Regional Emerging Technology Advisory Committee (RETAC)

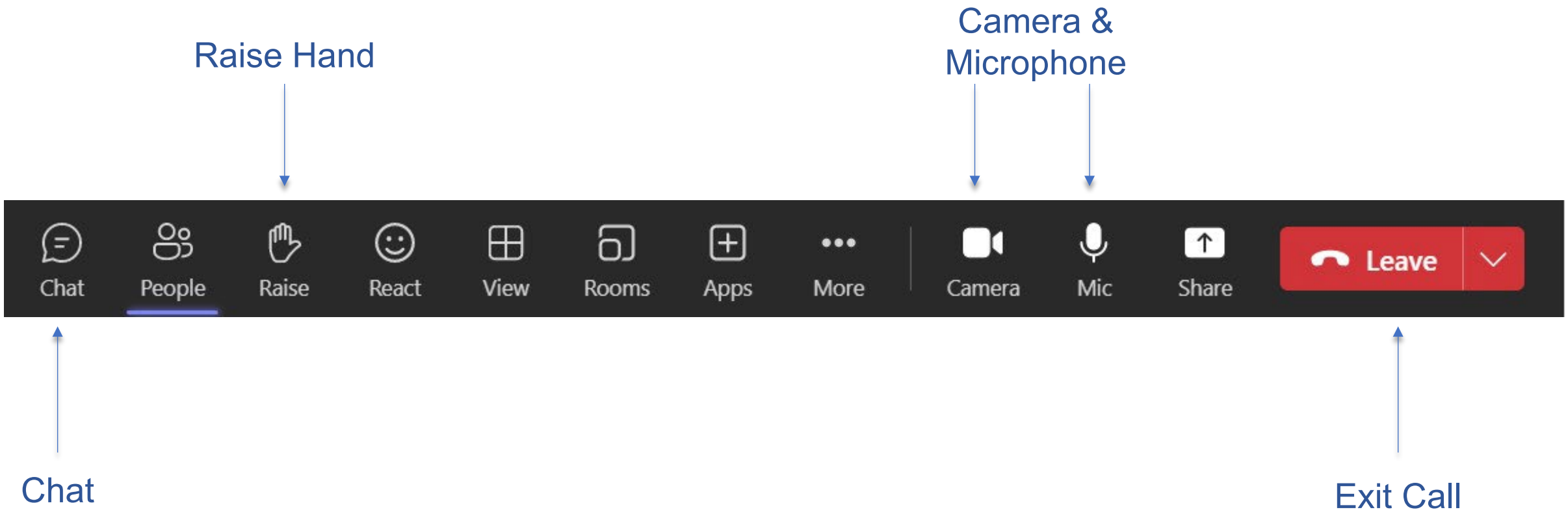
Northwest Energy Efficiency Alliance

Q1 2025 Meeting

March 13, 2025

8:30 a.m. – 12:00 p.m.

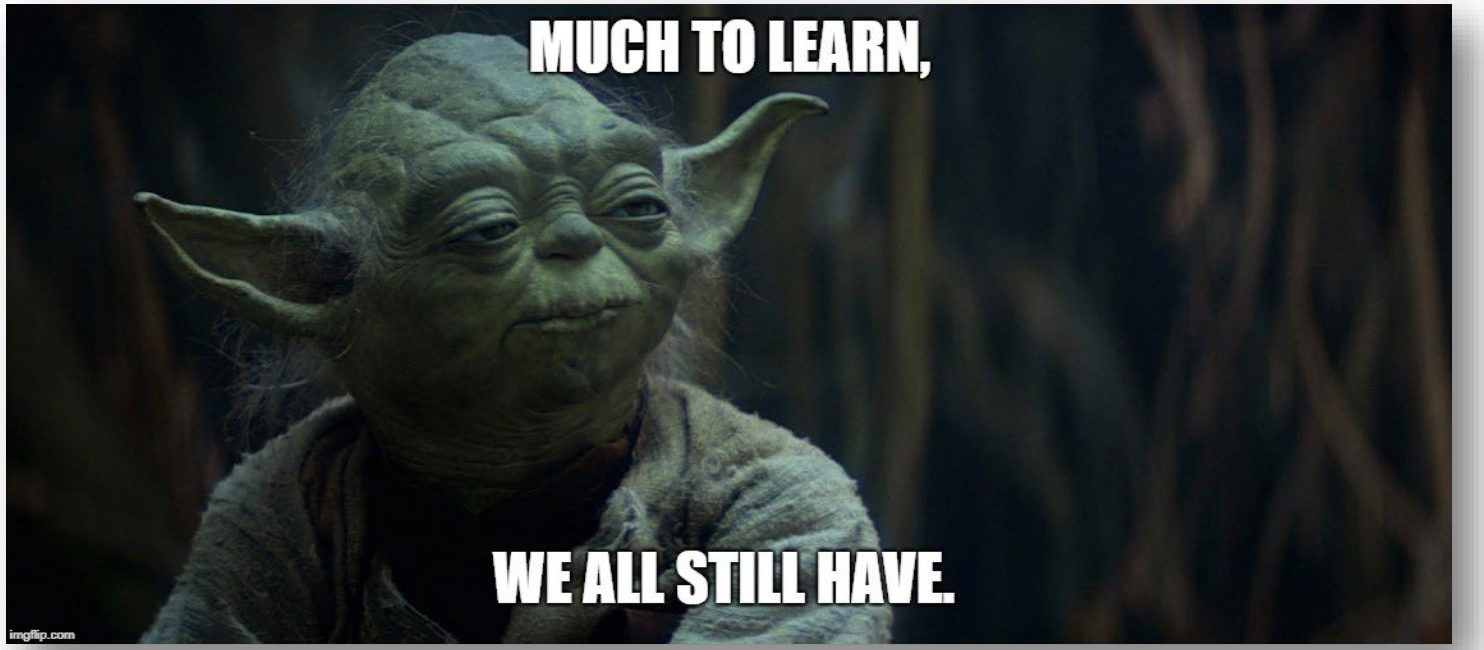
Navigating MS Teams Layout



Note: These options may vary, depending on which version you're using.

Name, Title, Organization and…

What's a skill you have always wanted to learn, but haven't yet?



Agenda

8:30 am	Welcome and Announcements
9:00 am	GTI Energy
9:45 am	*Break*
10:00 am	RETAC Round Robin
10:30 am	9th Power Plan Update
11:00 am	AHR Expo/ASHRAE Conference Debrief
11:45 am	Wrap-Up

Efficiency Exchange 2025

Early Bird Registration

February 18 – April 25

neea.org/EFX

EFX25 Hybrid Conference

May 20-21 in Portland

In-person + Virtual

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Feedback Requested on NEEA Reports

- Assessing value/content of various NEEA reports
- **REQUEST**: Take survey by Friday, March 28th
- May lead to streamlining materials and/or communication channels

Q1 2025 Emerging Tech Newsletter

2025 Q1 Emerging Technology Quarterly Newsletter

WHAT'S NEW:

Welcome to 2025. This quarterly Emerging Technology update will highlight laundry products. As part of its long history with consumer products, NEEA started working on residential clothes dryers many years before ENERGY STAR® added that category. NEEA staff continue to explore innovations in laundry technology including residential and commercial heat pump dryers, all-in-one combination washers and dryers, and top load washer innovations.

The 2025 Consumer Electronics Show (CES) comprised demonstrations of several other laundry innovations, including smart dosing systems, AL wash optimization, and (a favorite) robotic sorting and folding. Smart dosing technology accurately identifies the washing needs of each load, adds the correct amount of detergent, and sets the wash parameters to ensure the best results. This technology offers many benefits including efficiency since it potentially reduces waste by accurately matching each load's need. NEEA will continue to track these technologies to determine their value for the Northwest and look for market transformation opportunities.

Recent and Upcoming Product Councils:

- November 5, 2024 – Heat Pump Water Heater Installation Tool
- December 3, 2024 – FEI Rated Fans and Flue Gas Thermo-Cooling: The Last Steps in Building Efficiency
- March 25, 2025 – Low Load Efficient Heat Pumps

Information on upcoming Product Councils is always available at https://neea.org/get-involved/product-council.

Please reach out to any of NEEA's product managers with questions or suggestions on NEEA's emerging technology work. NEEA staff would love to hear from you.

TABLE OF CONTENTS

Questions about this report may be addressed to:
Mark Rehley
Director, Codes, Standards, New Construction and Emerging Technologies
mrehley@neea.org

PUBLISH DATE: MARCH 3, 2025

https://neea.org/resources-reports

2025
Meeting Dates

Q1	Thursday, March 13
Q2	Wednesday, June 18
Q3	Wednesday, September 24
Q4	Thursday, December 4

Conferences & Product Councils

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Conferences

Past Conferences

- Consumer Electronics Show – January
- CEE Winter Member Meeting – January
- 2025 Dry Climate Forum – January
- MEEA Conference – January
- AHR Expo – February
- ASHRAE Winter Conference – February
- ACEEE Hot Air and Hot Water Forums – March
- Urban Land Institute Idaho Sustainability Conference – March
- ARPA-E Conference – March
- HVAC Excellence Education Conference - March

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Conferences

Upcoming Conferences

- Seattle 2030 Vision Awards – April
- IFMA Symposium 2025 – April
- Siting and Permitting Conference – April
- Western Energy Institute – Operations Conference – April
- IEEESusTech 2025 – April
- Getting to Zero Forum – April
- PLMA Conference – May
- Northwest Facilities Expo – May
- IFMA Greater Seattle Chapter Expo – May
- Efficiency Exchange 2025 – May
- CEE Summer Conference – 2025 – June

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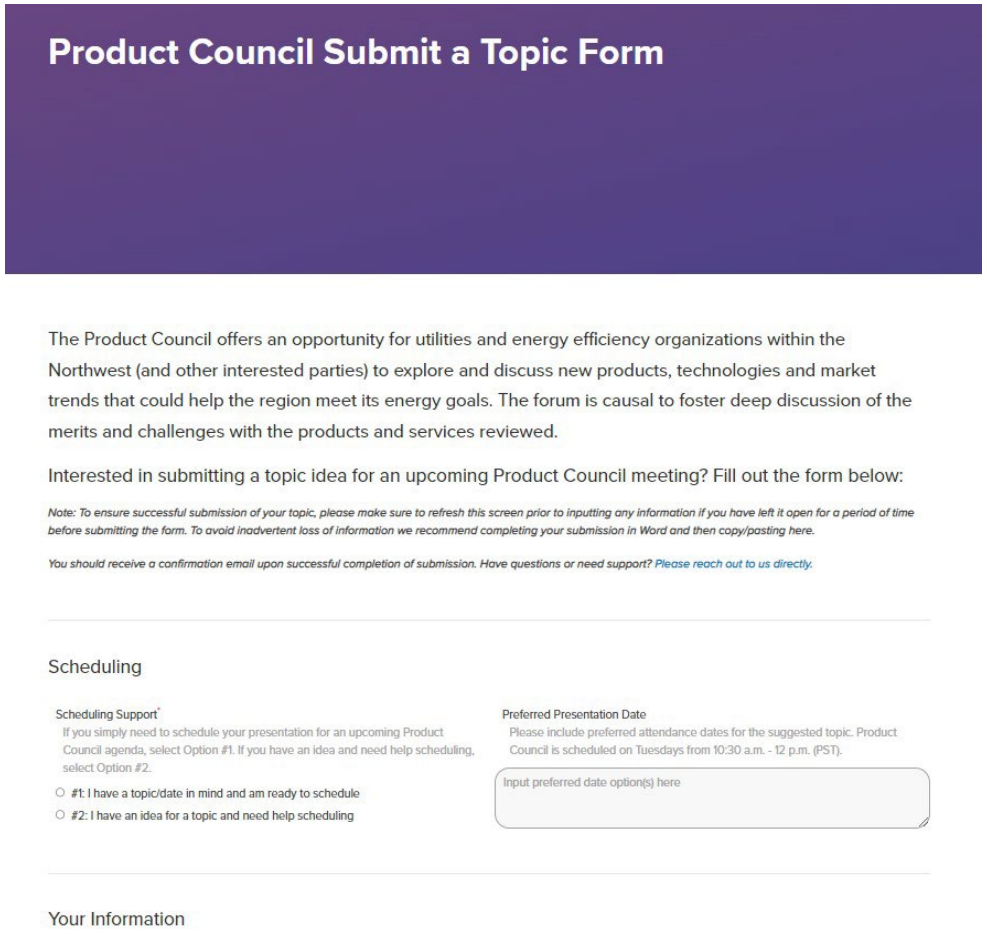
Q1 2025 Product Council Presentations

Presenter	Topic	Date Scheduled	Webinar Recording
NEEA/TRC	Low-Load Efficiency Heat Pump Performance	March 25, 20025	Registration Link

Upcoming Product Council Presentations



Product Council Submit a Topic Form

The Product Council offers an opportunity for utilities and energy efficiency organizations within the Northwest (and other interested parties) to explore and discuss new products, technologies and market trends that could help the region meet its energy goals. The forum is causal to foster deep discussion of the merits and challenges with the products and services reviewed.

Interested in submitting a topic idea for an upcoming Product Council meeting? Fill out the form below:

Note: To ensure successful submission of your topic, please make sure to refresh this screen prior to inputting any information if you have left it open for a period of time before submitting the form. To avoid inadvertent loss of information we recommend completing your submission in Word and then copy/pasting here.

You should receive a confirmation email upon successful completion of submission. Have questions or need support? Please reach out to us directly.

Scheduling

Scheduling Support*
If you simply need to schedule your presentation for an upcoming Product Council agenda, select Option #1. If you have an idea and need help scheduling, select Option #2.

- #1: I have a topic/date in mind and am ready to schedule
- #2: I have an idea for a topic and need help scheduling

Preferred Presentation Date
Please include preferred attendance dates for the suggested topic. Product Council is scheduled on Tuesdays from 10:30 a.m. - 12 p.m. (PST).

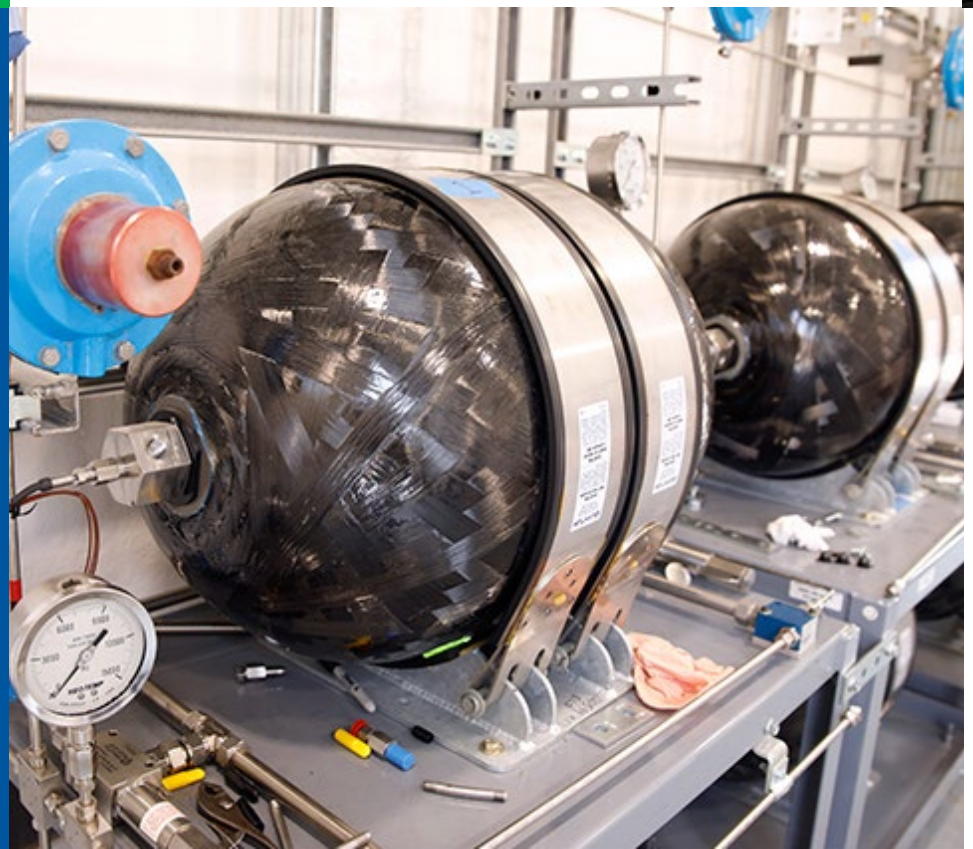
Input preferred date option(s) here

Your Information

https://neea.org/product-council-submit-a-topic-form

GTI ENERGY

solutions that transform



GTI Energy Update

NEEA RETAC | March 2025

Ryan Kerr

rkerr@gti.Energy; 847-768-0941

Agenda

- GTI Energy Overview and Evolution
- Buildings Project Showcase
  - Envelopes: Retrofit Process Improvement, Wall Systems, Windows
  - HVAC: Geothermal and Air-to-Water Heat Pumps
- Residential Dual Fuel Systems
- Commercial Dual Fuel Systems

We develop, scale and deploy solutions in the transition to low-carbon, low-cost energy systems

GTI ENERGY

SOURCE MAKE MOVE STORE USE

500
Enterprise Employees

We work collaboratively to address critical energy challenges impacting gases, liquids, efficiency and infrastructure

OTD Operations Technology Development

UTD Utilization Technology Development

GTI ENERGY EMERGING TECHNOLOGY PROGRAM

LCRI LOW-CARBON RESOURCES INITIATIVE

GTI End Use Labs

GTI Buildings Labs – Validating Today's and Developing Tomorrow's Energy Efficiency Solutions

