Heat Recovery Roundtable

Innovative Products for New York Real Estate

NEW YORK STATE | NYSERDA

May 20, 2025

Agenda

Networking + Breakfast (9:00 – 9:30 AM)

NYSERDA Welcome (9:30 AM)

Swegon Presentation + Q&A

Huber Technology Presentation + Q&A

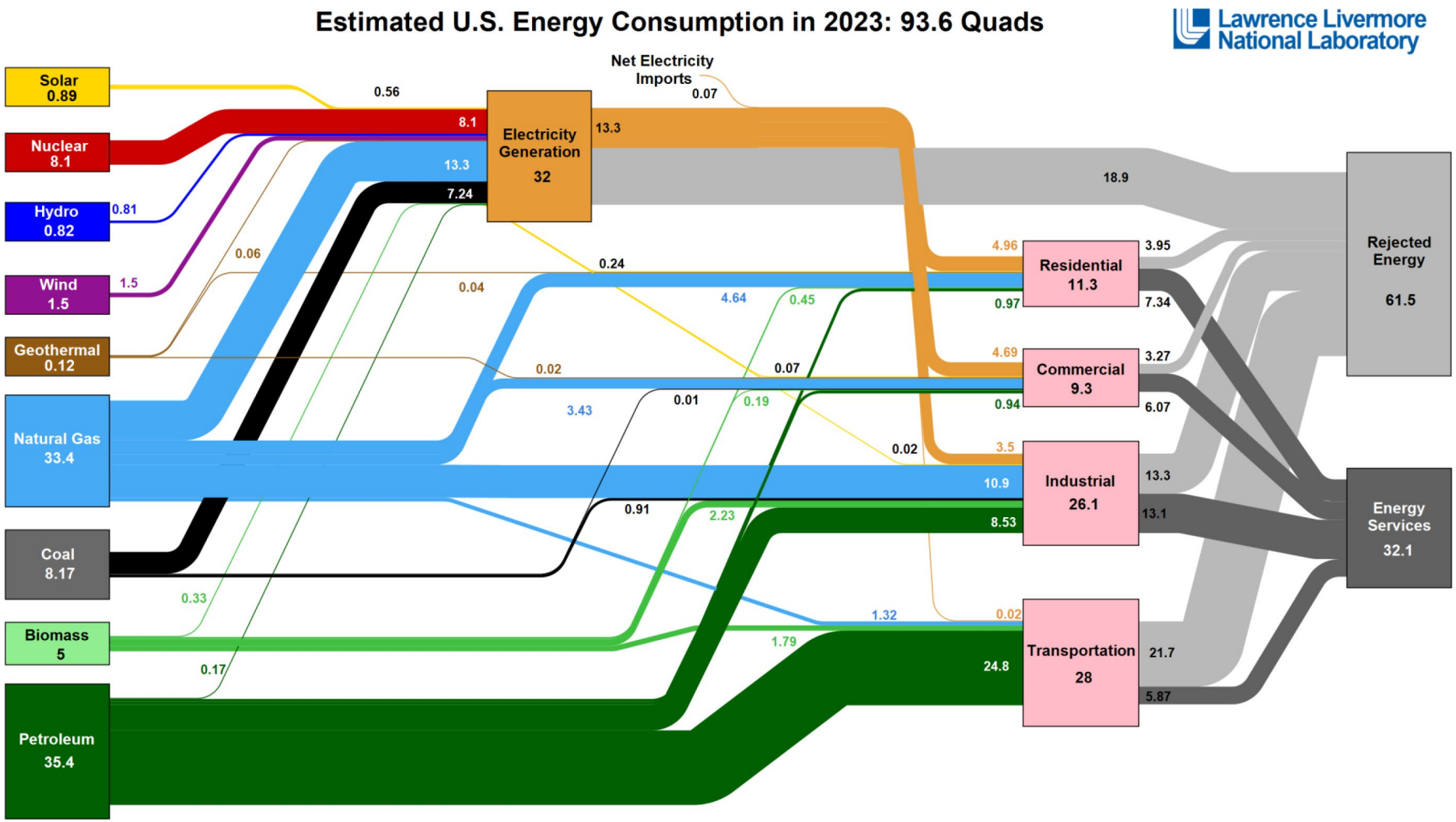
10 Minute Break

Sunamp Presentation + Q&A

Energy Machines Presentation + Q&A

NYSERDA Closing and Networking

Why care about waste heat?



Heat recovery turns a problem into an opportunity.

Buildings waste heat through ventilation, cooling, wastewater removal and more.

Recovering wasted heat and recycling it directly at point of use or storing it for later represents a promising approach to existing building decarbonization.

Cooling produces heat

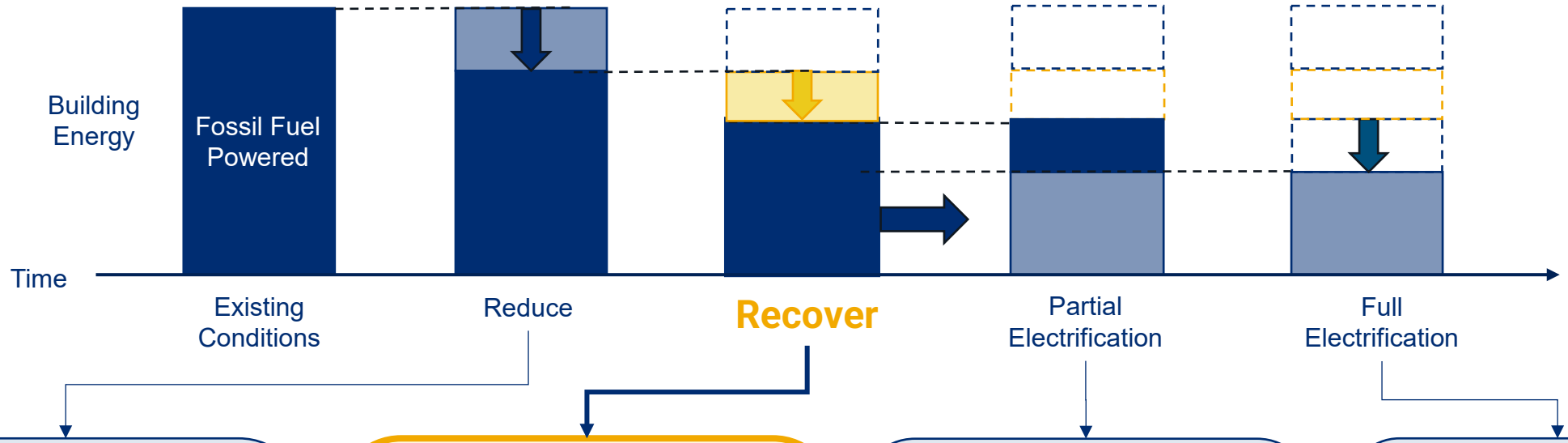
Heat is lost through ventilation…

…or goes down the drain

Internal processes also produce heat

Heat can be stored

Heat Recovery is an Essential Step in Resource Efficient Decarbonization



Reduce Energy Load and Reconfigure

- Building Envelope Improvements
- Control Optimization
- Ventilation Improvements
- Dedicated Outside Air System
- Hydronic Distribution
- Lower Heating Supply Temp.
- Terminal Units Replacement

Recover Wasted Heat

- Ventilation Heat Recovery
- Cooling Heat Recovery
- Wastewater Heat Recovery
- Thermal Storage

Partial Electrification

Replace fossil fuel inputs and prioritize the techno-economic portion of load

- Air Source Heat Pumps
- Water Source Heat Pumps
- Geothermal
- Thermal Layering

Full Electrification

In-time, replace or remove the remaining peak load equipment

- Heat Pumps
- Thermal Storage
- District Thermal Network
- Grid-interactivity

The NYSERDA Heat Recovery Solutions Qualification

- **Heat Recovery Effectiveness:** Competitive uniqueness separating the proposed product from others available in the market.
- **Application in Existing Buildings:** We ask for case studies and performance data.
- **Technology Readiness:** Commercialized product meets or exceeds Technology Readiness Level (TRL) 6.
- **Market Acceptance:** Product addresses a significant problem or overcomes retrofit barriers in NYS.

Explore Our List of 30 Qualified Heat Recovery Solutions

The Heat Recovery Program offers $27M in funding across four categories:

Category Name	Funded Activities	Maximum NYSERDA Funding Per Award	Application	Building Eligibility
Category 1: Heat Recovery Opportunity Assessment	Document current operations and define heat recovery opportunity	$40,000 75% cost-share	Rolling - Apply by November 17, 2025	Existing buildings in NYS All sectors, excluding new construction and single family Both SBC and non-SBC customers
Category 2: Heat Recovery Project Design	Develop schematic designs for viable heat recovery project	$80,000 75% cost-share		
Category 3: Heat Recovery Demonstration	Implement eligible heat recovery projects	$2,000,000 50% cost-share OR 75% for DAC or Affordable Multifamily	Competitive - Submit proposal by June 3, 2025	
Category 4: Manufacturer Growth Initiative	Business development for Manufacturers qualified under RFQL 5217 - Heat Recovery Solutions	$100,000 75% cost-share	Apply to RFQL 5217, then apply to Category 4 by November 17, 2025	N/A

Swegon

Welcome!

NYSERDA Heat Recovery Roundtable

Mike Woolsey, CPHD, WELL AP, WELL Faculty
Business Development Manager, Ventilation
Swegon North America
+1 612 685 6519
Mike.Woolsey@swegon.com

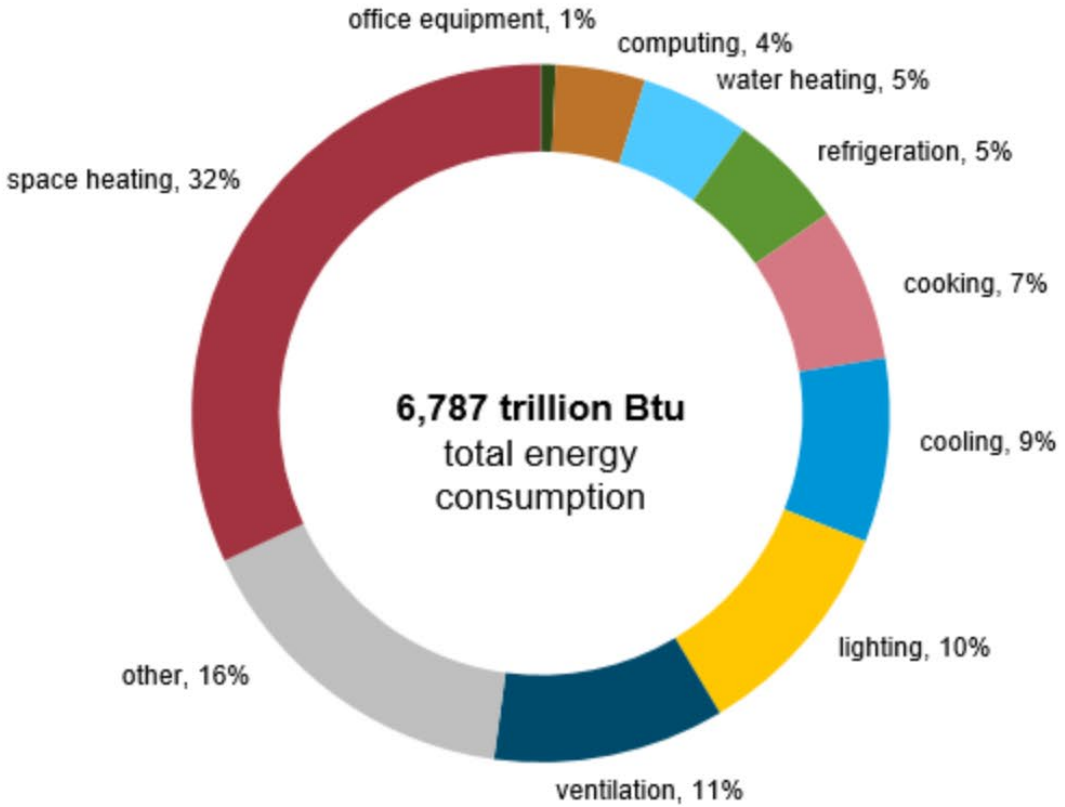
Tyler Zenda
Principal
Tower Enterprises
TylerZ@towerenterprises.net
www.towerenterprises.net

The need for heat recovery

Swegon’s Global Viewpoint

Space heating accounted for close to one-third of end-use consumption in 2018

Major fuels consumption by end use, 2018
share of total

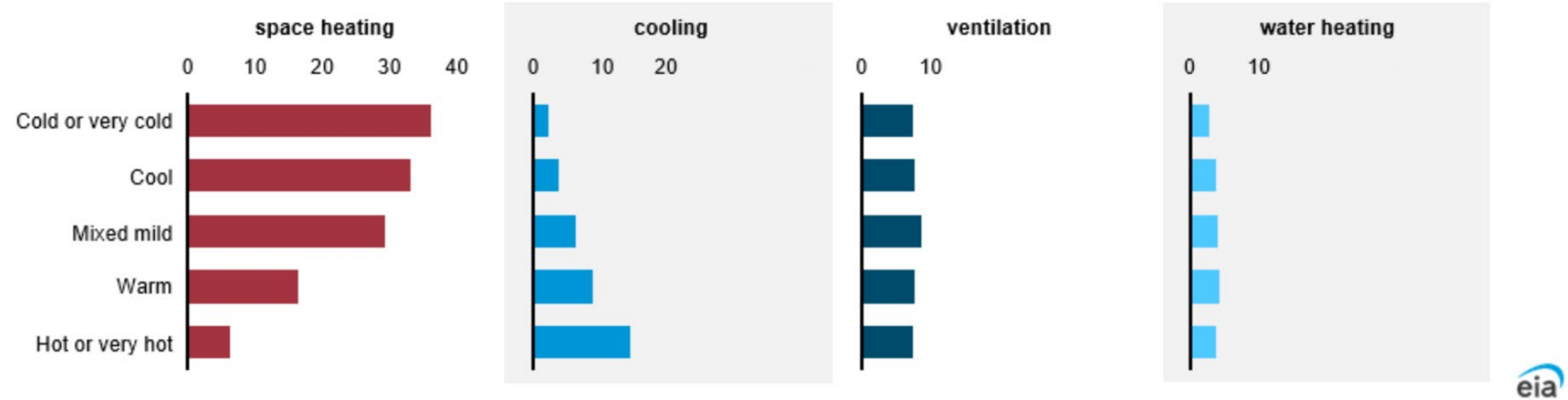


- Space heating was the most common end use in commercial buildings. About 32% (2,167 TBtu) of energy was consumed for space heating.
- Other, ventilation, and lighting each accounted for 10% or more of total energy consumption. Other end uses can include miscellaneous plug loads, process equipment, motors, air compressors, and natural gas dryers.

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

Space heating was the most energy-intensive end use, especially in colder climates

Major fuels energy intensity by climate zone and selected end uses, 2018
thousand British thermal units per square foot



Note: Climate affects energy consumption for the end uses selected.
Data source: U.S. Energy Information Administration, *Commercial Buildings Energy Consumption Survey*

- Buildings in cold and very cold climates were nearly five times more energy intensive for space heating (36.1 MBtu/sf) than buildings in hot or very hot climates (6.3 MBtu/sf).
- Cooling energy intensity was higher in warmer climates. Buildings in hot or very hot climates consumed over five times more energy for cooling (14.2 MBtu/sf) than buildings in cold or very cold climates (2.3 MBtu/sf).
- Ventilation and water heating energy intensities were similar across climate zones.

Ventilation Drives Commercial Energy Use

- ventilation drives heating and cooling loads due to energy used for conditioning outdoor air that is brought into the building for ventilation.

U.S. Building Stock Characterization Study

A National Typology for Decarbonizing U.S. Buildings

Janet Reyna,[1] Eric Wilson,[1] Andrew Parker,[1] Aven Satre-Meloy,[2]
Amy Egerter,[3] Carlo Bianchi,[1] Marlena Praprost,[1]
Andrew Speake,[1] Lixi Liu,[1] Ry Horsey,[1] Matthew Dahlhausen,[1]
Christopher CaraDonna,[1] and Stacey Rothgeb[1]

1 National Renewable Energy Laboratory
2 Lawrence Berkeley National Laboratory
3 Rocky Mountain Institute

NREL is a national laboratory of the U.S. Department of Energy
Office of Energy Efficiency & Renewable Energy
Operated by the Alliance for Sustainable Energy, LLC

This report is available at no cost from the National Renewable Energy Laboratory (NREL) at www.nrel.gov/publications.

Contract No. DE-AC36-08GO28308

Technical Report
NREL/TP-5500-83063
Revised July 2022

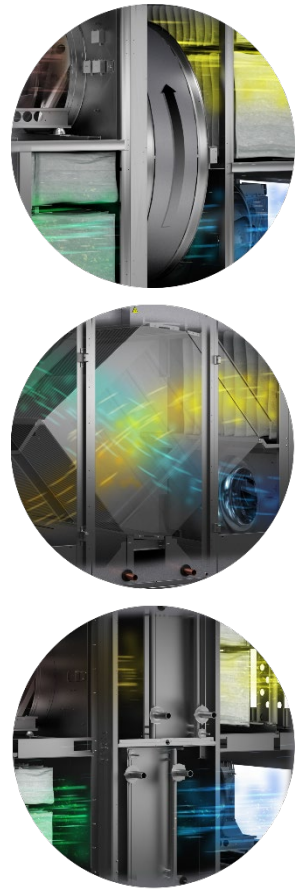
Each project is unique

Requirements and demands can vary

- Air handling capacity
- Energy efficiency
- Available space
- Etc.

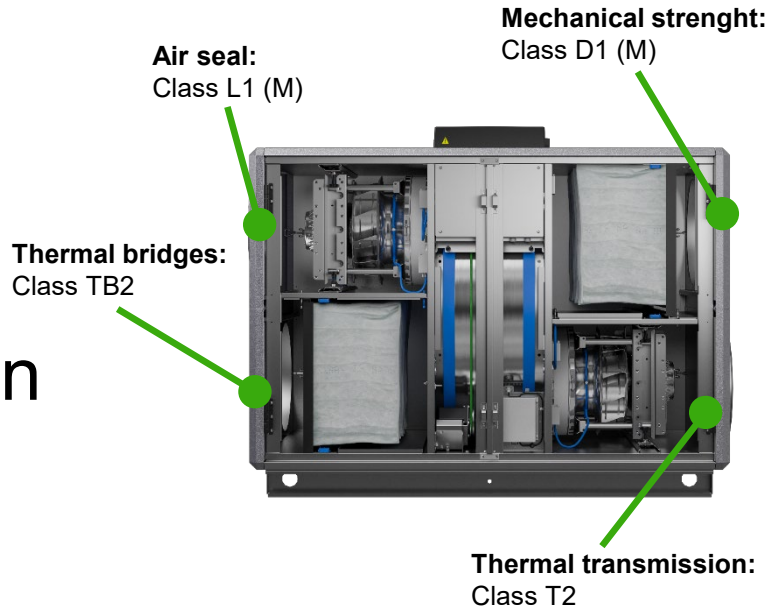
5 ways to optimal energy recovery

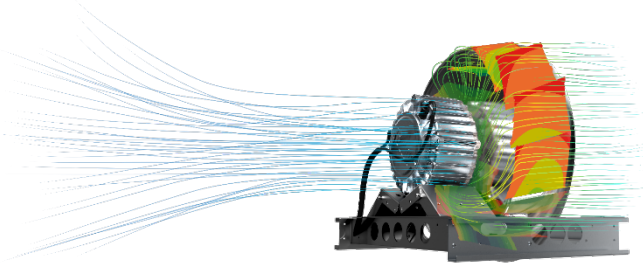
- Turbulent air flow in rotor
- Carry-over rotor control functionality
- Recovery of heat and moisture
- Adaptive demand-controlled defrosting
- Options and flexibility for footprint reduction



5 ways to minimised energy consumption

- Excellent performance as standard
- High internal and external seal
- High fan efficiency, at high and low airflows
- Fans designed for minimal noise and vibration
- Wide working range



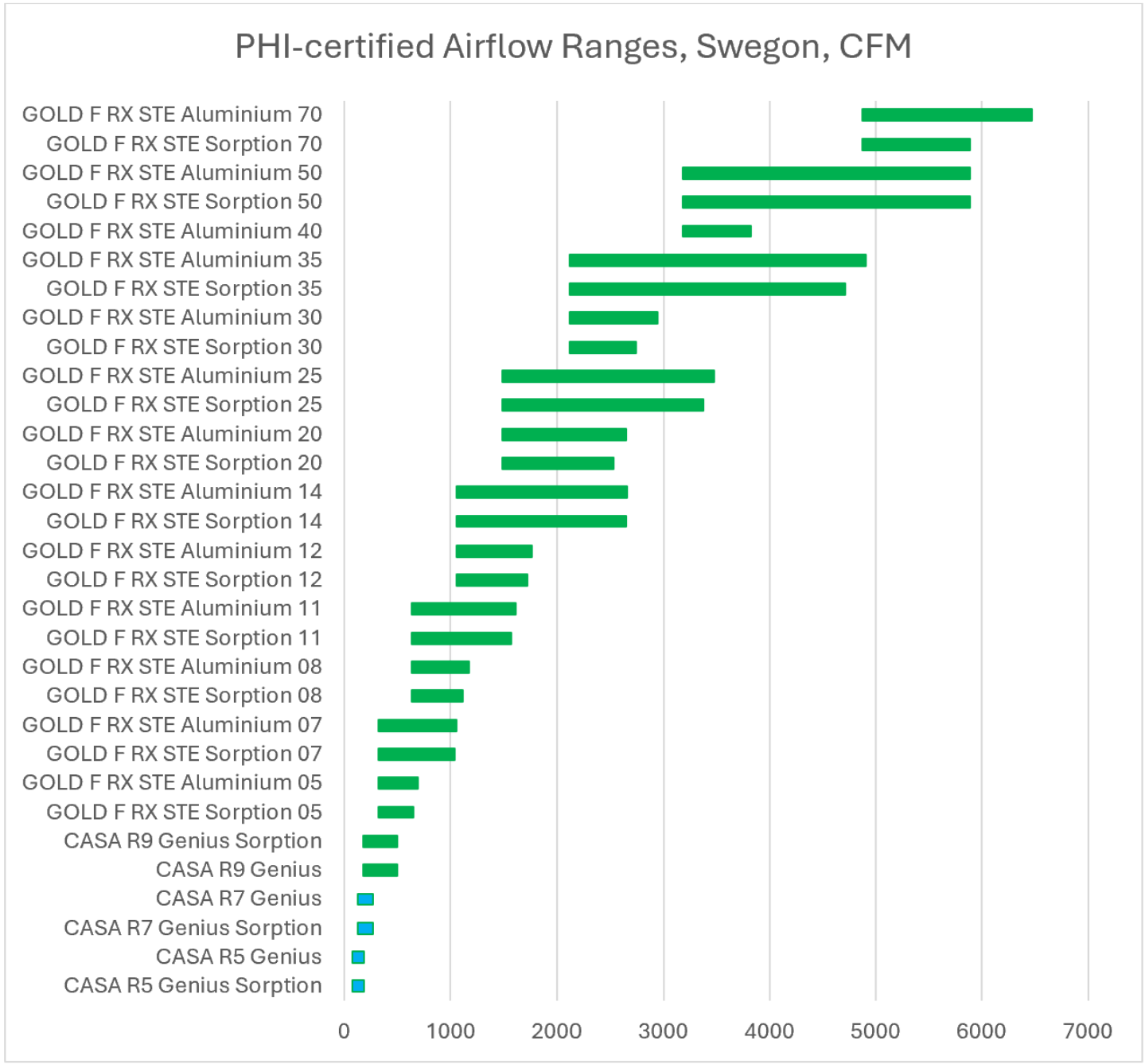


5 ways to adapt to your needs

- Multiple options for duct connection, fan arrangement etc.
- Low noise – easy to find good installation locations
- Multi-functional sections for custom configurations
- Full-function controls – always easy to modify
- Compact physical dimensions

5 ways the control system makes life easier

- Intuitive hand-held terminal
- Integrated server and easy connection with other systems
- Complete control equipment as standard
- Standardised assembly and installation
- Multiple ways to access the unit



- 31 PHI-certified HRV & ERV Model Size combinations
- Certified range:
  71 to 6475 CFM (120 to 11000 m^3/h).

