.aceee.org/research-report/ie2201
Website: https://www.aceee.org/industrial-heat-pumps
# Market Transformation is Needed in both Supply and Stoking Demand

<table>
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<tr>
<th>Where we are:</th>
<th>Where we want to go:</th>
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<tbody>
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<td>• Robust domestic IHP market supported by capable workforce</td>
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<td>• IHP manufacturing and implementation support equity, create jobs in underserved communities</td>
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<td>• There is limited knowledge on the current potential of IHPs for end-users</td>
<td>• Full market awareness of IHP potential</td>
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**Current Barriers**

- **Where we are:**
  - End-users have process heat needs that can be met with available IHP tech
  - There is limited commercial availability of IHPs in the U.S.
  - The U.S. has fallen behind the EU and others in IHPs, industrial electrification at large
  - New plants are looking to be fueled by 100% carbon-free electricity
  - There is limited knowledge on the current potential of IHPs for end-users

- **Where we want to go:**
  - Robust domestic IHP market supported by capable workforce
  - IHP implementation at scale in both new and retrofitted facilities
  - Decarbonization of process heat, enabling of other solutions (i.e., thermal storage, on-site renewables)
  - IHP manufacturing and implementation support equity, create jobs in underserved communities
  - Full market awareness of IHP potential
There are Important Stakeholder Interconnections to Identify in the IHP Value Chain

**IHP Suppliers and supply chain**

- Suppliers provide *product availability*, technical support to end-users

**Utilities and Energy Governance Orgs.**

- Utilities help *connect IHP suppliers with end-users*, find *candidate sites for demos*. Possible future equipment incentives

**Industrial End-Users**

- *Farm Bill*
- *USDA Grants*
- *48C*
- *IAC Grants*

**Federal policies, programs & funding**

- *48C*
- *DPA funds*

**Energy Engineers**

- *TAPs Program*

**ACEEE & other NGOs**

- ACEEE and others serve a convening role, aggregating demand and connecting players with each other and federal funding opportunities

**NEMA**

- NEMA serves a convening role, gathering and representing IHP suppliers

Federal policies and programs supporting early IHP adoption. Federal funding (White House, DOE, Treasury) is used to support manufacturing, testing infrastructure, implementation, and engineering of IHPs.
Highlighted Barriers

Supply Side:
- Workforce gaps
- Intellectual property constraints on IHP components
- Large manufacturers not operating domestically at scale
- Codes and regulatory constraints
- Perceived risk from suppliers, implementers w/out demonstrations/market assessment

Demand Side:
- Limited domestic IHP product availability
- Lack of demonstrated energy/GHG and cost savings
- Lack of knowledge of opportunity
- Limited current vendor support for international product
- Need engineering to support implementation and integration at end-user facilities
- Resource adequacy - supply of electricity
- Economic constraints for end-users, large capex investment
- Fuel switching
Ongoing ACEEE Work to Help Overcome Barriers

Supply Side:
• ACEEE and partners are engaging with DOE, White House, Treasury, and other possible sources of federal funding to:
  • outline the most significant barriers IHP manufacturers face in increasing domestic production, and possible enablers
  • connect players with funding opportunities (FOAs) as we gain understanding
• Identifying contacts with IHP suppliers for further collaboration, NEMA
• ACEEE response to RFI on DPA co-funding for heat pumps

Demand Side:
• ACEEE is engaging with utility sponsors, creating IHP pilot projects for end-users in their service territories
• ACEEE is engaging with the Renewable Thermal Collaborative and their network of end-users

*Pilots give proof of concept & build knowledge base in the marketplace for both suppliers and end-users
Use of DOE’s IACs and TAPs program for implementation assistance and maintenance

Alleviating codes constraints for IHP components and refrigerants

Creation of a national industrial heat pump test facility

Co-funding opportunities for demonstrations

Utility programming in support of IHP implementation

National trainings on opportunities for engineers, others

*Combination of policy action & connection of key supply chain actors

Where we are

Where we want to go
Next Steps

Understanding of barriers, coalition, alignment on consistent messaging

ACEEE, NEMA, RTC IHP Initiative
IHP Workshop at ACEEE Summer Study

Communicating priorities, identifying best pathways for mitigating barriers

Convening of stakeholders from across IHP value chain
Public event for stakeholders to commit to accelerating US IHP market

Affecting action, demonstrations, funding

Congressional briefing/hearing On IHPs
Advancing installed IHP capacity and pilots

Key Outcomes
Upcoming Events and Resources

• ACEEE IHP report: https://www.aceee.org/research-report/ie2201
• ACEEE IHP website landing page: https://www.aceee.org/industrial-heat-pumps
• RTC industrial electrification report: https://www.renewablethermal.org/electrifying-us-industry/
• Australian Alliance for Energy Productivity’s online heat pump estimator: http://www.heatpumpestimator.com/

• Next IHP workshop at ACEEE’s Energy Efficiency as a Resource Conference in October
Questions?