GTI ENERGY

Direct Carbon Capture

Frontier Energy

FRONTIER energy

Energy efficiency, market transformation, and advanced transportation

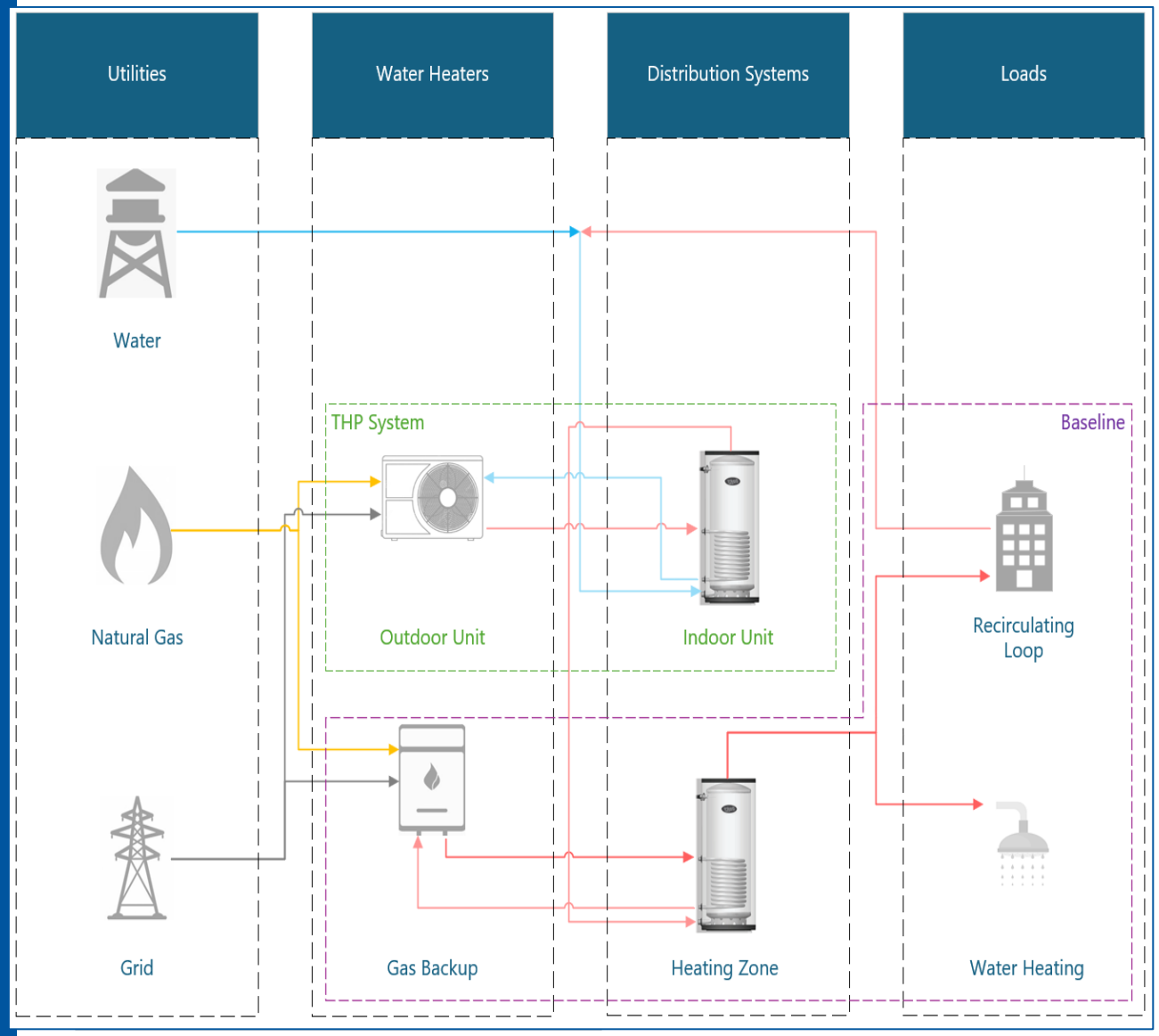
Providing creative solutions to help business and utility clients achieve their energy goals

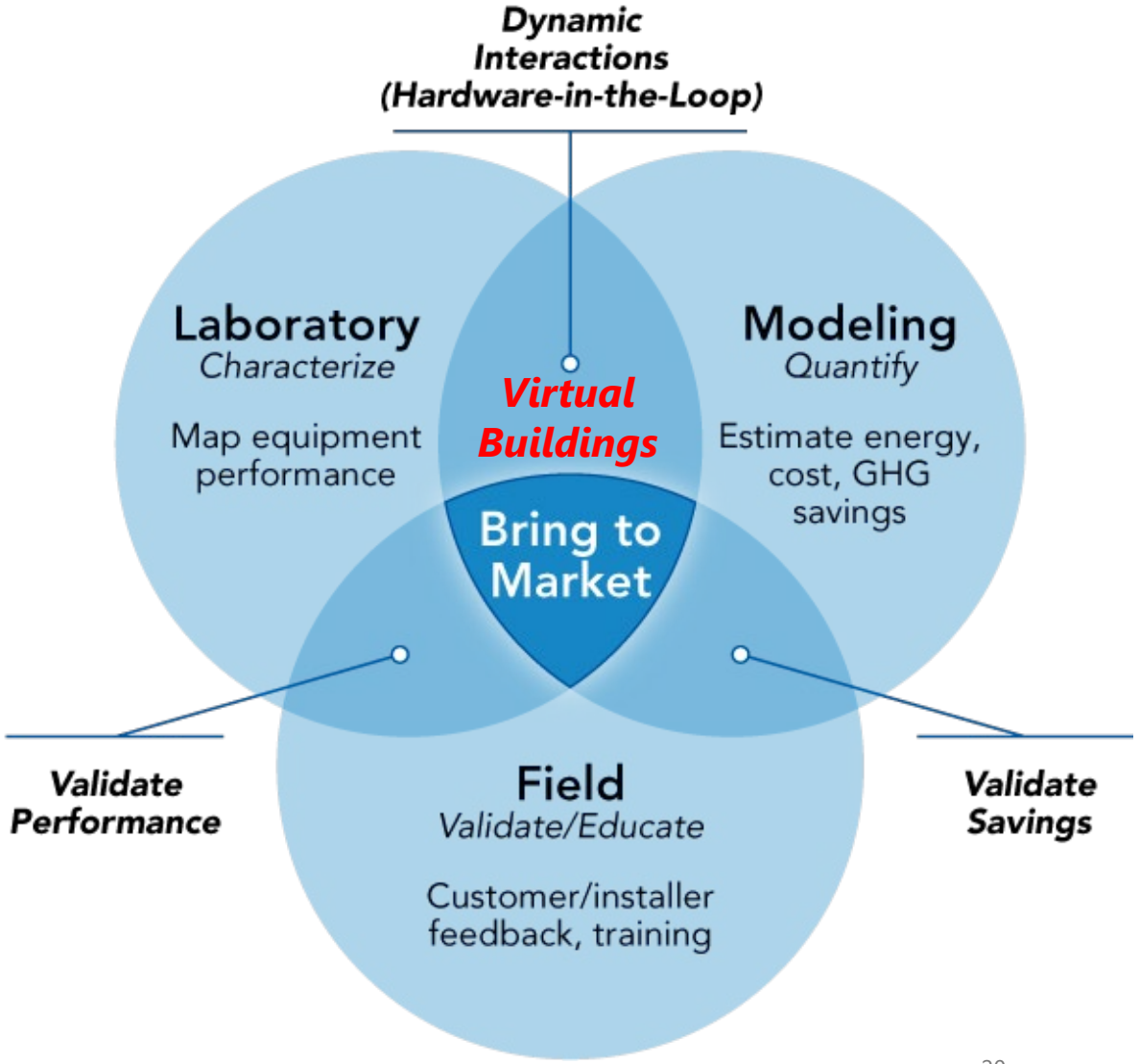
- Energy efficiency programs
- Engineering consulting
- Data collection
- Outreach
- Software solutions

Expertise:

- Demand-side management
- Building research and energy consulting
- Commercial foodservice
- Transportation and power
- Software solutions

Accelerating Real-World Performance Evaluation

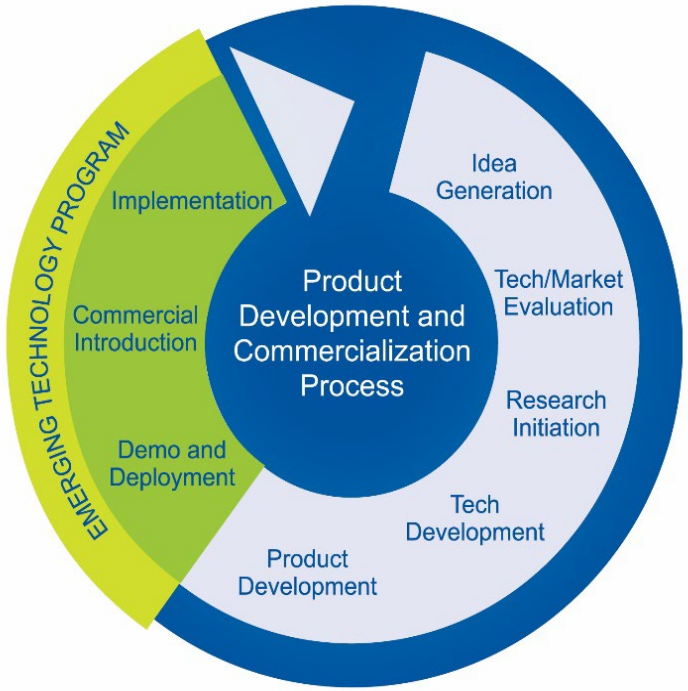




Emerging Technology Program

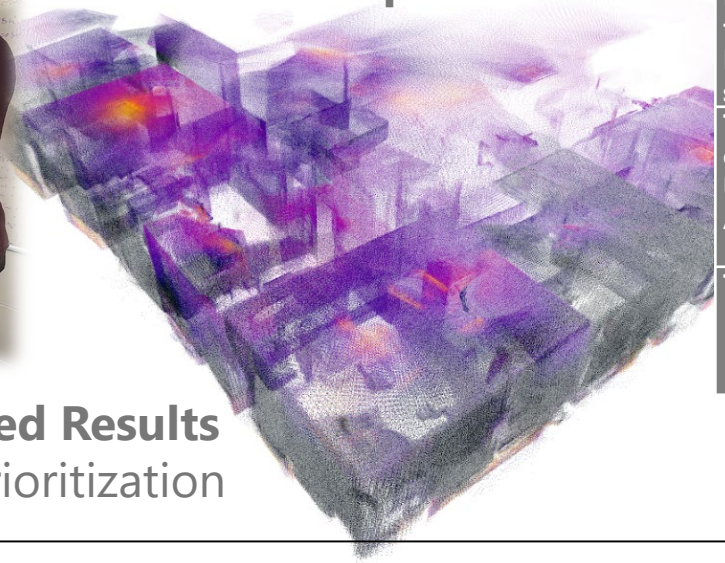
GTI ENERGY EMERGING TECHNOLOGY PROGRAM

- GTI Energy-led, utility-supported, North American collaborative targeting residential, commercial, and industrial low carbon energy solutions
- ETP's goal is to accelerate the market acceptance of emerging technologies for use in near-to-mid term energy efficiency and decarbonization programs



Scaling Infiltration Assessment in Large Buildings

1. Non-invasive Scan
2. Thermal point cloud



3. AI-Generated Results
with retrofit prioritization

Current state-of-the-art testing procedures	Raw output	Occupant Disruption	Reporting process	Visit labor 50,000 ft² building	Test Costs
Blower door / pulse testing to ASTM E779 or similar standards	Accurate flow rate, single number metric	Highly disruptive to building operations	Analysis from testing software	4 people, 2 days (64 hours)	$15,000-$20,000
Target Level of performance: UNSEALED-AIR process	Point cloud of surfaces with geospatial map of thermal data	Non-invasive	Automated report with retrofit guidance	1 person <1.5 hours, automated report	<$100 labor cost; $300-500 retail
Thermal camera	Qualitative indicators of air leakage	Non-invasive	Manual report creation	1 person, 5 hours plus reporting	$2,000-$5,000

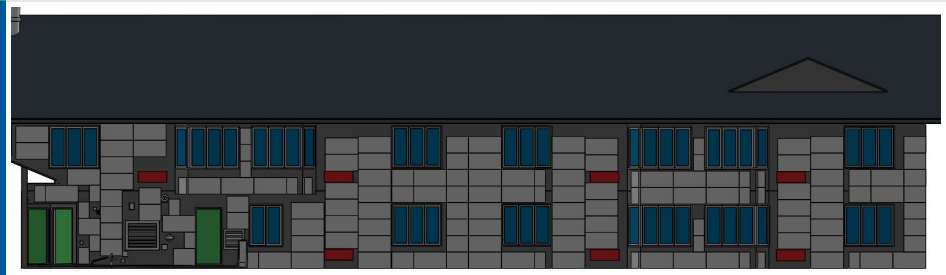
BENEFIT FY24

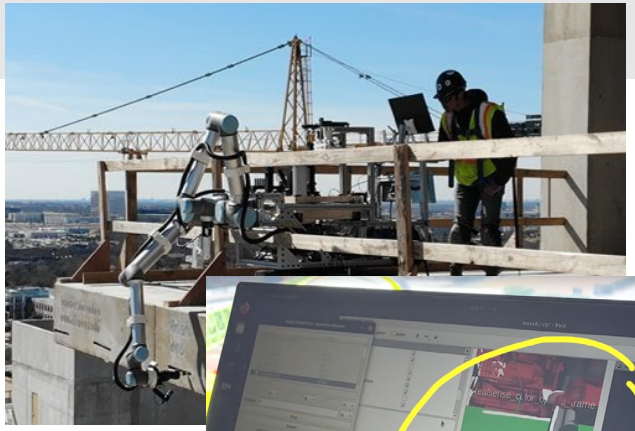
Challenge: Assessing air leakage in large buildings without occupant disruption and complex fan setups.

Solution: Develop machine learning to enhance commercially available tool, characterizing air infiltration in building shells for a fraction of the cost of conventional approaches. Develop a localized contractor scope of work based on the assessments. Perform digital scans and whole building testing to calibrate the AI tool.

Non-invasive scan with detailed air sealing scope of work for $500

Digital Tools and Robotics for Enhanced Envelope Retrofits





From left to right:

- Digital façade modeling using 3d scans to design and prefabricate retrofit panels
- Raise robot arm and visualization interface: Place and fasten insulation panels within ±3 mm accuracy
- FLX Bot: Remote air-sealing and QA/QC

$1.1M NYSERDA + $75K National Fuel Funding

Challenges: Current retrofit solutions are labor intensive and expensive; Lack of trained construction workforce; Lack of adequate quality assurance (QA) and quality control (QC).

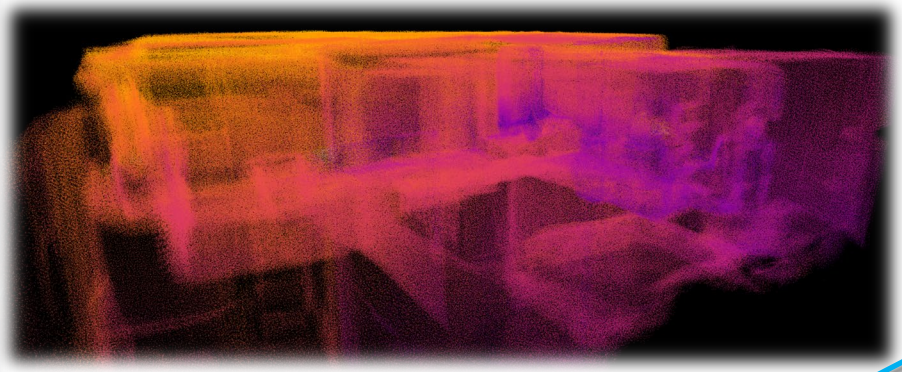
Solution: Holistic approach of building envelope scanning and digital modeling-assisted retrofit panel design and robotics-assisted installation. Programmable robotics coupled with boom lifts to easily access the various parts of a multi-story exterior wall for air sealing, retrofit insulation panel installation, and QA/QC.

Faster and higher-quality envelope retrofits using digital and robotic tools

COBotics for Attic Technical Testing and Infiltration Control (COBATTIC)

GTI ENERGY

Handheld iphone-based AI thermal imaging assessment to target air sealing



Adapt commercially available cobotic arm with air sealing and insulation tools

iCRT INDOOR CLIMATE RESEARCH & TRAINING

CEDA

FLX SOLUTIONS

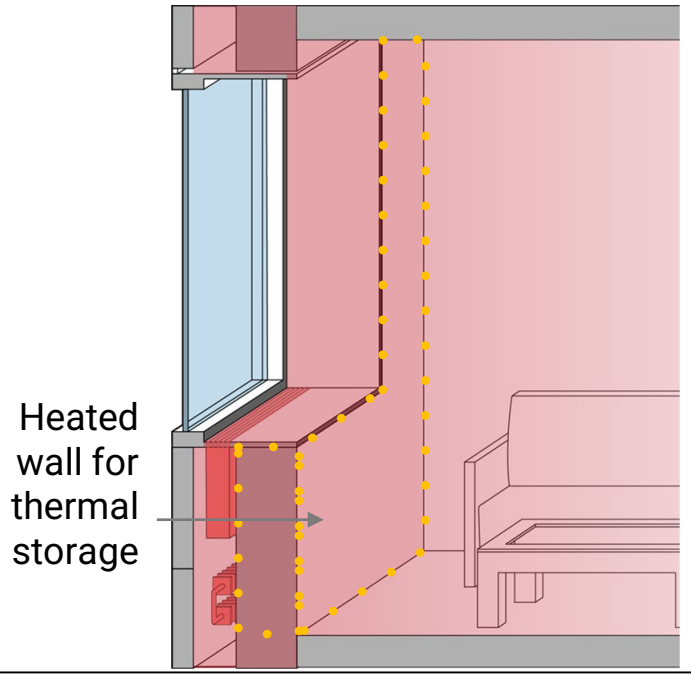
BENEFIT FY24

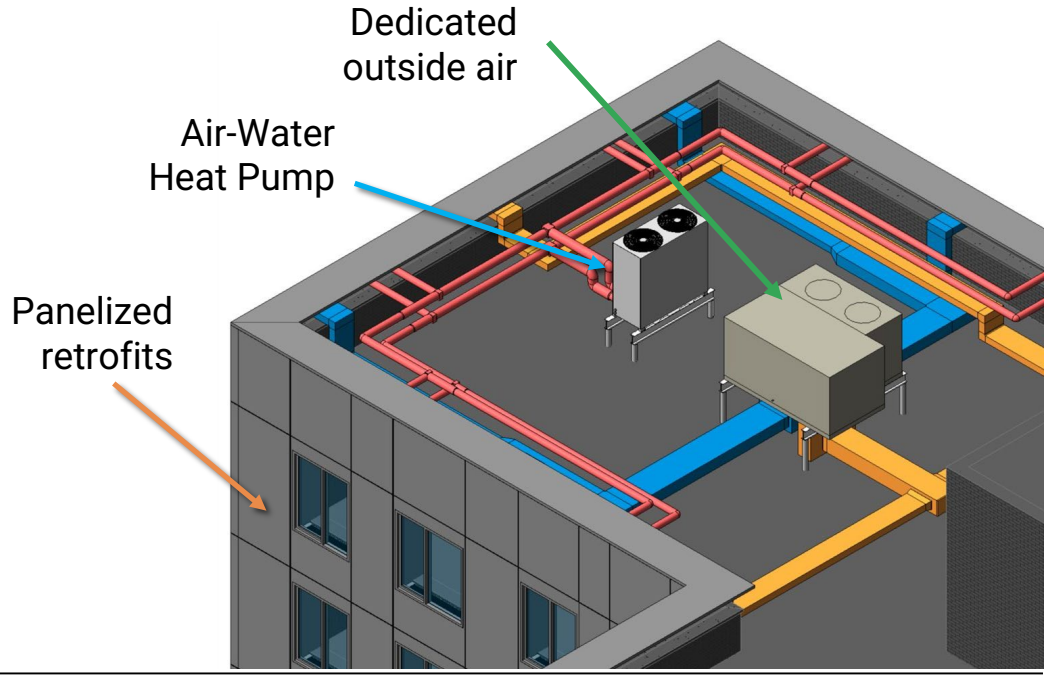
Challenge: Attics are often poorly air sealed/under-insulated.