Developing NYC Heat Recovery Solutions

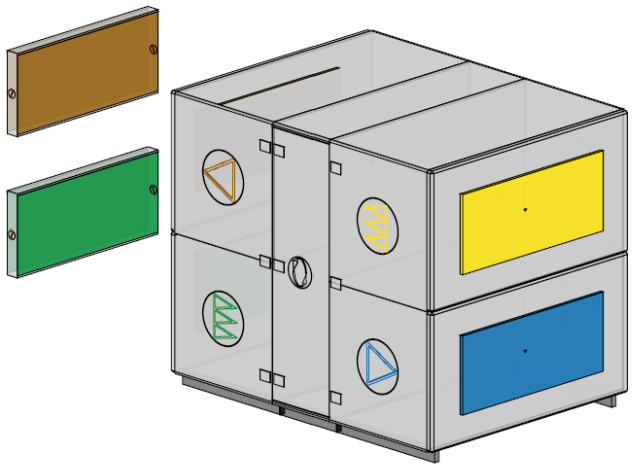
- Partnering with HVAC and Data Cooling manufacturers
- Support NYC engineers, contractors, and building owners
- Product launch and growth of new HVAC equipment
- Customized solutions required for each building
  - Assessment, design and demonstration phases

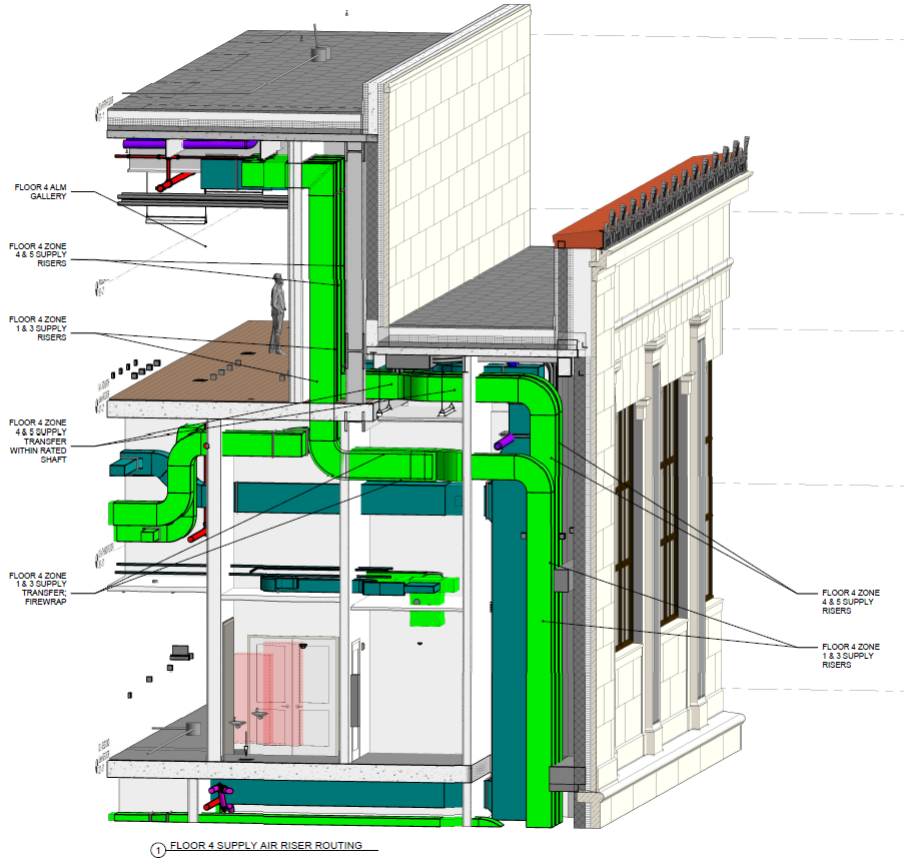
NYU Rubin Hall – Swegon GOLD RX

- EnerPHit Model
- All electric design
- Existing HVAC infrastructure capture
- DOAS/ERV - Rooftop
  - PHI certified performance
  - Heat Pump Integration
  - Dehumidification and occupant comfort
  - Space and sound constraints

NY Historical Society – Swegon GOLD RX

- Museum expansion
- Modular ERV construction
- Reduced mechanical load
- Low sound requirement





Swegon

Feel good **inside**

HUBER THERMWIN WWHR

5/20/25

AGENDA

- CHARACTERISTICS OF WASTEWATER
- WASTEWATER HEAT RECOVERY (WWHR) OVERVIEW
- SYSTEM COMPONENTS
- APPLICATION & SIZING CONSIDERATIONS
- INSTALLATION REFERENCES

CHARACTERISTICS OF WASTEWATER

- Mixture of solids, liquids, and greasy waste
- Solids can be fibrous (i.e. string, cloth, etc..)
- Foul Odor
- Wide range of temperatures (i.e. steam condensate)

TYPICAL WASTEWATER TEMPS

BUILDING

SEWER

PUMP STATION

WWTP

SURFACE WATER

65-75°F

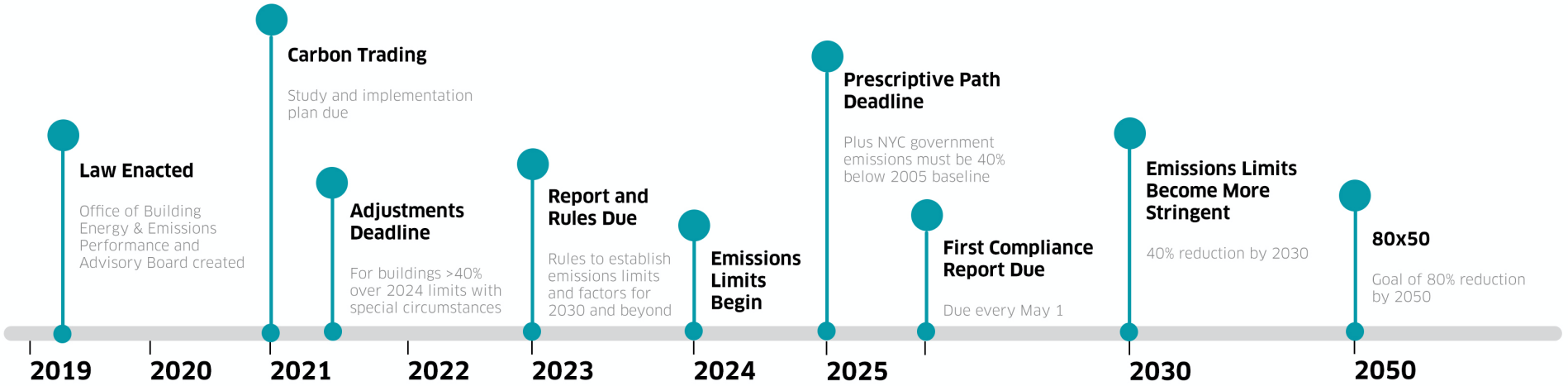
55 – 60°F

50 - 57°F

50 - 53°F

BENEFITS OF WWHR

- Aligns with electrification/carbon reduction initiatives
- Increases overall system efficiency = owner savings $
- Provides a water-source option for all bldg. types
- No roof space requirement
- Eligible for state & federal tax incentives



NYC Local Law 97 – Carbon Reduction Mandate

FEDERAL REBATES & NYSERDA FUNDING

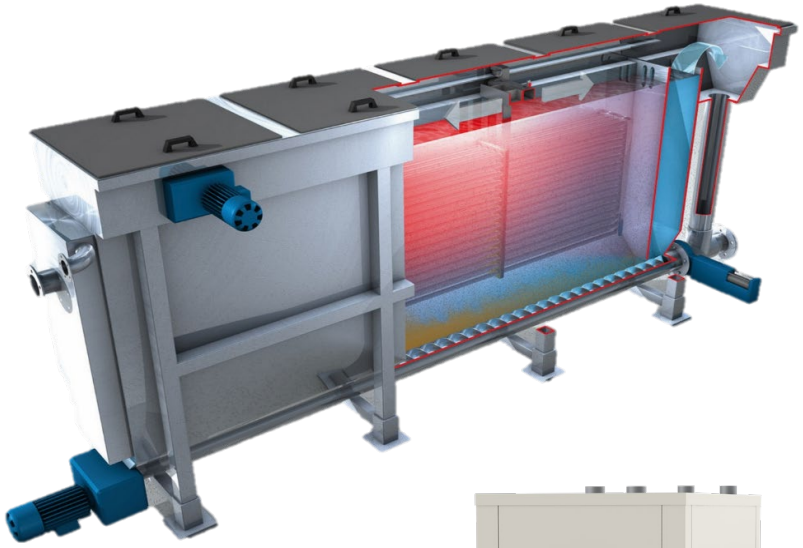
- Inflation Reduction Act (IRA) & ITC 48E (Clean Electricity Investment)
- NYSERDA – HEAT RECOVERY SOLUTIONS

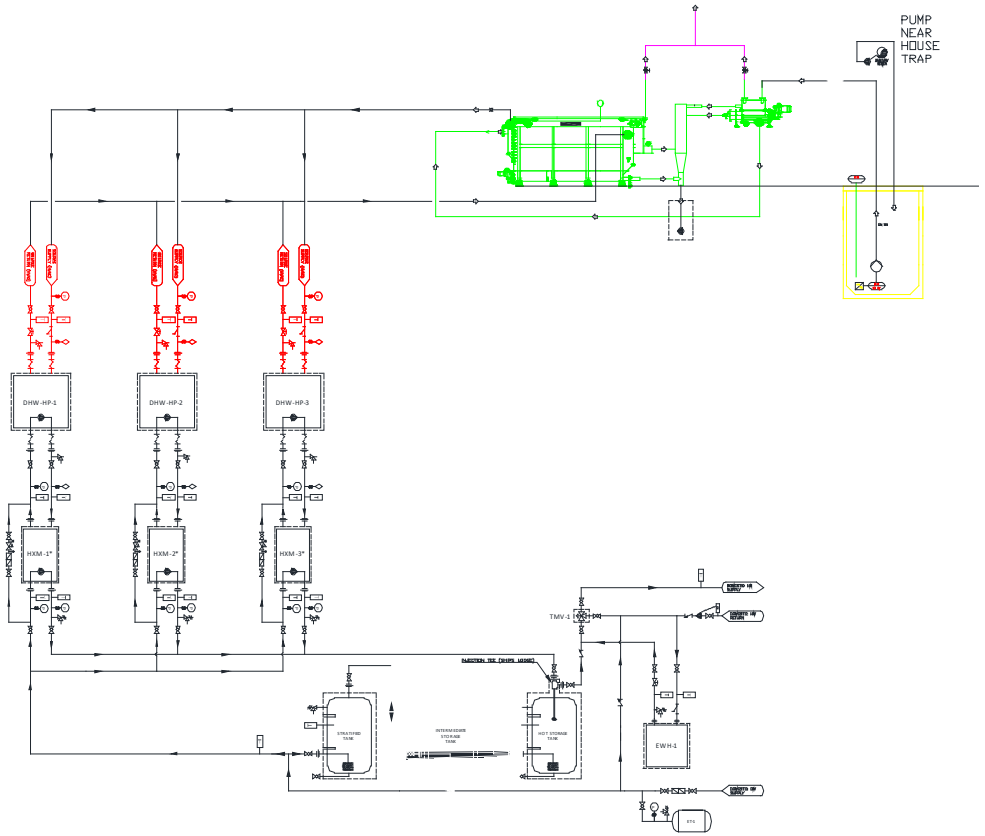
Heat Recovery Solution Manufacturers and Products

Show: 10 rows | Search: | Filter By Product Type: Show All Types

Manufacturer	Description	Product Type
Elstor	This power-to-heat thermal storage system enables cost-effective heat and steam production with renewable electricity. The solution is based on an optimized remote-controlled energy storage technology that stores electricity as thermal energy in the form of steam.	Thermal Storage
Enerdrape	A geothermal panel than can turn any underground structure, like parking garages, building basements, and tunnels into geothermal exchange systems. The Enerdrape panel technology can be easily installed in both existing and new constructions, representing a turn-key solution to decarbonize buildings.	Airside Heat Recovery
Energy Catalyst Technologies	This geothermal heat pump technology provides air cooling and domestic hot water that can be retrofitted into existing hydronic high-temperature radiators designed for 180°F water while using 140°F or lower temperature water. The product supplements the lost thermal capacity by providing heated air through the ductwork.	Process Heat Recovery
Energy Machines	Energy Machines makes it possible to combine heating, cooling, ventilation, and solar and wind power into one integrated system with unique benefits. Unlike traditional HVAC installations that are powered externally and operate separately within the same building, their integrated system generates, stores, and reuses its own energy.	Thermal Storage
Hayzel	This turbine can be retrofitted onto industrial chillers to recover lost energy, lowering net energy consumption by 10%.	Process Heat Recovery
HUBER Technology, Inc.	The HUBER ThermWin process allows heating and cooling of buildings by using the wastewater in the sewer system as a regenerative energy source. Sewer wastewater temperature is usually between 12° and 20° C, and hardly drops below 10° C even in winter, making wastewater an ideal energy source for operating a heat pump. This technology is applicable to all larger buildings and local heating networks.	Wastewater Heat Recovery

SYSTEM COMPONENTS



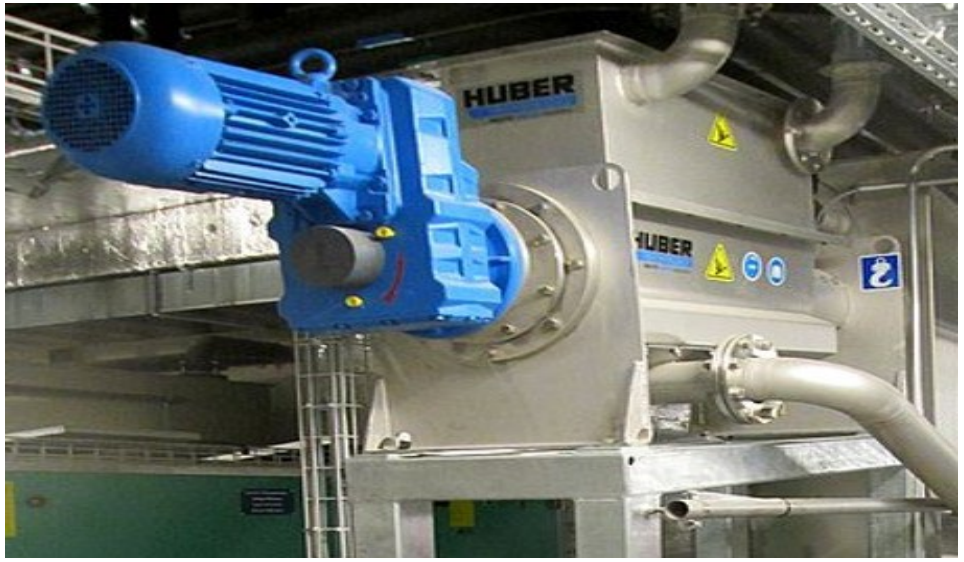


FLEET

SYSTEM COMPONENTS

- Large bldgs are their own ecosystem (mini municipal system)
- Populations can rival or exceed some towns
- People flush all kinds of items down the drains
- WWHR systems need to be comprised of municipal grade equipment

WASTEWATER SCREENER



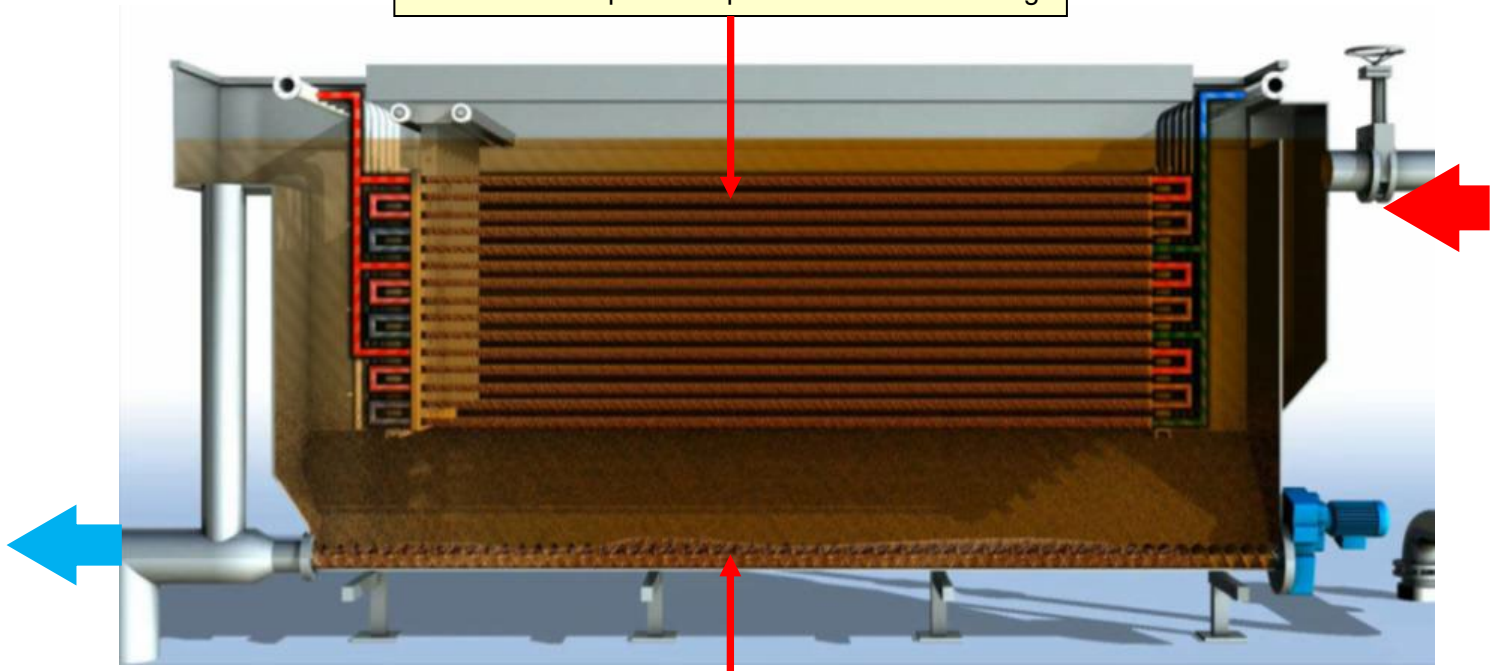
- Mechanical screening of solids
- Up to ~ 3,000 gpm processing rate
- Designed to handle course materials
- Entire assembly constructed of stainless steel
- Passivated for corrosion protection (acid bath)
- Base spec for NYC DEP

WASTEWATER HEAT EXCHANGER

- Processing rate up to 900 GPM
- Modular design with compact footprint
- U-tube heat exchanger with automatic tube cleaning system
- Turbulence generator to breakup grease & optimize heat transfer
- Can be provided in sections with flanges for retrofits
- **Service intervals 7-10 years apart**

