

## Validate Performance of Existing Pre-Commercial, Gas-Fired Equipment



Oak Ridge National Laboratory  
Ahmad Abu-Heiba, R&D Associate  
[abuheibaag@ornl.gov](mailto:abuheibaag@ornl.gov)

# Project summary

## Timeline:

Start date: October 1, 2017

Planned end date: September 30, 2018

## Key Milestones:

1. Acquire at least one equipment; 5/30/2018
2. Install in environmental chamber; 6/30/2018

## Budget:

### Total Project \$ to Date:

- DOE: \$10,000
- Cost Share: \$0

### Total Project \$:

- DOE: \$150,000
- Cost Share: \$0

## Key Partners:

Gas Technologies Institute
Northwest Energy Efficiency Alliance
American Gas Association
SaltX Technology Holding AB

## Project Outcome:

Unbiased laboratory performance evaluation that supports commercialization activities of newly-developed gas-fired heat pump technology.

# Team

ORNL collaborated with technology managers at NEEA, AGA and GTI to compile list of existing pre-commercial gas-fired, heat pump-based equipment and assess their commercialization potential.

SaltX will provide a heat pump water heater for laboratory evaluation.

Work will be performed within ORNL's Building Technologies Research & Integration Center (BTRIC) user facility which is the premier building technologies research facility in the United States.

- 4 environmental chambers
- Water conditioning unit for water heating testing.



# Challenge

**Problem Definition:** Newly developed technologies face challenges in commercialization, including high initial cost of the final product, high development cost and the questioning of developer-published performance information.

Validating the published performance information by unbiased scientific institutions mitigate the last challenge. Such validation increases the confidence that manufacturers, retailers and consumers need to invest in these products.

**FY16 – FY20 MYPP: HVAC/WH/Appliances Strategies, Current and Planned Activities, and Key Targets: *Commercialization Support Strategy: Accelerate the market availability of technologies....***

# Approach

Project execution has three main stages:

1. Compile list of existing pre-commercial gas fired heat pump products.
2. Assess impact of ORNL laboratory performance evaluation on the commercialization of each.
3. Secure performance evaluation agreement with the highest impact product.

Performance validation at ORNL is an asset to developers:

1. Unbiased performance evaluation.
2. ORNL-published data is highly credible.
3. Leveraging BTO funds for testing offsets some of the developer incurred sunk cost.
4. ORNL has user facilities and expertise that are not available at most developers.

THE KEY ELEMENT TO THE SUCCESS OF THE PROJECT IS IDENTIFYING THE RIGHT EQUIPMENT.

# Impact

---

Successful execution of the project's approach will have one or more of the following impacts depending of the current status of the technology or the product under investigation:

- Facilitate licensing of the technology to manufacturers through increasing their confidence.
- Facilitates securing field demonstrations.
- Support market acceptance through increasing consumer confidence.
- Provide critical performance data needed for potential performance improvements.

# Progress: Equipment survey

First, input was gathered from collaborators to compile a list of pre-commercial innovative heat-pump-based products (13 total candidates).

Product	Technology	Purpose
Blue Mountain Energy Gas Engine Driven Heat Pump	Vapor Compression	Space Heating and Cooling
boostHEAT	CO2 - Vapor Compression	Water Heating
E-Sorp	Absorption - GAX	Space Heating and Cooling
M-Trigen	Vapor Compression	Space heating and Cooling + Power Generation
Robur K18	Absorption	Space Heating
SaltX HeatBoost	Adsorption	Water Heating
Semi-open Membrane-Based Absorption	Absorption	Water Heating
SMTI Water Heater	Absorption	Water Heating
Sortech AG Chiller	Adsorption	Chilled Water
Thermolift GHP	Vuilleumier	Space Cooling and Heating
Valliant zeroTHERM	Adsorption	Water Heating
Viessmann Vitosorp 200F	Adsorption	Water Heating
Viessmann Vitosorp 300W	Absorption	Water Heating

# Progress: Down selection – commercial status

Commercially available products were excluded.

