Breaking 100% Efficiency Barrier for Heating

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Thermally Driven Heat Pump (TDHP)

- **Warm Comfort**: useable in all heating system types
- **All Climates**: perfect for cold weather!
- **All Fuels**: natural gas, propane, fuel-oil, bio-fuels
- **Very High Fuel Efficiency**: 145% (COP)
- **Natural Refrigerant** (GWP = 0)

Many Uses:
- Residential Space Heating
- Residential Water-heating
- Commercial Water Heating
- Commercial Space-heating
- Pool Heating
SMTI Fuel-Fired Absorption Heat Pumps

\[ \text{COP}_{\text{HHV}} = 1.45 \text{ at } 47/120^\circ\text{F} \]

- Fuel-Fired, Air to Water Heat Pump
- Condensing
- 4:1 Modulation
- 10,000 to 140,000 Bth Heating Output Models
- 20\(^\circ\) F Hydronic Differential
- Outdoor Installation (no venting)
- GWP = 0

*Patents Pending*
SMTI Prototype Programs, 3rd Party Verification, Field Testing

10 kBth  20 kBth  80 kBth  140 kBth

Anything In-Between
21 Field Test Sites, Over 8,000 hours on 80 kBth Life Test Unit
• Standard Boiler – 80% efficient
• Condensing Furnace – 92% efficient
• Standard Electric AC – 14 SEER
• Standard EHP – 14 SEER/8.2 HSPF
• Cold Climate EHP – 18 SEER/12 HSPF
• Resistance Heaters – 100% efficient

Note: Performance curves for EAC/EHPs taken from published data of commercially available systems
Techno-Economic Modeling

**Annual Operating Cost**

- Portland, ME
- Harford, CT
- NYC, NY
- Albany, NY
- Concord, NH
- Burlington, VT
- Worcester, MA

Legend:
- 80% Boiler + 14 SEER
- LFHP + 14 SEER
- 18 SEER CCHP w/boiler backup

**15-Yr Total Ownership Cost**

- Portland, ME
- Harford, CT
- NYC, NY
- Albany, NY
- Concord, NH
- Burlington, VT
- Worcester, MA

Legend:
- 80% Boiler + 14 SEER
- LFHP + 14 SEER
- 18 SEER CCHP w/boiler backup
A more economically viable path to decarbonization

All – Electrification (EHPs)

- Prohibitive cost of building out the grid for winter heating loads
- A much higher energy price for consumer
- Who pays for abandoning existing pipeline assets?
- Challenge to retain consumer comfort
- Storage costs expensive

Thermally – Driven Heat Pumps

- Low carbon footprint
- Low operating cost in all important heating climates
- Retains consumer comfort
- Makes use of existing distribution assets
- Good policy route for an economically viable bridge to an all-renewables future
Stone Mountain Technologies, Inc.
Next Generation Heating Innovation

- **Game-changing technology for fuel heating appliance markets**
  - 30-50% Savings for Space & Water Heating
  - *Economically most practical method to decarbonize heating on a mass scale*
  - *Cost-favorable comparison to competing AHPs & other advanced HPs*

- **Realistic pathway to market with differentiated product**
  - *Lowest risk & cost to OEMs (market partner – not a competitor)*
  - *Fastest timeline*

- **SMTI is dedicated to OEM success in the market place**
  - *Product Development – oriented towards high-volume applications and lowest cost to benefit all*
  - *Direct partnerships in Field Tests, Market Research and Development, etc. …*

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Attic
Commercial Water-heating

DHW (Food Service, Hospitality, Laundry, etc...)

Strategies:
- Baseload / Peak load
- Extend life of existing tanks
Heating & Cooling HYBRID

• Project Time: Q2-2019 to Q4-2020

• Scope: Design and prototype “single-box” heating & cooling. Best-in-class thermodynamics (absorption, vapor compression) for all home loads (including DHW). Lowest operating cost and competitive installation.

• Target Market: single-family residential
Multi-family “Combi” Heating

- Project Time: Q4-2017 to Q4-2019
- Location: Chicago, Illinois, USA
- Scope: Retrofit Integration design and Field Testing (140 kBTU AHP)