AUTOMATIC CLEANING SYSTEM

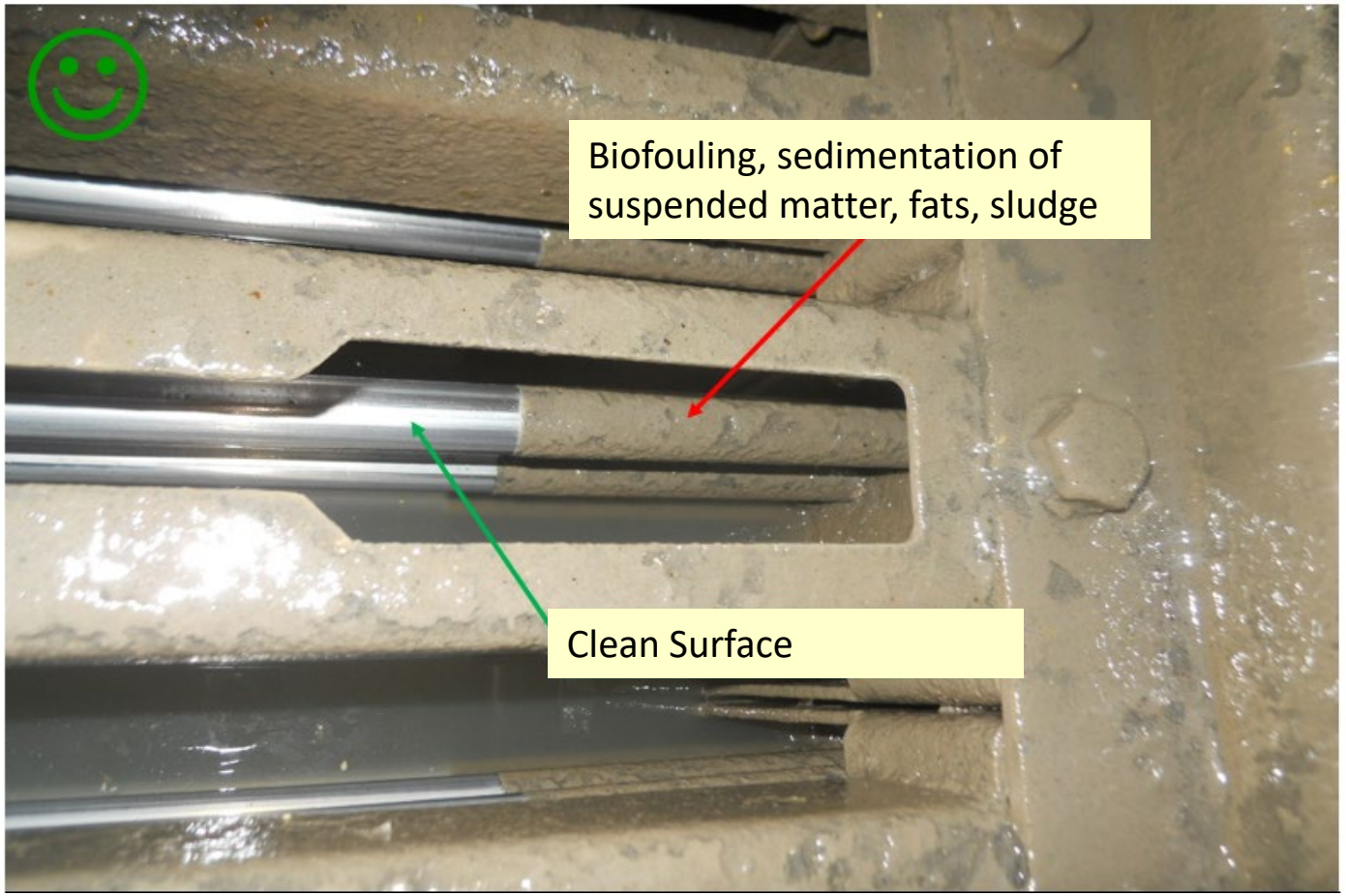
Deposits on the tube bundle reduces heat transfer
- reduction of up to 60% possible without cleaning



Sediment formation – Removed automatically by the discharge screw (auger)

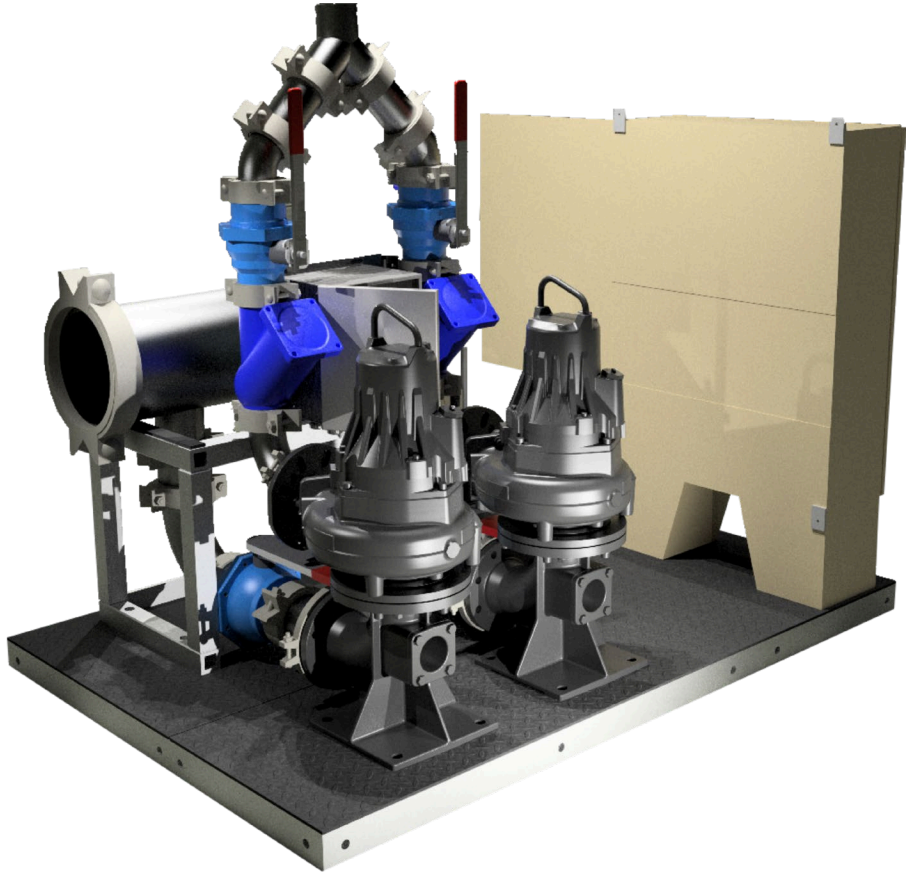
Self-Cleaning HX Video

AUTOMATIC CLEANING SYSTEM

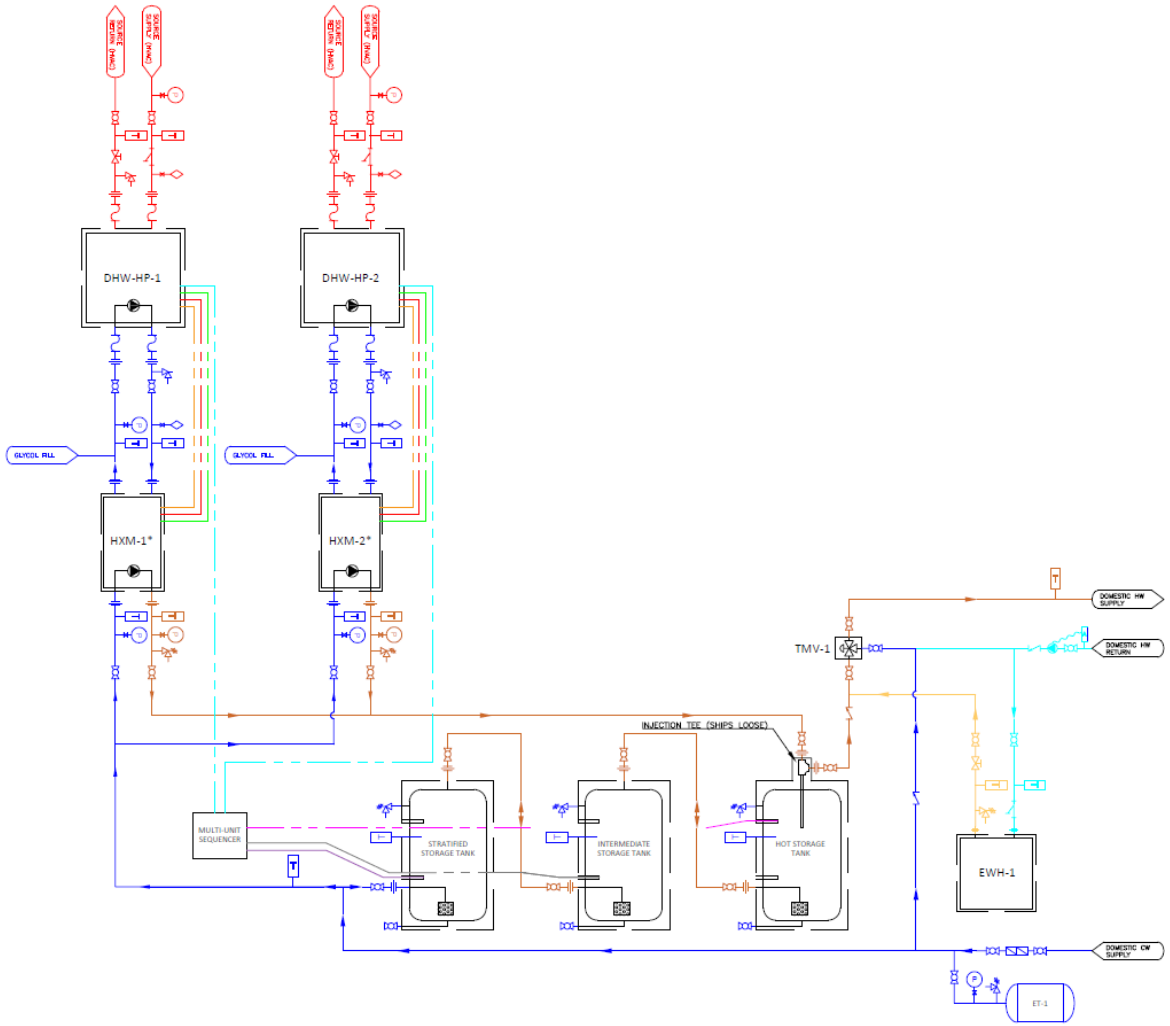


HUBER – THERMWIN WWHR SYSTEM

TRANSFER PUMPS – WET WELL OR DRY-PIT



WATER-SOURCE DHW HEAT PUMPS



WATER-SOURCE DHW HEAT PUMPS

The CO_2 Advantage

- DHW temps up to 170°F
- Natural Refrigerant
  - Future proof (not subject to regulation)
- Environmentally Friendly
  - GWP = 1
- Non-Toxic & Non-Flammable (A1)
- NO COMPRESSOR HP RESTRICTIONS (NYC)

WATER-SOURCE DHW HEAT PUMPS

Synthetic Refrigerant Options (i.e. R513A, R32, R454)

- DHW Temps up to 150°F (~ 15% more storage as compared to 170°F)
- Non-Toxic but Mildly-Flammable (A2L)
- NYC Fire Code Considerations (compressor HP requirements)
- Subject to GWP legislation under **NYS Part 494**:

Refrigeration, Air-Conditioning, and Heat Pump Products		
Subsector	**EPA GWP100 Limit**	**NYS Prohibition Date**
Air-conditioning chillers	20	January 1, 2030
Heat pump chillers	20	January 1, 2034
Residential and light commercial air conditioning and heat pumps	10	January 1, 2034
Variable refrigerant flow (VRF/VRV)	10	January 1, 2030

EXAMPLE APPLICATION SIZING

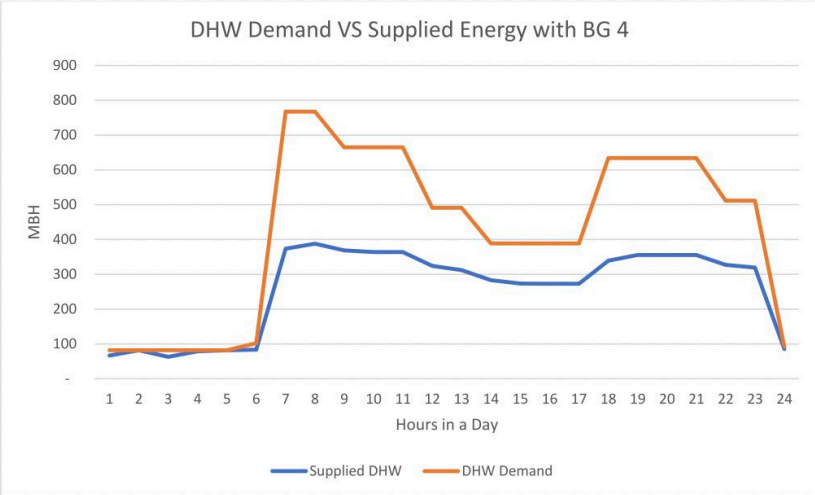


Figure 1: DHW Demand VS Supplied Energy with BG 4

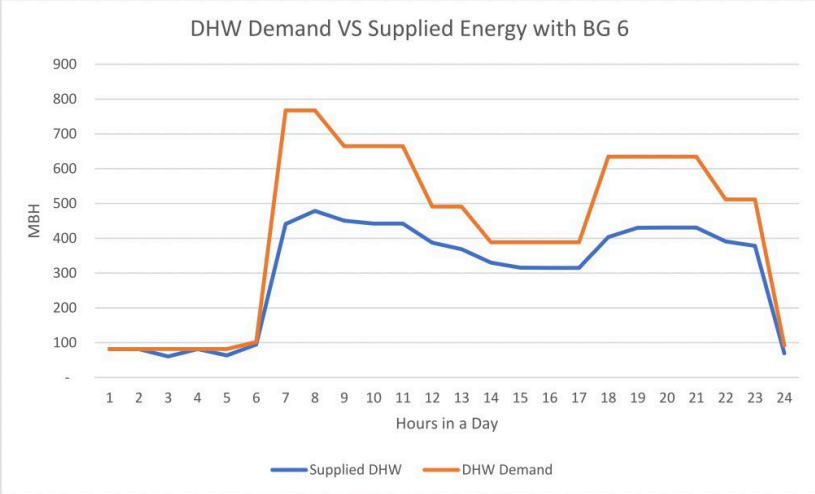


Figure 2: DHW Demand VS Supplied Energy with BG 6

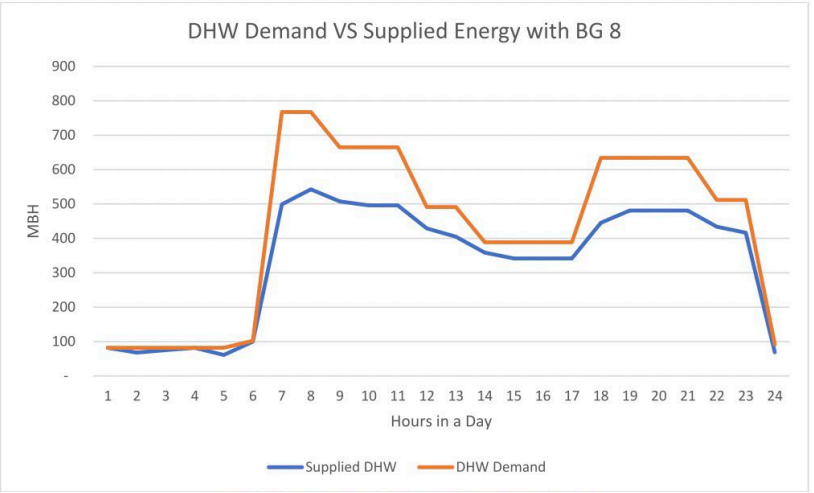


Figure 3: DHW Demand VS Supplied Energy with BG 8

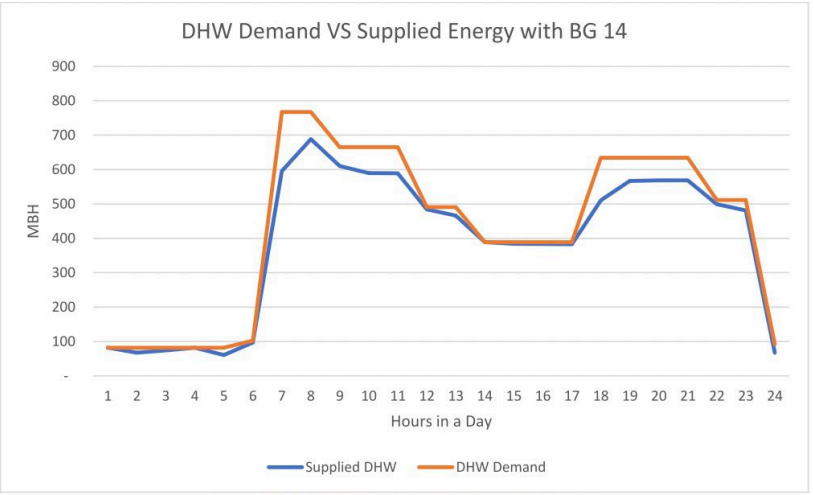


Figure 4: DHW Demand VS Supplied Energy with BG 14

INSTALLATION REFERENCES

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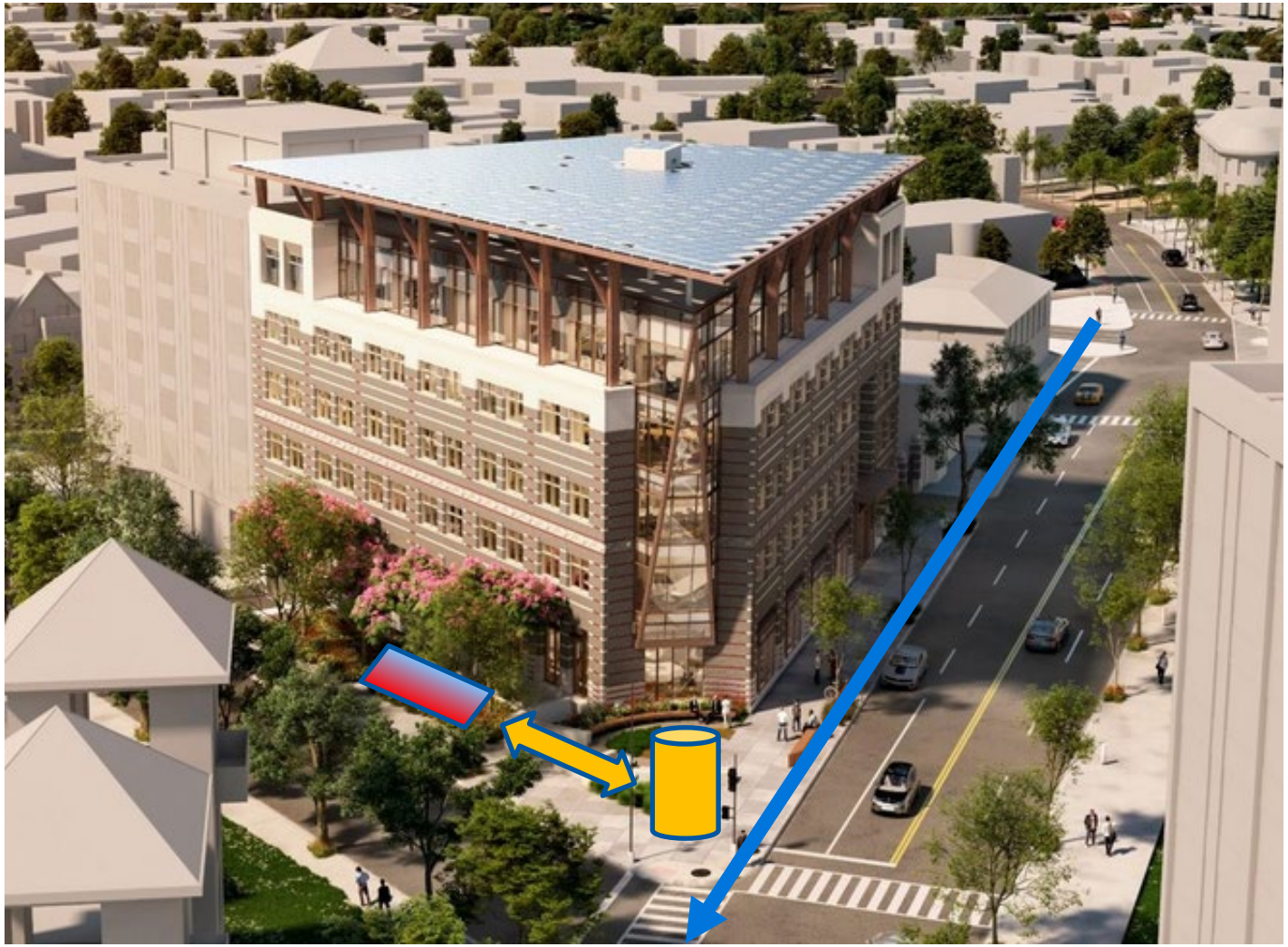
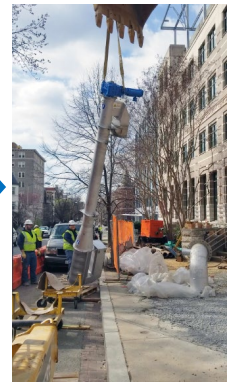


INSTALLATION REFERENCES

AGU – Washington, D.C.