Solution: How much can we improve the effectiveness of attic air-sealing and insulation retrofits while reducing the time workers need by leveraging “cobotic” technologies and portable AI-enabled assessments?

Increasing weatherization effectiveness in disadvantaged communities

Multifamily Panelized Deep Energy Retrofits





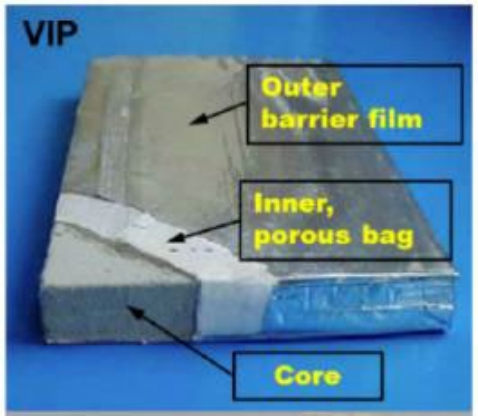
Challenge: Deep energy retrofits without disrupting occupants is labor-intensive and time consuming.

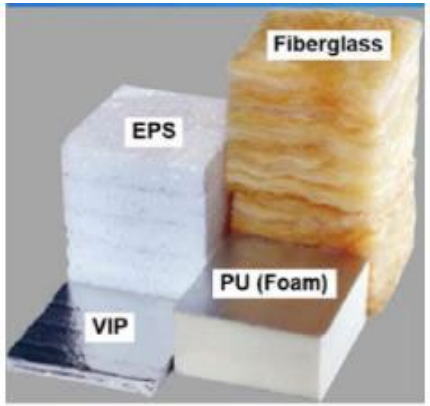
Solution: Integrated panelized retrofits combing triple-glazed windows, R30 wall panels, and hydronic distribution with dedicated ventilation air. Ideally paired with air-to-water heat pumps; all refrigerants are packaged. Heated wall area uses existing masonry as thermal energy storage for peak demand management.

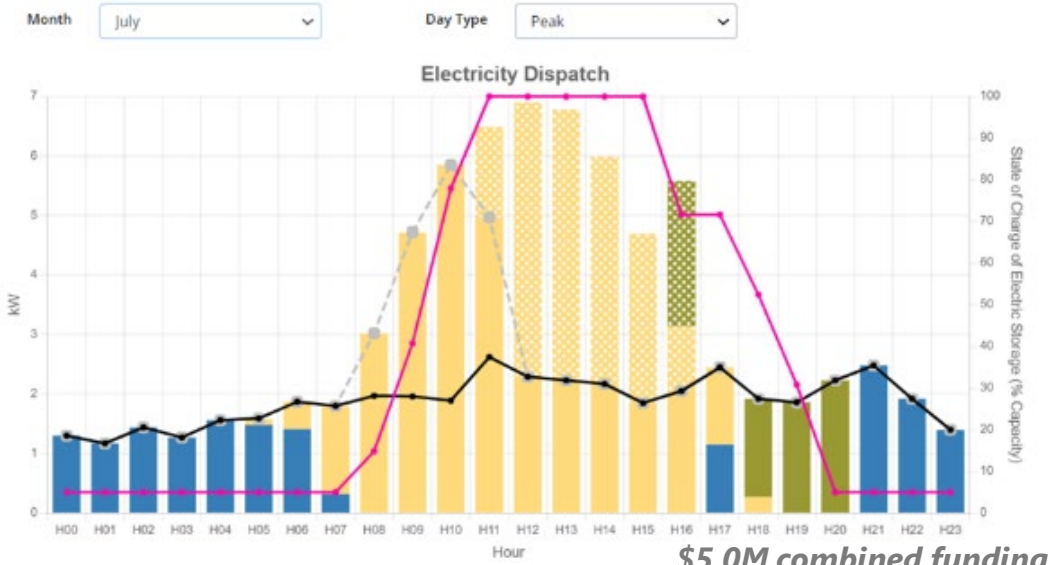
Projected building energy use reduced >60%

CEC Grants on Manufactured Homes

- EPC-19-043: Develop and demonstrate manufactured homes with vacuum insulation-based envelope technologies
- EPC-23-018: All-electric manufactured homes meeting Title 24 code requirements and can achieve Zero Carbon operation







$5.0M combined funding

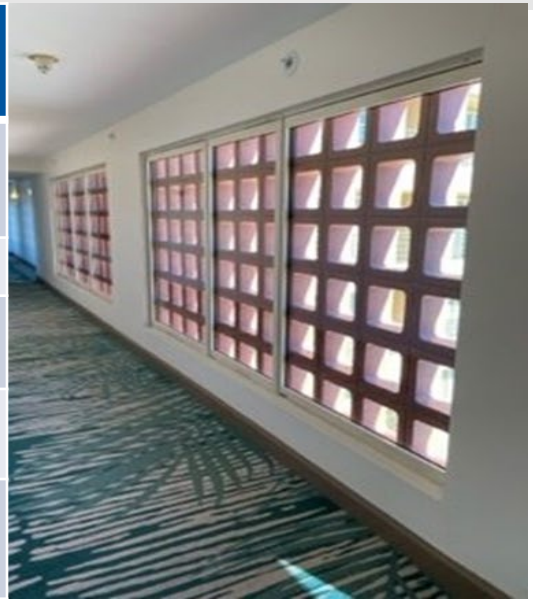
Challenges: Manufactured homes are focused on low-cost state-of-the-art technologies

Solution: Advancing multiple aspects of construction, including automation, reducing labor, incorporating vacuum insulated panels, and exploring zero operational carbon controls will help achieve cost-effectiveness.

Advancing technologies in manufactured / modular homes

Developing Triple-Pane/Vacuum Glass Window Inserts

Performance Metric	Baseline Performance	Target Performance
Retrofit cost / sf	$100 / sf	**$35 / sf**
R-Value	R3	**R7.7-R9**
U-Factor	0.34	**0.11-0.13**
SHGC	0.24	**0.20-0.24**
V_T	0.28	**0.20-0.24**



$1.6M Funding CEC, SoCalGas, NEEA

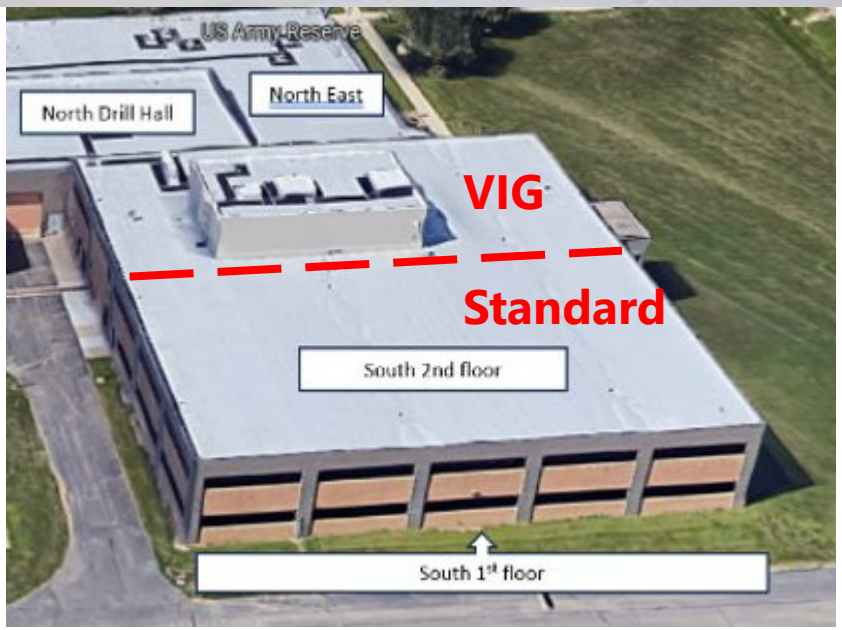
Challenges: Windows for commercial building are not cost-effective energy improvements for replacement; secondary window products maturing, but only offering conventional glazing

Solution: Merging two commercially available products from Alpen, along with novel technologies of vacuum insulated glazing (VIG) and aerogel-based glazing to create an R7 low-cost retrofit.
Demonstration in Palm Springs (CA Climate Zone 11/ ASHRAE CZ4) with 1,500 ft^2 glazing replacement

Advancing technologies in manufactured / modular homes

Case Study: Peoria, IL office building

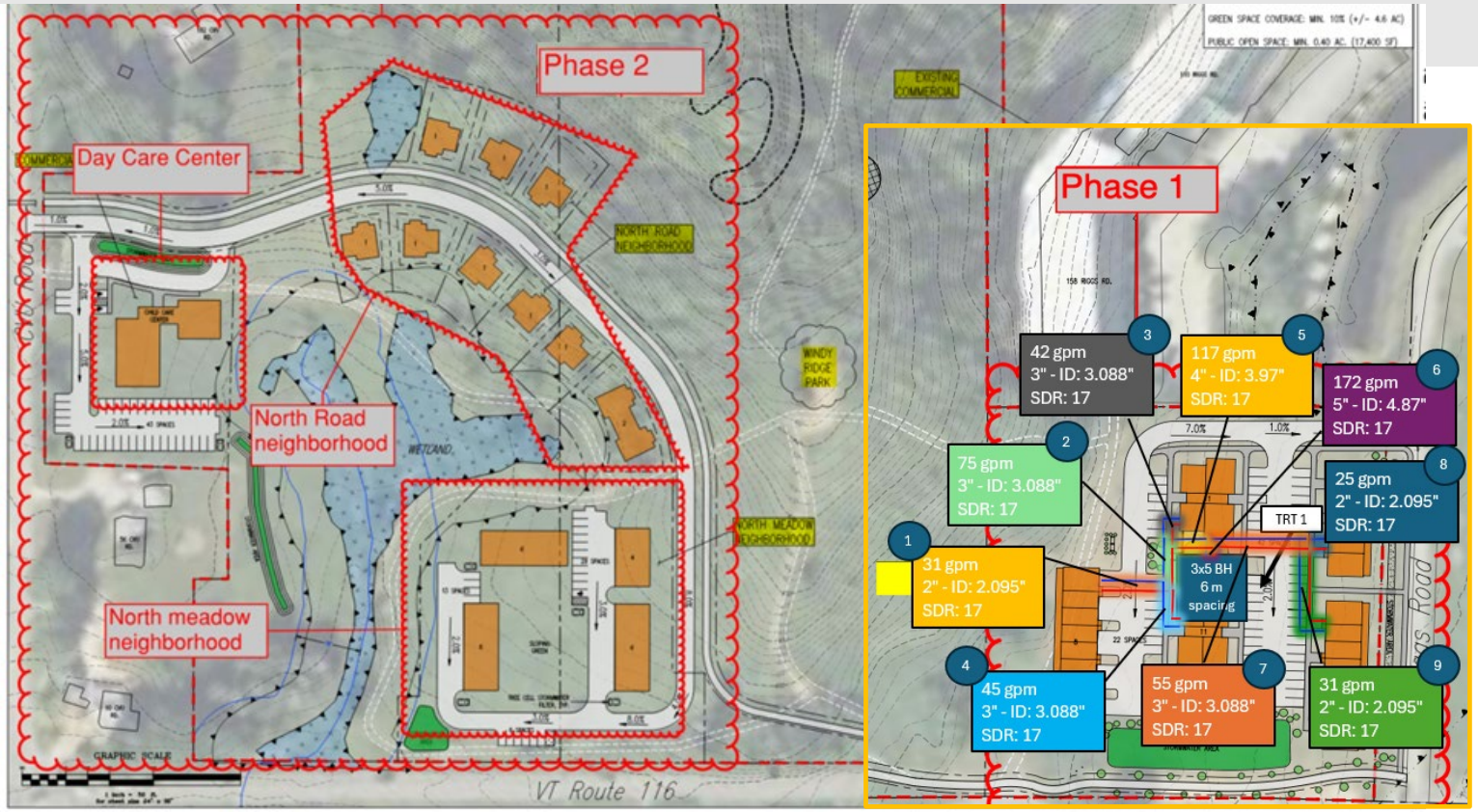
- Retrofit 175 windows on 23,000 ft^2 second floor, served by two **electric VRF** zones (installed 2024)
- Installed on existing double-paned, commercial aluminum framed insulated glass units in Q1 2024
  - 110 **Standard** double-pane units (Alpen) (**R3** secondary windows)
  - 65 vacuum insulated glass (**VIG**) units (Inovues) (**R10** secondary windows) Evaluate both internally and externally mounted
- HVAC system energy consumption will be monitored pre/post for heating savings per zone
- Sound and comfort measured as well (site is adjacent to Peoria airport)



Coalition For Community-Supported Affordable Geothermal Energy Systems (C2SAGES)

GTI ENERGY

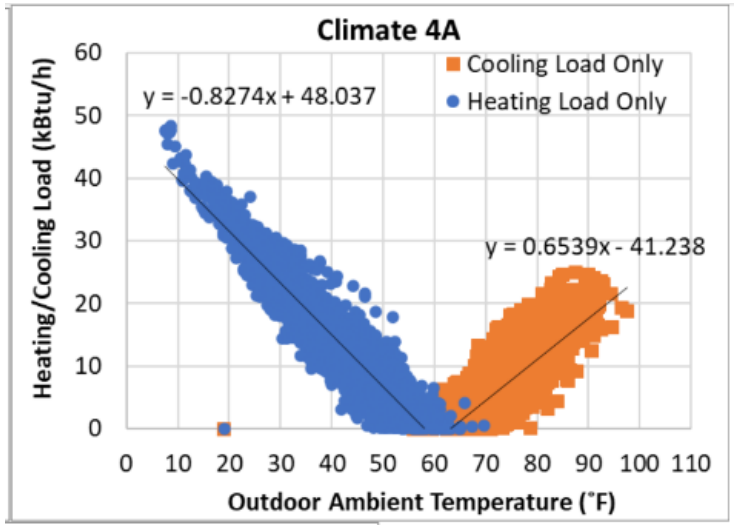
FY22 Geothermal Technology Office FOA



- Phase 1 Community Geothermal Feasibility Study for a new affordable housing development in Hinesburg, VT
- Engineering design, technical feasibility and M&V planning for potential future deployment
- Community inputs on geothermal design, workforce needs, benefits and barriers, financing options, etc.
- Preliminary financial modeling with multiple ownership scenarios: Single vs. split ownership of geothermal loop and interior equipment between utility and developer/owner (while also considering IRA tax rebate implications)

Daikin Altherma Lab Validation

Load-based testing



Challenge: What are the benefits of electric air-to-water heat pump (A2WHP) as an emerging technology?

Solution: Evaluate Daikin Altherma 3 monobloc and high-temperature units are being evaluated in steady-state operations to develop performance curves for space heating, cooling and water heating. GTI will then validate COP, savings and emissions for Sacramento, New York, and Boston using load-based testing.

