



NY - GEO 2026
March 24-25, 2026 | Brooklyn, NY



Applications of Waste Heat Recovery & Thermal Storage

Moderator: Lauren DeLaFuente / *NYSERDA*

Panel: Brian Cha / *Goldman Copeland*

Geoff Cullen / *G.A. Fleet (Huber Technology)*

Brendan Hall / *CHA Solutions*

Doug Mayone / *Fischer Energy Partners*



From Waste Heat to Useful Energy: Approach to Heat Recovery Design

Presented by

GOLDMAN **C**OPELAND

Overview



Heat Recovery Opportunity

Building Thermal Sources

Thermal Exchange Technologies

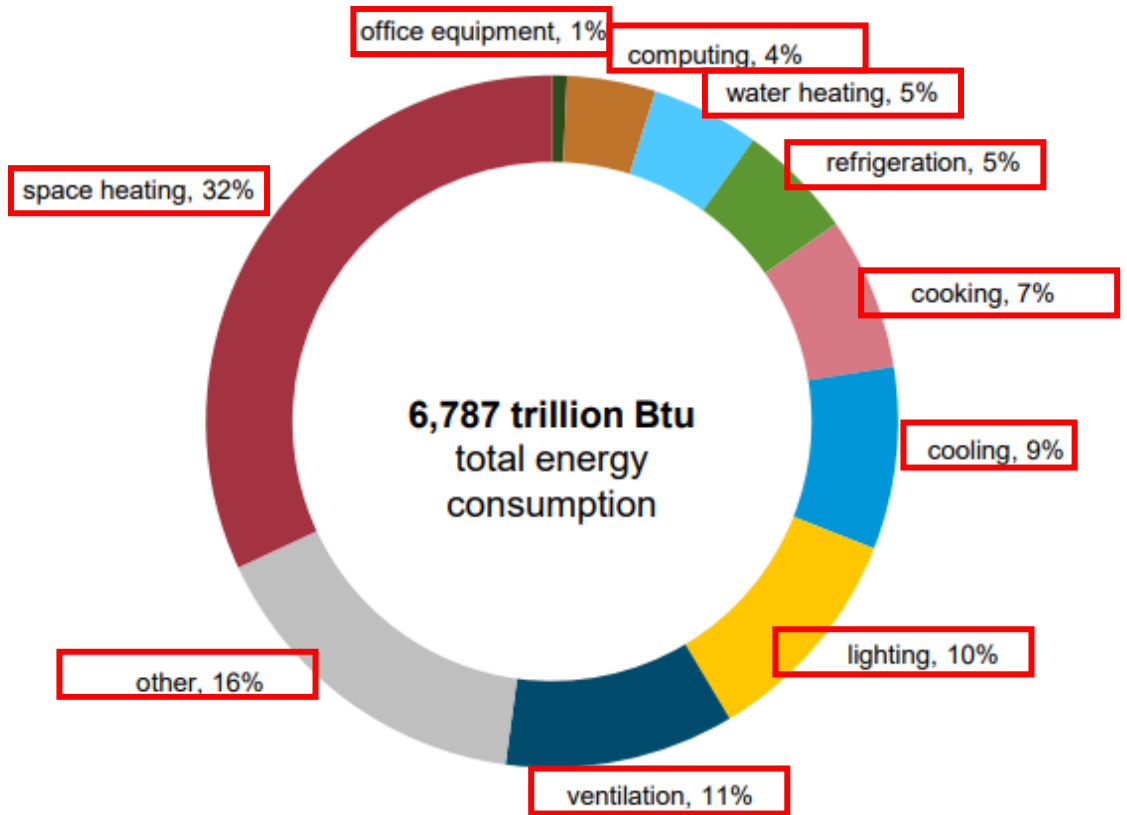
Assessment & Design Considerations

Heat Recovery Assessment Data

Future Outlook

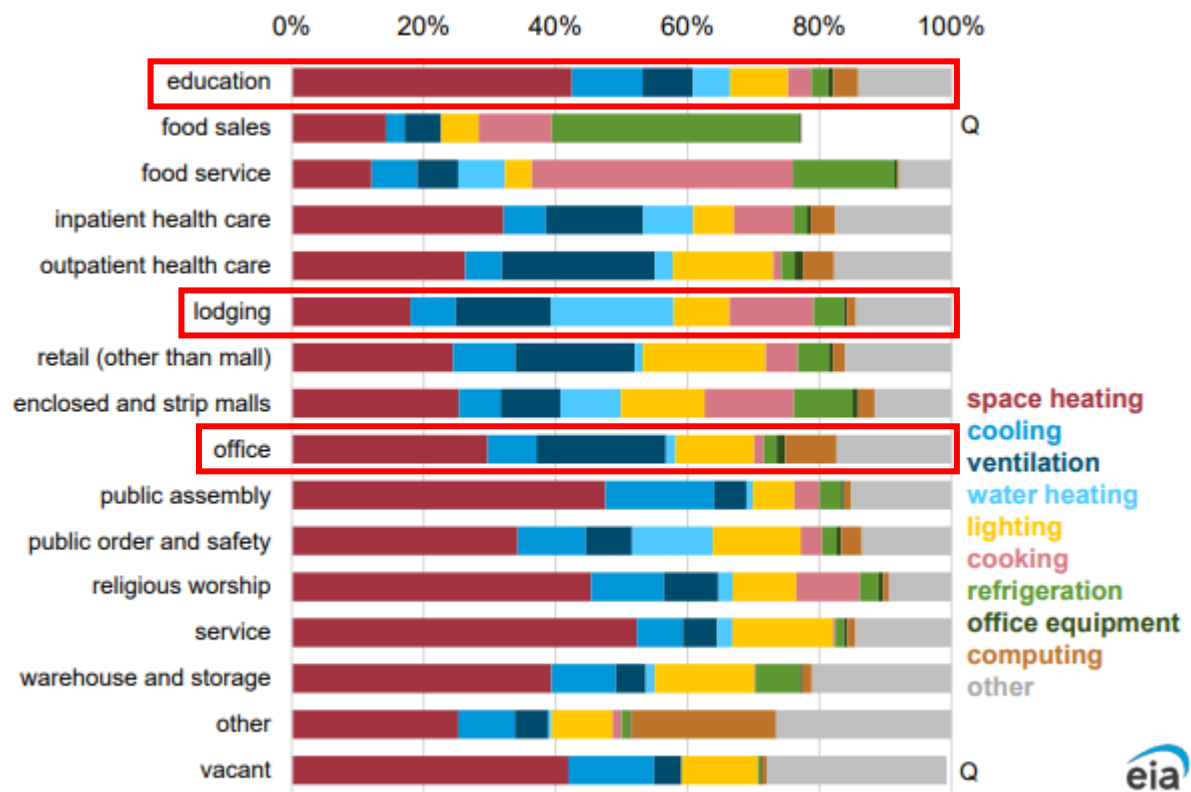
Heat Recovery Opportunity

Major fuels consumption by end use, 2018
share of total



Data source: U.S. Energy Information Administration, *Commercial Buildings Energy Consumption Survey*
Note: Btu = British thermal units

Major fuels consumption by principal building activity and end use, 2018
percentage



Data source: U.S. Energy Information Administration, *Commercial Buildings Energy Consumption Survey*
Q = Data withheld because the relative standard error was greater than 50% or the reporting sample had fewer than 20 buildings. Water heating, computing, and other end uses were withheld for food sales buildings. Water heating and cooking were withheld for vacant buildings.



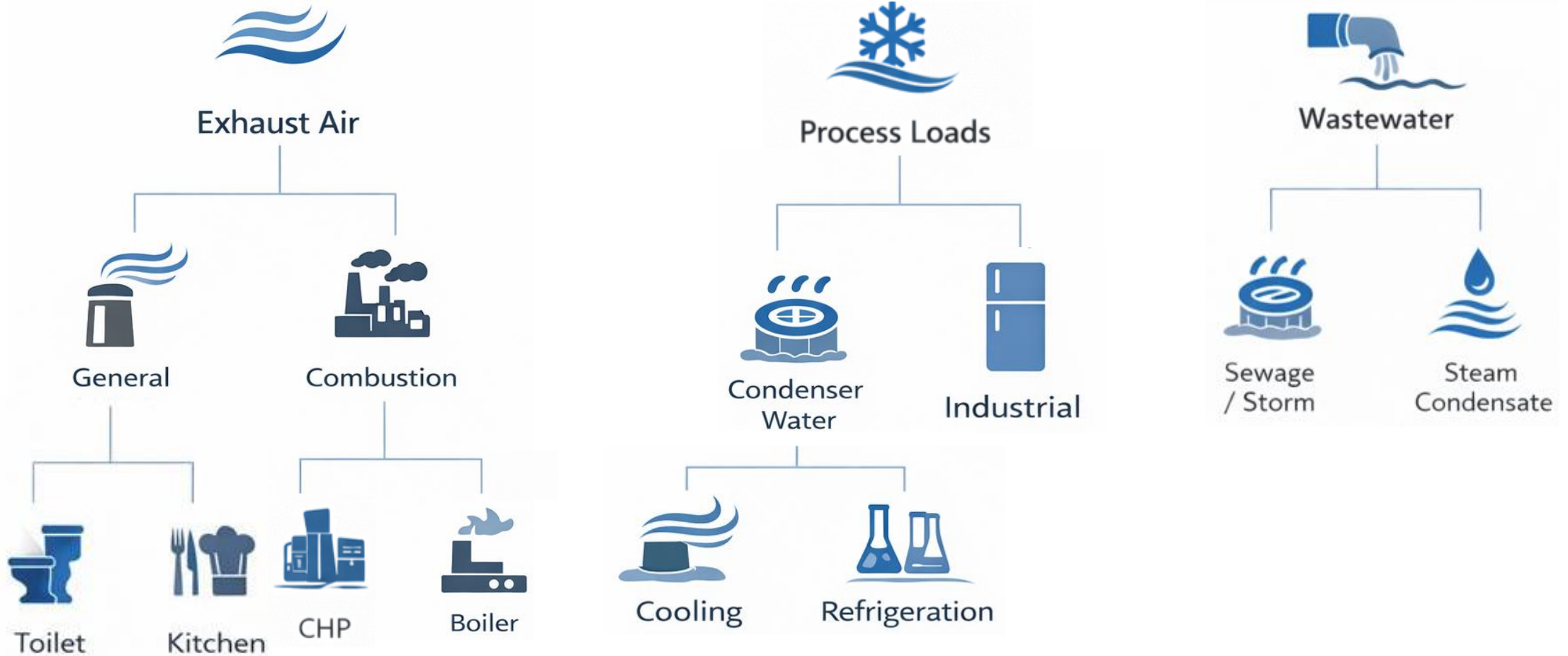
Heat Recovery Opportunity

US National Median EUI (kBtu/ft ²)*			LL97 2030 Target	LL97 2035 Target
Occupancy Type	Site EUI	Source EUI	Heating EUI**	Heating EUI**
Office	52.9	116.4	50.7	31.1
Multifamily Housing	59.6	118.1	63.0	50.7
University	84.3	180.6	79.1	46.6
Supermarket	196	444	127.2	80.1
Restaurant	325.6	573.7	76.0	57.0
Hospital	234.3	426.9	138.1	87.6

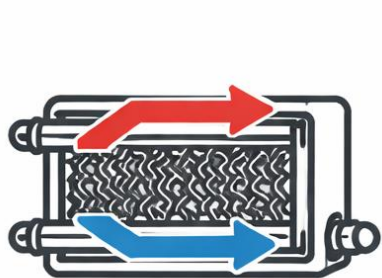
*ESPM Technical Reference (August 2024)