Heating & cooling with wastewater
100% energy supply through wastewater (NO cooling tower available)
Total energy = 250 kW
Direct cooling via plate heat exchanger
Equipment from HUBER SE
1x HUBER Shaft Screening Plant ROTAMAT® RoK4
1x HUBER Wastewater Heat Exchanger RoWin 8
510 gpm @ 10 – 15 °F

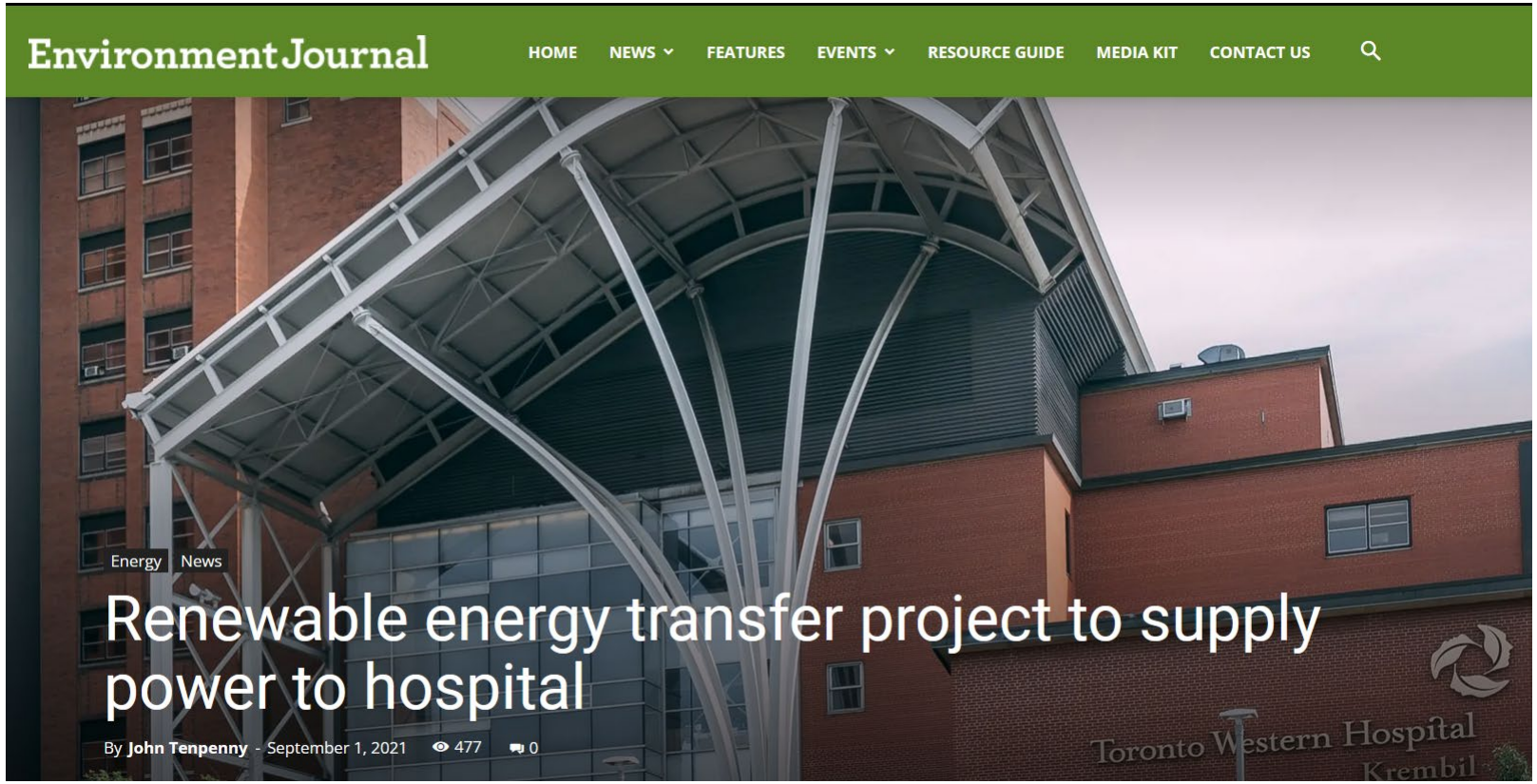
Heat pump / plate heat exchanger



HUBER SE · www.huber.de

INSTALLATION REFERENCES

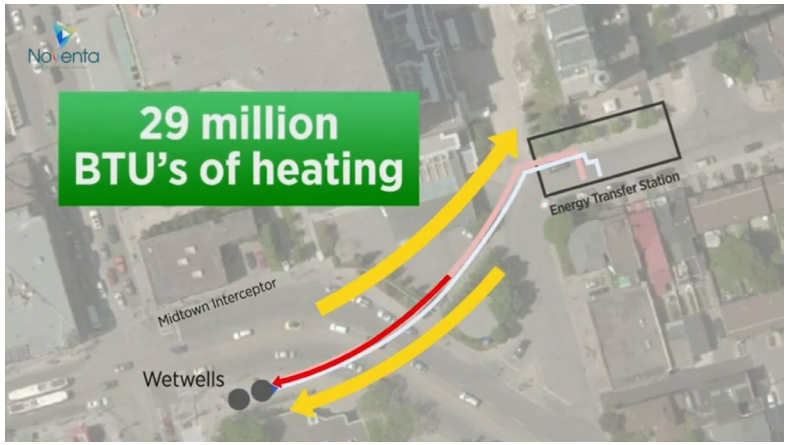
Western Hospital – Toronto, CA



INSTALLATION REFERENCES

Western Hospital – Toronto, CA

- The project will provide over 19MW of low-carbon thermal energy to the hospital facility
- ~ 90% of the hospital's heating and cooling requirements.



Over the next 30 years:

- Reduce CO_2 emissions by 250,000 tons
  - Equivalent to taking 1,800 cars off the road annually
- Save over 141M kWh of electricity
- 130 million cubic meters of natural gas (4,590,906,673 ft^3)
- 340 million gallons of cooling water

Summary

Conclusion

Thank you for your time!

Sean Dabroski, LEED AP
Manager, Commercial Engineering
G.A. FLEET Associates

10 Minute Break

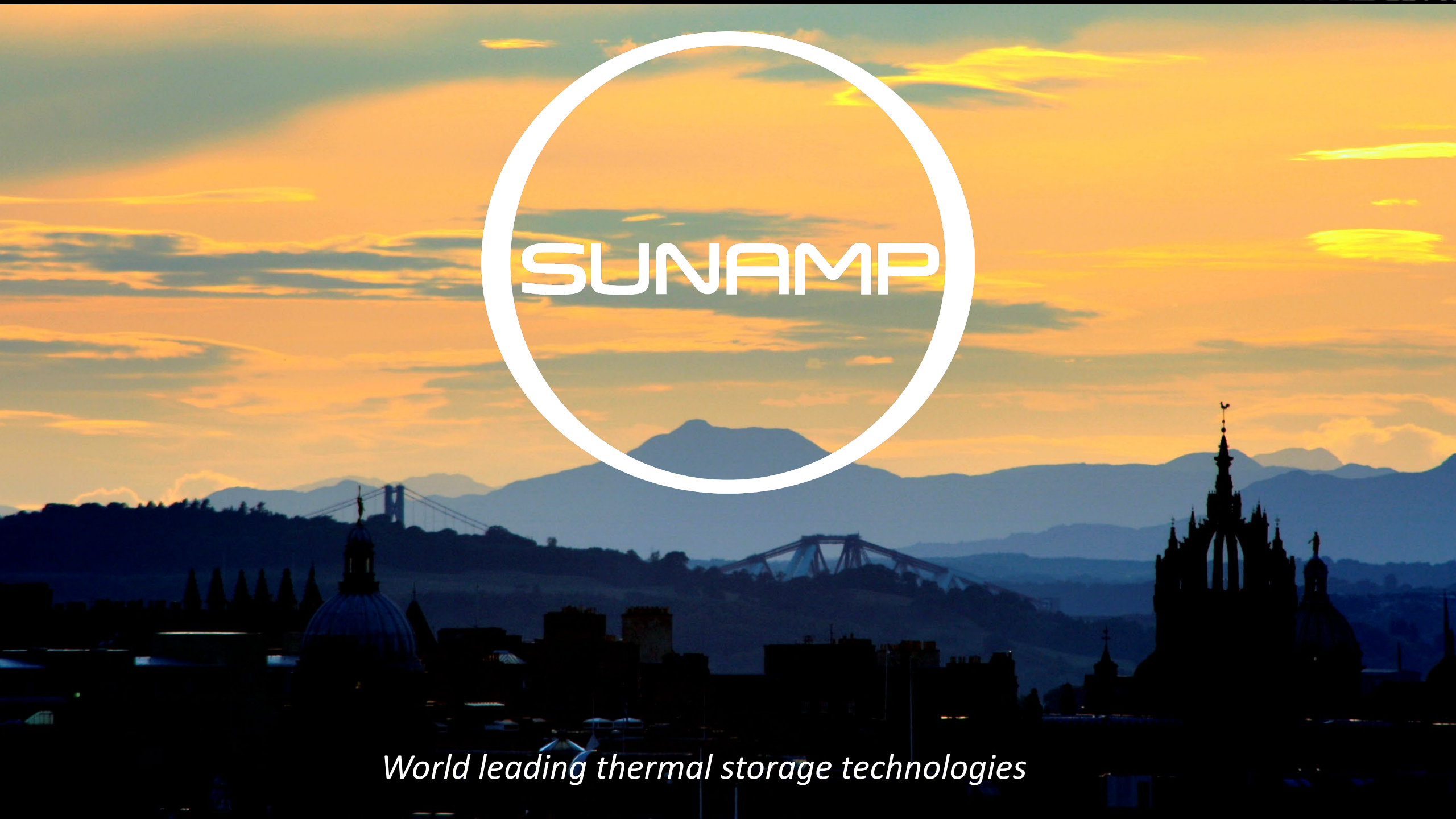
Up next

Sunamp Presentation + Q&A

Energy Machines Presentation + Q&A

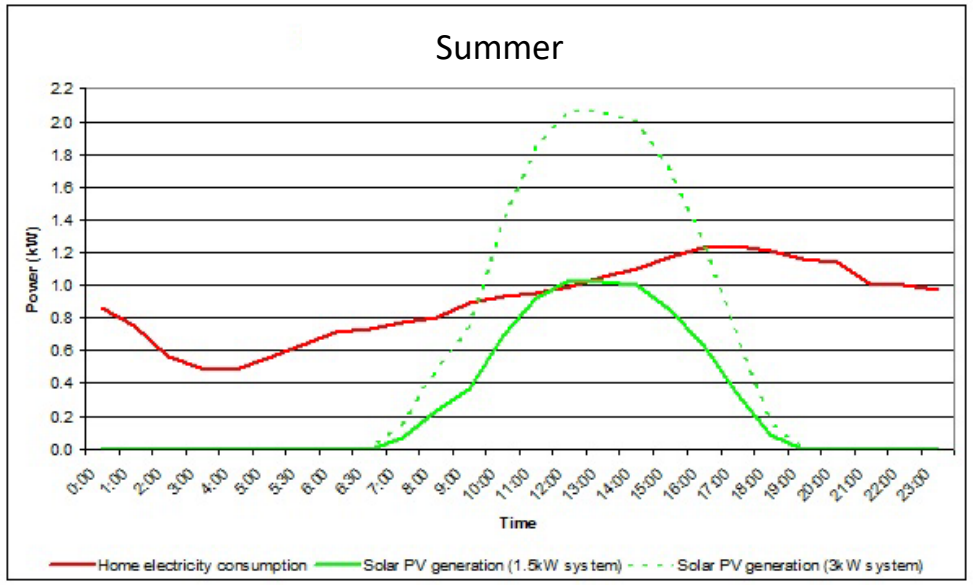
NYSERDA Closing

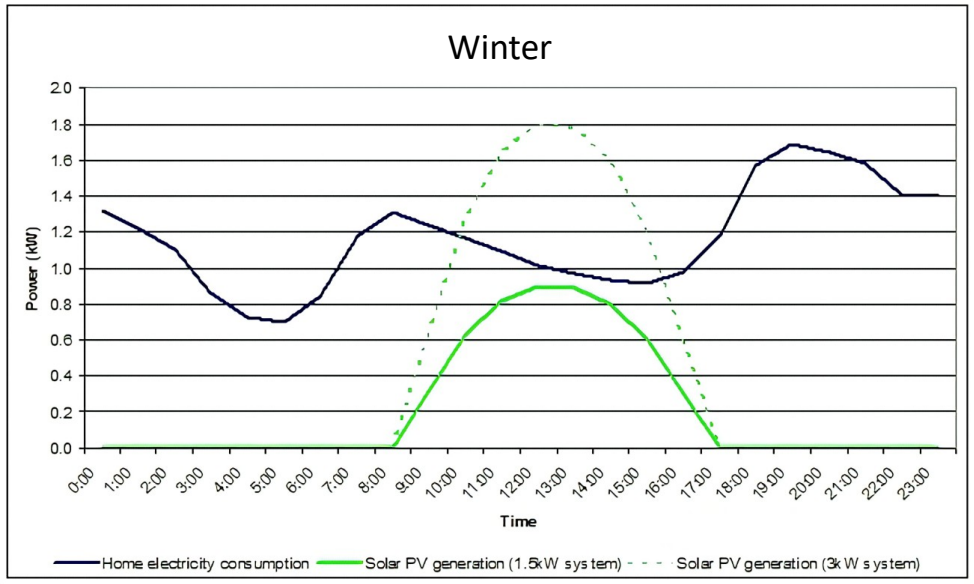
Networking


SUNAMP
World leading thermal storage technologies

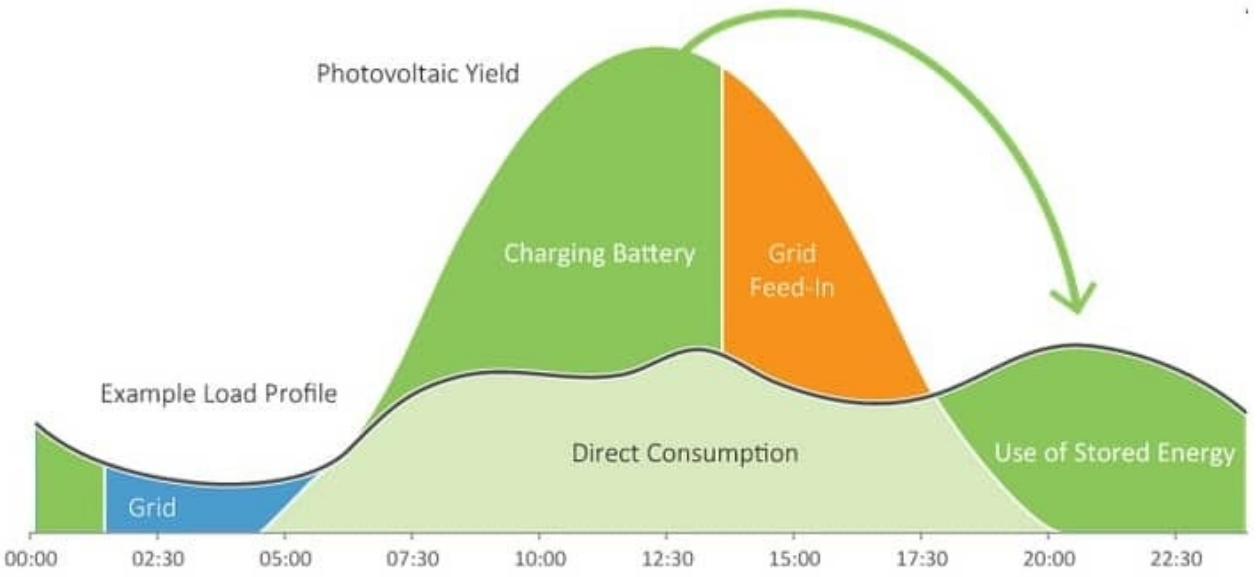
Energy Challenge

Energy Consumption per hour X PV Generation per hour:





How to balance the curve?

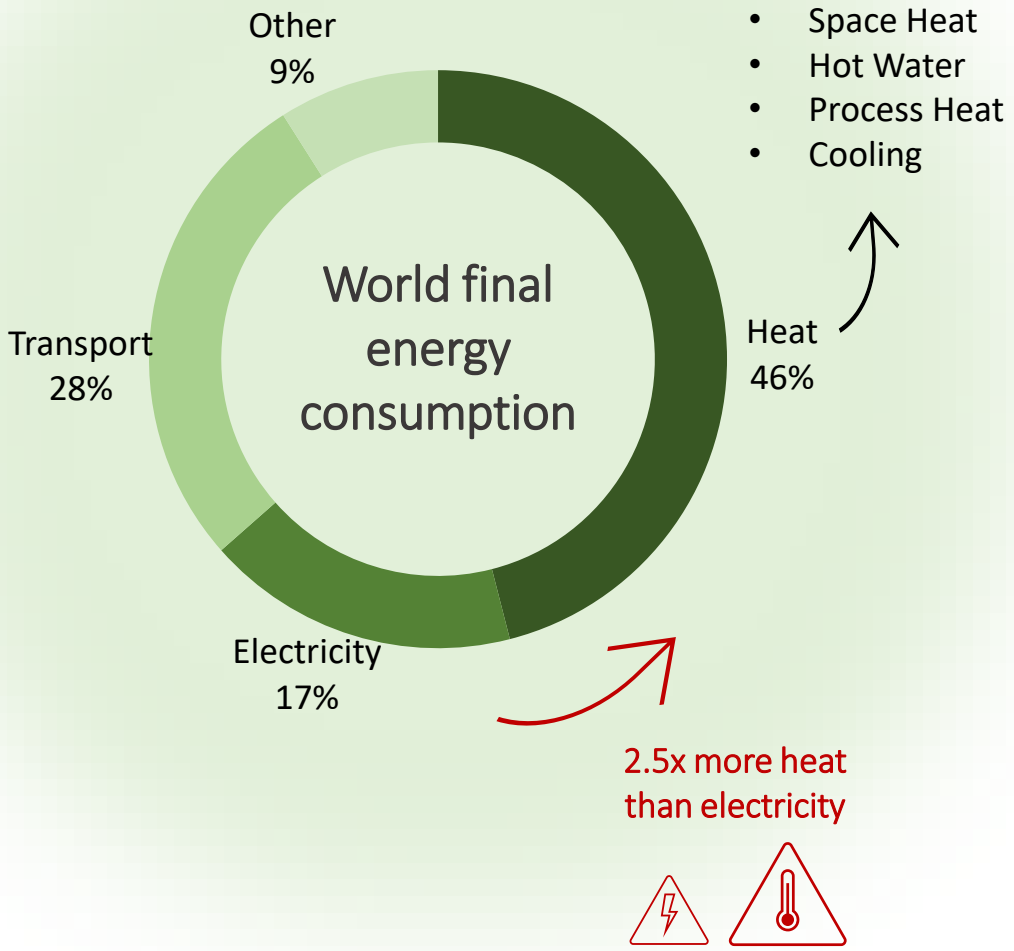


Benefits:

- **Peak Shaving** – by storing heat energy when there is less demand and releasing when there is high demand.
- **Grid Reliability** - reduce cost of reinforcing the distribution grid in order to accommodate the increase in peak demand.
- **No exposure to on peak tariff** - Increase the overall building energy efficiency.
- **Reduce gas emissions** - Compliance with local laws and regulations