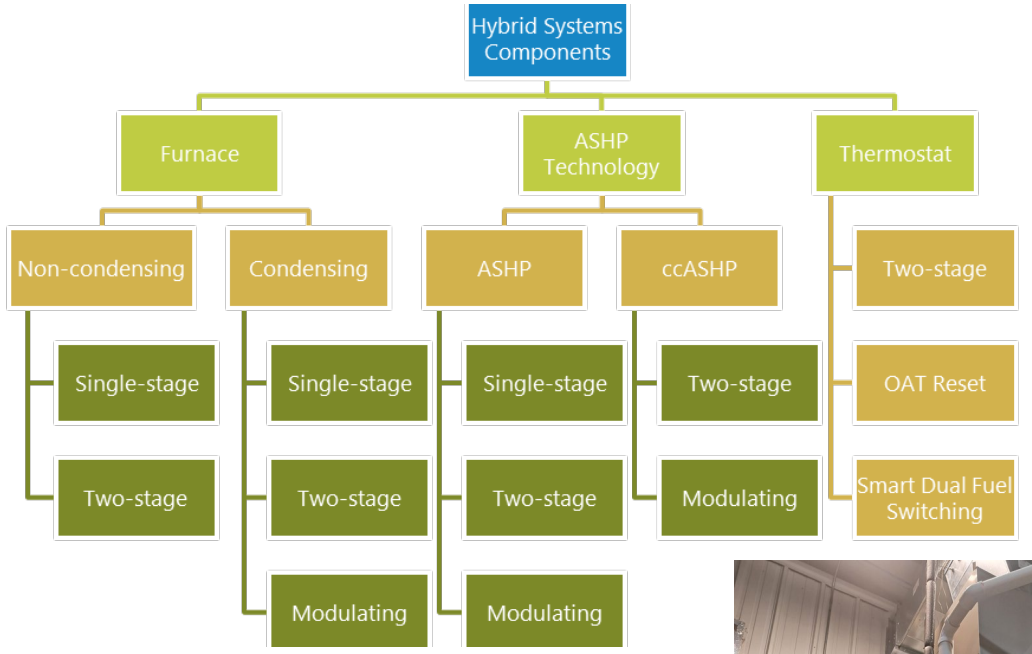
Validating energy savings across climates in simulated use conditions

Residential Hybrid Techno-Market Assessment: Modeling Method and Systems

GTI ENERGY

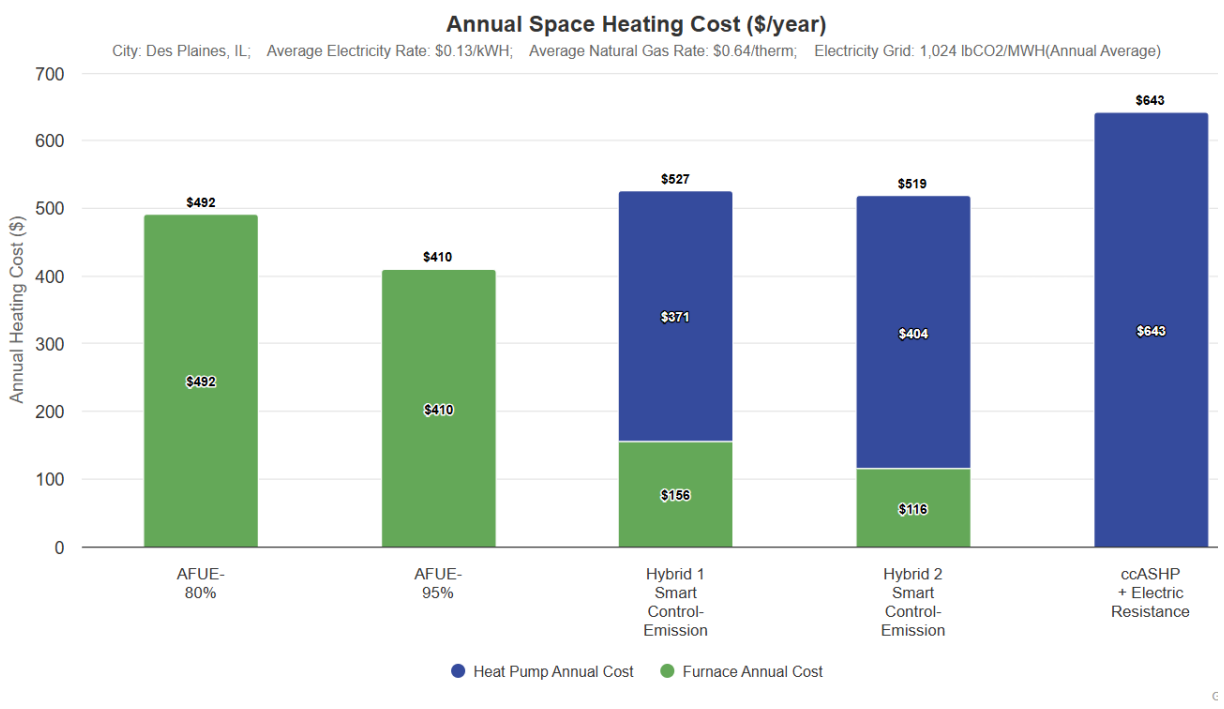
Hybrid (Dual-Fuel) Model

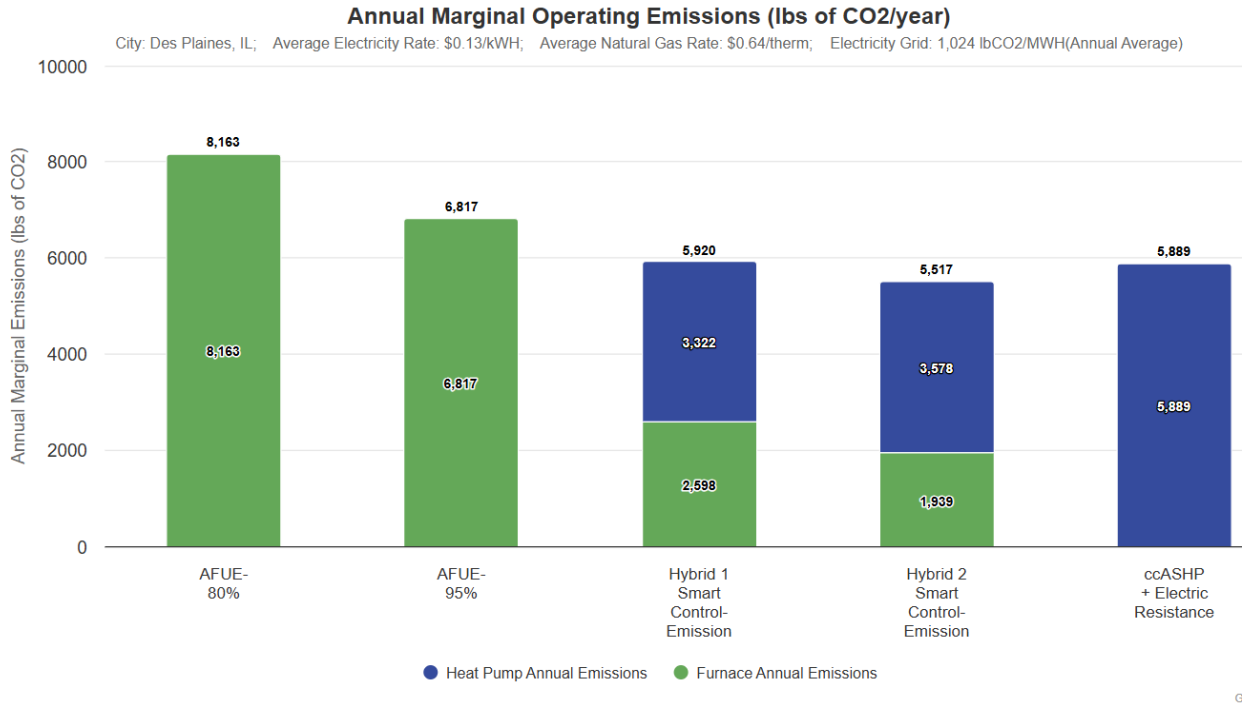
- The model is made up of four sub-core programs:
  - *Building (New and Existing) and Thermostat (Control Strategy)*
  - *Appliances Performance*
  - *Utility Rates and Emission Data*
    - *Natural Gas: Gas utility*
    - *Electric Rates: OpenEI.org*
    - *Emission: WattTime*
  - *Core Decision Logic*



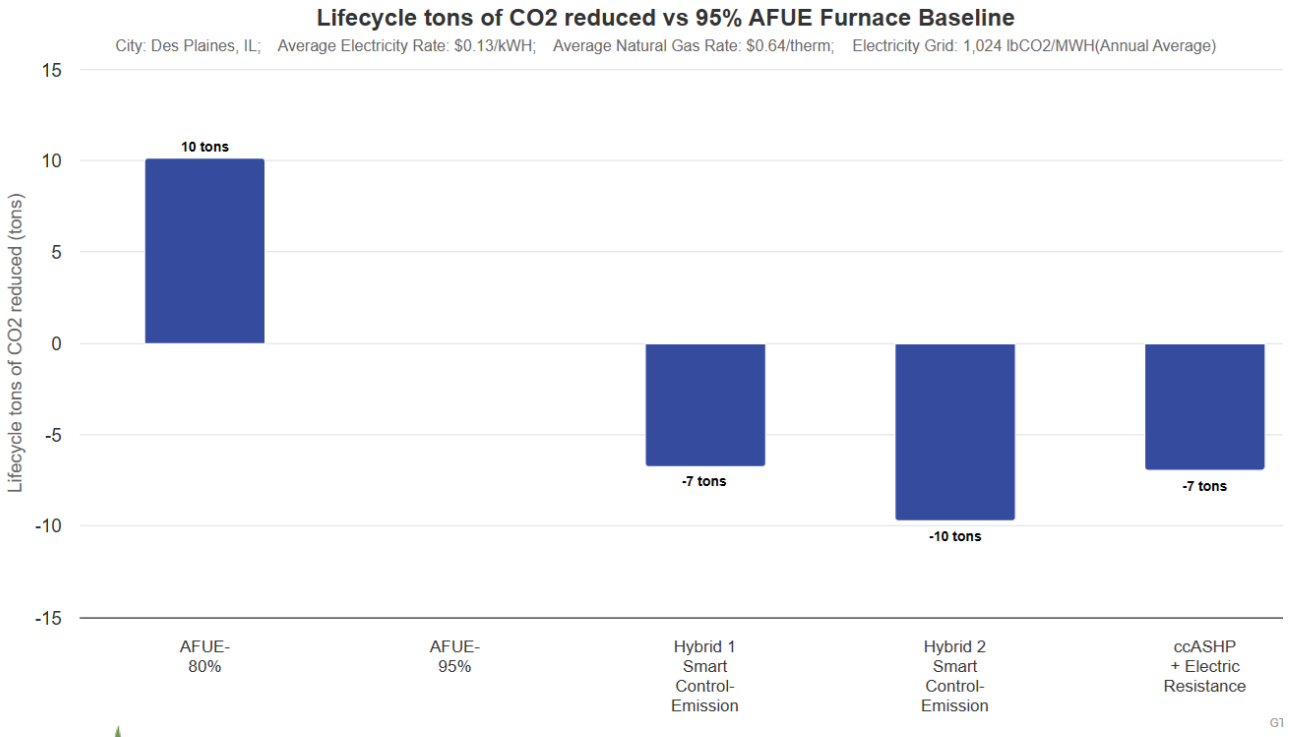
- Actual Meteorological Year (AMY) data for 2022 was used
- Marginal Operating Emissions data for respective electric grids were used from WattTime for 2022 (5-minute interval real-time marginal grid emissions)
- Utility Rates sourced from EIA, utility input or rate tariff plans from utility website
- Equipment Costs are sourced from EIA

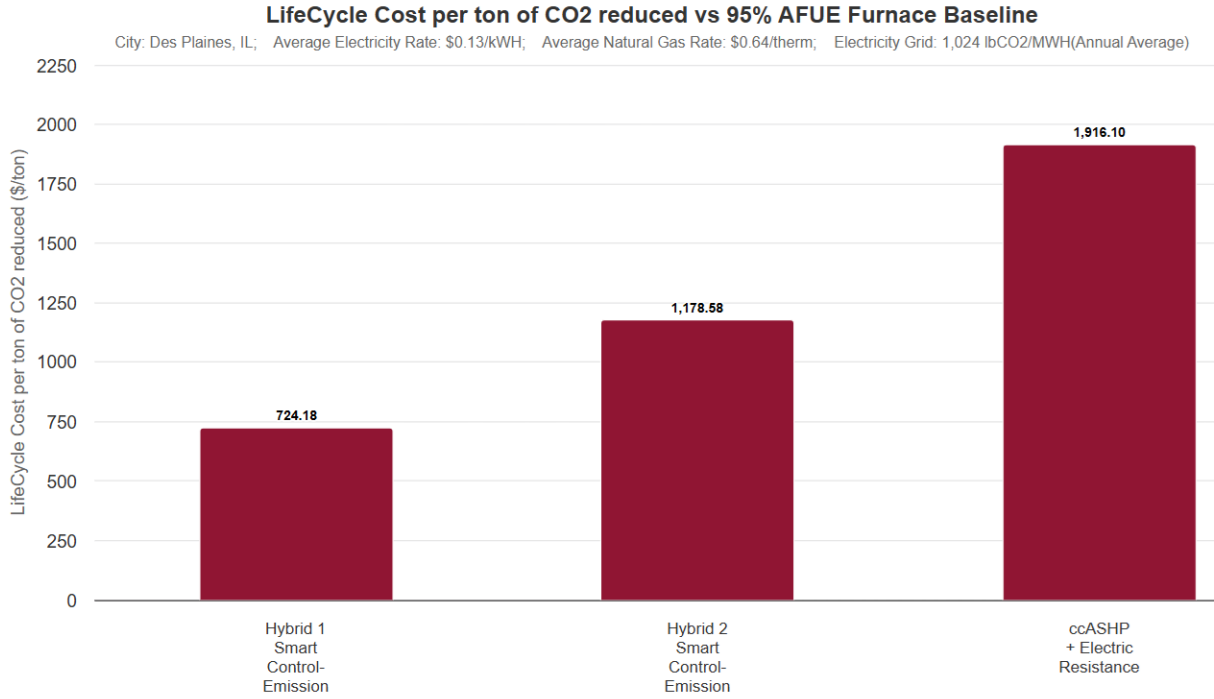
Residential Hybrid Techno-Market Assessment: Chicagoland Results





Residential Hybrid Techno-Market Assessment: Chicagoland Results





Dual-Fuel Decision-making - Web Interactive Tool in development

GTI ENERGY

GTI ENERGY
EMERGING TECHNOLOGY PROGRAM (ETP)

Hybrid (Dual-Fuel) Calculator: Sizing and Optimization Tool

Inputs

Cities
Washington DC

Home Vintage
2006 IECC

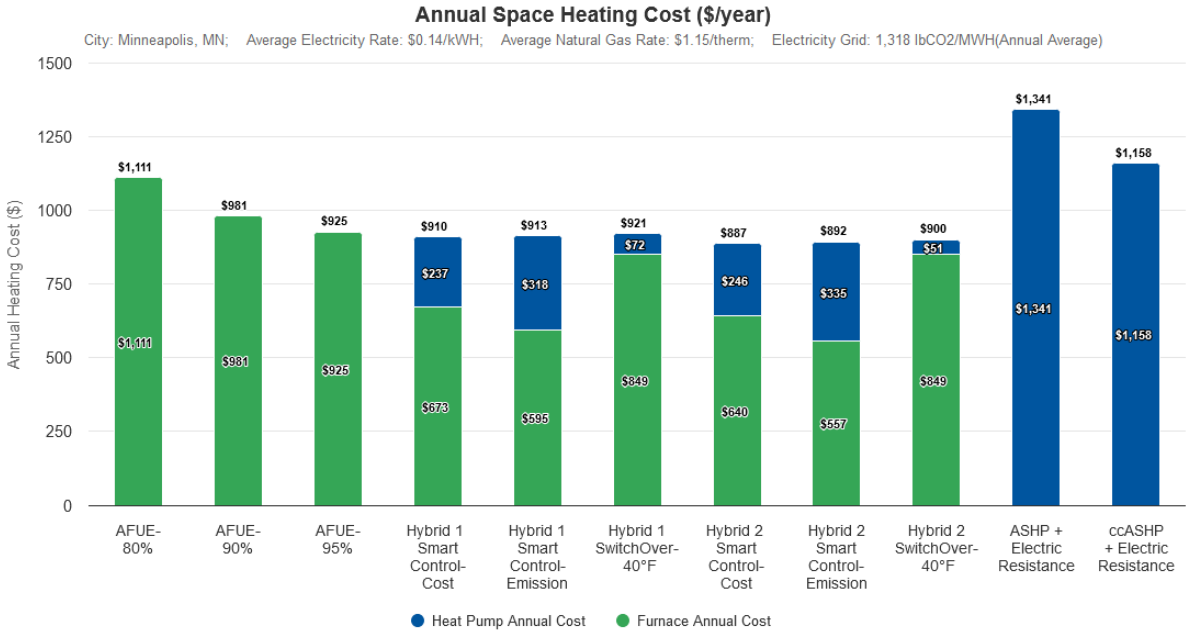
Hybrid Model
Furnace Baseline 80%

Equipment Models
80% AFUE Furnace, 90% AFUE Furnace, 95% AFUE Furnace, ASHP, ccASHP, Hybrid 3 (Furnace + ASHP), Hybrid 4 (Furnace + ccASHP)

Hybrid Control Strategy
Hybrid Cost Optimization, Hybrid Emission Optimization, Hybrid Switchover Temperature

Hybrid 2 Switchover Temperature
20°, 30°, 40°

Web-Interactive Tool for Stakeholder decision-making



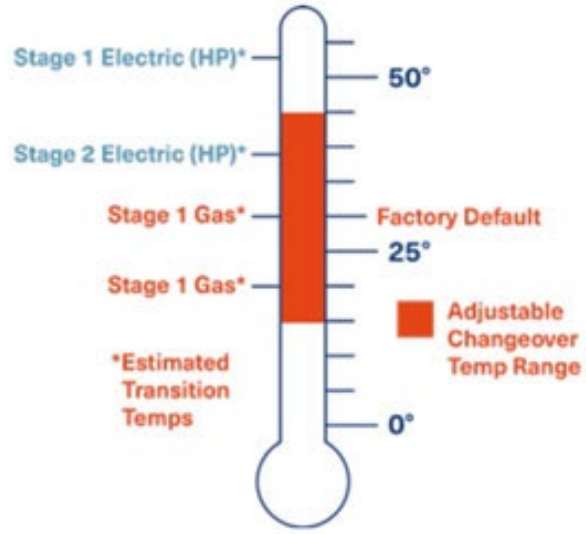
- Estimate the operating cost, emission reduction, lifecycle costs to reduce carbon based on control selection
- Provide sizing information for the heat pump
- Provide optimized outdoor ambient temperature for switch-over control

Res Hybrid Modeling Phase 2 in 2025 – Upcoming (Lab and Modeling)

- Add more features to web tool and analysis
  - Forward looking utility rates and GHG emissions for electric/gas grid
  - Customization and user-input rates/emission factors
  - Additional home sizes/vintages
- Peak Electric Demand Reduction
  - Winter peak day analysis
  - Avoided cost on electric grid infrastructure
- Performance characterizations of additional high-efficiency cold-climate heat pumps into the model, including several integrated hybrid system
  - Combi system-based hybrid heating systems (like iFLOW)
  - Additional ASHP and ccASHP options (currently 9 HSPF and 10.5 HSPF respectively)

Defining Drop-in Dual Fuel / Hybrid RTUs

- Nearly 1,000,000 RTU systems are installed in the Northeast and Mid-Atlantic region, most with lower efficiency.[1]
- Dual-fuel RTUs use heat pumps at low ambient temp
  - Inverter scroll compressor operation down to 0^0F
  - Part load rating up to 20+ IEER
- Providing backup heat flexibility
  - Gas furnace for supplement heat instead of electric heat strips
  - **Crossover point** can be adjustable
- Use existing gas / electrical service (**drop-in**)
- Shifting to low-GWP refrigerants (R-32, R-454b)



The changeover temperature from heat pump to natural gas can be adjusted to occur between 45°F and 15°F depending on your goals for balancing comfort, payback and emissions reduction.