**Assuming natural gas heating and no Scope 2 emissions

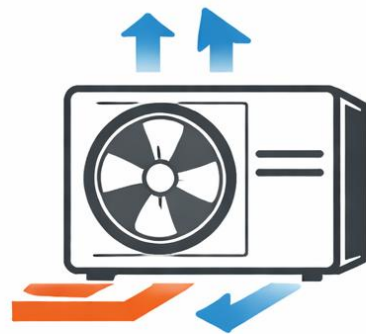
Building Thermal Sources



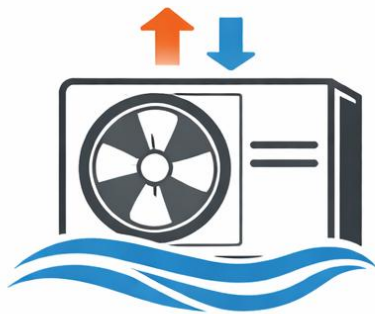
Thermal Exchange Technologies



Heat Exchanger



Air-Source
Heat Pump



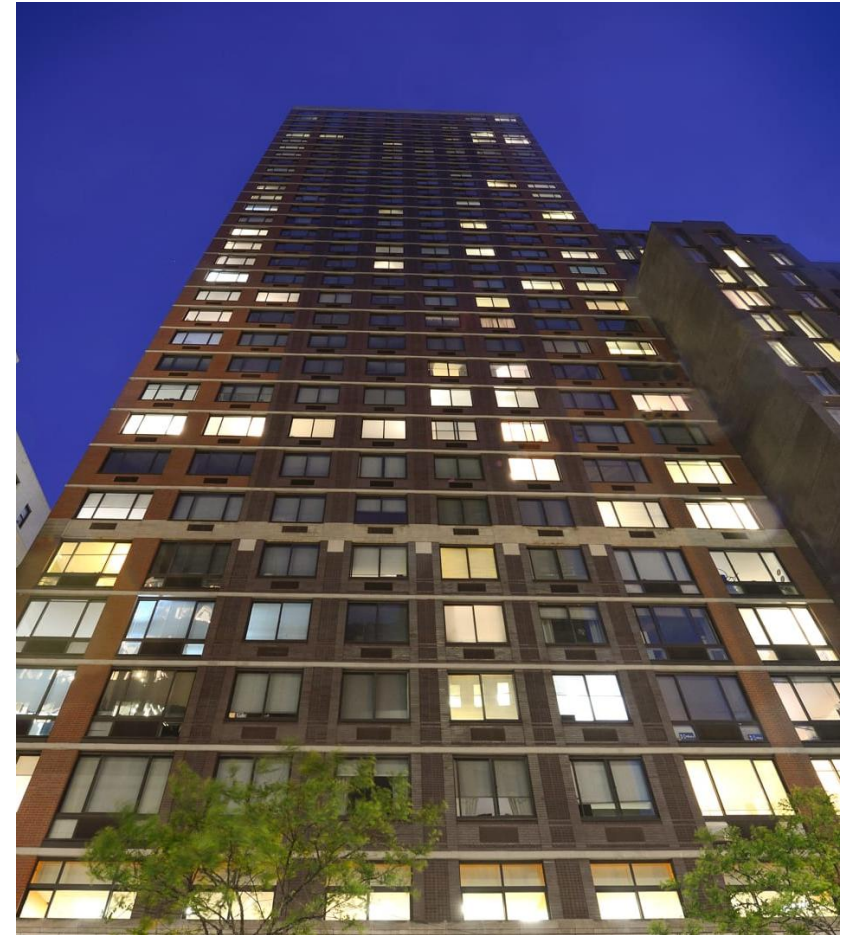
Water-Source
Heat Pump

- ❖ Semi-Passive vs. Active Thermal Exchange Devices
- ❖ Local vs Networked Thermal Systems
- ❖ Thermal Storage
- ❖ Combined Heat and Power (CHP)

Pre-Design Considerations

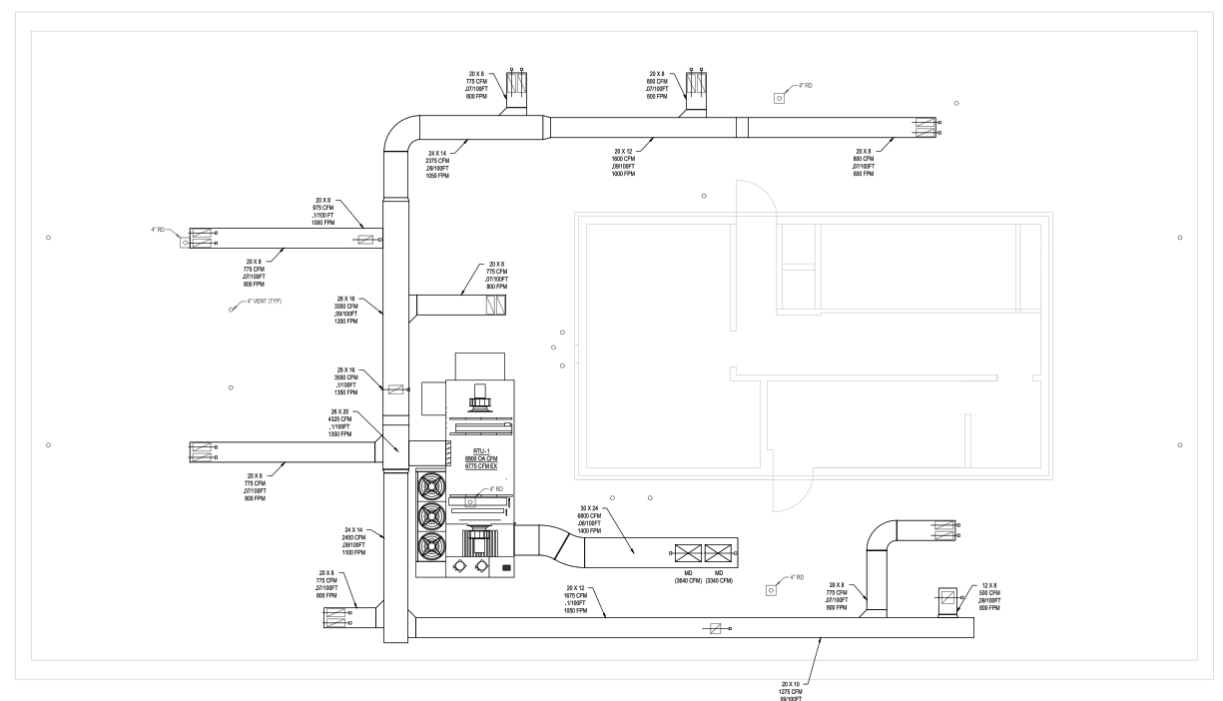
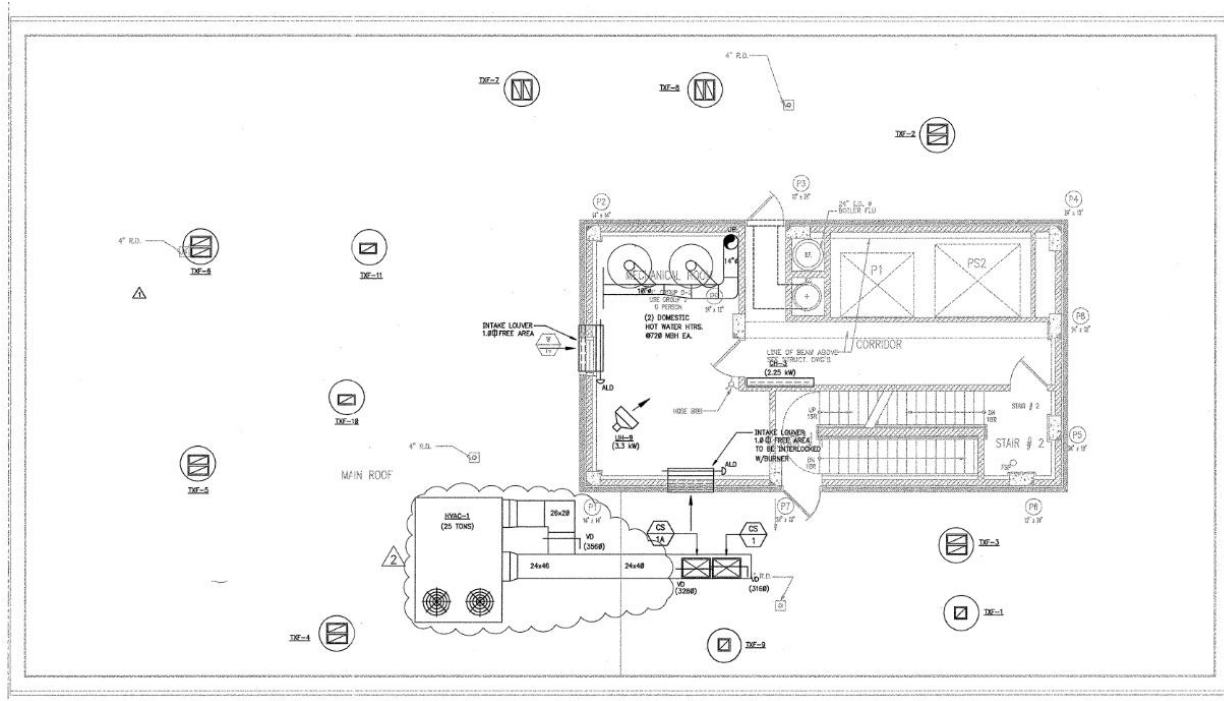
Assessment Phase

- ❖ Building Heat and Cooling Load Profiles
- ❖ Low-Cost Energy Measures
- ❖ Coincide with EOL equipment replacement
- ❖ Electrification
 - ❖ Assess existing electrical infrastructure
 - ❖ Combine Heat Recovery with fuel switching
- ❖ Life Cycle Cost Analysis



