Central Heat Pump Water Heating
April 2020

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Background

- Federal Agency serving 140+ public utilities
- Service territory 8 states
- Almost exclusively hydro based system – low carbon
- Multi-family water heating is top research priority

Millions invested CHPWH market for over 10 years:

- Research
- Pilot Projects
- Manufacturer Engagement
- Technical Development
Central Water Heater Market Environment

- Provide support for and address
  - Policy Requirements
  - Utility Program Support
  - Market Adoption/Deployment

- A perspective and approach to align
  - Technology Innovation Model Framework (TIM)
GOAL: Advance the development and adoption of HPWH Technologies faster together

- HPWH are standard practice in new construction and retrofit
- COP ~ 3
- Low-GWP refrigerants
- Plug-and-play packaged systems
- Cost-effective
- Reliable
- Ability for load shift
Technical Innovation in Market Context

- Technical Innovation
- Utility Programs
- Market Adoption
- Policy
Technical Information is Critical to Adoption Pathways

Technical Innovation

System Metrics
Predictable and Specific Outcomes

Policy

Market Adoption

Utility Programs
Technology Innovation Model (TIM)

**Feasibility Study**
- Manufacturer Engagement
  - Outreach
- Development Assistance

**Application Testing**
- Performance Testing
  - System Specifications
- Performance Parameters

**Demonstration**
- Testing
  - Performance Map
  - Performance Simulation Model

**M&V System Metrics**
- Component Descriptions

**Supporting Research**
- Tool Development
  - Sizing Tool
- Load Shift Module

- Temperature Maintenance Module
- Temperature Maintenance Best Practice

- Research / Data Analysis
- Application Guidelines
Driving Market Outcomes

- Feasibility Study
- Application Testing
- Demonstration
- Measurement and Verification

System Metrics
Predictable and Specific Outcomes
Feasibility Study

- Engineering documentation review to identify patent defects
- Provide code, market, constructability feedback to manufacturer
- Prep for Applications Testing
- Provide 3rd Party assessment for funders and developers

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Application Testing

- Identify and demonstrate a complete package of equipment necessary for product to perform in the field
- Can be completed in factory, lab or bench test
- Can be used to collect range of data needed to complete Performance Map
- Develop schematic of proposed engineered applications
Field Demonstration

- **Validate** performance, design strategies, seasonal effects, and user interactions
- **Develop** installation drawings and specifications aligned with manufacturer’s guidelines and emerging code and best practice requirements
- **Demonstrate** product readiness
- **Establish** supply chain readiness
- **Account** for full system actual costs
Measurement & Verification

- True performance in situ integrated performance over course of a year with real loads
- Two purposes
  - Short-term optimization
  - Long-term monitoring and persistence savings
- Provides for Performance Map
Completed by utilities, manufacturers or with M&V data from a controlled demonstration
Performance Simulation Model

- ASHRAE Medium
- ASHRAE Low
- Market Rate with Low Flow Fixtures
- CBECC 36 Units

Normalized Draws (l/hour) vs. Hour of Day
Prescriptive Sizing and Layout Requirements for Central Heat Pump Water Heaters for Multifamily Buildings
<table>
<thead>
<tr>
<th>System Metrics</th>
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<tbody>
<tr>
<td>Component Description</td>
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<tr>
<td>Performance Map</td>
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<tr>
<td>Performance Simulation Model</td>
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<tr>
<td>Application Guidelines</td>
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</tbody>
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- Proven
- Demonstrated
- Documented complete system
- Performance Measurements
- Reliable Results
Allied Objective

- Use the Technology Innovation Model to structure our work and drive to System Metrics
- Use System Metrics to align and advance Policy, Utility Programs and Market Adoption
- Provide consistent messaging to manufacturers about path to market
- Standardize minimum code requirements and self certification
- Complete supporting research and leverage funding research
- Flexible participation
- Discrete supporting research projects
- Support collaborative initiative
## Conceptual Funding Model

<table>
<thead>
<tr>
<th>Task</th>
<th>Description</th>
<th>Funding</th>
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<tbody>
<tr>
<td>Feasibility Study</td>
<td>50-50 Split between Manufacturer and Alliance</td>
<td>x</td>
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<tr>
<td>Application Testing</td>
<td>Costs for design and oversight funded by Alliance. Equipment and set-up costs funded by manufacturer</td>
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<tr>
<td>Demonstration</td>
<td>Various funding streams including owner/developer, local utility, Alliance, manufacturer</td>
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<tr>
<td>Measurement and Verification (M&amp;V)</td>
<td>Alliance to fund collection, analysis, reporting of performance data and lessons learned</td>
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<tr>
<td>Design Guidelines</td>
<td>Manufacturer literature and guidance funded by manufacturer</td>
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<td>Design requirements for Code funded by regulators or Alliance</td>
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<tr>
<td></td>
<td>Design requirements for utility programs funded by utilities</td>
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<tr>
<td>Performance Map</td>
<td>Performance Map: May derive from applications testing, third party lab, or Demonstration M&amp;V</td>
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<tr>
<td>Codes and Programs</td>
<td>Code language and tools</td>
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What’s Next

- Seek alignment around the Technology Innovation Model
- Seek participation in funding additional supporting research
THANK YOU!