Glossary of Terms used by OEMs / industry:

Switchover point
Crossover point
Balance point
Lockout temperature

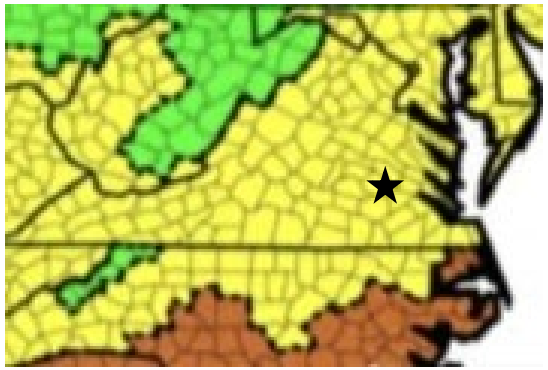
(Pretty much all used interchangeably)

[1] Northeast and Mid-Atlantic High Performance Rooftop Unit Market Transformation Strategy Report (NEEP 2016)

Dual-Fuel RTUs – Active Demos

- GTI Energy is actively evaluating **10+ dual-fuel RTU's** across a range of representative climate zones
  - 5 dual-fuel RTU's in IL CZ 4C and CZ 5C (IL National Guard)
    - Cost-optimized crossover point
  - 3 dual-fuel RTU in IL CZ 5 (Naval Station Great Lakes)
    - Different sizing approaches
  - 4 dual-fuel RTU's in VA CZ 4C (Army Fort Gregg-Addams)
    - Adding advanced, dynamic controls (cost, emissions)

They look like normal RTUs (a bit bigger)



When do we switch from heat pump to gas?

- When the equipment capacity drops off?
- When the outdoor temp gets too low to avoid heat pumps running in defrost?
- When GHG emissions are lowest?
- When the fuel costs are lower?
- When avoided peak demand is valued?
- Never?

This could be:

5°F

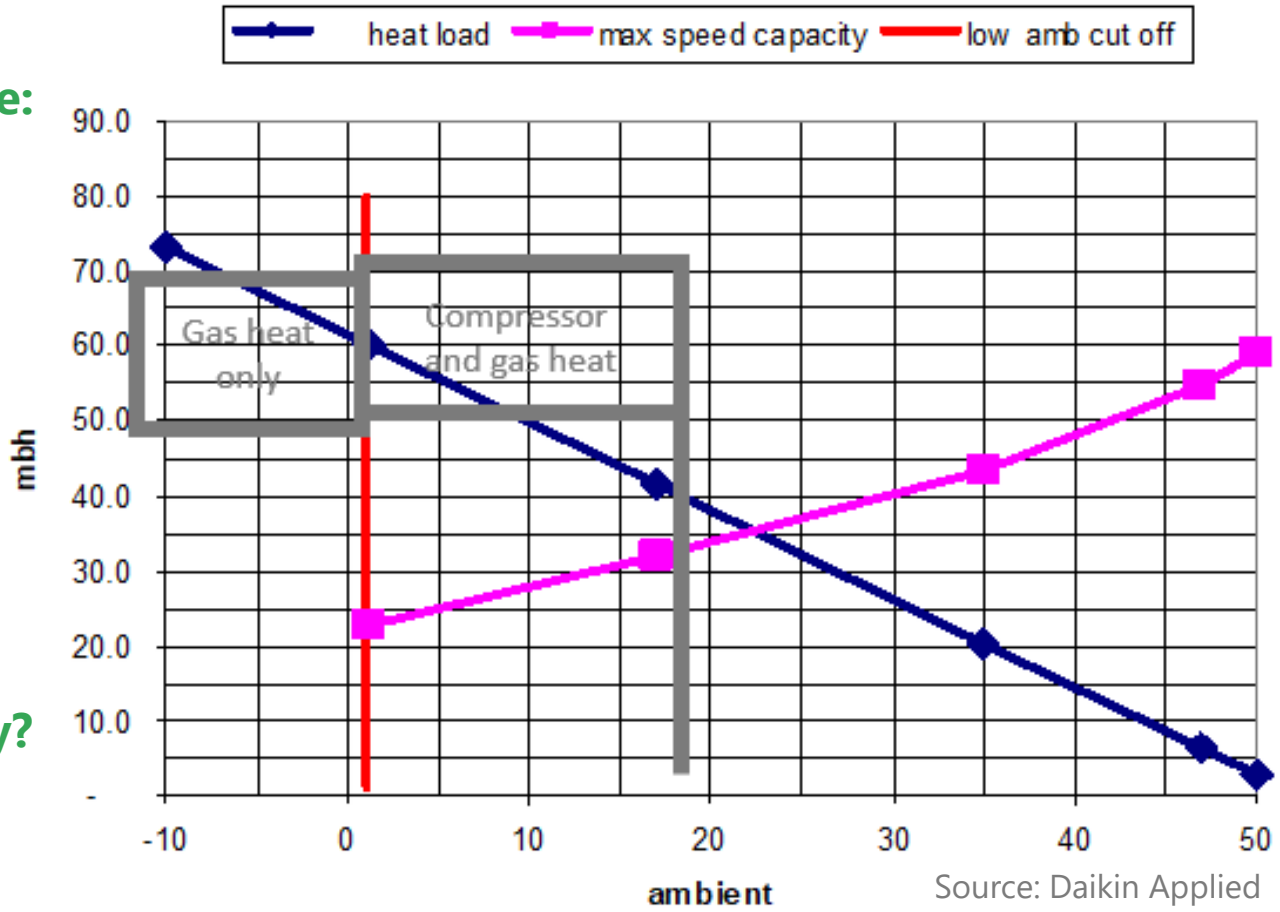
35°F

Static?

45°F

DR?

Just electrify?

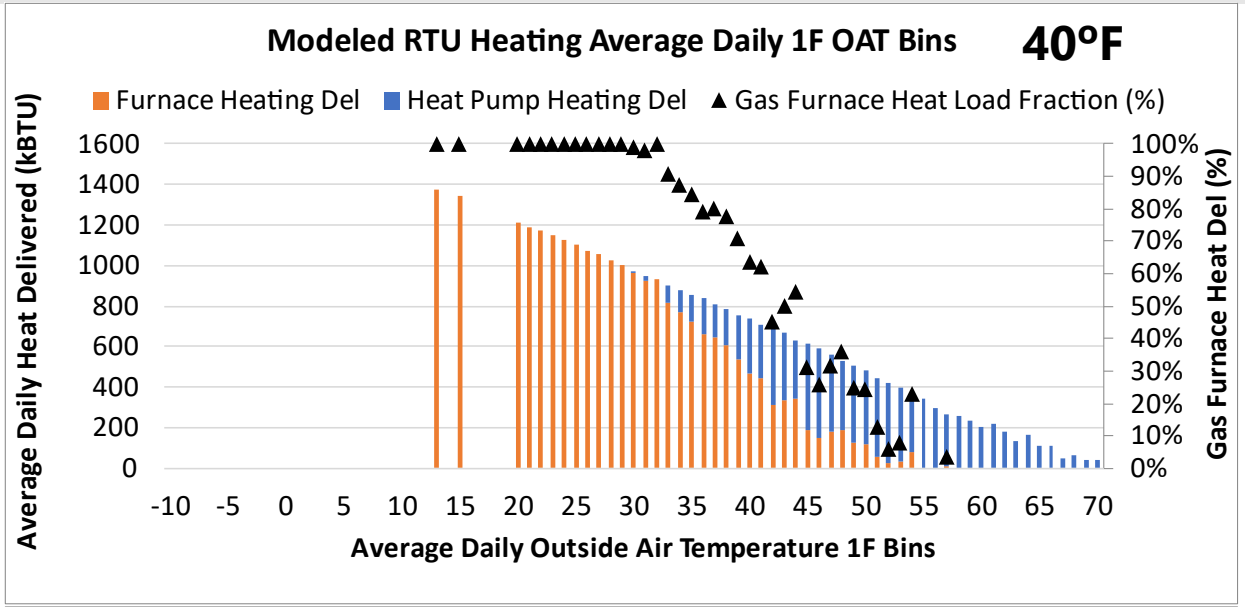


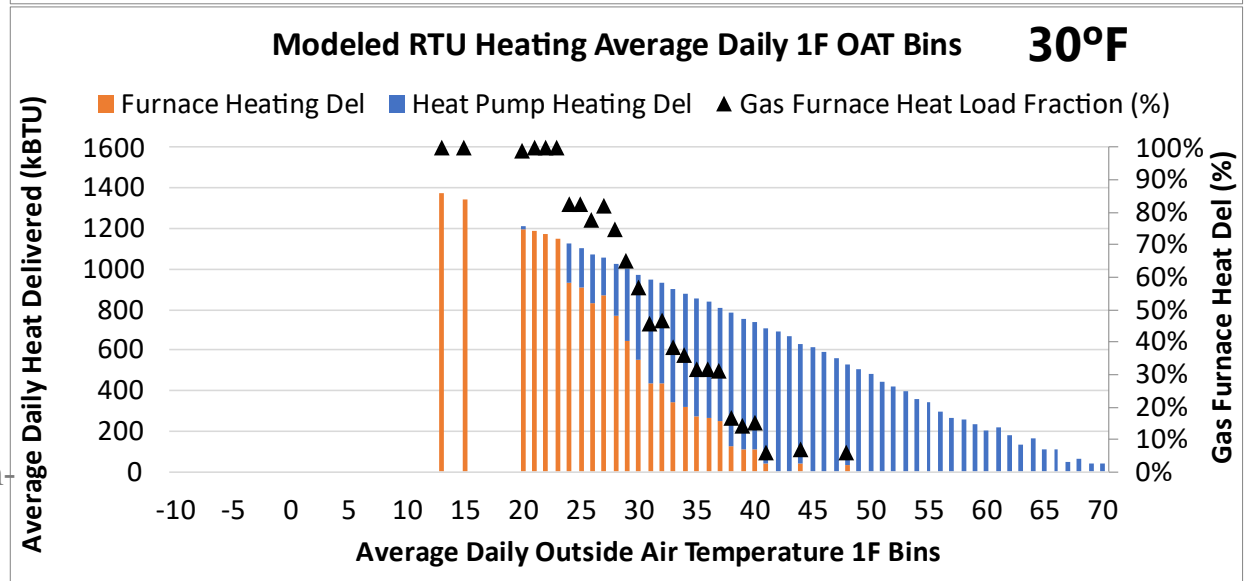
Source: Daikin Applied

Modeled Switchover Point Impacts: 40ºF vs 30ºF

CZ4	Gas Use (therm)	Heat Pump Use (kWh)	Total Cost ($); [Savings]	Total GHG Emissions (1000lb CO_2e); [Savings]
Baseline RTU	1761	0	$1,550	25.6
40°F OAT Switchover	1072	2,619	$1,196 [$354]	20.9 [4.8]
30°F OAT Switchover	493	5,574	$972 [$578]	18.4 [7.3]

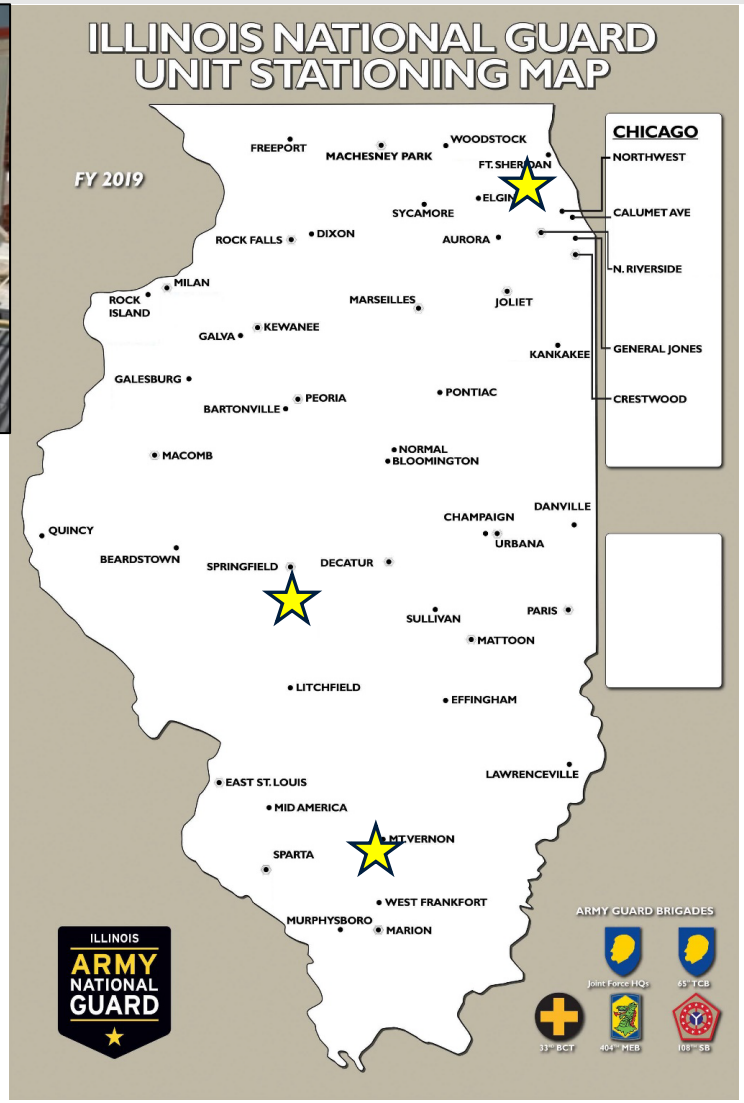
$.88/therm and $.0965/kWh; eGRID 2021 SRMW CO2e emission factor for Non-baseload Electricity of 2,006 lb/MWh and for Natural Gas of 145.68 lb/MMBtu





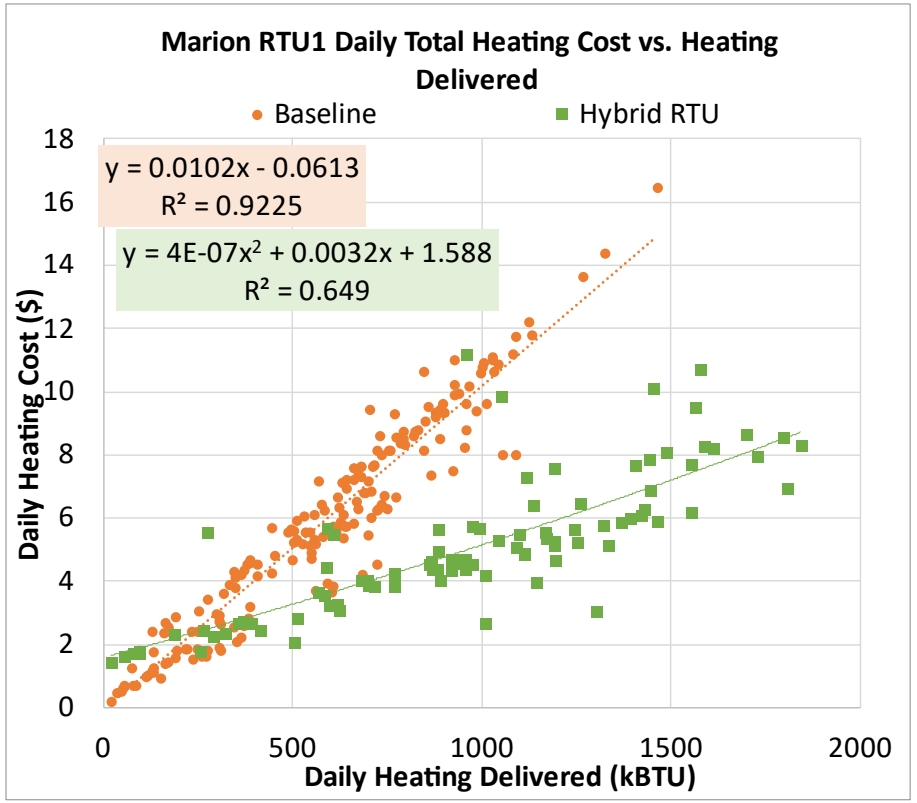
Field Installation Challenges for Dual Fuel RTUs

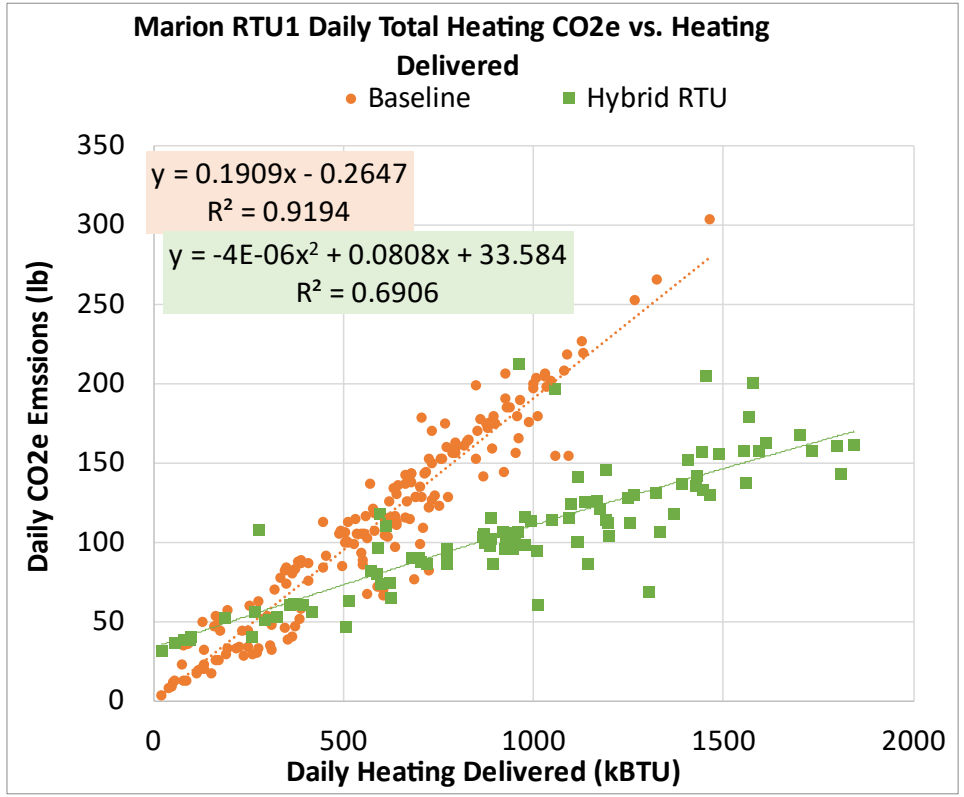
- New equipment physically larger than original equipment (parapet concerns)
- Supply chain issue hangover? Ordered May 2022, installed Oct 2023
- Location of outdoor air temperature sensor critical for proper switchover impact.
  - Shielded from sun?
  - Not placed near other exhaust air?
- Commissioning (and re-commissioning) provided from manufacturer reps