180 Montague Apartments in Brooklyn Heights | [EquityApartments.com](https://www.equityapartments.com)

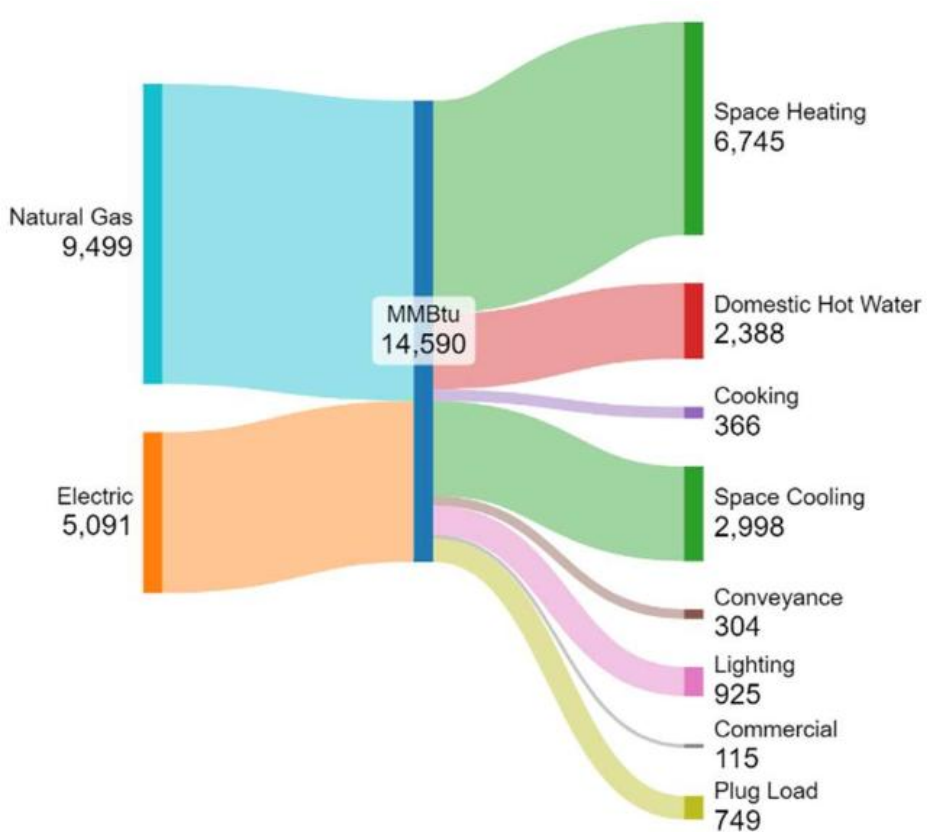
Case Study– Exhaust HR



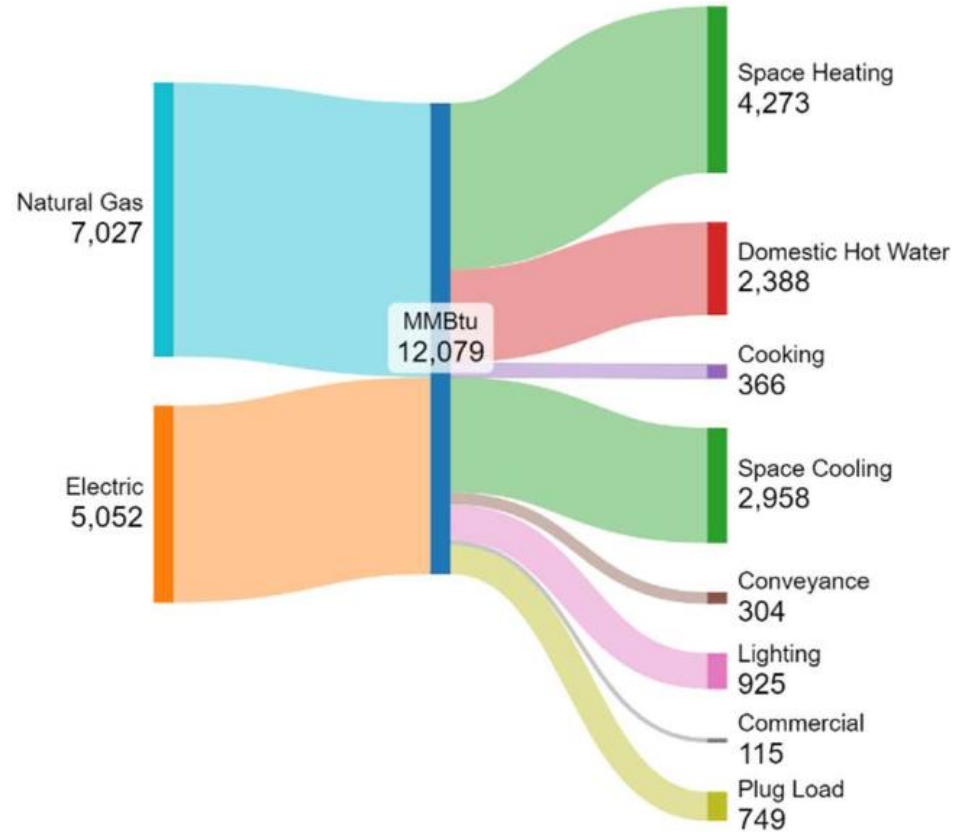
Existing Gas-Fired DOAS and Exhaust Fans

Proposed Heat Pump ERV

Case Study– Exhaust HR



Baseline Energy (Site EUI 70.7 kBTU/SF)



Proposed Energy (Site EUI 58.5 kBTU/SF)

Life Cycle Costs

- ❖ Capital ↑
- ❖ Maintenance ↑
- ❖ Utility Cost ↓
- ❖ Local Law 97 Fines ↓

HR Design Considerations

- ❖ Space Constraints
 - ❖ Thermal Storage vs Plant Capacity
- ❖ Minimize Construction Costs
 - ❖ Right Size Equipment
 - ❖ Maximize Incentives
- ❖ System Redundancy
 - ❖ Project Phasing
- ❖ Design for Future Connections
 - ❖ Centralize Systems
 - ❖ Thermal Networks



Case Study- Wastewater HR

- ❖ Capacity vs Storage
 - ❖ Modular WSHP Water Heaters
 - ❖ Treated Wastewater Storage
 - ❖ DHW Storage

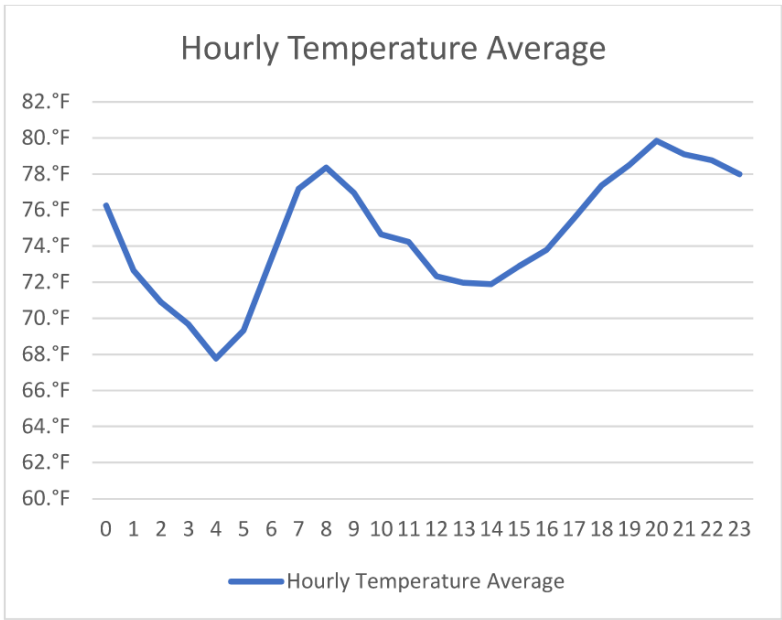
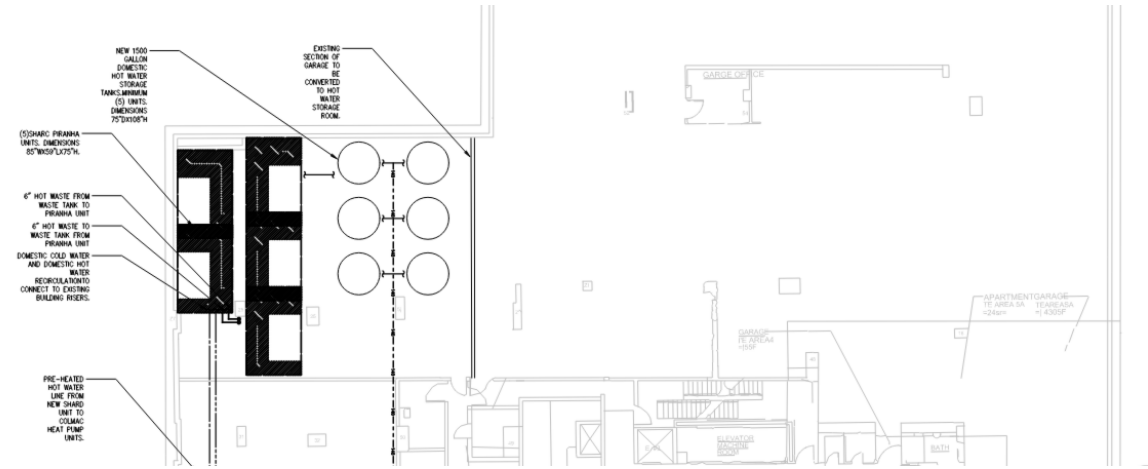
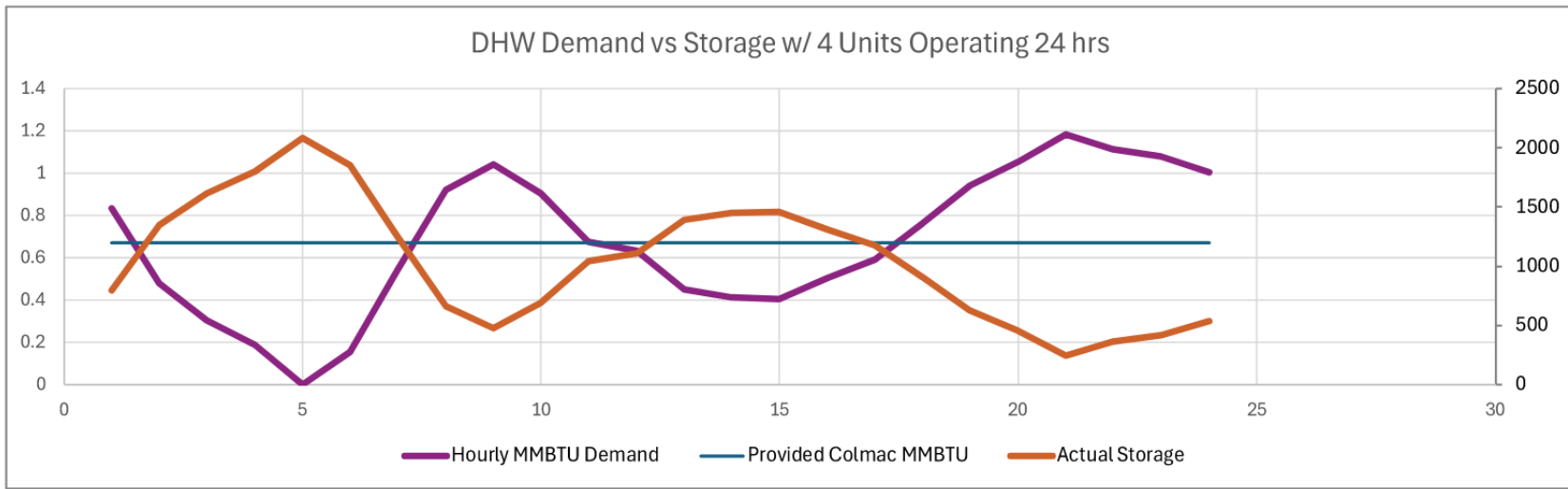


Figure: Storm Runoff + Sewage (°F)



HR Assessment Data

Building Data			
Building Types	Square Footage	Total Energy Usage (MMBTU)	Average EUI (kBTU/sqft)
Office	6,200,912	649,723	103
Multifamily/Hotel	1,456,373	212,895	119
Other	145,611	12,792	85

Energy Recovery Study Summary			
Energy Recovery Type	Project Description(s)	Most Applicable Building Types	% Building Energy Savings
Exhaust Air	Replace DOAS with ERV	Multifamily/Hotel	14%
Process Cooling	Water-Source Heat Pumps	Commercial Office, Other	5%
Boiler Flue	Preheat Makeup with Boiler Flue Exhaust	Multifamily/Hotel, Office, Other	7%
VRF w/ Heat Recovery AWHP w/ Heat Recovery	Floor Fitouts & Central Plant Retrofits	Commercial Office, Other	20%
Wastewater	Domestic Hot Water Production	Multifamily/Hotel, Office, Other	28%

Heat Recovery Future Outlook

- ❖ Electrification
- ❖ Hybrid Systems
- ❖ Code Requirements
- ❖ Data Centers
- ❖ District Thermal Networks



Thank You

Contact Me

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Wastewater Heat Recovery

March 25th 2026

Presented by:
Geoff Cullen, PE
GA Fleet Associates
gcullen@gafleet.com



FLEET[™]