Global Footprint

Thermal X Electric Storages

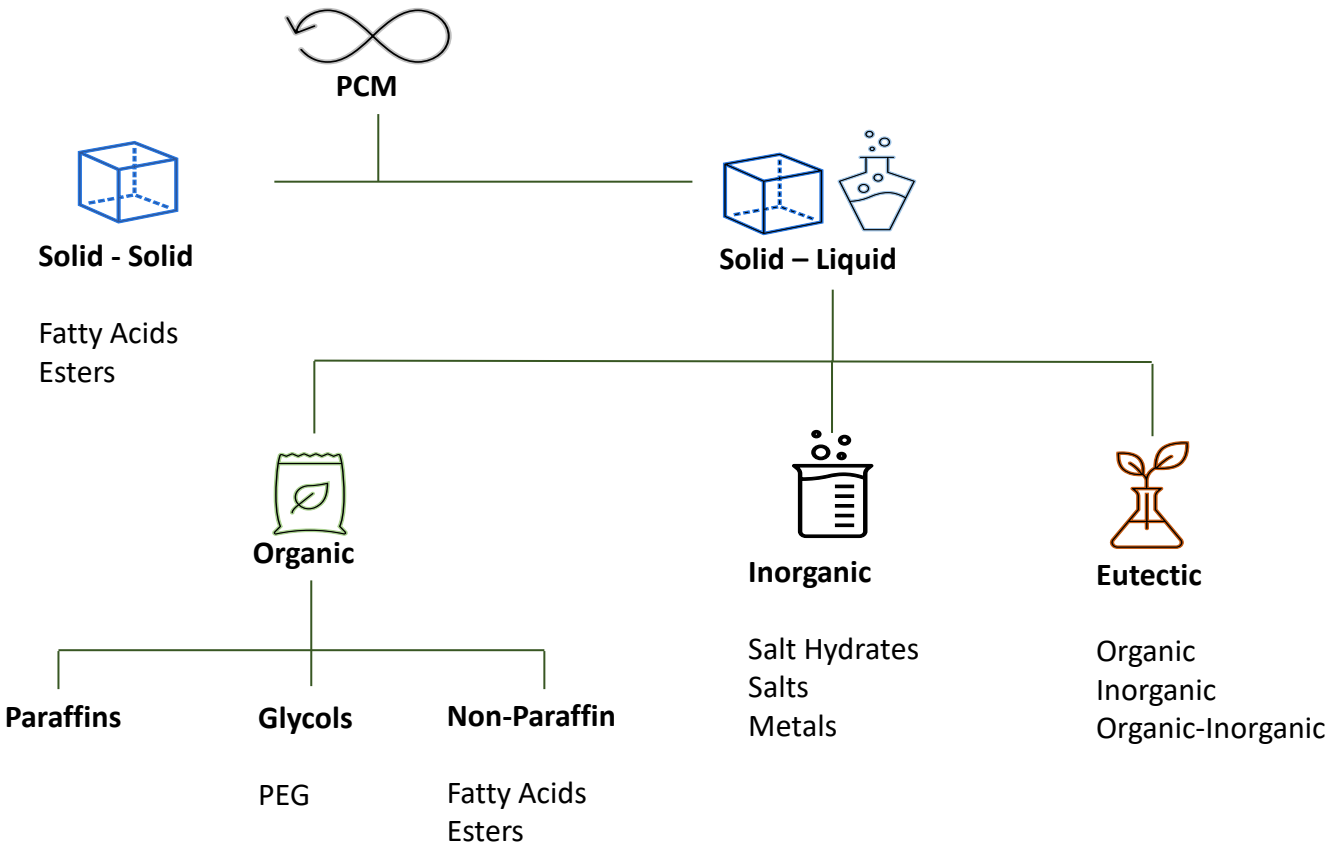


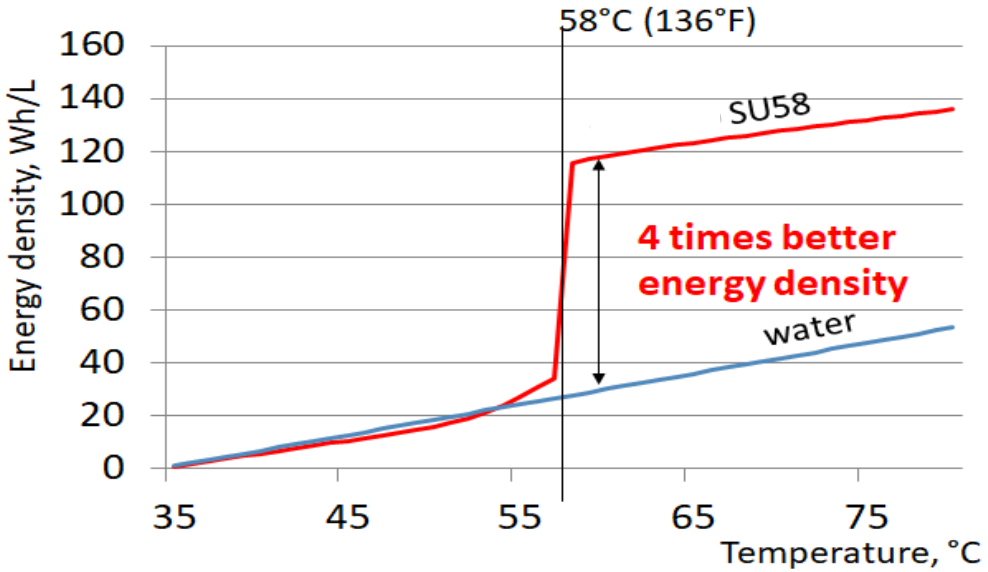
	THERMAL	ELECTRIC
	RESIDENTIAL	RESIDENTIAL
	14 KWH	13.5 KWH
	$ 3,230	$ 8,500
	10 YEARS (tested 43k cycles)	10 YEARS
	22.6in/14.3in/41.3in	29.9in/6.3in/62.8in
	513 lbs	343.9 lbs
	MULTIPLE SOURCES	SOLAR/GRID
	NON FLAMABLE	FLAMABLE
	NON-TOXIC	TOXIC*

$ $

2.7x more expensive (proportionally)

Phase Change Material





- Large temperature range
- Cyclability stabilized
- Complex heat exchanger developed

2022

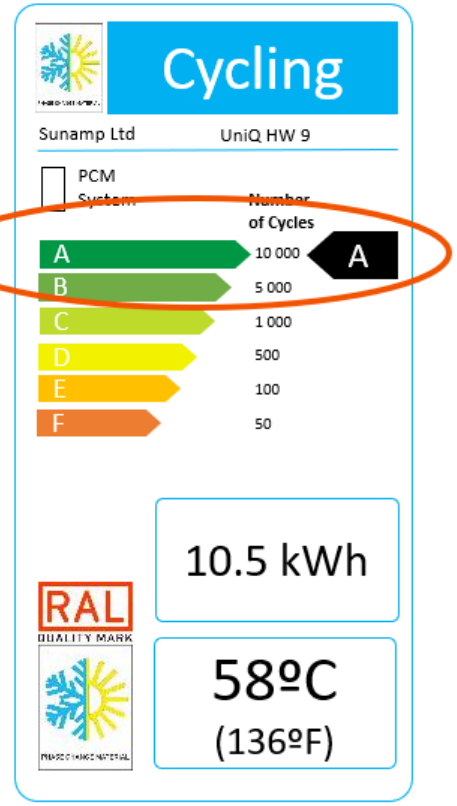
Overcoming the two principal challenges

Poor cycle stability – **Overcome**

- The RAL Quality Association PCM has very recently awarded the RAL Quality Mark to Sunamp Ltd. for its UniQ line of thermal batteries with the leading SU58 material.
- In independent testing conducted by ZAE Bayern, a prestigious German test lab, the PCM was successfully melted and solidified in a UniQ heat battery for 10,000 cycles.
- At the end of the test, no significant differences in stored thermal energy capacity were found between the cycled samples and an uncycled sample of the PCM. Sunamp's UniQ earned the association's highest level of certification:

Grade A

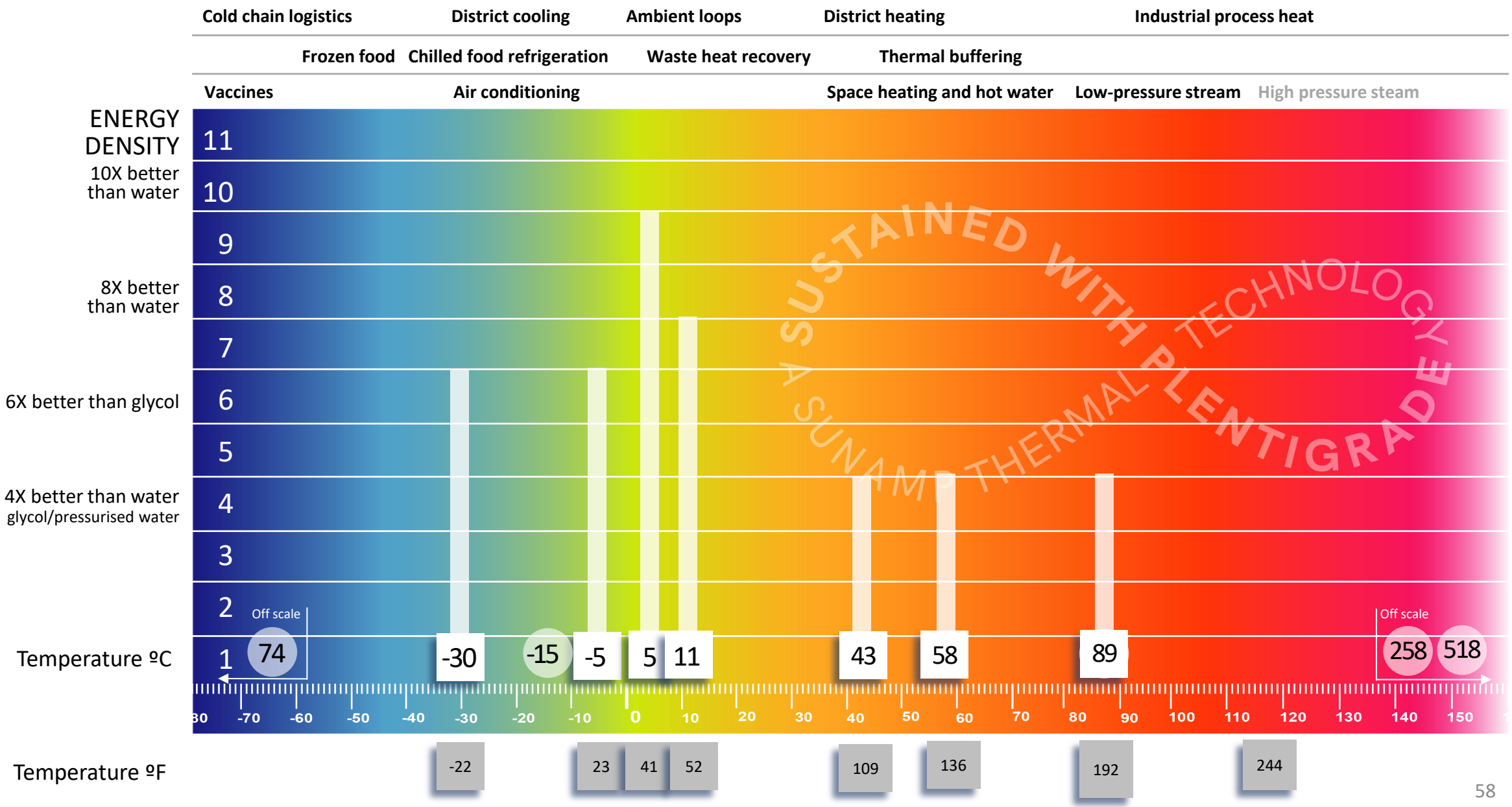
This is the only product in the world to get this certification



Slow or failure to release heat when wanted – **Overcome through HX**

Factory

- Currently producing circa > 200 thermal batteries per week
- Macmerry capacity 20,000 per year
- Easily scalable
- Own and manufacture our PCM


Cold chain logistics
District cooling
Ambient loops
District heating
Industrial process heat
Frozen food
Chilled food refrigeration
Waste heat recovery
Thermal buffering
Vaccines
Air conditioning
Space heating and hot water
Low-pressure stream
High pressure steam
ENERGY DENSITY
10X better than water
8X better than water
6X better than glycol
4X better than water
glycol/pressurised water
11
10
9
8
7
6
5
4
3
2
1
SUSTAINED WITH PLENTIGRADE TECHNOLOGY
A SUNAMP THERMAL
Off scale
74
-30
-15
-5
5
11
43
58
89
Off scale
258
518
Temperature ºC
-80 -70 -60 -50 -40 -30 -20 -10 0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150
Temperature ºF
-22
23
41
52
109
136
192
244

Flexible and modular products

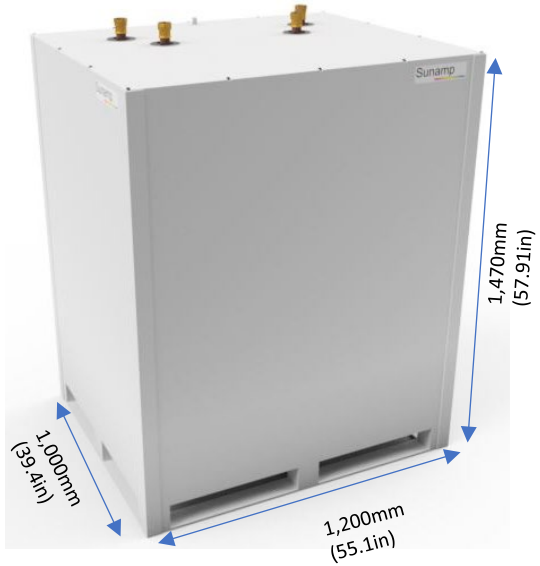
Thermino 20

Thermino 40

Thermino 60

Thermino 80

Central Bank Mini

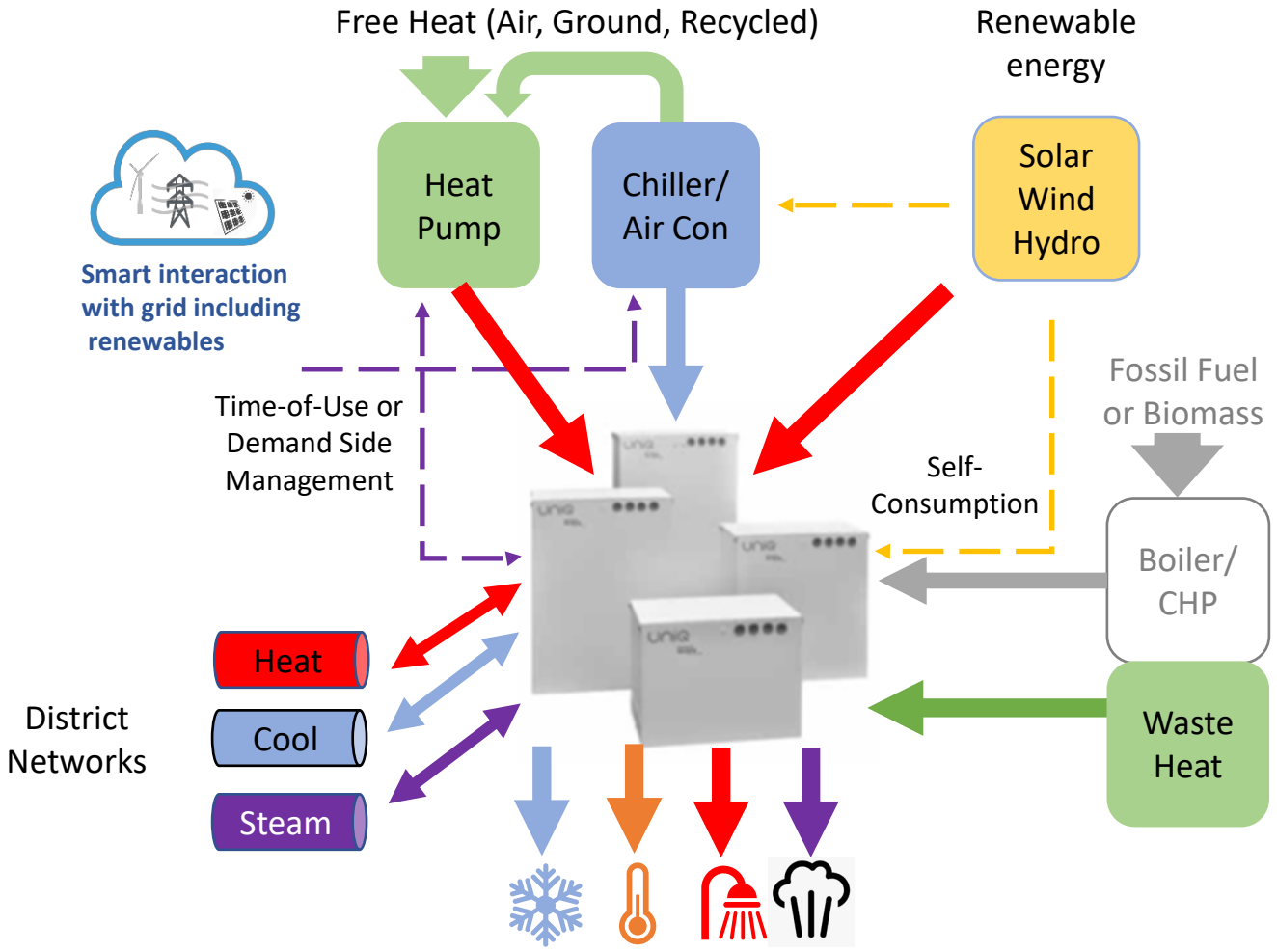


*height for models including stand-by electric heaters

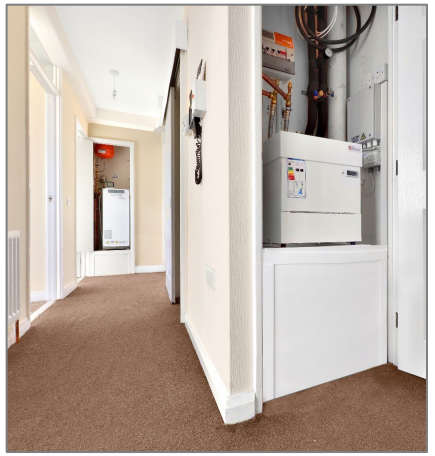
Model Example	Measured kWh / (BTU/h)	Equivalent cylinder (L) / (g)	Heat Loss (kWh/24h)	Comments	ErP Rating
UniQ HW 3	3.5 / (11,942)	70 / (15)	0.449	Stackable two high for larger storage	A+
UniQ Heat 6	7 / (23,885)	140 / (31)	0.649		A+
UniQ HW 9	10.5 / (35,827)	210 / (46)	0.738		A+
UniQ Dual 12	14 / (47,770)	280 / (61)	0.809	Palletised, 1.5 Tonnes	A+
UniQ Heat 80	90 / (307,093)	1800 / (395)	2.2 (provisional)		No / Non ErP

Published Worldwide PCT Applications:
WO 2009/138771, WO 2011/058383, WO 2014/202974,
WO 2014/195691, WO 2014/191778, WO 2015/025175, WO 2017/221025

Integrator technology for the future world



Compact



Enabling solution:

Space constrained apartments (fitted in <400mm (15 ¾ inches) depth cupboard.

Charged by water to water heat pump COP >3 from a ground loop.

Luxury flow of instantaneously hot water

Reduced operational expenditure

- Reduced fire risk
- No legionella risk
- Lower heat loss
- No annual maintenance
- Emergency hot water back up in the event of a failure in the loop
- Landlord savings ~GBP £1.65m/pa
- Tenant saving ~GBP £230/pa/apartment
- Glide path to zero as grid decarbonises

Standalone Sunamp heat battery applications and case study (commercial installation) for space heating and domestic water heating.

- ✓ We are working with **Chartered Properties** to decarbonize their multifamily properties.
- ✓ The attached photo of installation in one of their buildings, shows **7 Thermino 80s** piped together in parallel.
- ✓ These will be used to provide DHW and heating for the building of **6 apartments**.
- ✓ They will take advantage **time of use low-cost electric** to charge the batteries via their internal heaters.
- ✓ There will be an electric flow boiler installed into the central heating loop as well for extreme conditions.
- ✓ The building originally had an old gas fired boiler that provided heat and DHW for the building. The new installation allows the building to **comply with LL97** and therefore avoid any fines and is expected to provide lower operating costs (being monitored to confirm).

College Campus Cuts Carbon Emissions with Hybrid Energy Center

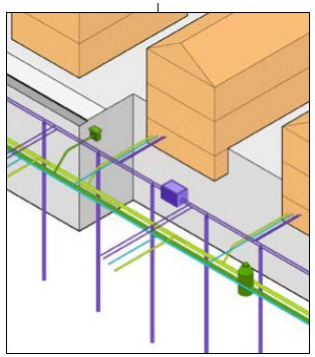
A hybrid energy centre at Wirral Met College has an integrated heating and electrical supply solution that provides 65% of electricity and almost all of the campus' heating and hot water needs by using thermal storage batteries.

- The energy centre has a hybrid set up with two 65kWe Capstone gas turbines, two thermal batteries storing in excess of 130kWh and 134kWh TESVOLT Lithium-ion batteries.
- The thermal batteries, along with the Lithium-ion batteries, store energy during periods of low demand and supplement the heating and electrical systems when demand is high
- This allows the Combined heat and power (CHP) units to operate more efficiency and maximize the return from the sale or avoided purchase of electricity to the grid
- The batteries provide the flexibility to balance the system by quickly releasing stored energy when needed.

- Supplying majority of heating and hot water needs for the college campus, cutting energy costs by 40%
- Reducing site-wide carbon emissions by 18%
- Thermal batteries take up less space in the plantroom as they are 70% smaller in volume than the equivalent traditional hot water cylinders.

Example

PV electricity or



Geothermal Network

Heat Pump

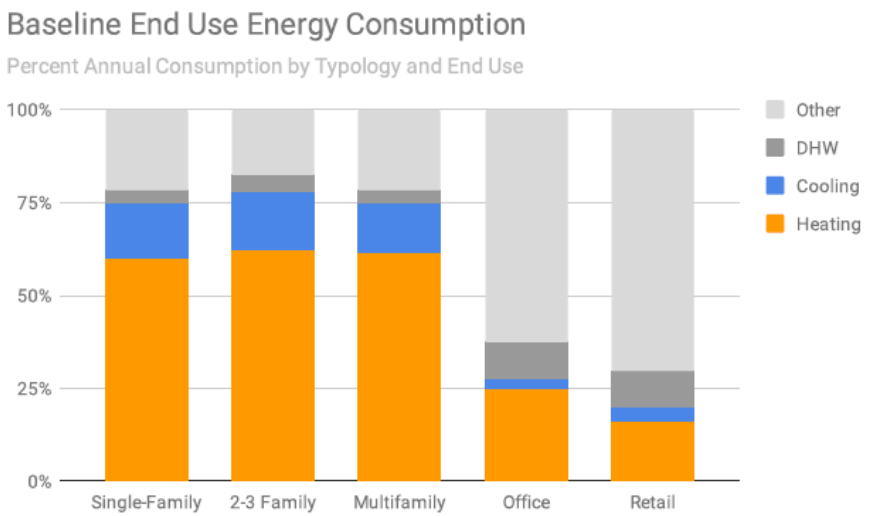
Battery 1 - 60°C (140°F) for charging
Battery 2 - 8°C (46°F) for charging

Heat Pump

Battery 1 - 60°C (140°F) for charging
Battery 2 - 8°C (46°F) for charging

15°C (59°F) cold main water

+ as many houses as possible in the same street



Hot water
Heating/Cooling

Battery 1 - DHW:
46°C (114°F) out from TES (60gal)
Battery 2 - Heating:
46°C (114°F) out from TES (10kWh)
Battery 2 - Cooling:
12°C (54°F) out from TES (5kWh)

Hot water
Heating/Cooling

Battery 1 - DHW:
46°C (114°F) out from TES (60gal)
Battery 2 - Heating:
46°C (114°F) out from TES (10kWh)
Battery 2 - Cooling:
12°C (54°F) out from TES (5kWh)

Developing low carbon heat

- Running successfully since 2013
- Running costs savings 45% to 57% , carbon emission reductions 17% to 36%
- Replicated at ONGO homes in 2016/2017, installing in old coal cellars

CASE A

This is a 2-bedroomed house with 2 working occupants. They are heavy hot water users having 2 deep baths in the morning and 2 deep baths in the evenings

Annual Savings on Heat and Hot Water		
Energy saving	Bill saving	CO_2 Saving
59%	56%	29.1%
8,404 KWh	£602.17	1259 $KgCO_2$

CASE B

This is a 3 bedroomed house lived in by a young working couple, their heat and hot water usage is normal. This household had night storage heater. Comfort has improved.