Cost-focused Switchover Results for Dual-Fuel RTU

- Gas load shifted to heat pump at mild temperatures (low HDD), delivering cost and GHG savings





	Total Cost ($)	Heat Del (MMBtu)	Total Savings ($)	Total Savings (%)	Payback:
Baseline RTU1	$1,985	201			
Hybrid RTU1	$721	201	$1,264	63.7%	2.37

Hybrid RTU Retrofits at Naval Station Great Lakes

- High-efficiency dual-fuel heat pump RTUs with gas backup, replacing steam-driven systems:
  - Heat pump sized for <u>cooling load</u>
    Switchover: at low ambient temperatures, longer furnace runtime.
    - **B3212-A South:** CAV fan
    - **B3212-A North:** VAV fan for multi-zone comfort
  - Heat pump sized for <u>heating load</u>
    Switchover: at HP lock out temperature, longer heat pump operation
    - **B3212-C:** CAV fan
  - Timing: Installation before winter 2025-2026

Naval Station Great Lakes

Hybrid Dual Fuel Heat Pumps	
Models	DSK/DHK
Capacities	3-25 Tons
Fuel Type	Electric Heat Pump + Gas
Efficiencies	Standard & High Efficiency
Ambient Temperature Range	-20°F to 125°F
Unit Controller	Symbio® 700 with Service & Installation App
Warranty	3 Year Parts, 5 Year Compressor, 10 Year Heat Exchanger
Humidity Control (HGRH) Option	Yes
Stable Temperature Control (Modulating Gas Heat) Option	10:1 Natural Gas, 6:1 LP
Refrigerant	R-454B

Source: Trane Website //elibrary.tranetechnologies.com/public/commercial-hvac/Literature/Sales/RT-SLB057-EN_09252024.pdf

Developing Smart Fuel-Switching RTU Controls

- Demonstrating four 20-ton Dual Fuel RTUs
- Adapting proprietary controller to adjust OEM Lockout temperature dynamically through cloud-based controller that is monitoring:
  - Equipment performance (capacity)
  - Forecasted time-of-use rates (local utility)
  - Grid emissions (via WattTime)
  - Local weather
  - Potential for demand response events
- Research goal: Evaluate dynamic **GHG** or **pricing** control of dual-fuel RTUs

Questions and Next Steps

- Emerging Technology Program
  - Ryan Kerr- 847-768-0941; rkerr@gti.energy

LARGE SCALE RESIDENTIAL ENERGY MODELING

TECHNOLOGY SNAPSHOT

TS-R45

GTI ENERGY
solutions that transform

OVERVIEW

- **End Use:** Residential
- **Applications:** Retrofits

MARKET OPPORTUNITY

- **Sector:** Existing Residential buildings
- **Customer:** Utilities and/or local governments

COSTS & BENEFITS

- **Energy Savings:** The platform provides energy-saving options for both gas and electric.
- **Non-Energy Benefits:** Reduced barrier to program participation for homeowners, along with enhanced accessibility to all available incentives. For program implementers, reduced administration costs per home.

SUCCESS FACTORS

- **Product and Market Maturity:** The XeroHome product has been deployed in approximately 17 cities as of late 2023. Early products may be available from other manufacturers.
- **Program Readiness:** Certain products are ready for deployment by targeting municipalities.

THE TECHNOLOGY

Whole home energy modeling deployment at a mass regional scale can transform energy efficiency program implementation.

Large-scale whole-building energy modeling is a growing technology area aimed at reducing barriers to participation in energy efficiency programs. XeroHome is one such energy modeling and engagement platform designed to facilitate large-scale deployment of residential building decarbonization. Aimed at addressing barriers to deploying residential energy efficiency technologies, the platform evaluates energy upgrade opportunities and promotes options to residents over a web platform. XeroHome employs a two-pronged approach, providing a dashboard for the city/utility to review upgrade opportunities and potential savings for all homes in a designated region. It also provides a web-based interface for residents to review opportunities to reduce their home's energy use, utility bills, and carbon footprint.

The technology works by leveraging building energy modeling software, public housing data, and Geographic Information System (GIS) technology to perform 3-dimensional modeling and comprehensive evaluations of home energy utilization without relying on performing in-person energy audits or less reliable aerial heat maps. Energy simulations are run on the utility/city dashboard before launching the tool to homeowners, at which point homeowners can opt to submit information by answering survey questions such as recent home upgrades, thermostat settings, or existing HVAC specifications. Homeowners can also opt to provide access to their

Figure 1 – Sample Utility and Customer-Facing Dashboards from XeroHome

Break

Return at 10:00

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Agenda

8:30 am	Welcome and Announcements
9:00 am	GTI Energy
9:45 am	*Break*
10:00 am	RETAC Round Robin
10:30 am	9th Power Plan Update
11:00 am	AHR Expo/ASHRAE Conference Debrief
11:45 am	Wrap-Up

Round Robin

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EE and the Ninth Power Plan: What's New?

Presentation to RETAC

March 13, 2025

Kevin Smit

Northwest **Power** and **Conservation** Council

Introduction

- The Northwest Power and Conservation Council (Council) produces a regional power plan every five years (since 1980) as required by the NW Power Act
  - The Power Plan is essentially an Integrated Resource Plan for the region
  - The primary results is a resource development strategy that ensures an adequate, efficient, and reliable power system
  - A key aspect of the resource strategy is the conservation (EE) target
- Currently, the Council is working on the Ninth Power Plan
- Current planning environment:
  - Significant load growth projected from data centers
  - Continuing load growth expected from state policies that result in electrification
  - Growth in intermittent resources (e.g., solar, wind) which are low cost, but are not available 24/7
  - Also, continued retirements of base-load coal plants
  - Flexibility, storage, demand response have increased importance

What will all this do to the value of EE?

Ninth Power Plan Timeline

Jan-Mar 2025
- Global assumptions
- Scope of new resource and transmission risk scenario
- Natural gas and coal fuels price forecast
- Generating resource reference plants

Apr – Jun 2025
- Demand forecast and trajectories
- Demand side resource supply curves (energy efficiency, demand response, other distributed energy resources)

Jul – Sep 2025
- Market assessments
- Needs assessments
- Scope of hydro flexibility scenario

Oct – Dec 2025
- Scenario modeling
- Other analysis needed to inform potential plan recommendations

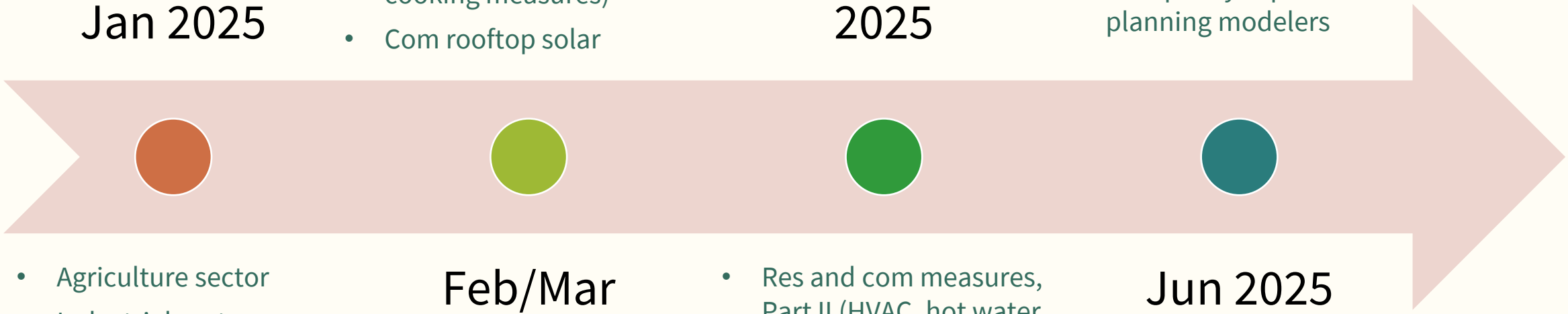
Jan-Mar 2026
- Continue scenario modeling

Apr – Jun 2026
- Developing draft power plan

Jul – Sep 2026
- Release of draft power plan and initiating public comment process

Oct – Dec 2026
- Developing and releasing final power plan

EE Supply Curve Review Timeline



Jan 2025

- Agriculture sector
- Industrial sector
- Non-res motors
- Res rooftop solar

Feb/Mar 2025

- SEM, water/wastewater efficiency
- Res and com measures, Part I (appliances, plug loads, cooking measures)
- Com rooftop solar

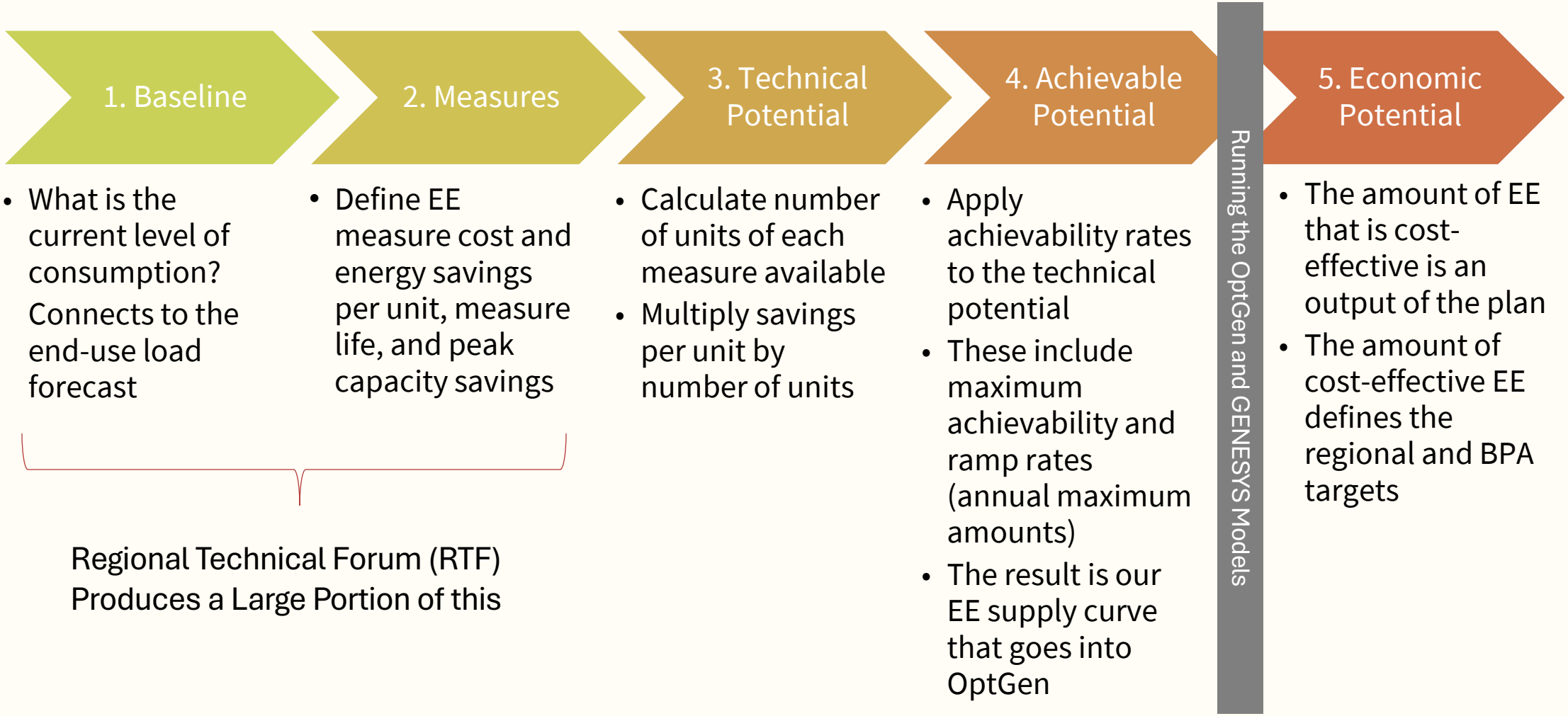
Apr/May 2025

- Res and com measures, Part II (HVAC, hot water, lighting)
- Distribution efficiency
- New and emerging measures

Jun 2025

- Pass EE supply curves to capacity expansion planning modelers

Process Flow – Supply Curve and EE Target

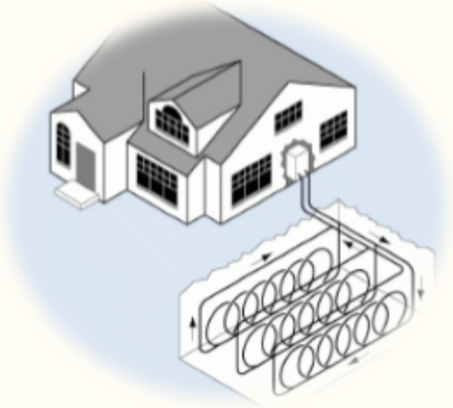


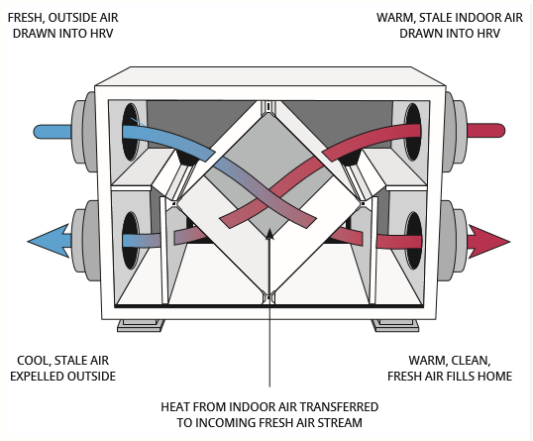
What's New for EE in the Ninth Plan?

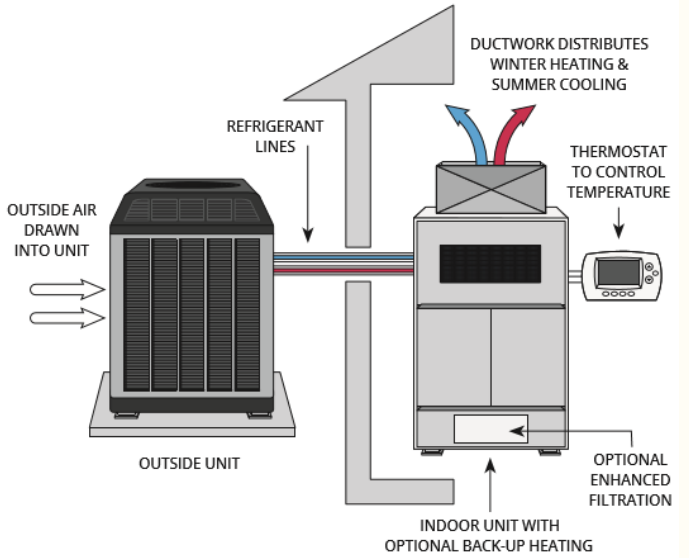
- Commercial and Residential HVAC
- Deep retrofits/whole building
- Building resilience
- Electric Vehicle Research
- Data Centers
- Industrial Heat Pumps
- Misc. Other New Measures

Heat Pumps and other Heating, Ventilation and Cooling (HVAC) Technologies

- Planning to update and expand our heat pump and HVAC measure suite, for both the residential and commercial sectors:
  - Ducted and ductless air source heat pumps
  - Ground source (“geothermal”) heat pumps
  - Smaller packaged and micro-heat pumps
  - Recommissioning of existing, poorly performing heat pumps
  - Heat Recovery Ventilation (HRV) systems
  - Dedicated Outside Air Systems (DOAS)