HUBER
TECHNOLOGY
WASTE WATER Solutions



Problems Faced by Current Electrification Implementations

Energy Recovery



- Lost energy goes **unused**

Space



- Smaller WSHP in less valuable real estate

Cost



Lower OPEX

Reduced Operating Expenses



Lower CAPEX

Reduced Capital Expenditure

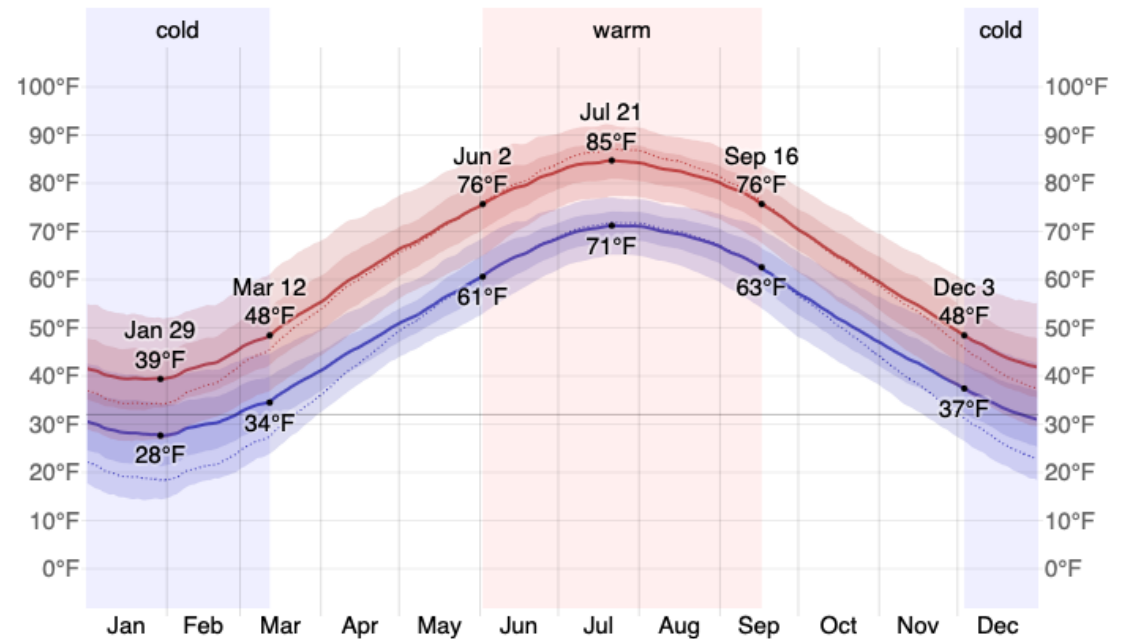


Incentives Further Reduce Cost

Benefits of WWHR

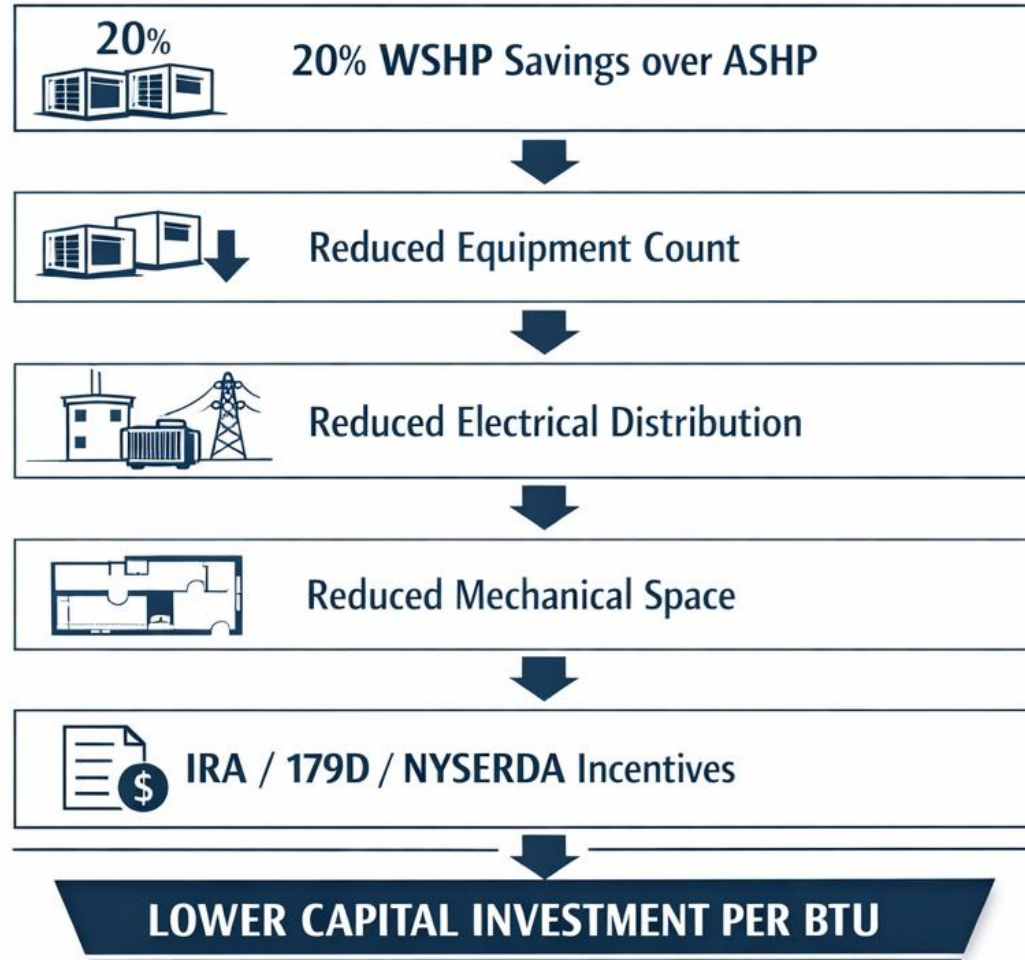
Water Source for All

- Wastewater (WW) has very consistent annual temperatures
 - 50-60° F before the meter
 - 60-70° F after the meter
- WSHPs allow the use of low grade energy sources
- WSHP Annualized COP = 4.0 v. 3.0 for ASHPs
 - 25% OPEX Savings
- Free cooling drives further OPEX savings



Benefits of WWHR

Reduce CAPEX



[IRA - Clean Electricity Investment Credit \(ITC 48E\)](#)

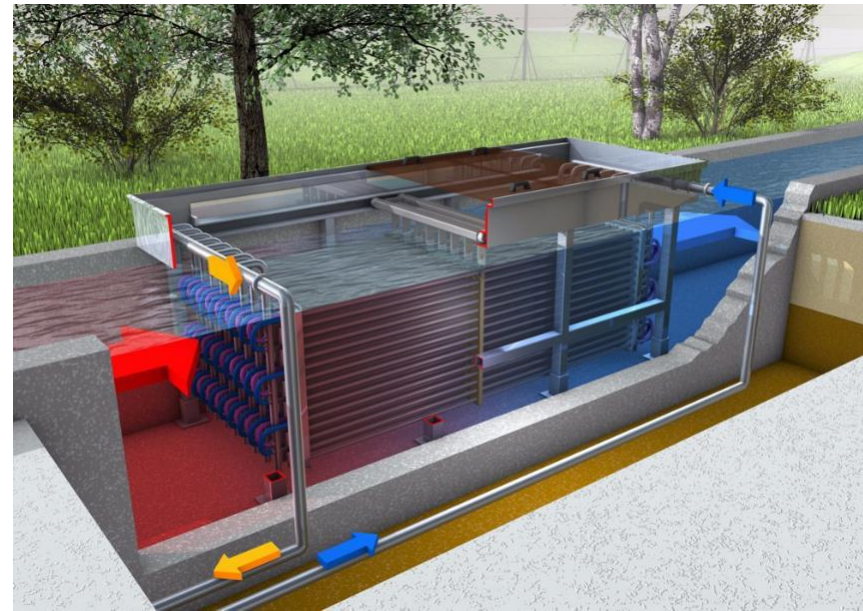
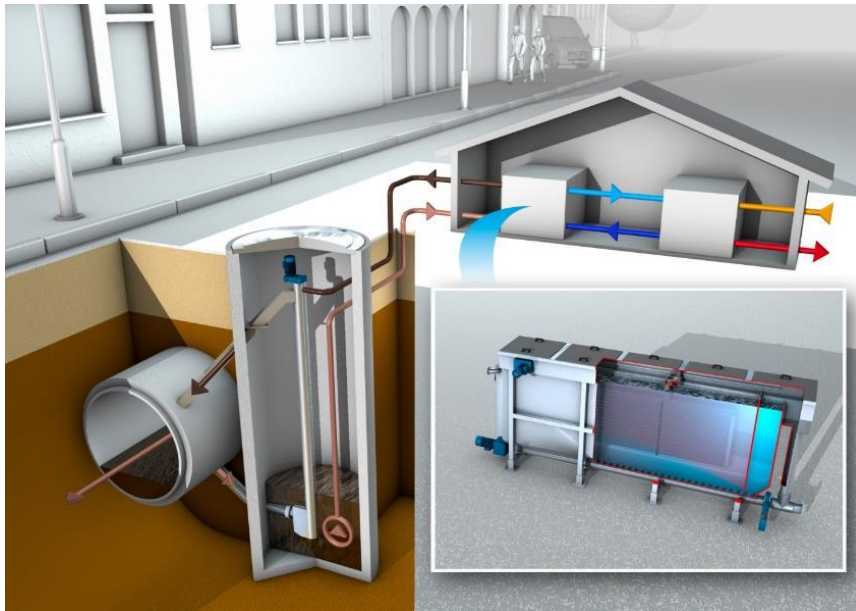
[179D IRS Deduction](#)

[NYSERDA](#)

WWHR Applications

Before the Meter

- Sewer systems represent the oldest district energy networks across the nation
- Can meet up to 100% of a buildings HVAC load



WWHR Applications

After the Meter

- Ideal for:
 - Energy recovery initiatives
 - Retrofit
 - Regulatory restrictions
- Supplemental System
 - Geothermal
 - ASHP
 - Fossil fuel reduction
 - Can provide up to 90% of DHW load



WWHR Equipment Selection

Design Criteria

- Huber developed/iterated their tech over 20+ years
 - 100-800kW
 - 80-450 GPM secondary water
 - 2:1 WW to CW
 - 8-10° F DT
- Energy transfer requirements and the WW flow pattern will dictate storage, storage isn't always required; consider existing pits
- Don't forget about energy use of system