Annual Savings on Heat and Hot Water		
Energy saving	Bill saving	CO_2 Saving
40%	45%	36%
4,921KWh	£414.78	1596 $KgCO_2$

CASE C

This is a one-bedroom house, semidetached bungalow. The occupier is a retired man who looks after his grandchildren in the early evening so the house must be warm - Achieved

Annual Savings on Heat and Hot Water		
Energy saving	Bill saving	CO_2 Saving
49%	57%	Not Available
3,291 KWh	£325.91	Not Available

CASE D

This is a 5-bedroomed house with 2 working occupants and 1 teenager child and 1 visiting young adult

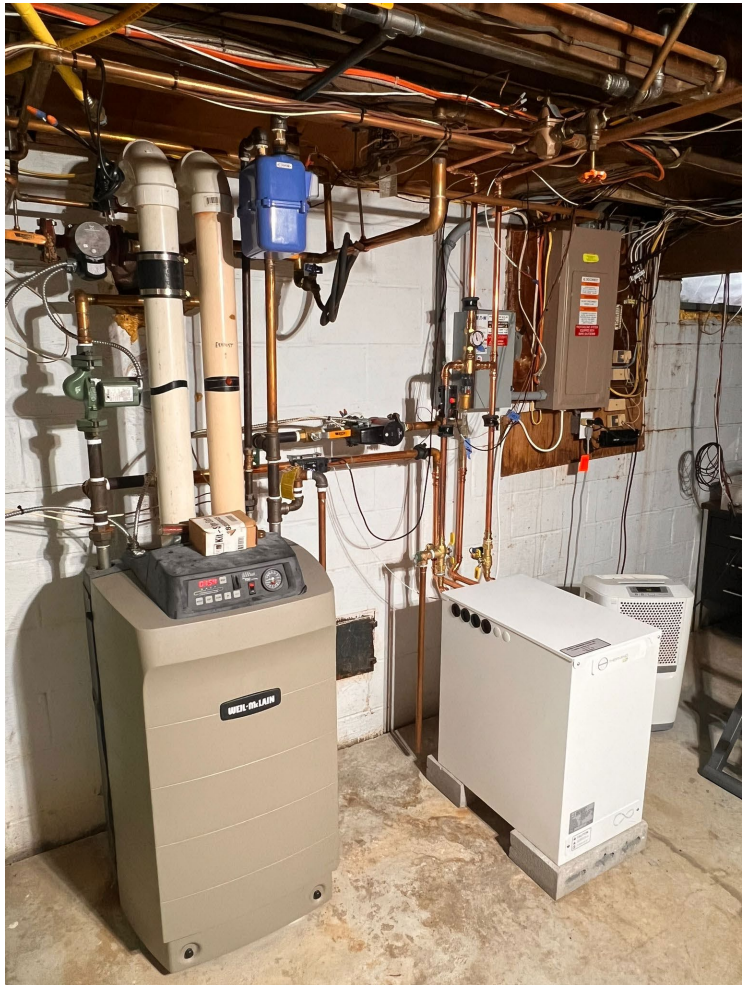
Annual Savings on Heat and Hot Water		
Energy saving	Bill saving	CO_2 Saving
77%	50%	46%
28,476 KWh	£926.77	3645 $KgCO_2$

Single house (3 people occupancy) - Albany, NY - Installation

Sunamp Thermal Batteries to provide domestic hot water

Previous system:
Weil McLain gas fired boiler and a Weil McLain 40 gallons tank

Solution after installation:
1 Thermino 150 – PCM 58°C /136°F
Smart mixing valve added to the system to keep safe temperature of the DHW
Boiler temperature set up in 149°F, necessary to charge the battery
Gas consumption and flow rates meters installed by OTS R&D.



Single house (3 people occupancy) - Albany, NY– Monitoring & Results (kBTu/gallon)

Sunamp Thermal Batteries to provide domestic hot water

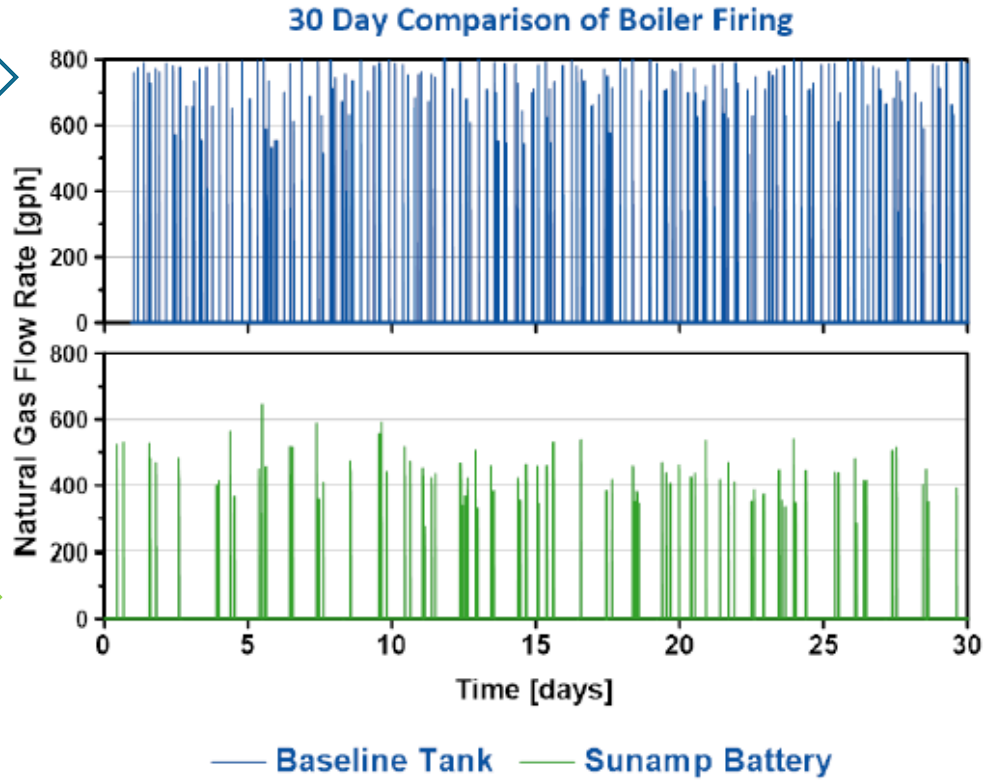
Previous System and Sunamp Solution monitored for 1 month to capture boiler's activity and water usage profile.

The tank ask for heat every time the water temperature is below 60C, making the boiler fire even if hot water is not being used.

The battery calls for heat only when it is 60% empty and keep the heat stored in the PCM with heat losses much smaller than the tank.

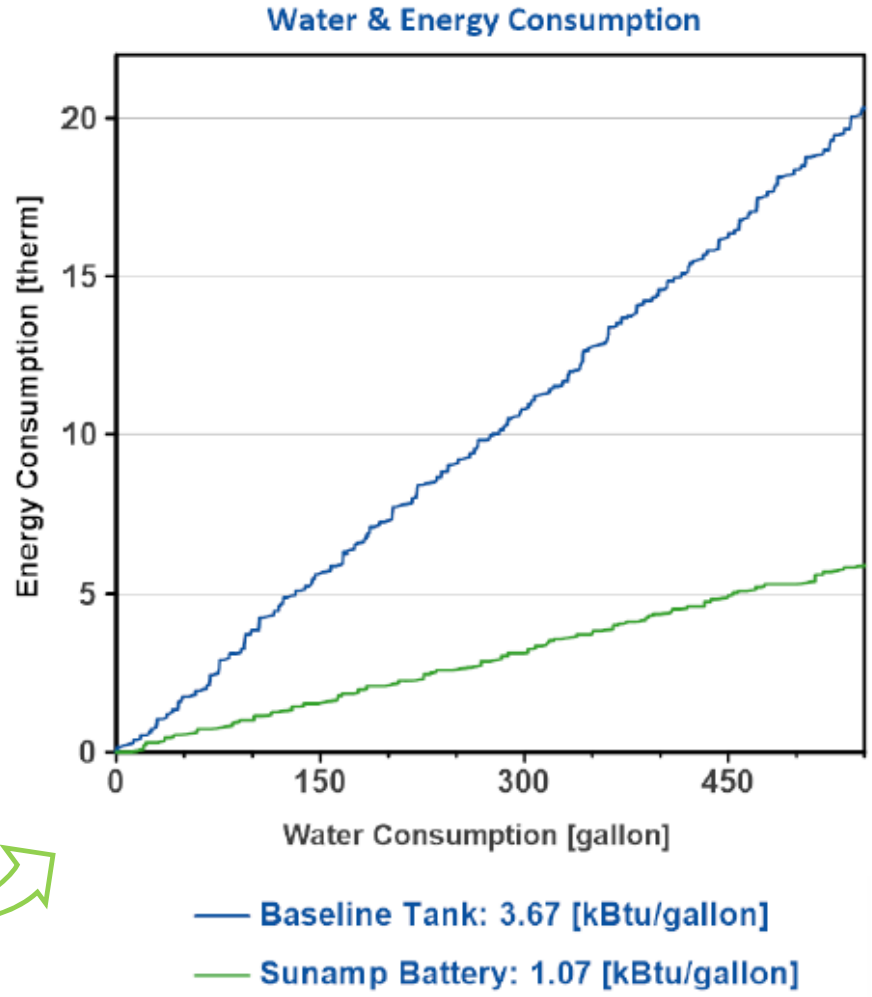
It improves boiler efficiency, reduce gas consumption and improves boiler's lifespan.

Sunamp also reduce legionella risk because the battery does not store water.



Energy necessary to heat a liter of water reduced ~50%* Sunamp battery help avoid waste of energy of keeping water hot without being used.

*Smart mixing valve may also help in the efficiency.



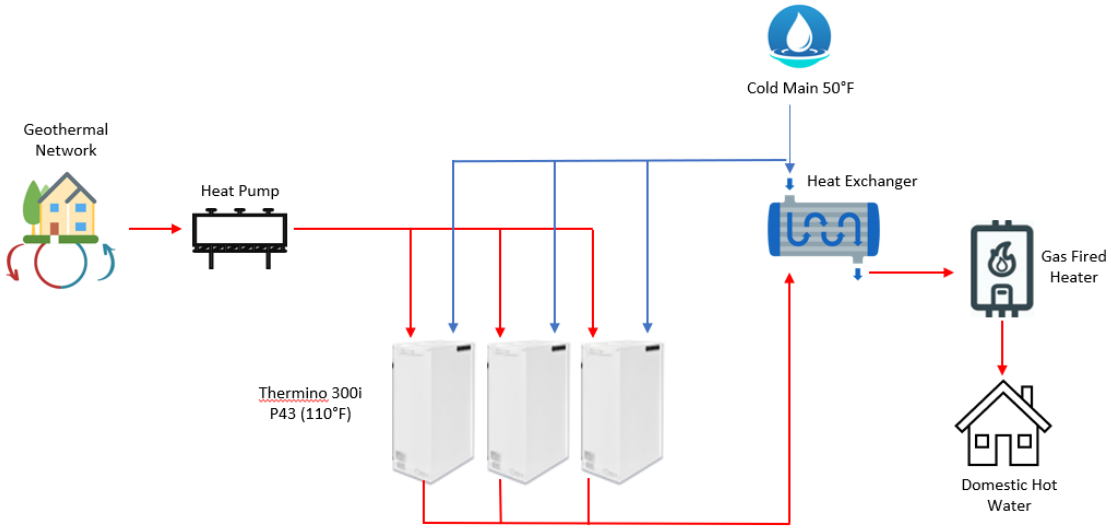
The News Apartments - Troy, NY

Sunamp Thermal Batteries to provide thermal storage for the preheating of the domestic hot water supply

- Actual System: uses geothermal water to water heat pumps to supply 3 gas fired heaters to provide domestic hot water in the apartments.

- Solution:
3 Thermino 300 – PCM 43°C/110°F
Geothermal water heat to heat pump and charge the batteries (necessary minimum of 43°C/110°F)
Pre heat water for the gas fired water heaters

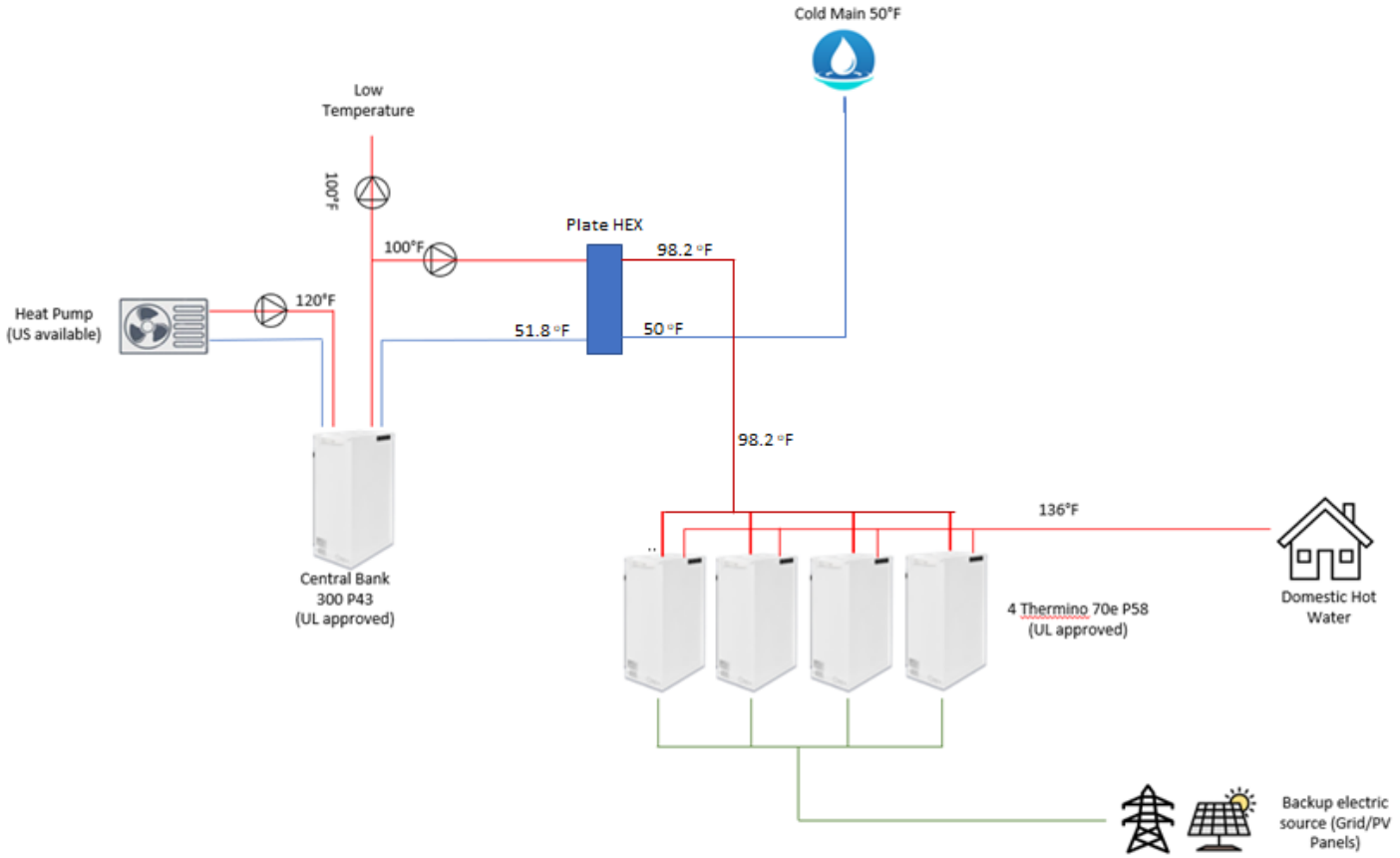
- Installation schedule for the first week of October/23



Pre Heat Solution

Sunamp Thermal Batteries to provide thermal storage for the preheating of the domestic hot water supply

	°F	°C	
CW Supply temperature	50.0	10.0	
CB 300 P43 - Discharge inlet temperature	51.8	11.0	
CB 300 P43 - Discharge outlet temperature	100.0	37.8	
Preheated CW inlet temperature to 70e P58	98.2	36.8	
HW supply temperature from 70e P58	136.0	57.8	
Temperature lift through CB 300 P43	48.2	26.8	
Temperature lift through 70e P58	37.8	21.0	
Energy fractionsupplied by CB 300 P43	0.56	0.56	
Energy fractionsupplied by 70e P58	0.44	0.44	
For 1 70e Battery	kWh	BTU	
Nominal storage capacity of 70e	3.00	10,236	
Heater input in 1st hour (85% On)	2.38	8,121	
Total energy availabe in 1st hour	5.38	18,357	3 x e70
	Litres	GAL	Litres
Water volume in 1st hour - Element ON	221	58.3	662
Water volume in 1st hour - Element OFF	123	32.5	369



Conclusion

Compliance with local laws and other applicable laws and regulations.

Increase the overall building energy efficiency.

Thermal storage helps on the peak shaving, where off-peak power is used to drive heat pumps that can produce heat or cold by a cheaper electric power

Reduction of peak demand and total demand, by storing heat energy when there is less demand and releasing when there is high demand.

Less investment capital cost for the combined storage system since thermal storage is cheaper than electric storage.

Thermal storage systems can reduce cost of reinforcing the distribution grid in order to accommodate the increase in peak demand.

Sunamp's GHG intensity per sold product associated with the direct emissions of its business activity is approximately zero.

Reduce CO_2 emissions and costs by making sure energy is used when it is cheaper and/or when is more renewable energy in the mix.


ENERGY
MACHINES
Integrated Energy Solutions

Javier Aleman

EXPERIENCE

- Competitive construction sales of BMS installations for Automated Logic.
- End user direct consultative sales for Honeywell focusing on turnkey installations involving BMS and equipment solutions.
- Equipment salesman for Carrier Corporation focusing on applied equipment and custom engineered solutions.

EDUCATION AND CERTIFICATIONS

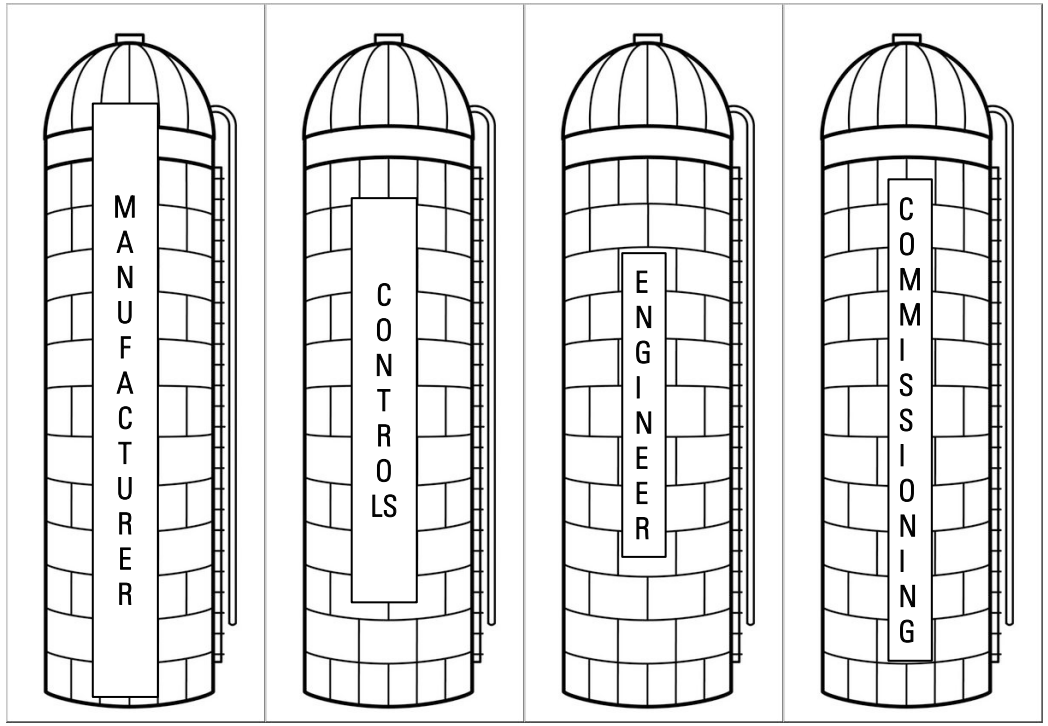
- Certified Energy Manager (CEM)
- LEED AP, BD+C
- MBA in Finance and Marketing
- Computer Science and Computer Engineering Majors

ENERGY MACHINES

Improved delivery and system design

ENERGY MACHINES

Today's Standard Practice



VS. ENERGY MACHINES

Commissioning

↑

Energy Modeling / System Design Assistance

↑

System Automation / BMS

↑

Manufacturer

Energy efficient and flexible

ENERGY MACHINES

Heat Pump Families

Low HW Temp		CHW – 44F HW – 126F
Mid HW Temp		CHW – 44F HW – 150F
High HW Temp		CHW – 44F HW – 180F+