Product	Technology	Purpose
Blue Mountain Energy Gas Engine Driven Heat Pump	Vapor Compression	Space Heating and Cooling
boostHEAT	CO2 - Vapor Compression	Water Heating
E-Sorp	Absorption - GAX	Space Heating and Cooling
M-Trigen	Vapor Compression	Space heating and Cooling + Power Generation
Robur K18	Absorption	Space Heating
SaltX HeatBoost	Adsorption	Water Heating
Semi-open Membrane-Based Absorption	Absorption	Water Heating
SMTI Water Heater	Absorption	Water Heating
Sortech AG Chiller	Adsorption	Chilled Water
Thermolift GHP	Vuilleumier	Space Cooling and Heating
Valliant zeroTHERM	Adsorption	Water Heating
Viessmann Vitosorp 200F	Adsorption	Water Heating
Viessmann Vitosorp 300W	Absorption	Water Heating



# Progress: Down selection – TRL Level

Products below TRL 6 were excluded.



Product	Technology	Purpose
Blue Mountain Energy Gas Engine Driven Heat Pump	Vapor Compression	Space Heating and Cooling
boostHEAT	CO2 - Vapor Compression	Water Heating
E-Sorp	Absorption – GAX	Space Heating and Cooling
SaltX HeatBoost	Adsorption	Water Heating
Semi-open Membrane-Based Absorption	Absorption	Water Heating
SMTI Water Heater	Absorption	Water Heating
Thermolift GHP	Vuilleumier	Space Cooling and Heating

# Progress: Down selection – ongoing projects

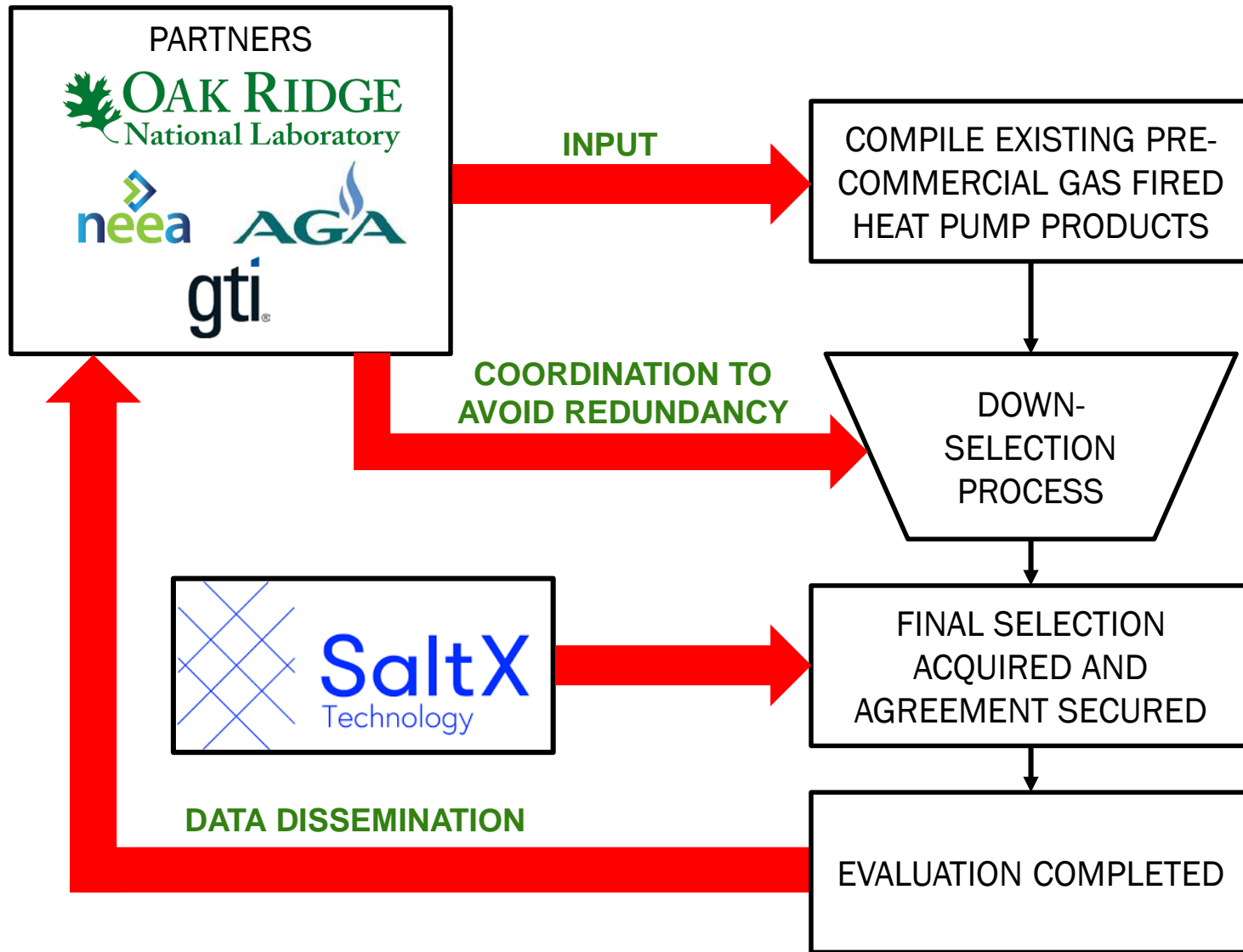
Products that are being or will be tested under other projects were excluded.