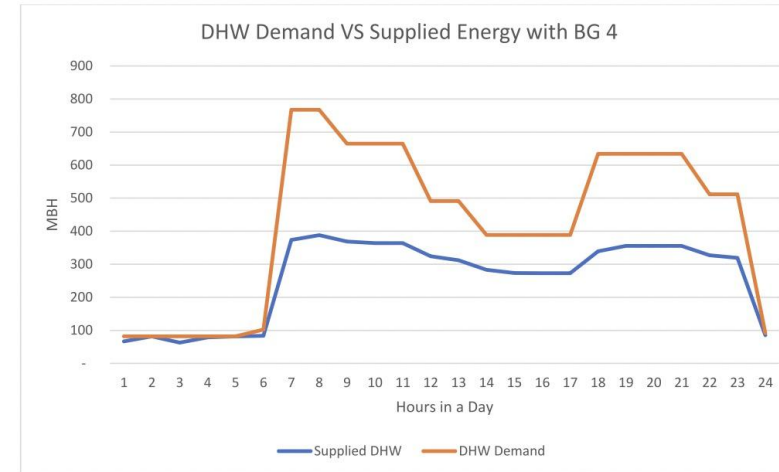


Figure 1: DHW Demand VS Supplied Energy with BG 4

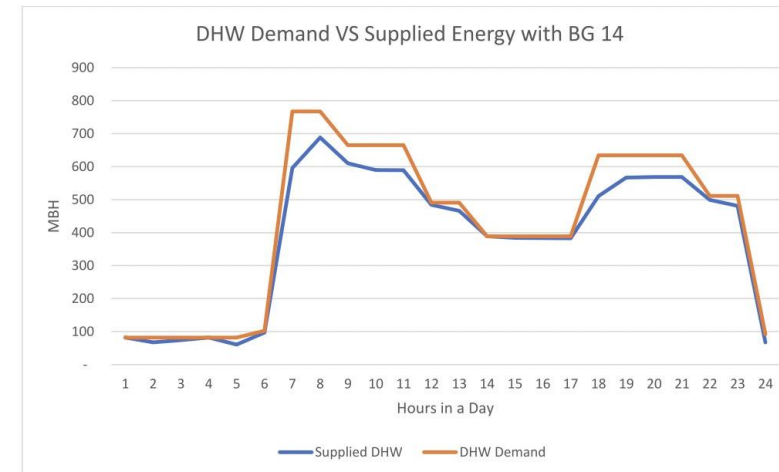


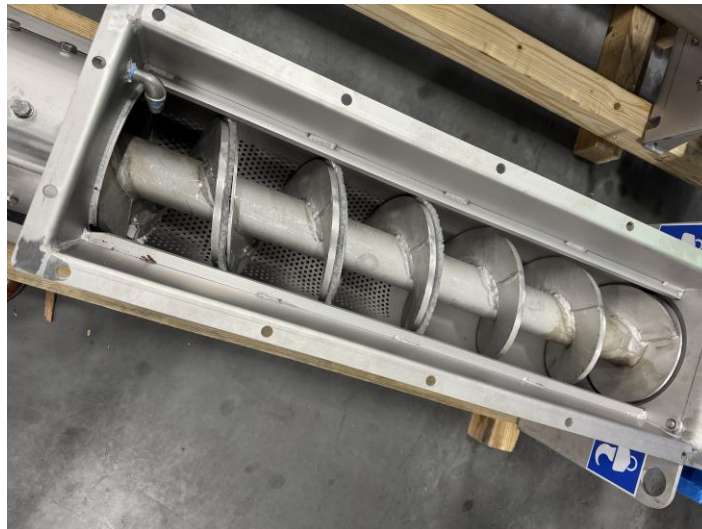
Figure 4: DHW Demand VS Supplied Energy with BG 14

WWHR Equipment Selection

Considerations – Solids Handling

	Screen	Macerator
Solid Handling	Removal + Reintroduce*	Maceration (Slurry)
Energy Use	Low	High
Maintenance	Low	High

*preferred by municipalities



WWHR Equipment Selection

Considerations – Heat Exchanger

	Shell & Tube	Plate & Frame
Heat Transfer	Good	Better
Maintenance	Low	High
Containment	Full	None
Water Volume	High	Low



Installation Reference

American Geophysical Union (AGU) – Washington DC

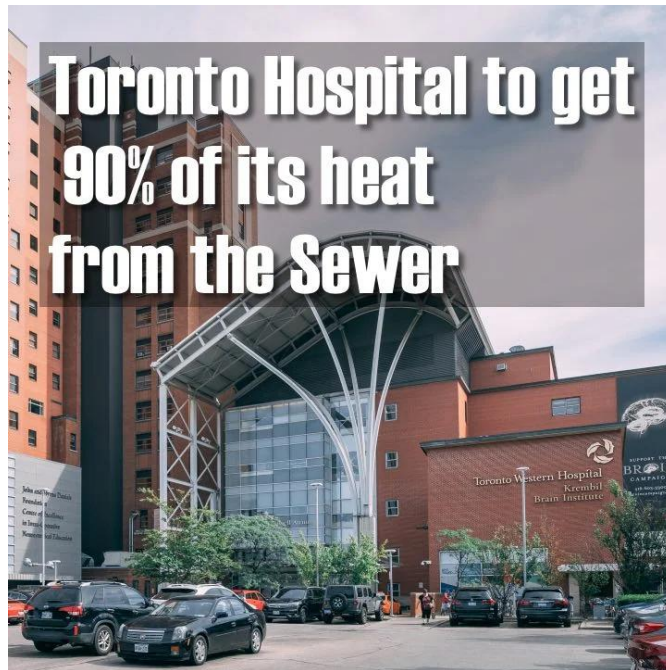
- Before the meter
- 250 KW (853 MBH, 71 Tons)
- 100% of HVAC Load (Net-Zero)



Installation Reference

Toronto Western Hospital – Toronto, ON

- Before the meter
- 17 MW (29M MBH, 2,400 Tons)
- 90% of HVAC Load
- Largest WWHR in the world



Installation Reference

Valsana Hotel – Arosa, Switzerland

- After the meter
- 165 KW (560 MBH, 47 Tons)
- 15% of HVAC Load (Geo + Ice Storage)
- 10 Years of Operation



Installation Reference

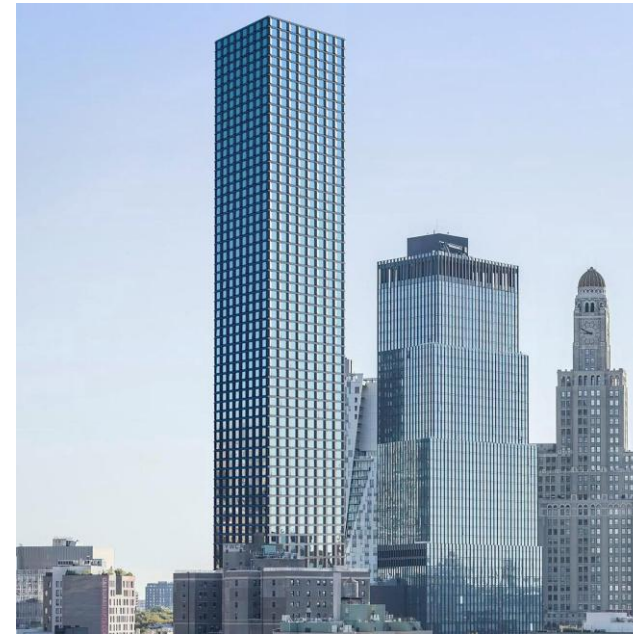
After the Meter in NYC

One Third Ave – Brooklyn

580 Mixed Use Apartments, 730' Tall
Passive House

510 KW (1700 MBH, 145 Tons)

Supplemental to geothermal system



895 Erskine Alafia A1/A2 – Brooklyn

425 Affordable Apartments, 350k+ Sqft

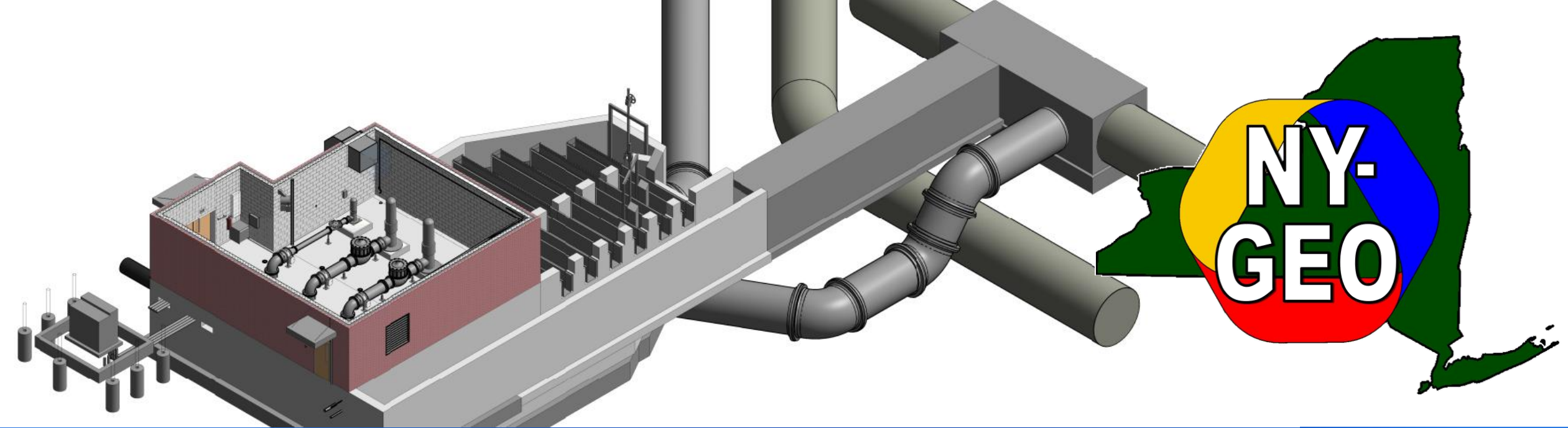
440 KW (1500 MBH, 125 Tons)

Supplemental to geothermal system



Thank you for your time!

Geoff Cullen, PE gcullen@gafleet.com



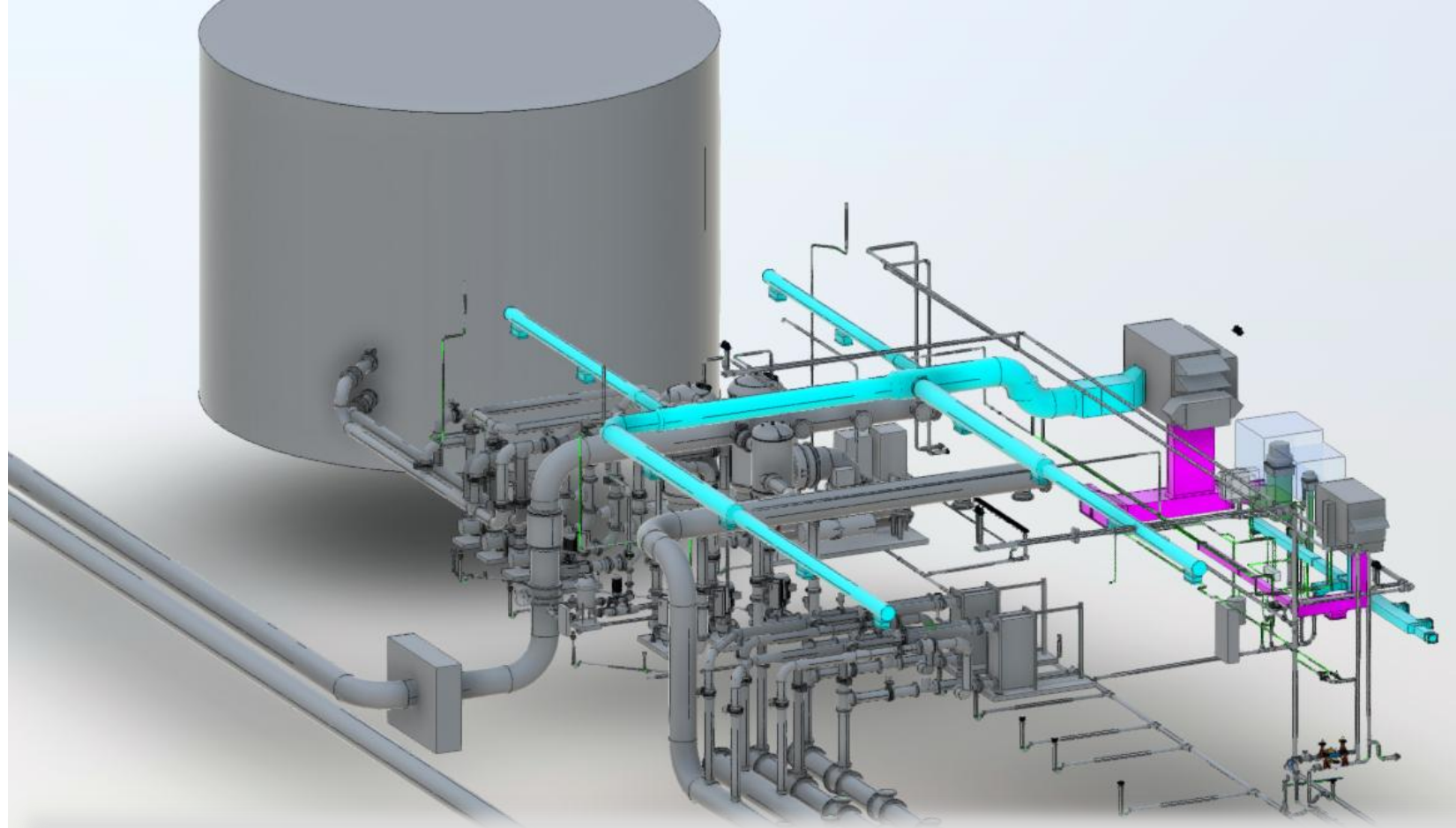
Applications of Waste Heat Recovery & Thermal Storage