Able to decarbonize domestic hot water

A1 low GWP or A2L Refrigerants

ENERGY MACHINES

No Minimum Flow

No Minimum Turn Down

Best In Class Efficiency COP: 4 to 10+

Self Balancing System

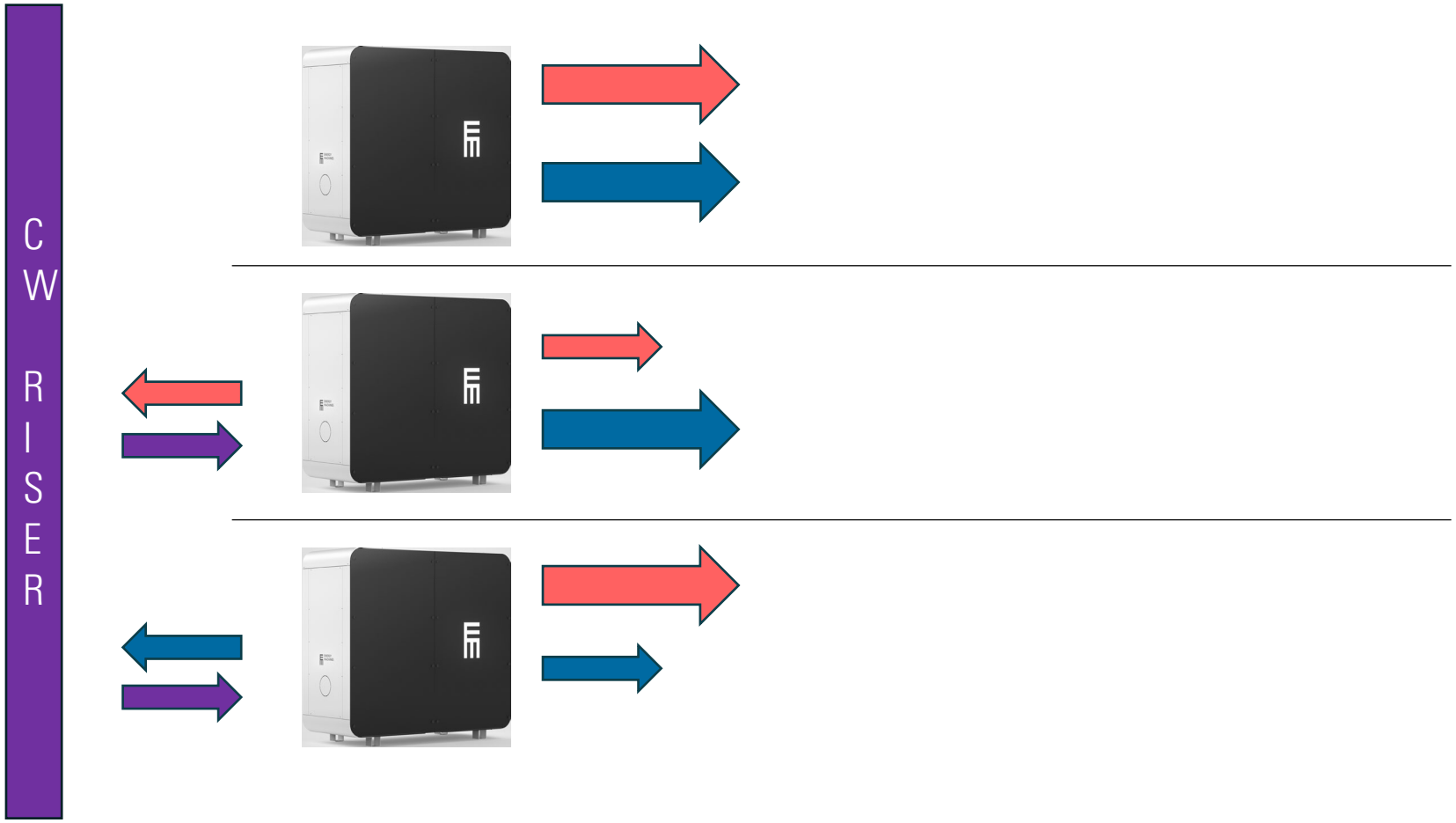
Easily Expandable

Energy is Redirected

Manufacturer Controls Beyond the Chassis

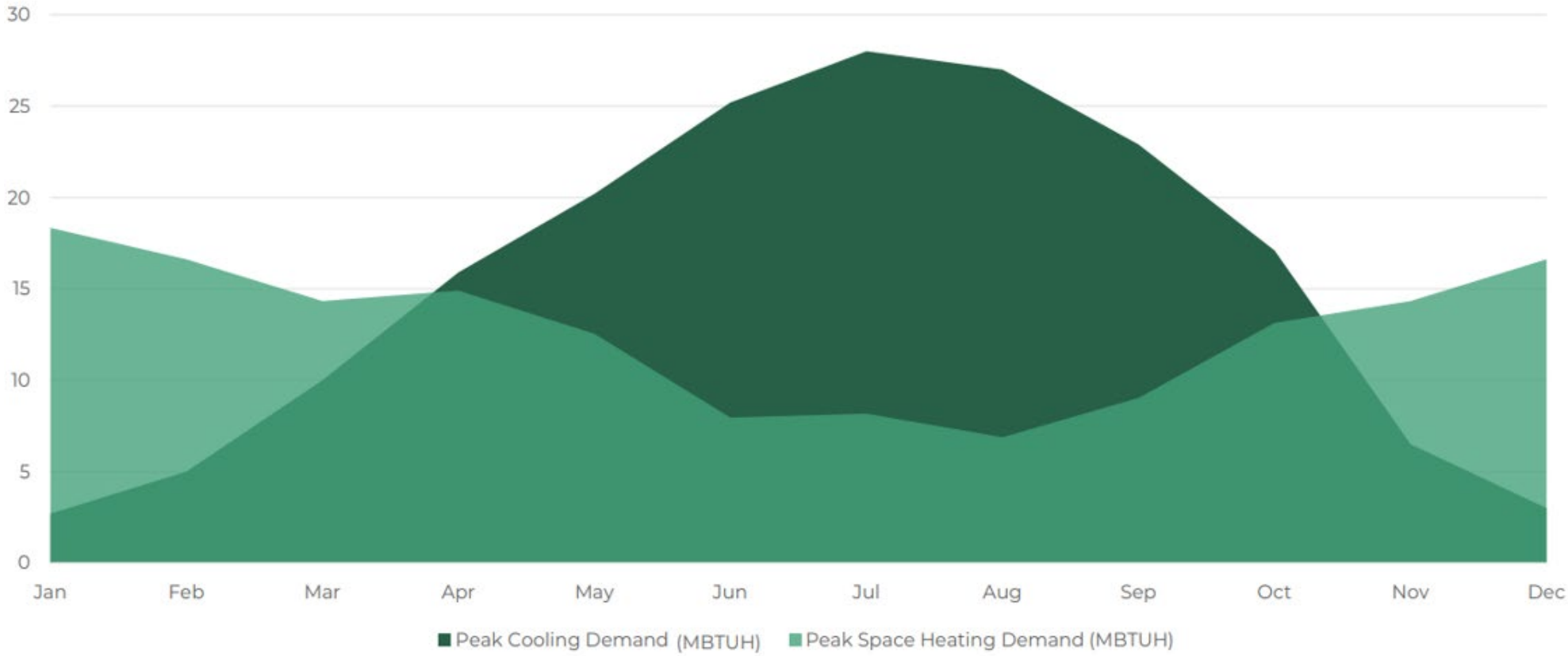
ENERGY MACHINES

Thermal Network

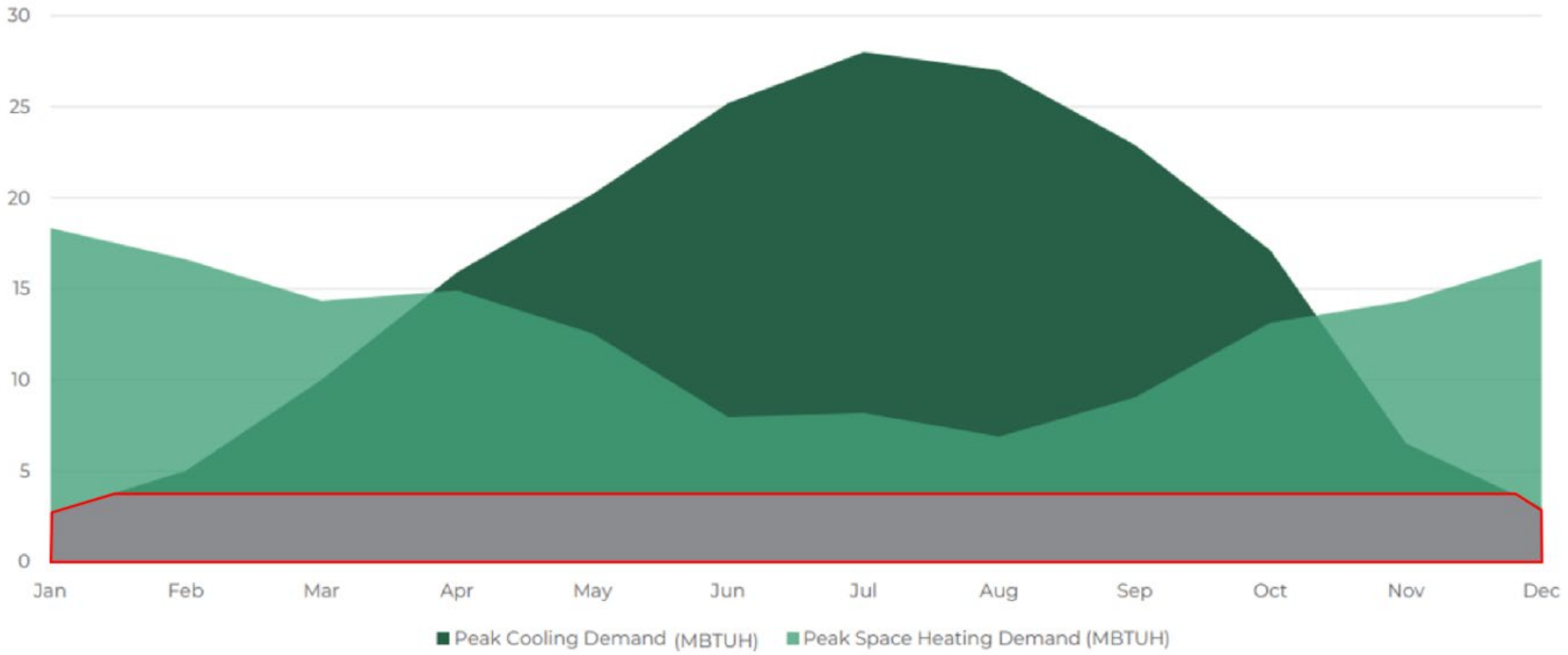


Energy is shared between systems, resulting in system-wide energy efficiency.

ENERGY MACHINES



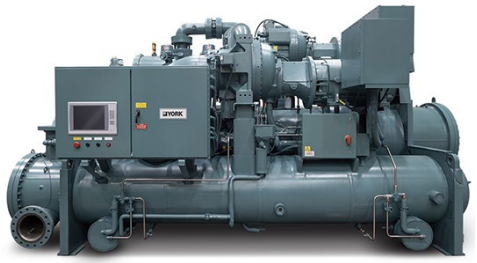
ENERGY MACHINES



ENERGY MACHINES

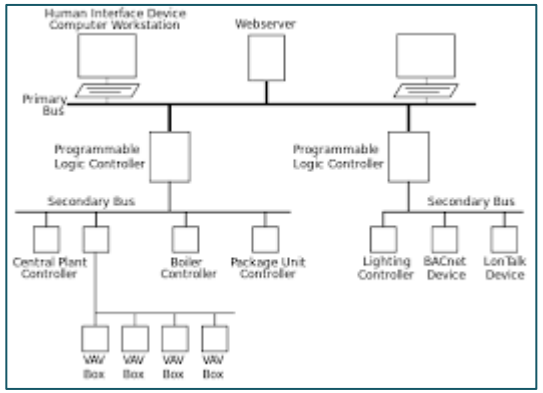
2,000 Ton Central Plant
150F Hot Water
44F Chilled Water

Cooling Tower
(Millions of Gallons of Water per year)



Heat Recovery Chiller
(Not Self Balancing)

Centrifugal Chillers



BMS

Modular Heat Pump Array

Fossil Fuel Steam Boiler

Extremely complicated to design mechanically. Even harder to commission!

This approach would lock in fossil fuels.

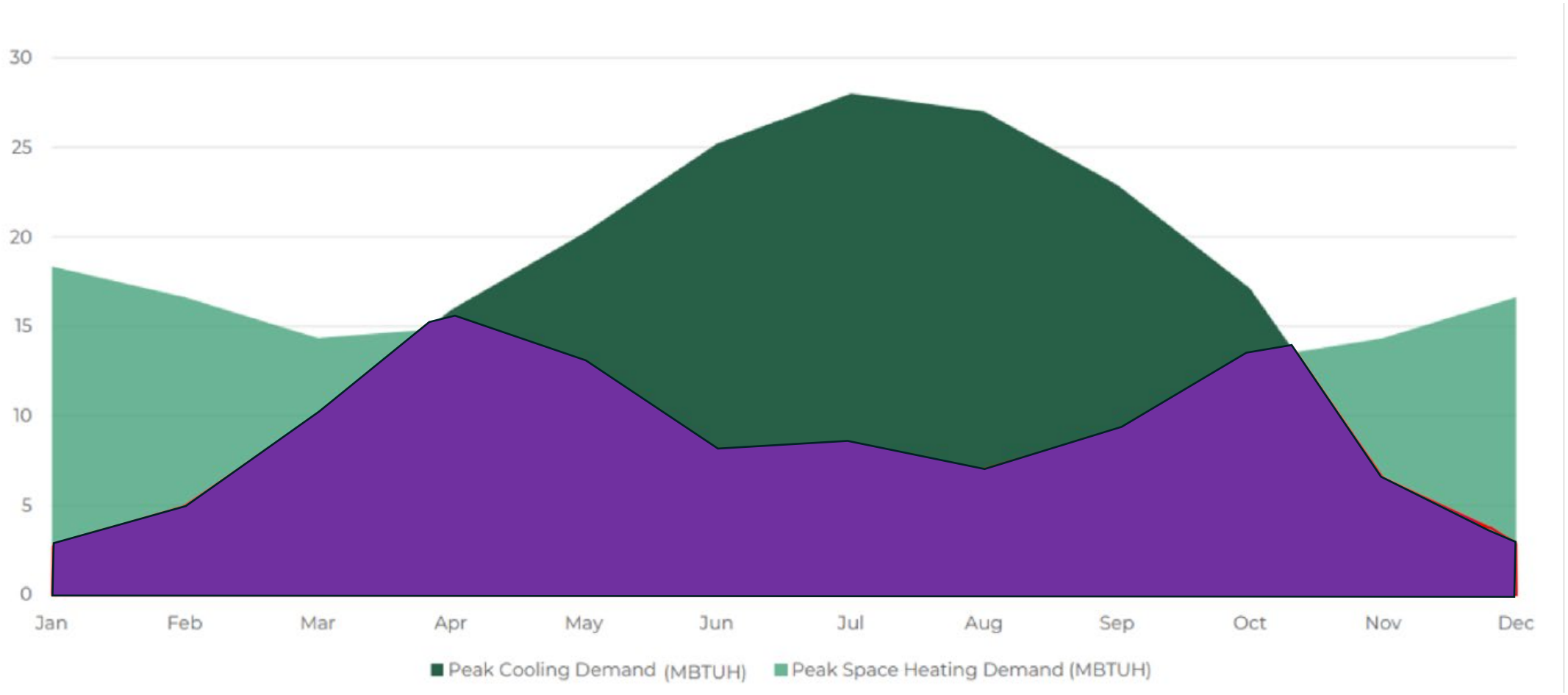
ENERGY MACHINES

2,000 Ton Central Plant
150F Hot Water
44F Chilled Water

Dry Cooler
(Bonus LEED points for Water Savings)

Energy Recovery in all possible scenarios.

ENERGY MACHINES

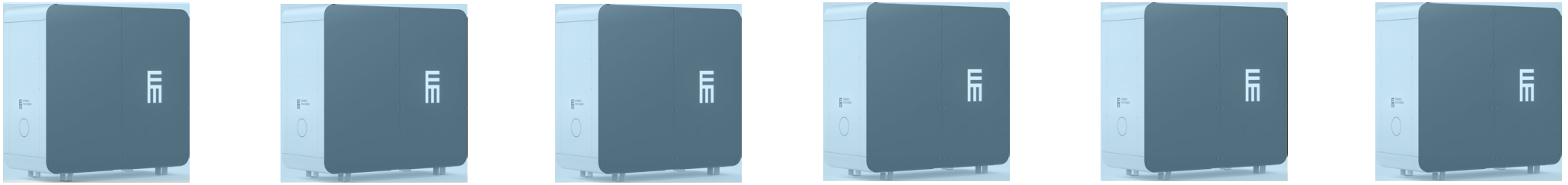


Energy Recovery in all possible scenarios.

ENERGY MACHINES

2,000 Ton Central Plant
150F Hot Water
44F Chilled Water

Dry Cooler
(Bonus LEED points for Water Savings)

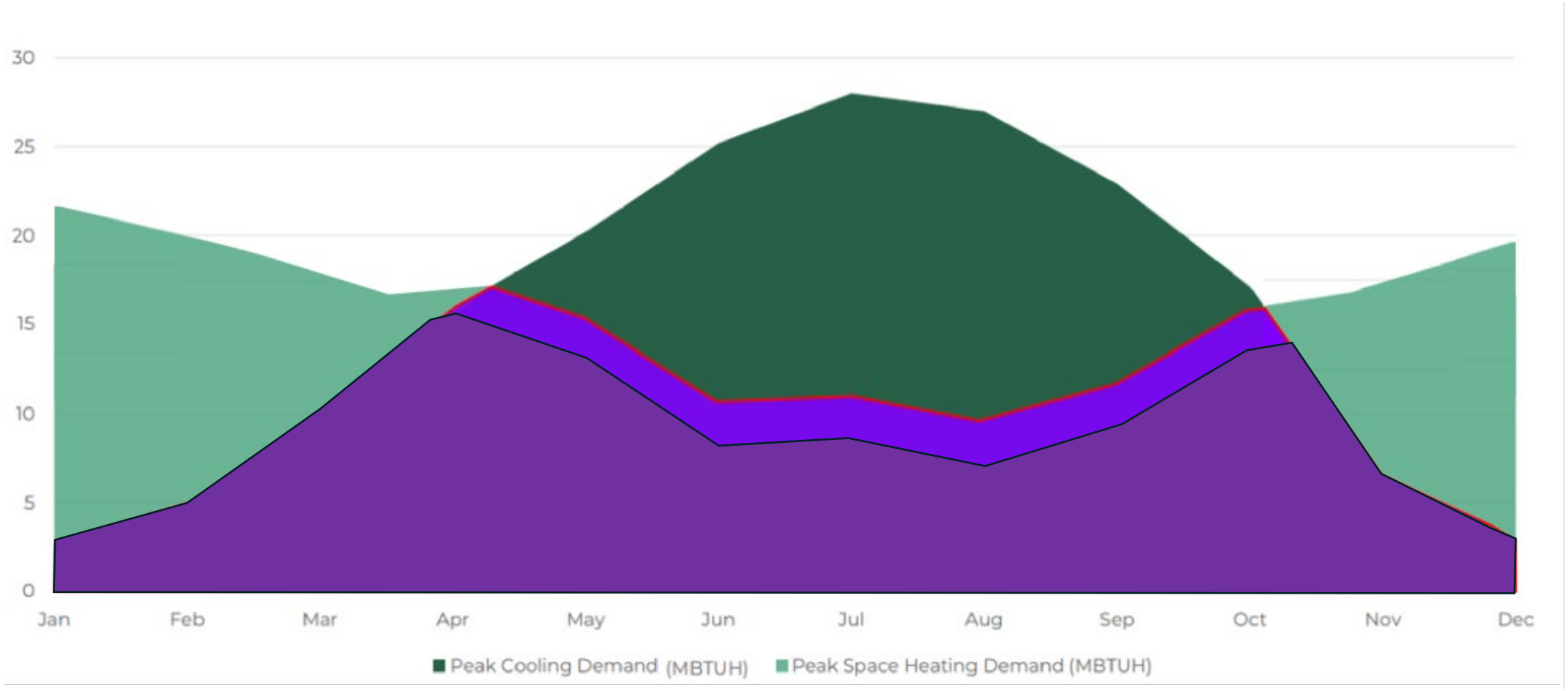


44F CHW
95F HW

44F CHW
150F HW

Energy Recovery in all possible scenarios.

ENERGY MACHINES



What if the load changes in the future?

ENERGY MACHINES

2,000 Ton Central Plant
150F Hot Water
44F Chilled Water

Dry Cooler
(Bonus LEED points for Water Savings)

44F CHW
95F HW

44F CHW
150F HW

Efficient Energy Recovery with Complete Decarbonization.

Adaptive Reuse Redefined!