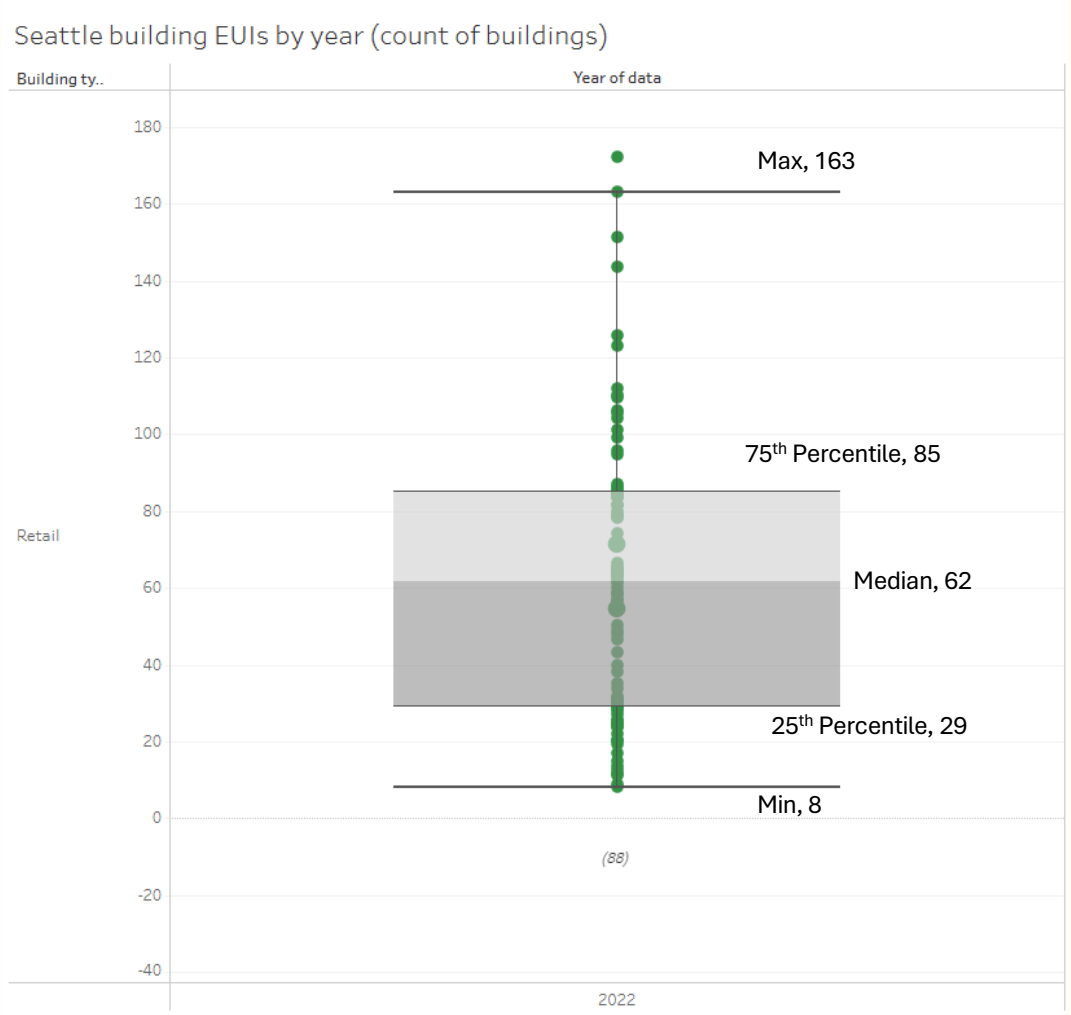






Deep Retrofits/Whole Building

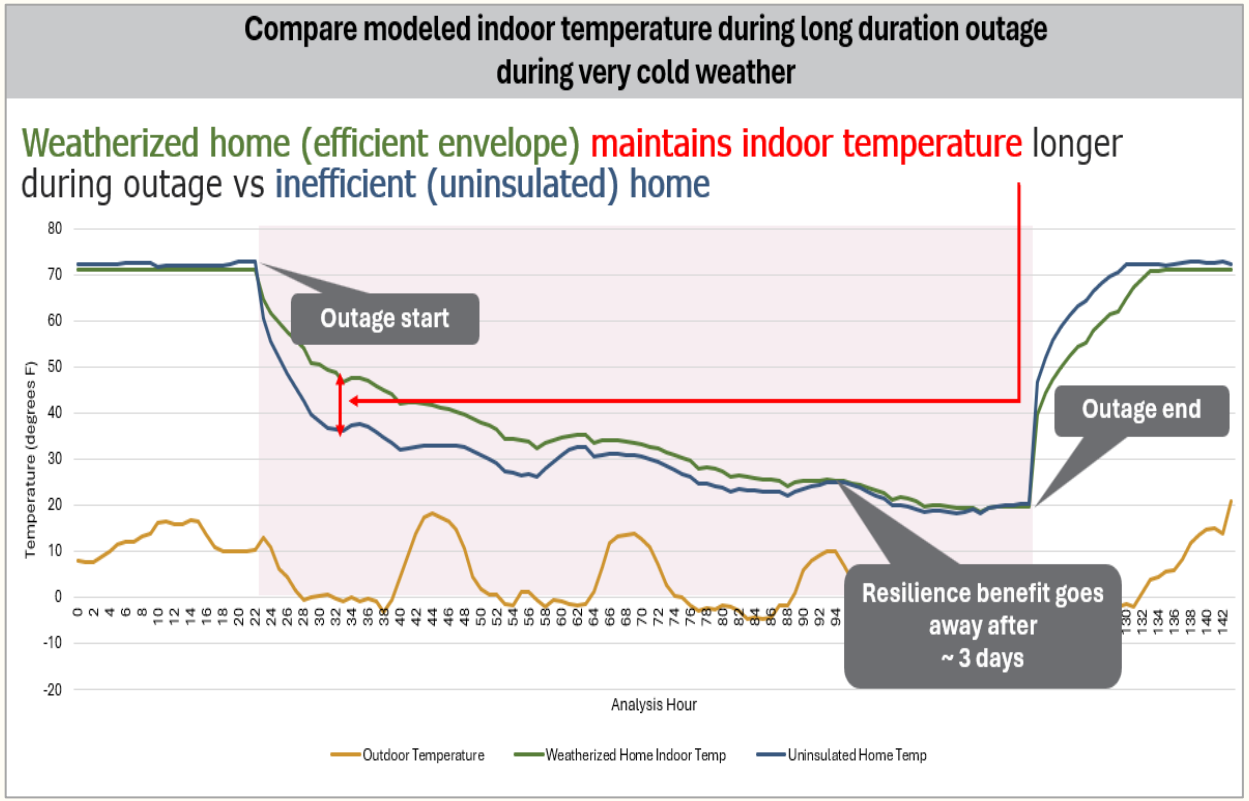
- National and local benchmarking programs have resulted in increased availability of Energy Use Intensity (EUI) data (Btu per SF, or kWh per SF)
- The 2021 Plan recommended the region develop an EUI data set and target buildings with high EUIs
  - Council staff hired a contractor to develop this data set
- WA and OR building performance standards
  - Both state standards set commercial building energy intensity targets that require large commercial buildings to reduce their EUIs over time
- Treatment of NW BPSs in the Ninth Plan
  - We will treat these standards similarly to how we treat EE programs
  - Difficult to quantify the impact and timing
  - Some impacts covered in the load forecast
  - Increases in EE ramp rates in the potential assessment
  - May develop a deep retrofit EE measure

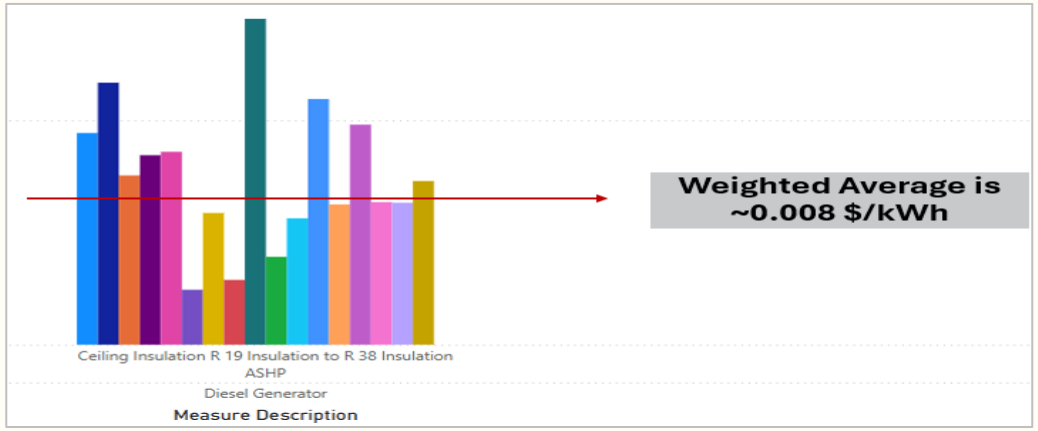


Building Resilience

- The RTF has conducted a study to quantify the benefits of added weatherization to a home's resilience
  - Resilience defined as the home's ability to maintain temperature through a power outage
  - Outage occurs during extreme weather events (hot or cold).
- This work is nearly complete; we are reviewing the results to determine how we use the resilience values in the 9th Plan
- CRAC feedback has been mixed
  - Working to address CRAC comments
  - Will using the resulting values
  - Estimate a 1-5% added benefit to weatherization measures

Link to presentation given to CRAC





Efficient Electric Vehicles

- The RTF contracted Apex Analytics perform a market characterization to assess the potential for defining energy efficiency among passenger class electric vehicles
- Study resulted in a detailed characterization of the market, technology, and assessment of possible EE measure(s)
- The study recommended not pursuing an EE measure at this time and provided suggestions for next steps at the RTF and other interested organizations.

EV Market Characterization Presentation to RTF, February 2024
RTF Follow-up Discussion of Possible Next Steps, December 2024

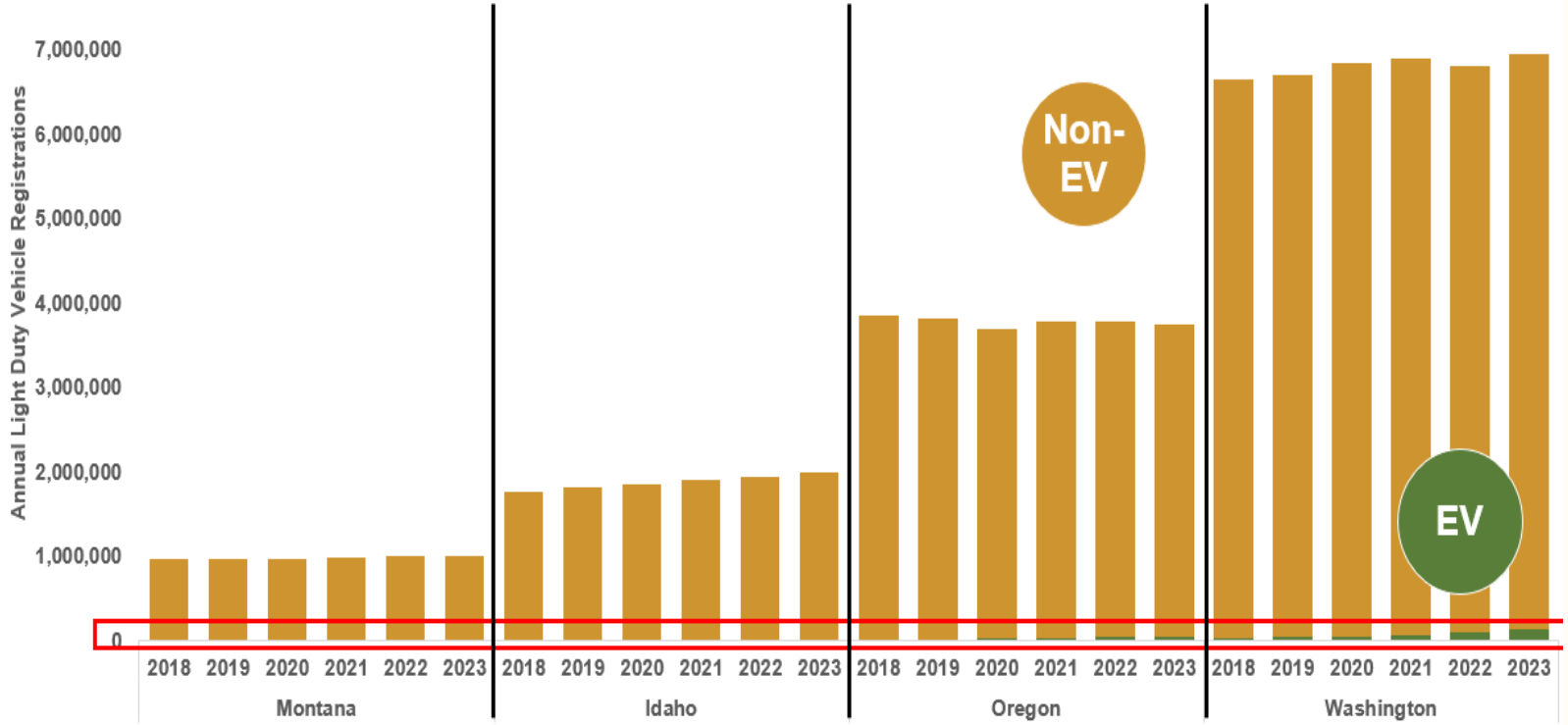
EV Study High Level Findings

- EVs represent a small part of the vehicles on the road in the Pacific Northwest though significant growth is expected in the coming years.
- Potential methods for identifying efficiency is possible but:
  - Significant uncertainty remains, particularly of real world versus testing data
  - Data reporting inconsistency challenges
  - Rapidly evolving market where findings and data appear to quickly be outdated
- RTF is continuing to explore potential for a measure, while simultaneously researching the commercial class market.

EVs a Growing "Blip" on Total PNW Vehicle Registration

APEX ANALYTICS

Note the Y-axis scaled to 7mm vehicles



Source: US DOE Fuel Economy (2018-2022) and State registration data (2023)

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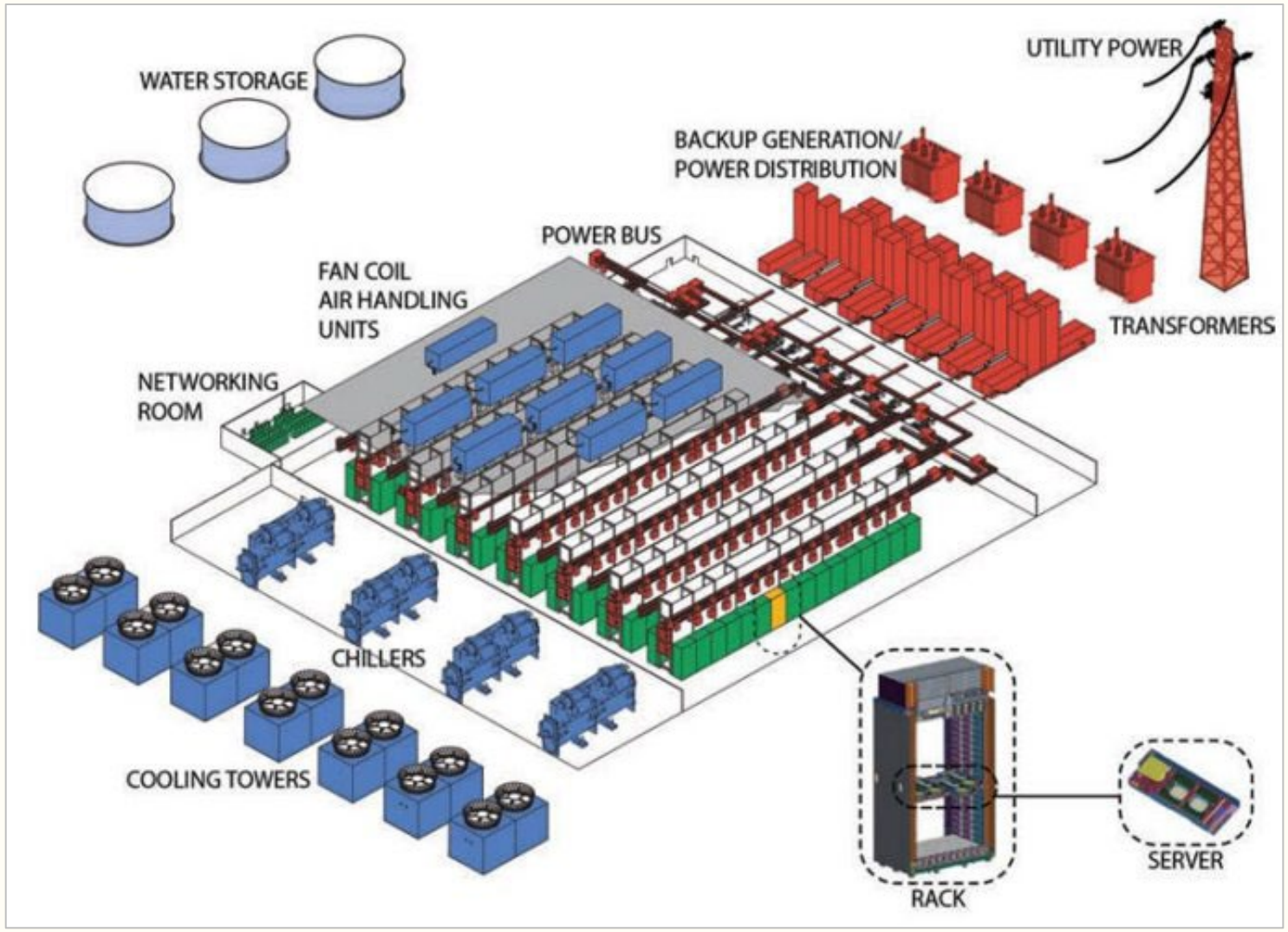
Data Center Efficiency

- The RTF contracted DNV to perform a market characterization of data centers, including detailing energy efficiency opportunities.
- Study resulted in a memo and workbook detailing the market by type of data center and providing details regarding existing energy efficiency practices.



Source: DNV Presentation at January 2025 RTF Meeting

Energy Efficiency in Data Centers

- For most data centers electricity is the largest cost and therefore efficiency is typically prioritized in the design of the facility.
- Most of the identified energy efficiency measures are common practice particularly for the mid-sized, large, and hyperscale data centers.