Product	Technology	Purpose
Blue Mountain Energy Gas Engine Driven Heat Pump	Vapor Compression	Space Heating and Cooling
boostHEAT	CO <sub>2</sub> Vapor Compression	Water Heating
<b>SaltX HeatBoost</b>	<b>Adsorption</b>	<b>Water Heating</b>
SMTI Water Heater	Absorption	Water Heating

# Current status

- **Communication has been established with SaltX.**
  - Planned commercialization activities:
    - US Field test during 2019 (planned)
    - Going into the US market in 2020 (planned)
  - Benefits of laboratory performance validation:
    - Requisite for field-testing
    - High-fidelity performance data
  - Testing to be done:
    - Standard DOE water heating rating (FHR and UEF)
    - Test matrix to be determined by SaltX to assess component-level performance.
- **In the process of developing agreement to cover procurement, data distribution, NDA, etc.**

# Stakeholder engagement



# Future steps

---

- Any other promising technologies that ORNL performance evaluation would help?
  - Some products are commercial outside the US and may be interested in entering the US market.
  - Some technologies are commercialize in certain products but developers may be interested in implementing them in different applications.

---

# Thank You

Oak Ridge National Laboratory  
Ahmad Abu-Heiba, R&D Associate  
[abuheibaag@ornl.gov](mailto:abuheibaag@ornl.gov)

---

# REFERENCE SLIDES

# Project Budget

**Project Budget:** Total budget of \$150k – 100% Federal share, 0% cost share

**Variances:** None

**Cost to Date:** \$10k

**Additional Funding:** None

## Budget History

FY 2017 (past)		FY 2018 (current)		FY 2019 (planned)	
DOE	Cost-share	DOE	Cost-share	DOE	Cost-share
0	0	\$150k	\$0	\$0	\$0



# Project Plan and Schedule

Project Schedule												
Project Start: October 1, 2018	Completed Work											
Projected End: September 30, 2019	Active Task (in progress work)											
	◆ Milestone/Deliverable (Originally Planned)											
	◆ Milestone/Deliverable (Actual)											
	FY2018											
Task	Q1 (Oct-Dec)	Q2 (Jan-Mar)	Q3 (Apr-Jun)	Q4 (Jul-Sep)								
Acquire at least one unit (GO/NO-GO)	█	█	█	█	█	█	█	█	◆			
Install unit in chamber									█	◆		
Conduct testing											█	█
Submit final evaluation report												█