Brendan Hall, PE, CGD

March 25, 2026

Renewable Thermal Energy Solutions

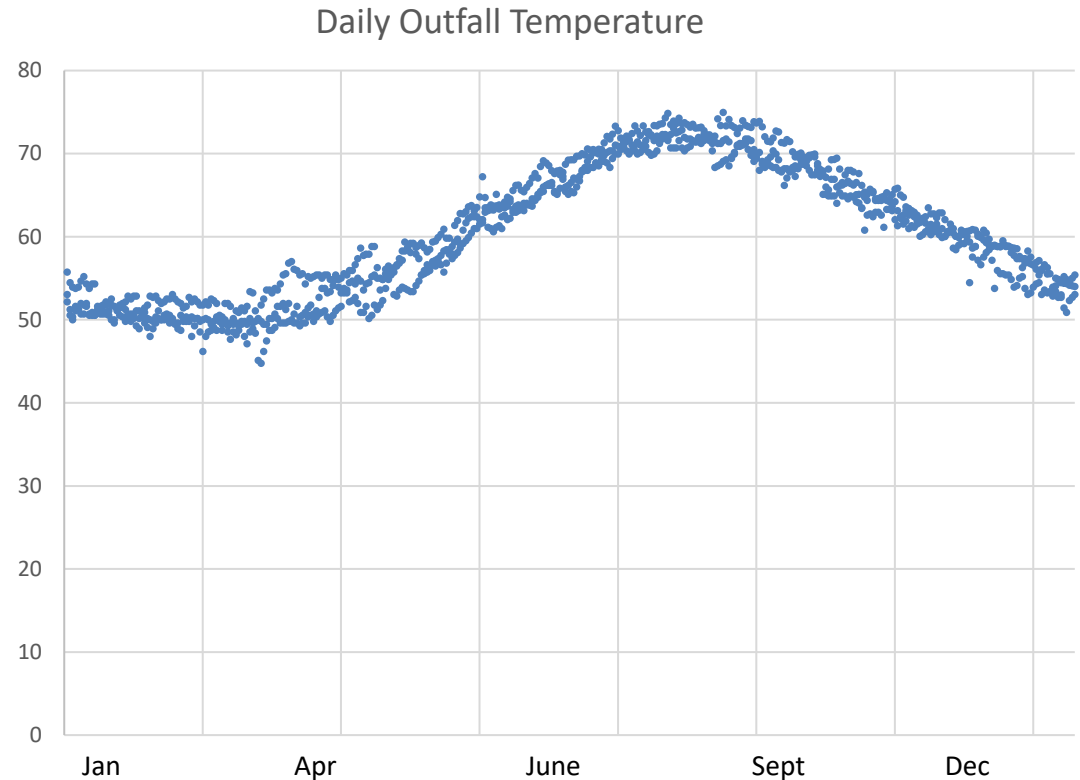
CHA's renewable thermal energy solutions (RTES) team delivers **innovative electrification, geothermal, and thermal energy network solutions** for campuses, utilities, and municipalities. We provide comprehensive design, engineering, and implementation services that enable sustainable, cost-effective heating and cooling at scale.



- Electrification
- Heat pump retrofits
- Geothermal design
- District/campus energy
- Thermal energy networks
- Thermal energy storage

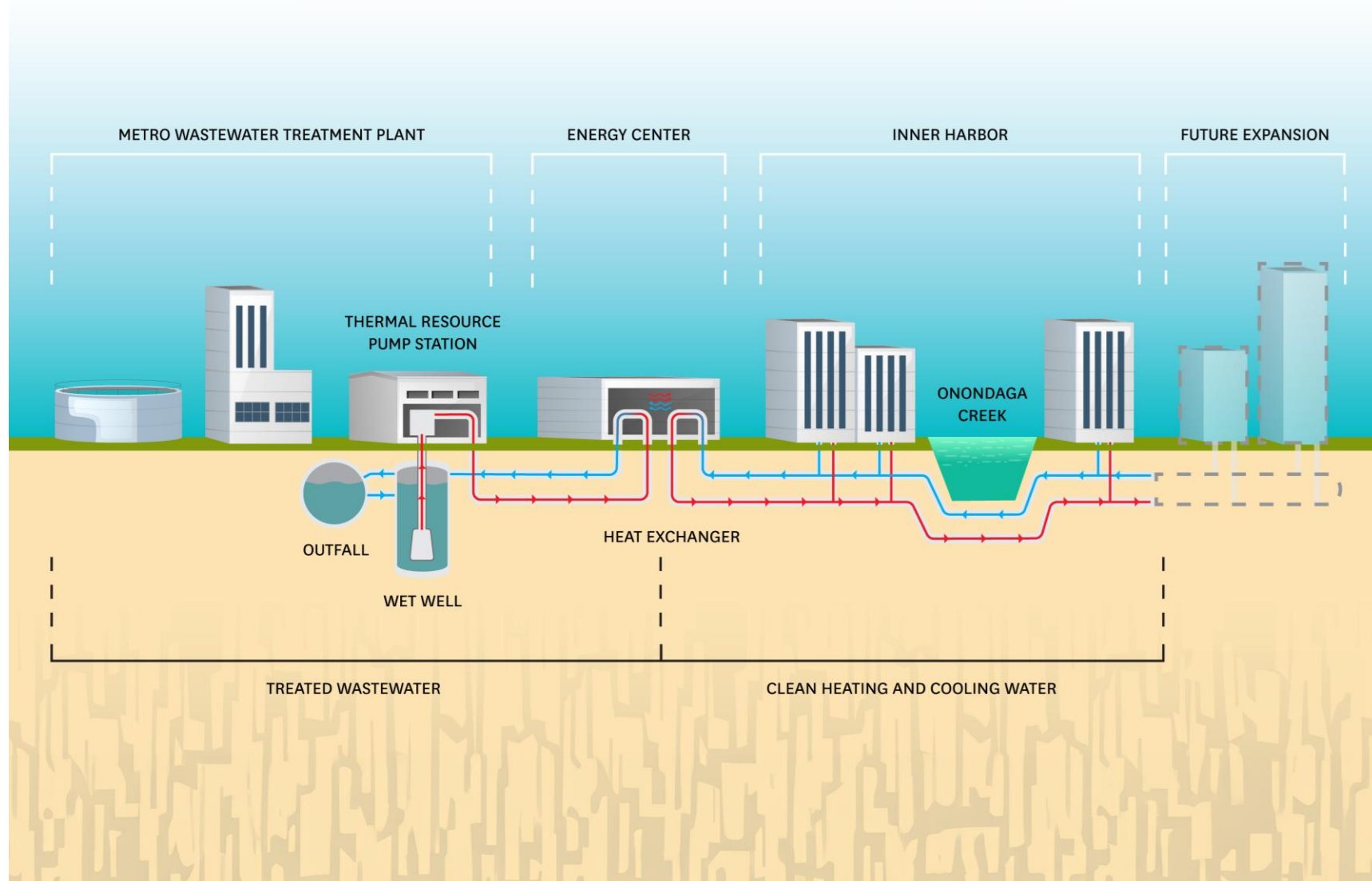
Wastewater: A Stable, Underutilized Thermal Resource

- Wastewater is a reliable and plentiful source of heat and cooling capacity that is very useful where available.
- Temperatures are typically between 50-75°F and are correlated closest with the shallow ground temperature throughout the year. Air temperature, rain fall and flow are secondary effects.
- Example temperature data from the effluent of a WWTP in the Northeast
- This is one of the most consistent low-grade heat sources available in cities.



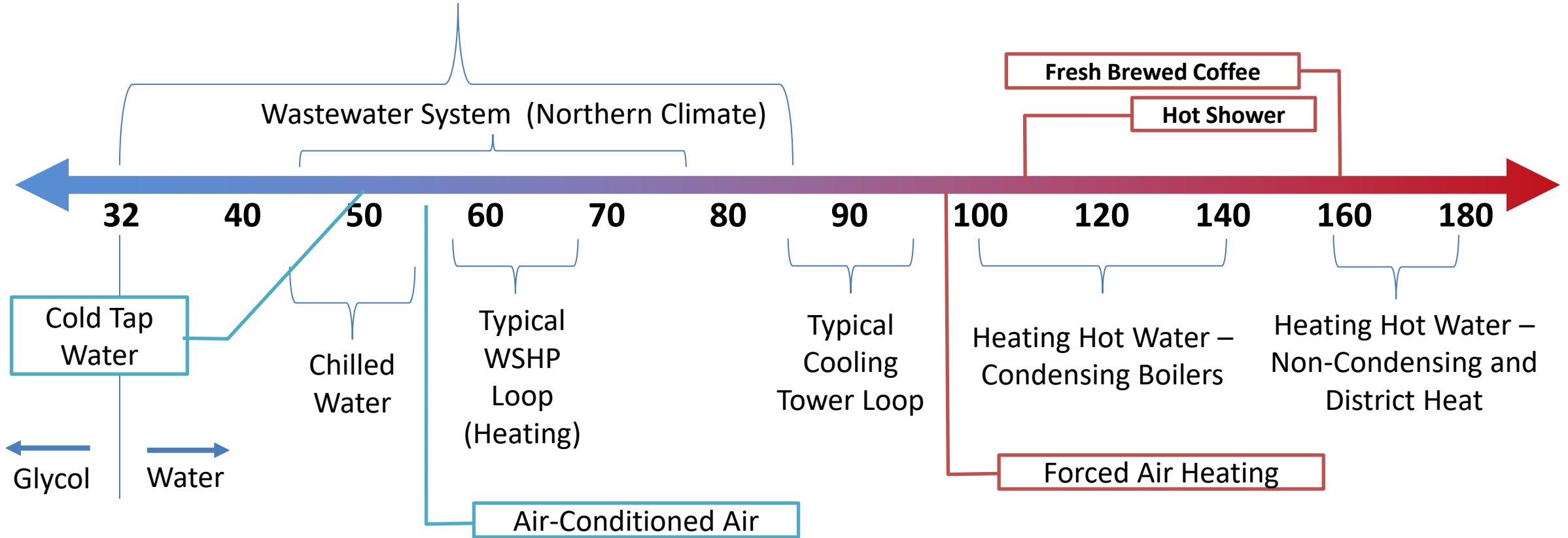
Utility Thermal Energy Network Syracuse, New York

- **Largest wastewater recovery project** in US when built.
- The scale is also what makes it valuable. Phase 1 is 7 MGD, expandable to 20 MGD.
- Phase 1 heating capacity is 7.3 MW, capable of supporting 10.5 MW of connected heat pumps.