Summary of Potential Energy Efficiency Measures by Data Center Type and Adoption

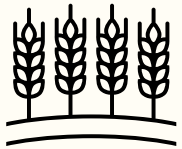
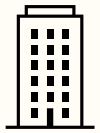
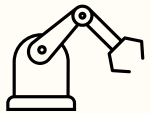
Energy Efficiency Measures	Embedded	Mid-sized	Large	Hyperscale
Information Technology Equipment/Systems (ex. server virtualization)	Moderate adoption	Widely adopted	N/A-Standard practice	N/A-Standard practice
Environmental Conditions (ex. humidity control)	Moderate adoption	Moderate adoption	Moderate adoption	Moderate adoption
Airflow Management (ex. aisle separation)	Moderate adoption	Widely adopted	Widely adopted	Widely adopted
Cooling Systems (ex. variable speed fan control)	Moderate adoption	Widely adopted	Widely adopted	Widely adopted
Central Cooling Plant (ex. evaporative cooling)	N/A	N/A	Moderate adoption	Moderate adoption
Power Distribution (ex. install modular UPS)	N/A	N/A	Widely adopted	Widely adopted

Other Possible New EE Measures

- Industrial heat pumps
- Dehumidification for indoor Ag
- Advanced irrigation management
- Dual fuel RTUs and Heat pumps
  - Electric savings from gas RTUs
  - Residential dual fuel heat pumps
- Induction stoves/cooktops
- A variety of new industrial measures
- New manufactured homes
- Reconductoring and GETs

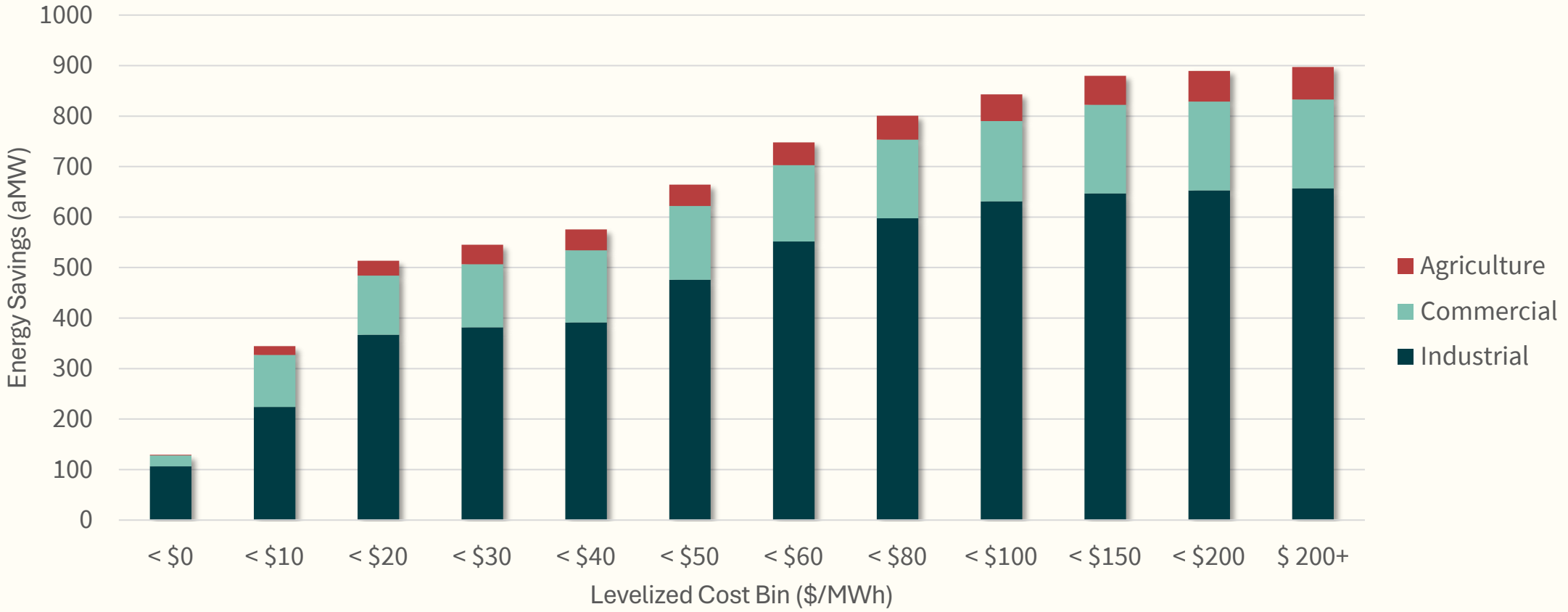
Progress to Date

Draft Ninth Plan EE Measures Already Out for Review

Sector	Measure Category	Measures Included	Date Posted	Date, Feedback Requested By
Agriculture 	Dairy Measures	Efficient milk vacuum pumps, pre-coolers, transfer pumps, heat recovery, and fans	1/27/25	2/21/25
	Irrigation Efficiency Measures	Conversion to low elevation spray applications (LESA), pressure reduction, variable rate irrigation		
	Irrigation Pumps	Efficient pumps, variable speed drives		
	Other Ag Measures	Energy free stock watering tanks, efficient generator block heaters		
Commercial 	Motor Measures	Efficient air compressors, circulator pumps, clean water pumps, fans, and variable speed drives	1/31/25	2/24/25
	Food Service	Efficient ovens, griddles, fryers, hot food holding cabinets, overwrappers, ice makers, and vending machines	2/27/25	3/21/25
Industrial 	Motor Measures	Advanced motors, pumps, air compressors, fans, and variable speed drives	1/31/25	2/24/25
	Industrial Retrofit Measures	Efficient water and wastewater treatment, strategic energy management, industry specific process efficiency	2/10/25	3/7/25

Snapshot: EE Supply Curve to Date

(Includes Only Draft Measures Completed and Out for Review as of 2/27/25)



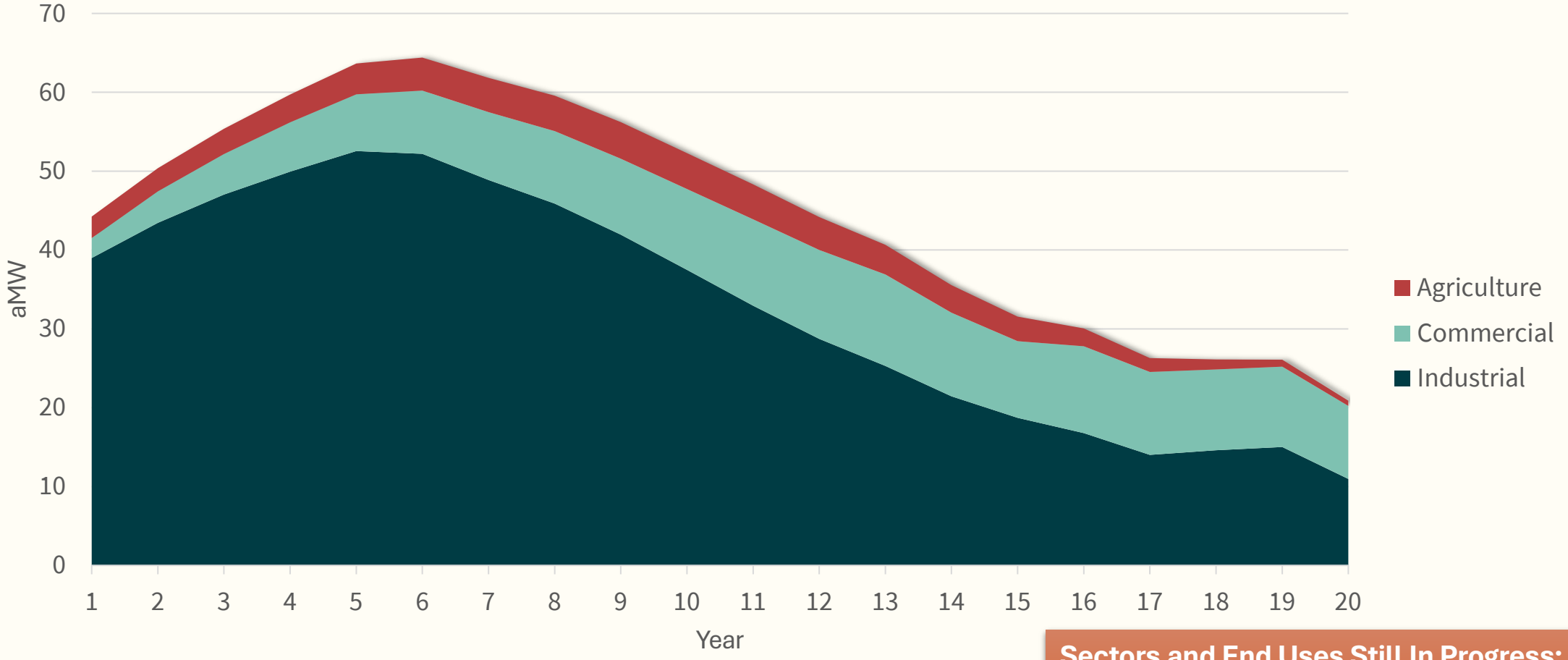
Represents cumulative energy savings over 20-year planning period using draft 9th Plan estimates

Sectors and End Uses Still In Progress:

- All of residential sector (~47% of 2021 Plan)
- Commercial HVAC, water heating, and lighting (~23% of 2021 Plan)

Snapshot: Incremental 20-Yr EE to Date

(Includes Only Draft Measures Completed and Out for Review as of 2/27/25)



Sectors and End Uses Still In Progress:

- All of residential sector (~47% of 2021 Plan)
- Commercial HVAC, water heating, and lighting (~23% of 2021 Plan)

Supply Curve Review, Feedback Process

EE Measure Tracker

The 9th Northwest Regional Power Plan

Draft Conservation Supply Curve Review

Updated: 2/10/2025

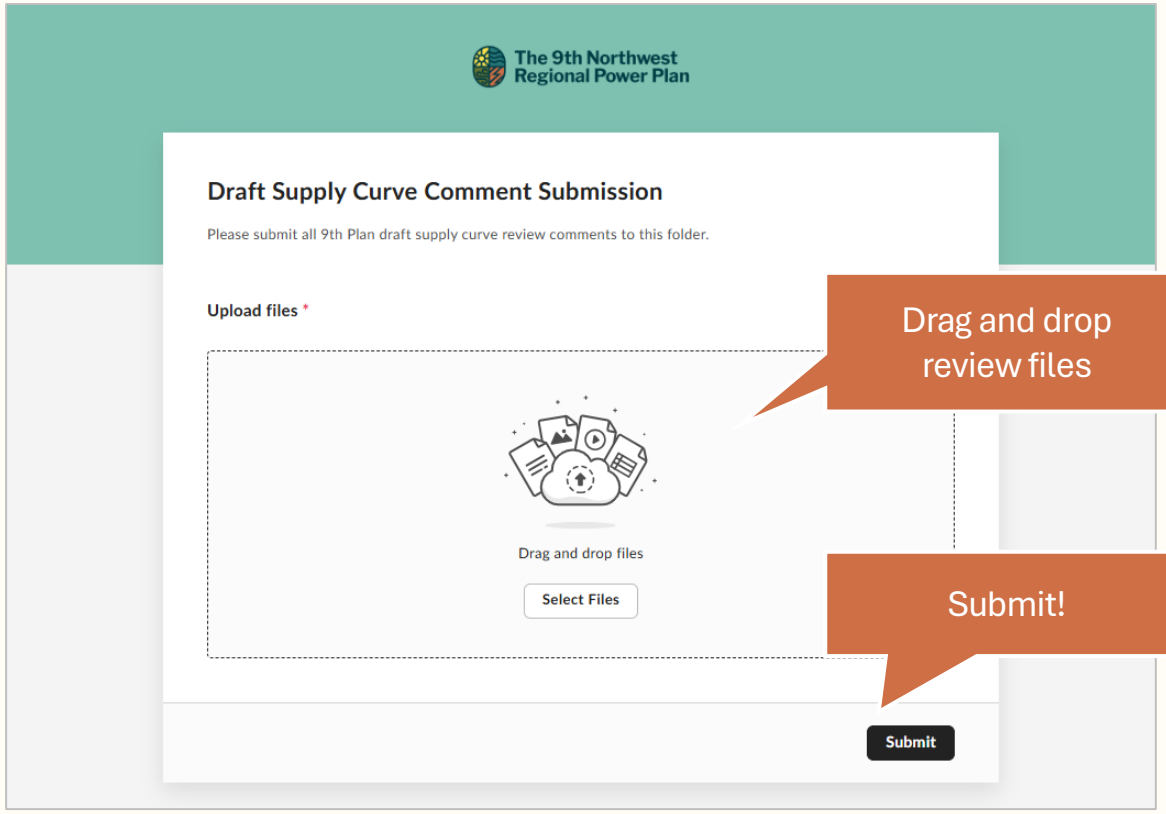
This table provides a summary of draft 9th Power Plan conservation supply curve measures that are ready for review. The table provides links to the appropriate measure and sector potential analysis workbooks, as well as important dates and notes for your review.

Workbooks will be posted on a rolling basis. To provide comments on the draft 9th Plan conservation curve work products, please use this feedback form[1] and upload the form to the online folder here[2]. Reviewers are encouraged to upload feedback forms as they complete each batch of measures.

For more information on the measures in the table below, please see recent presentations on the Council's Conservation Resources Advisory Committee (CRAC) webpage[3].

Sector	Measure Name	Link to Measure Workbook(s)	Link to Sector Potential Workbook	Date, Posted	Date, Review By	Notes for Reviewers
Ag	Forced Circulation Generator Block Heaters	Ag-CircBlockHtr-9P.xlsm	Ag-Potential-9P.xlsb	1/27/25	2/21/25	Same methodology as 2021 Plan. Significant reduction in savings (~>50%), due to updated weather input data and updated generator sizing more appropriate for the ag sector. Note: Ag sector forecasted growth still consistent with 2021 Plan, and has not yet been updated.
Ag	Dairy Measures	Ag-Dairy-9P.xlsx		1/27/25	2/21/25	Same methodology as 2021 Plan, with updated inputs and assumptions. Minimal change in ventilation savings. ~20% reduction in refrigeration savings due to

Comment Submission Portal



Questions for you:

- What are we missing?
- What new and emerging measures should we consider?
- What is the next big EE innovation that will show up in the next 10-20 years?

AHR Expo/ ASHRAE Conference Debrief

Dana Bradshaw, Sr. Product Manager - Residential Heat Pump Water Heater Manufacturers

Manufacturer Meetings:

- American Standard/Ariston
- A.O. Smith, launching a split system later this year
- Bradford White, new configuration
- Essency
- GE, re-entering the market
- LG
- Lochinvar
- Midea
- Navien, entering the market in April
- Noritz
- Outes
- Rinnai
- Stiebel Eltron
- Vaughn

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Chris Wolgamott, Sr. Product Manager - Efficient RTU's & HP HVAC

Manufacturer meetings

- Daikin
- Lennox
- Rheem
- LG
- Midea
- York
- RenewAire
- Ventacity
- Greenheck
- Oxygen8
- Swegon

- **VHE Doas & eRTU Presentation**
- **ASHRAE committees**
  - 90.1
  - TC5.5 DOAS/HRV
  - TC8.10
  - TC8.11
  - TC7.4
  - TC9.1

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Christopher Dymond, Sr. Product Manager - Residential HVAC

Manufacturer meetings:

- Carrier
- Midea
- LG
- Mitsubishi
- Trane
- Daikin
- Lennox
- Samsung HVAC
- Gree
- Emerson Copeland
- Fujitsu
- Bosch / JCI
- Panasonic
- GE / Haier
- Rheem / Friedrich

Key findings:

AHRI Database, Controls Verification, Connected Commissioning, TriMode Heat Pumps, Load Flexibility

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AHPC Delegation:

- MN CEE
- Evergreen
- CEE
- NEEA
- NEEP
- NRCan
- SCE
- TRC
- NYSERDA

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Noe Contreras, Sr. Product Manager – Dual-Fuel HVAC and Commercial Water Heating

- **ASHRAE** (American Society of Heating, Refrigerating and Air-Conditioning Engineers)
  - Low and Ultra-Low GWP Refrigerants (CO2 and R290)
  - Powering a resilient future with Microgrids
  - Standards for air-to-air and air-to-water open to dual-fuel solutions
- **AHR** (Air-Conditioning, Heating, and Refrigeration)

- HVAC

  - Hisense, Napoleon, Stiebel-electron-usa (A2W CC), Navien (hydro-furnace)

- Commercial Water Heating

  - ANESI, Robur, Colemac, LAARS, Transom, Vesta, Thermo Solutions, RBI, Armstrong Int

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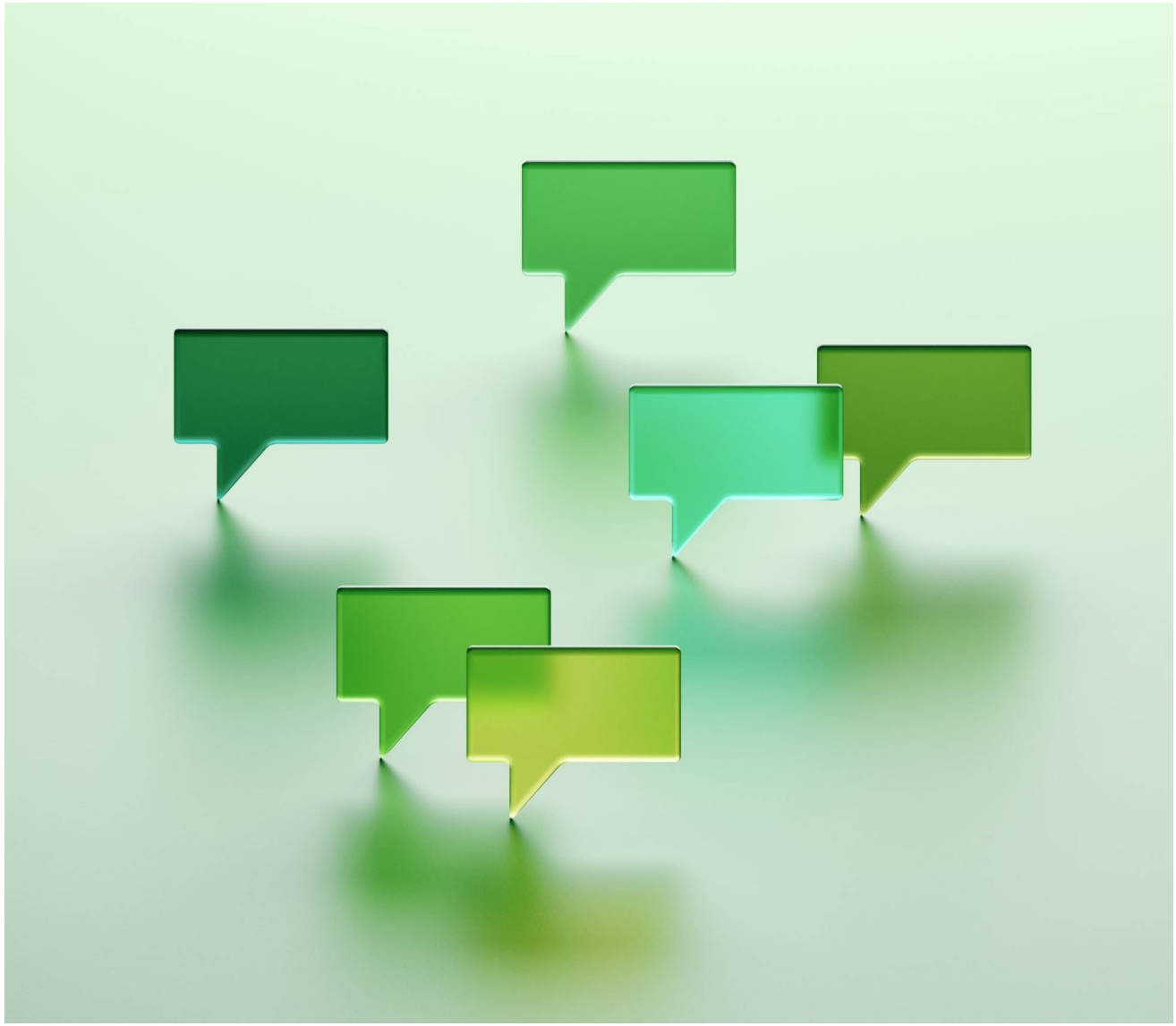
Closing

Open Discussion & Comments



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Thank You!