HVAC Temperature Scale

Ambient Loop



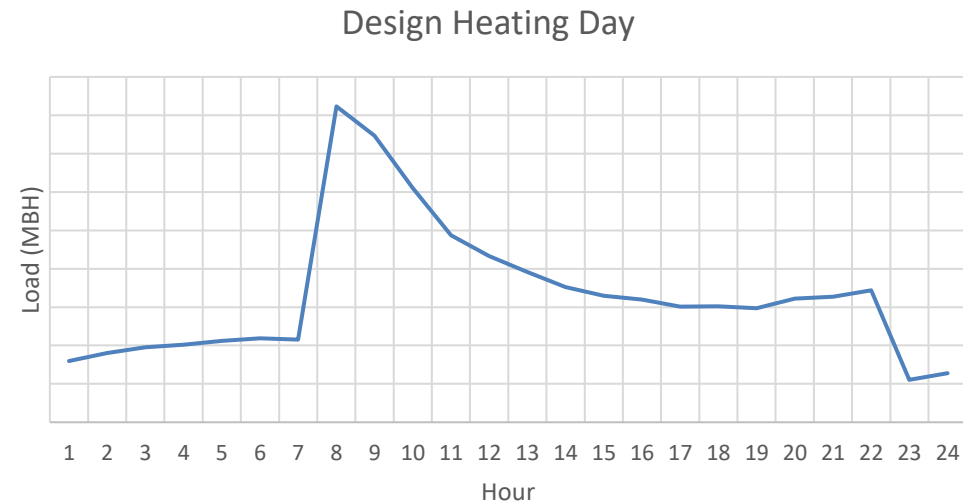
Wastewater Resource Considerations

Source

- How large is the pipe?
- How consistent is the flow?
 - At the WWTP vs Distribution Pipes
 - Combined Sewer Storm Overflow
 - Force Mains
- Who owns the pipe?
- What is feeding into that pipe?
- Keep in mind the owner of the pipe will want an access fee.
- A 1 MGD flow is equivalent to about 3500 MBH of heating input.

Load Demand

- What is the peak load?
- How consistent is the load?
- How much diversity is there in the load? (Peak vs Average)



Load Matching

- **Load and Source rarely match up**
 - Option 1: Source use is limited to make sure there is always enough load to absorb it.
 - Option 2: Source is plentiful enough to be used but occurs at different times of day than the load.
- **Typically thermal resource is serving heat pumps, which need minimum run times to prevent over cycling.**

Solutions

- **Variable flows are managed through thermal storage in some fashion**
 - Add Stability: Wastewater Holding Tank with sufficient volume for 15-30 min of runtime.
 - Shift in Location: Connect to Ambient loop to circulate until use.
 - Shift in Time : Provide Thermal Storage to source Side
- **Solution is going to be different depending on the scale of the system.**

Time Shifting Heat Recovery

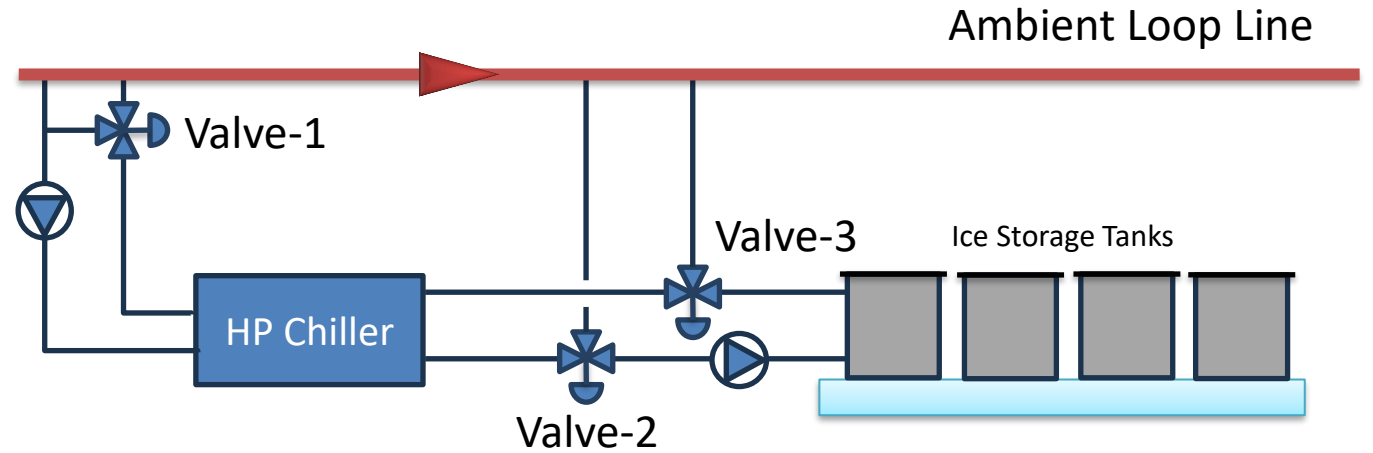
- Using ice as thermal storage allows for a range of things to serve as recovered heat that might not be otherwise useable and allows those loads to be shifted from when they occur to when can be used.
 - Wastewater
 - Free cooling systems
 - Solar Thermal
 - Boiler Blowdown
 - Data Center
 - Supermarket
 - Ice Rink



Ice Storage

Glycol from the ambient or process loop is used at off-peak times to melt ice. A heat pump can be used to increase the temperature and store more heat, faster but with an energy penalty of running the heat pump.

Valve 1 is required to recirculate some warm fluid back to the chiller to maintain minimum entering water temperature (EWT)



Ice Storage Tanks are much more compact than water storage. 4-5x more energy stored per pound of water

Valve	Charging	Discharging
1	Closed	Diverting flow to pump suction
2	Diverting to Storage	Open to Pump
3	Diverting to District	Open to Heat Pump Chiller

To release the heat, a heat pump chiller makes chilled glycol (23°F) to freeze the water in the tanks, rejecting heat from that process into the loop to do space heating at customer buildings.

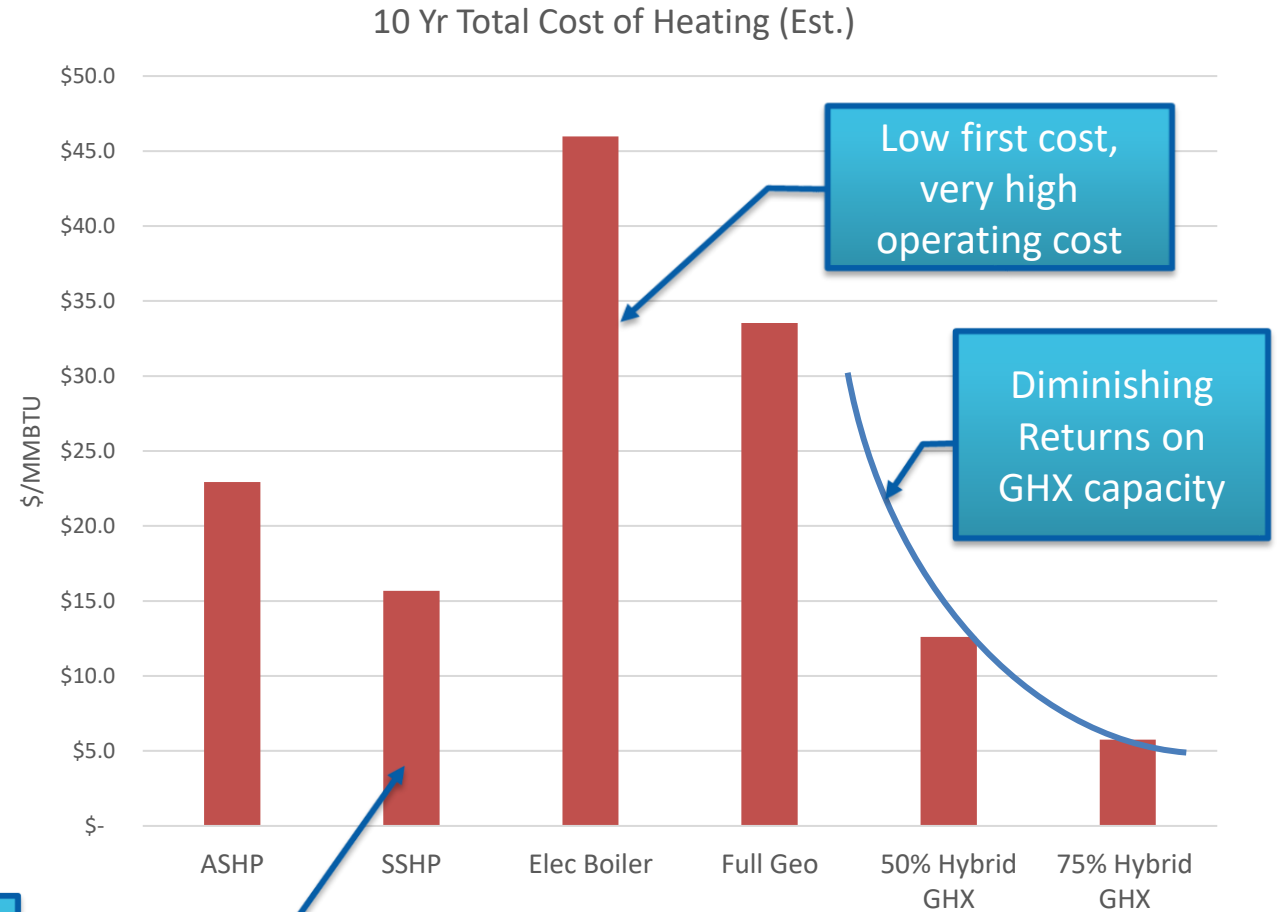
Example – Heat Pump Selections

- Low Lift Application
 - Discharge temp is typically the lowest allowable leaving condenser temperature (65-70°F)
 - HP Chillers can start up at low ambient temperature but some heat must be recirculated to maintain a minimum entering water temp for steady operation.
- Needs to be capable of ice making temperatures (22-26°F chilled glycol)
- Compressor type is driven by size of the load.
- Heat pump output is sized by the peak output needed to the system.



Total Cost of Heating - TCoH

- Additional heating sources are often still needed to cover the load in TENs.
- Costs are specific to this particular scenario, construction costs, and utility rates.
- TCOH costs consider first cost, output, usage over the first 10 years of operation.
- Comparisons of relative costs of energy sources hold though for other circumstances.
- All sources are assumed to be serving an ambient loop system.



Good next choice
after GHX



A Strategic Partnership

Heat Recovery Development

Alex Gulagaci
VP, Head of Engineering
RXR

Doug Mayone
President
Fischer Energy Partners

NY GEO BROOKLYN 2026

THE NYSERDA CATALYST



- **Risk Mitigation:** Leveraged NYSERDA Heat Recovery Program for de-risking early engineering.
 - **Phase 1 Assessment:** Technical deep-dive into thermal potential.
 - **Phase 2 Design:** Transitioned theoretical recovery into shovel-ready mechanical schematics.
- **Creative Decarb Pathway:** Opportunity to explore infrastructure upgrades as an early-adopter in NY.
- **Regulatory Alignment:** Positioned assets for long-term LL97 compliance.



Heat Recovery Program



IDENTIFY HIGH-VALUE CANDIDATES



Mechanical Systems

Buildings with existing condenser water loops and heating hot water were prioritized.



Thermal Loads

Focus on assets with simultaneous heating and cooling demands (data centers and critical cooling).



Building Profiles

Prioritizing large-scale commercial assets with consistent 24/7 core cooling needs.

COMPLETED ASSESSMENT METRICS



IDENTIFIED METRICS

14

Buildings

116,491 MMBTU Total Energy Savings

4,442 tCO₂e Reduction

\$3MM+ Annual Energy Savings

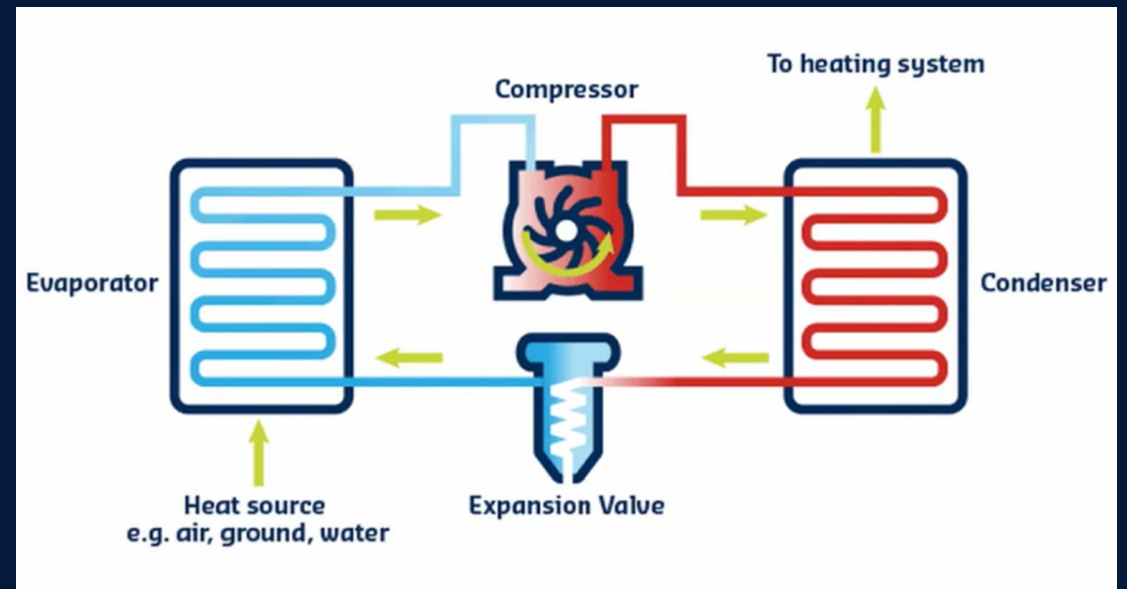
\$9MM+ Rebates

ASSESSMENT TAKEAWAYS

RXR™



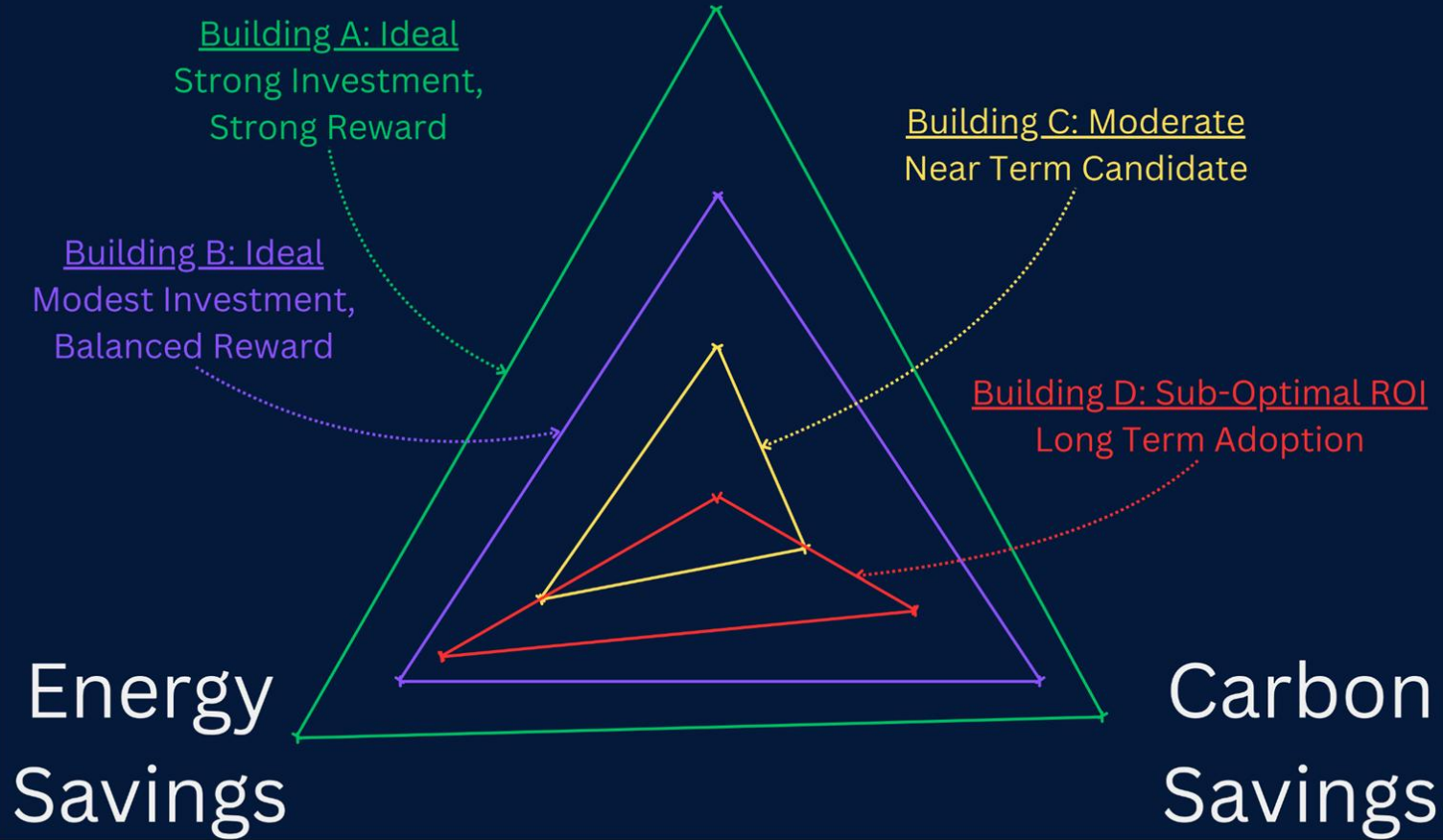
- **Variance in Cost Savings:** Utility Savings varied for each opportunity, from -\$30K to \$950K annually.
- **Natural Gas:** Excellent opportunity for carbon reduction, non-optimal fiscal metrics leading to challenging business cases.
- **Steam Consumers:** Combining Heat Recovery with electrification of district steam central plant provide optimal fiscal opportunities.
- **Domestic Hot Water:** Often included as a targeted heat-sink during assessment, DHW is a secondary opportunity to heating hot water loops.



SAVINGS RADAR



Cost Savings



Representative of (4) building assessments

ALIGNING STAKEHOLDERS & ROI



Internal Stakeholder Strategy

Leasing Teams:

Improved asset quality with utility cost savings & desirable ESG metrics

Investors:

Asset value improvement & ESG risk mitigation.

Facility Managers:

Optimize operating efficacy at the assets.

Asset Management:

Reduced operating costs and avoided LL97 penalties.


Financial Layering

- **NYSERDA:** head start with in depth analysis and shovel-ready design.
- **Utility Rebates:** Targeting \$9MM+ in custom rebates.
- **Avoided Costs:** Impactful utility savings and carbon penalty offset.

SCALING THE BLUEPRINT



Aligning building upgrades with end-of-life replacement is critical

 NOW

Pilot & Capital Planning

- Capital Alignment & RFP at asset level.
- Targeted optimal business case for immediate impact!

 NEXT

High Impact

- Integrated into Capital Planning
- Implement with lifecycle replacement

 LATER

Portfolio Standard

- Scale adaptable model across asset classes
- Next Steps to full building optimization

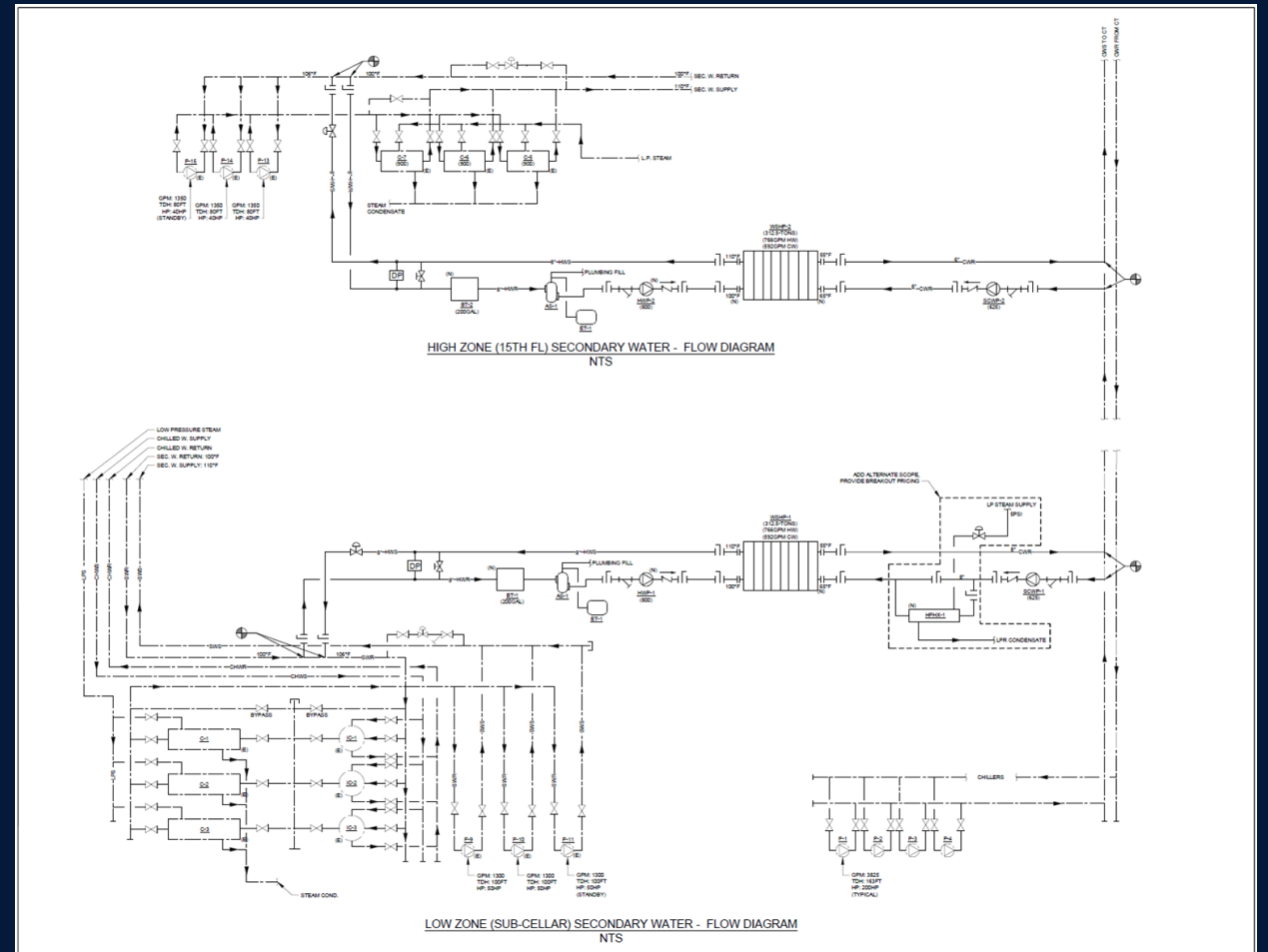
OUT FOR BID

RXR™



Class A, 1MM+ sqft bldg

- Out for bid to GCs
- Submitting rebate package
- Revisit business case after bid & rebate values are finalized
- Business Plan Programming
- Pre-purchase long lead time items



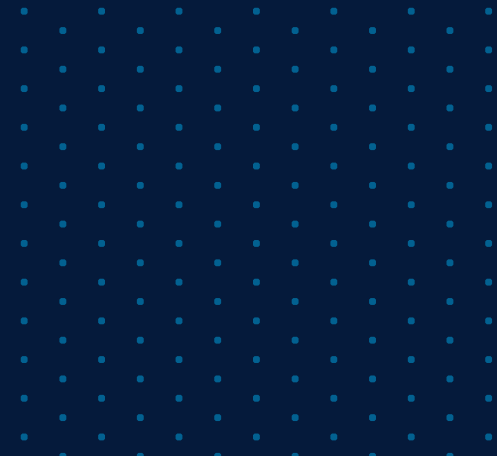


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