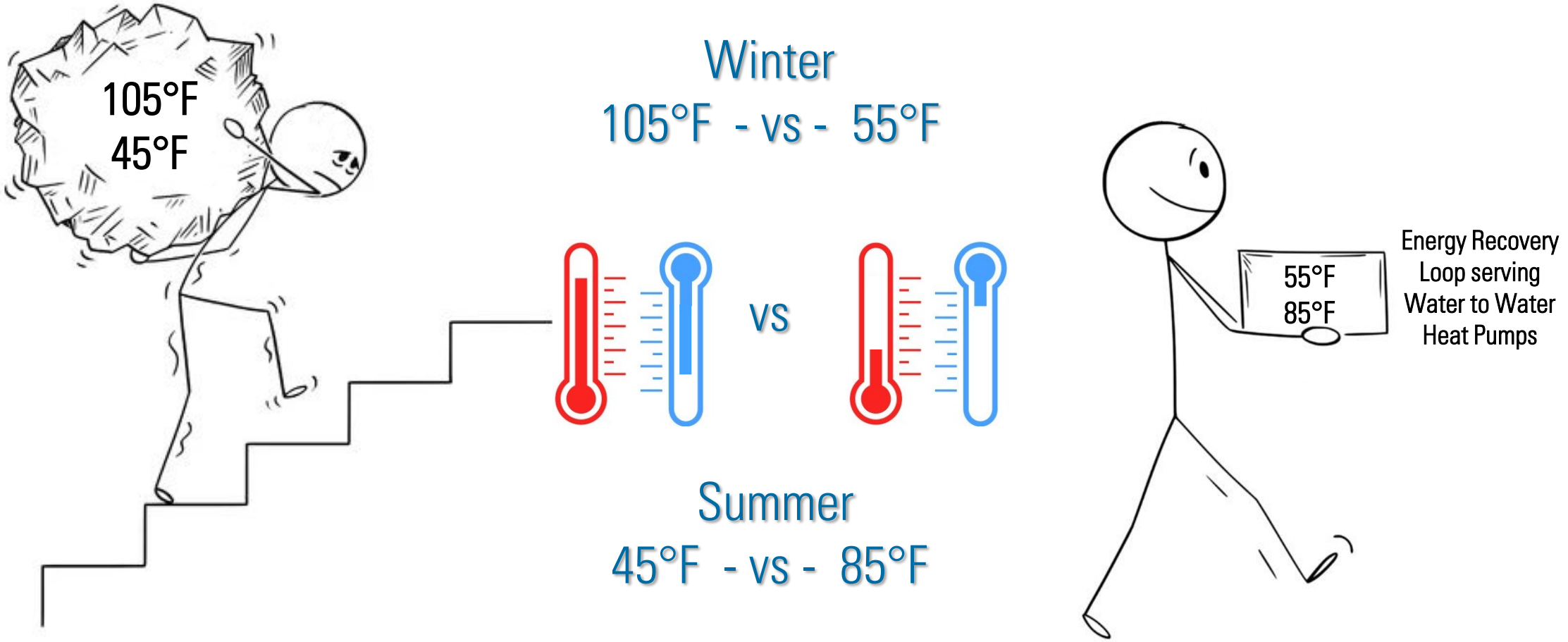
ENERGY MACHINES

Improved heat injection & rejection

ENERGY MACHINES

Typical ASHP Solutions

A Better ASHP Solution



Total BTUs injected / rejected doesn't change.

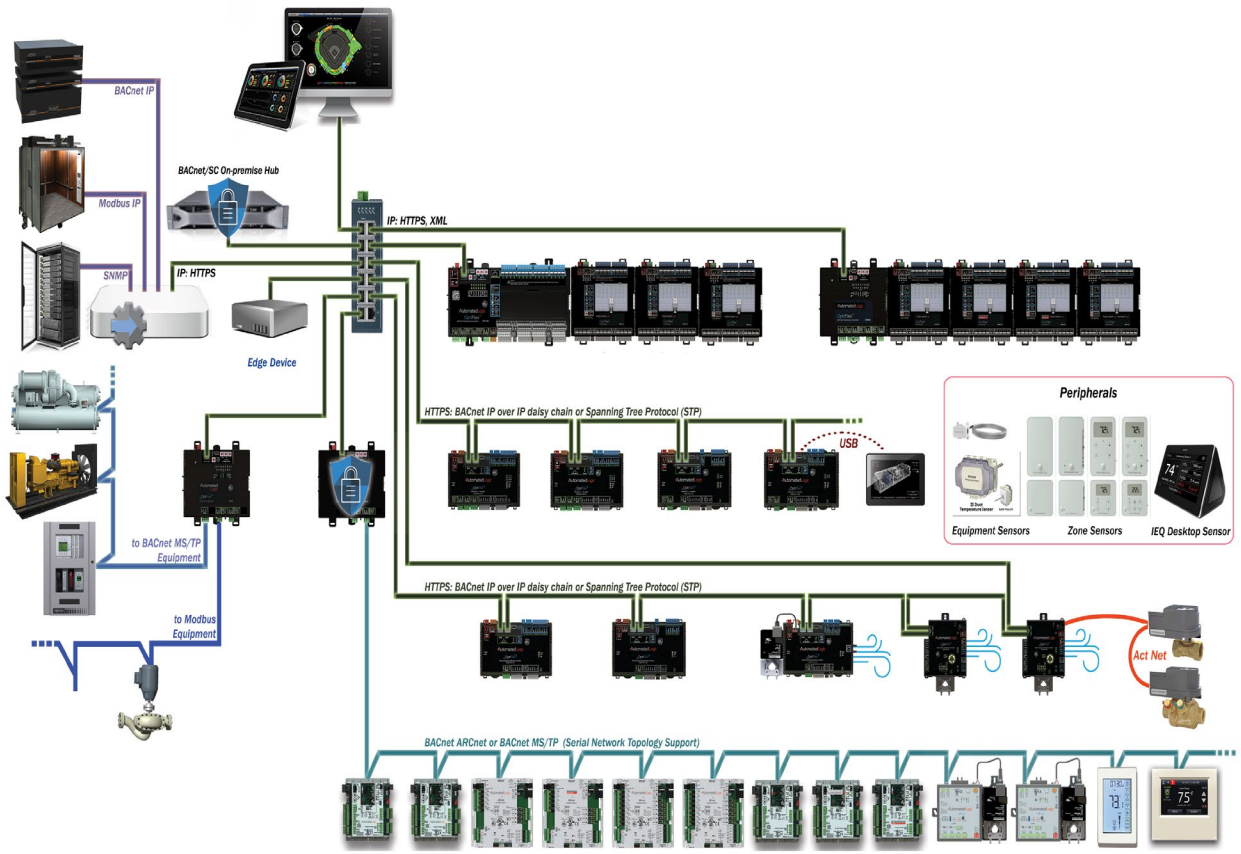
Only the set point changes!

ENERGY MACHINES

Building Automation

ENERGY MACHINES

Bringing it all together



- BTU meters measure and trend performance.
- Real time calculation and trending of COP values for each system.
- You can see the future...

ENERGY MACHINES

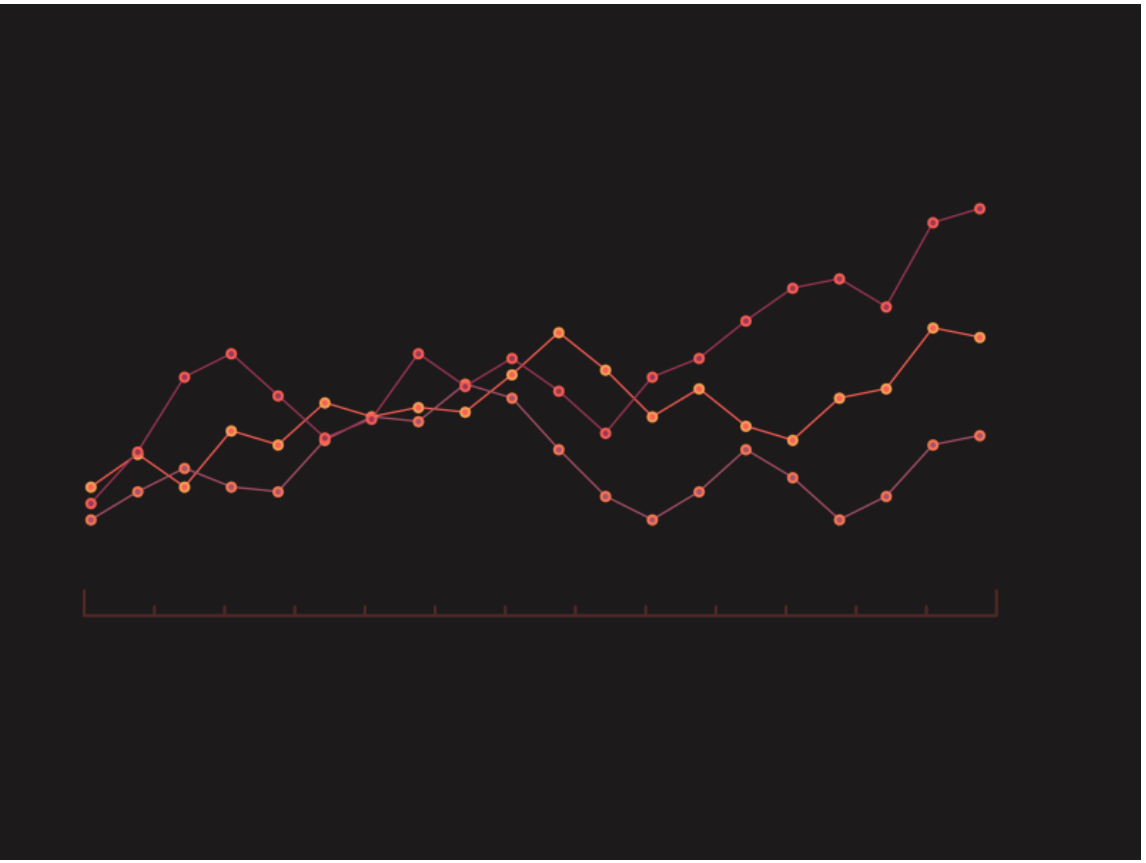
Today	Friday	Saturday	Sunday	Monday	Tuesday	Wednesday
Showers and a	An afternoon shower	Warmer with plenty of	Mostly sunny and	Sunny and pleasant	Sunshine, pleasant	A p.m. t-storm

Today

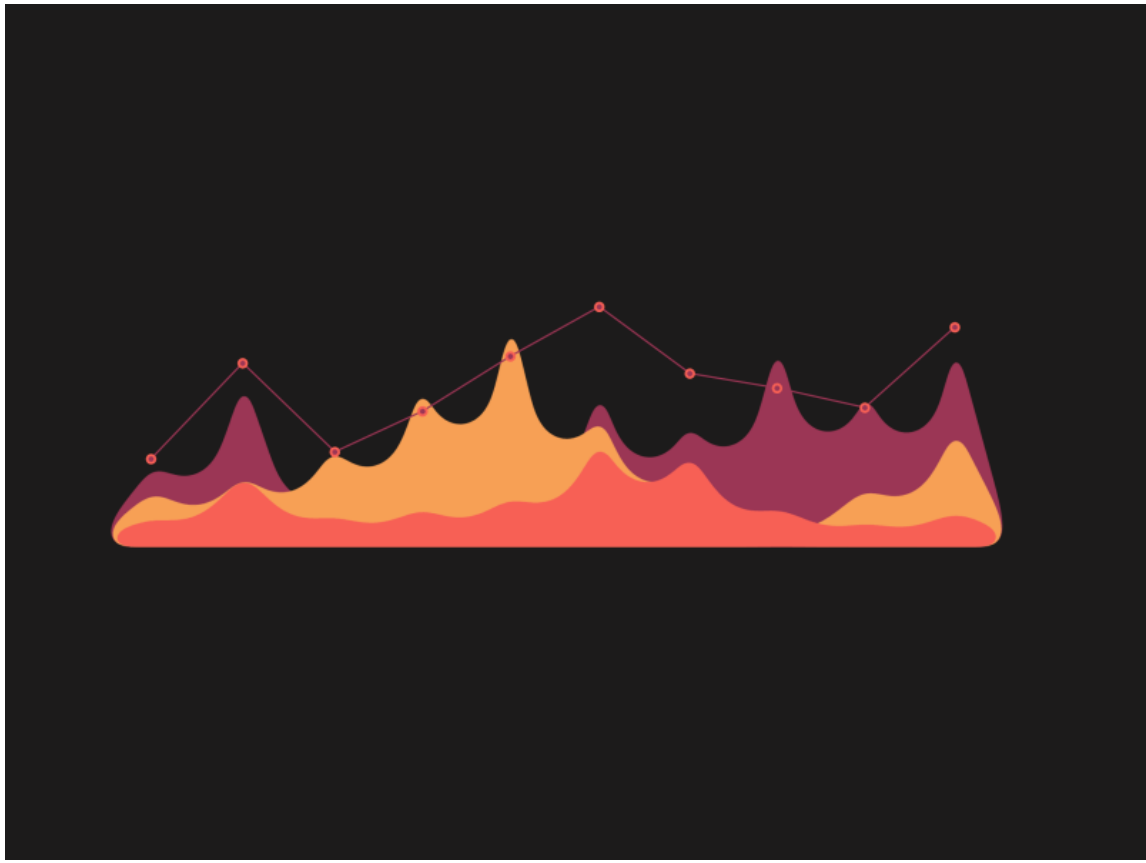
	12:00 PM	01:00 PM	02:00 PM	03:00 PM	04:00 PM	05:00 PM	06:00 PM	07:00 PM	08:00 PM	09:00 PM	10:00 PM	11:00 PM	12:00 AM	01:00 AM	02:00 AM	03:00 AM	04:00 AM	05:00 AM	06:00 AM	07:00 AM	08:00 AM	09:00 AM	10:00 AM	11:00 AM
All / Temperature	64°	64°	66°	66°	67°	66°	65°	64°	63°	61°	58°	56°	55°	54°	52°	51°	50°	48°	47°	47°	46°	47°	48°	49°
Wet Bulb																								
Dew Point																								
Humidity	89%	87%	83%	79%	79%	78%	82%	88%	93%	98%	100%	99%	95%	91%	85%	80%	75%	70%	70%	70%	74%	73%	74%	75%
Precipitation / Rain / Snow / Ice	47%	48%	53%	49%	48%	51%	47%	49%	60%	49%	60%	40%	34%	34%	34%	34%	38%	42%	38%	30%	20%	20%	20%	20%
Accumulation			0.15"			0.15"			0.09"		0.09"							0.01"						
Wind / Gust	16 / 24	17 / 25	18 / 25	18 / 25	18 / 25	18 / 24	16 / 23	14 / 21	12 / 21	9 / 12	8 / 12	8 / 10	8 / 10	8 / 10	8 / 10	8 / 10	8 / 10	8 / 10	8 / 10	8 / 10	8 / 10	8 / 10	8 / 12	9 / 12

As Reported At: Kennesaw, Georgia (Cobb), United States 05/04/17 11:25 AM

Data provided by AccuWeather.com



7 Day Forecast



Historical Data of Each System's Performance

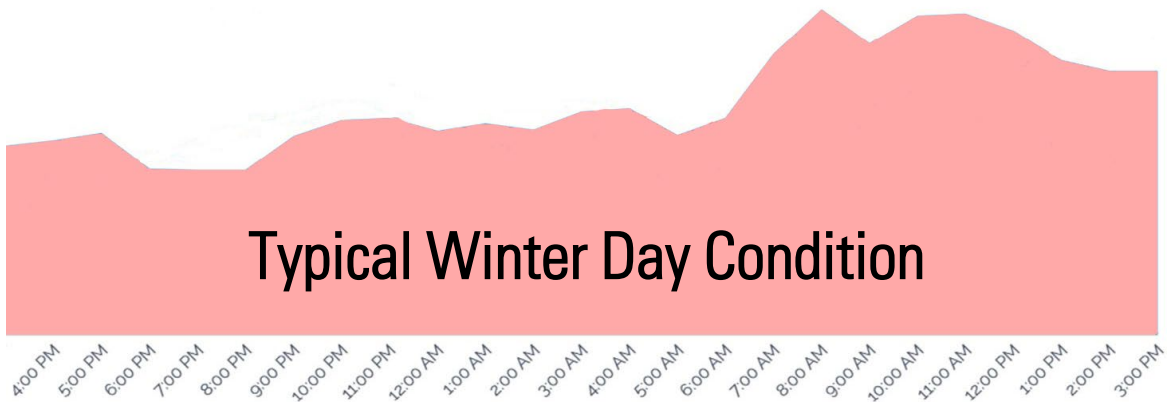
Know Which Systems to Use to Satisfy Demand while Saving Money and Energy

Add ADR connectivity to the utility and you now have a Grid-Interactive Efficient Building!

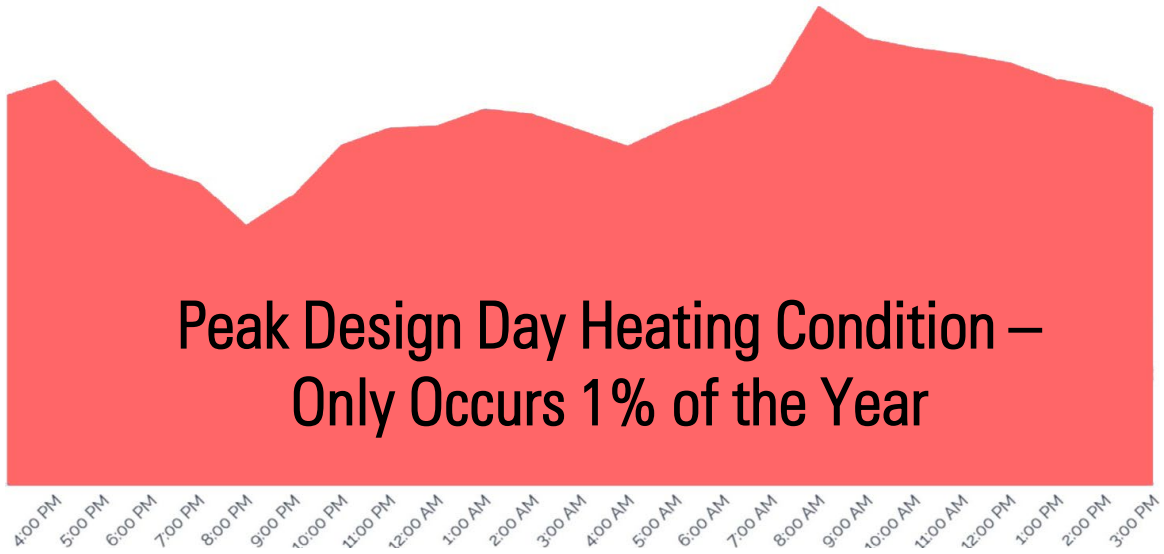
ENERGY MACHINES

Hybrid Primary Systems

ENERGY MACHINES

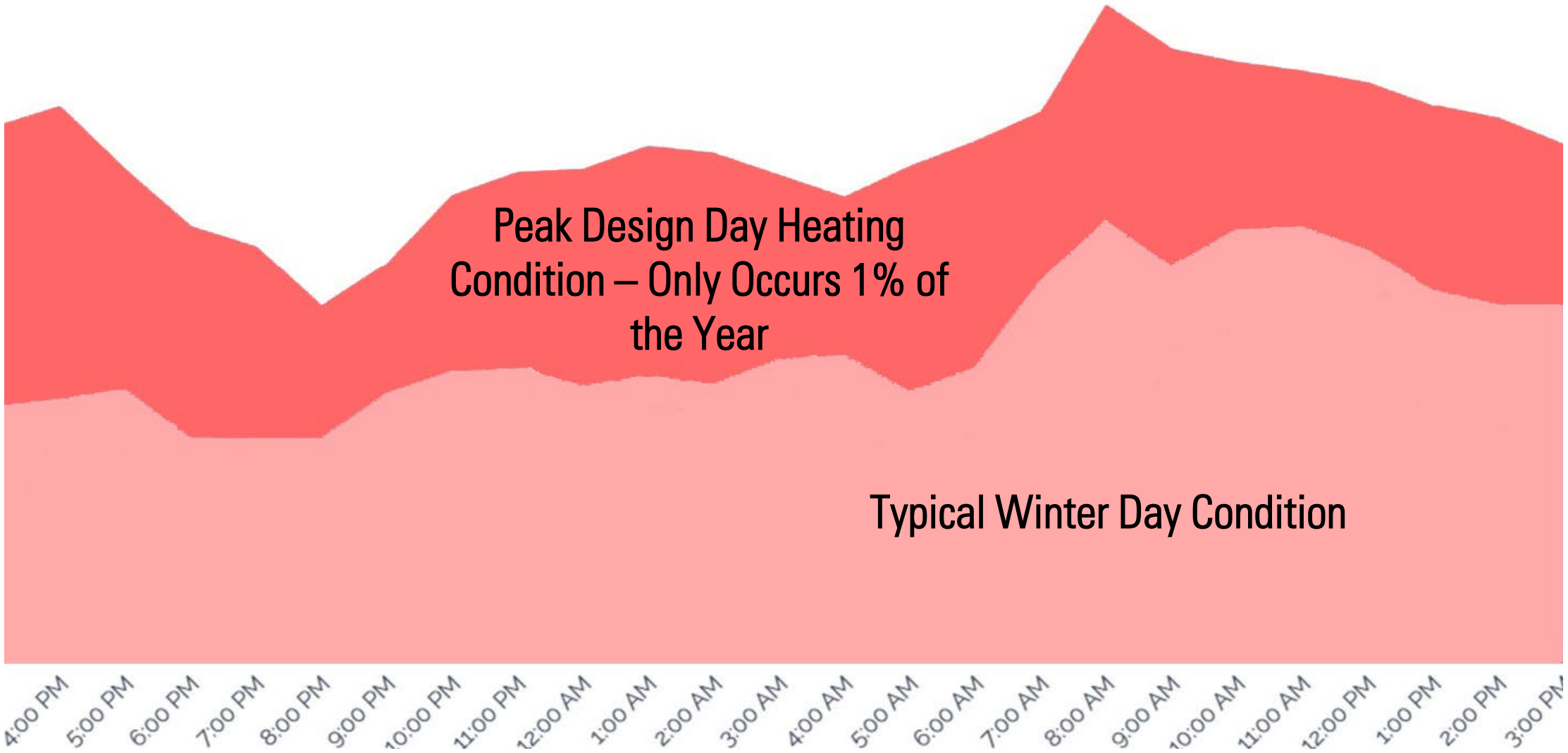


Typical Winter Day Condition

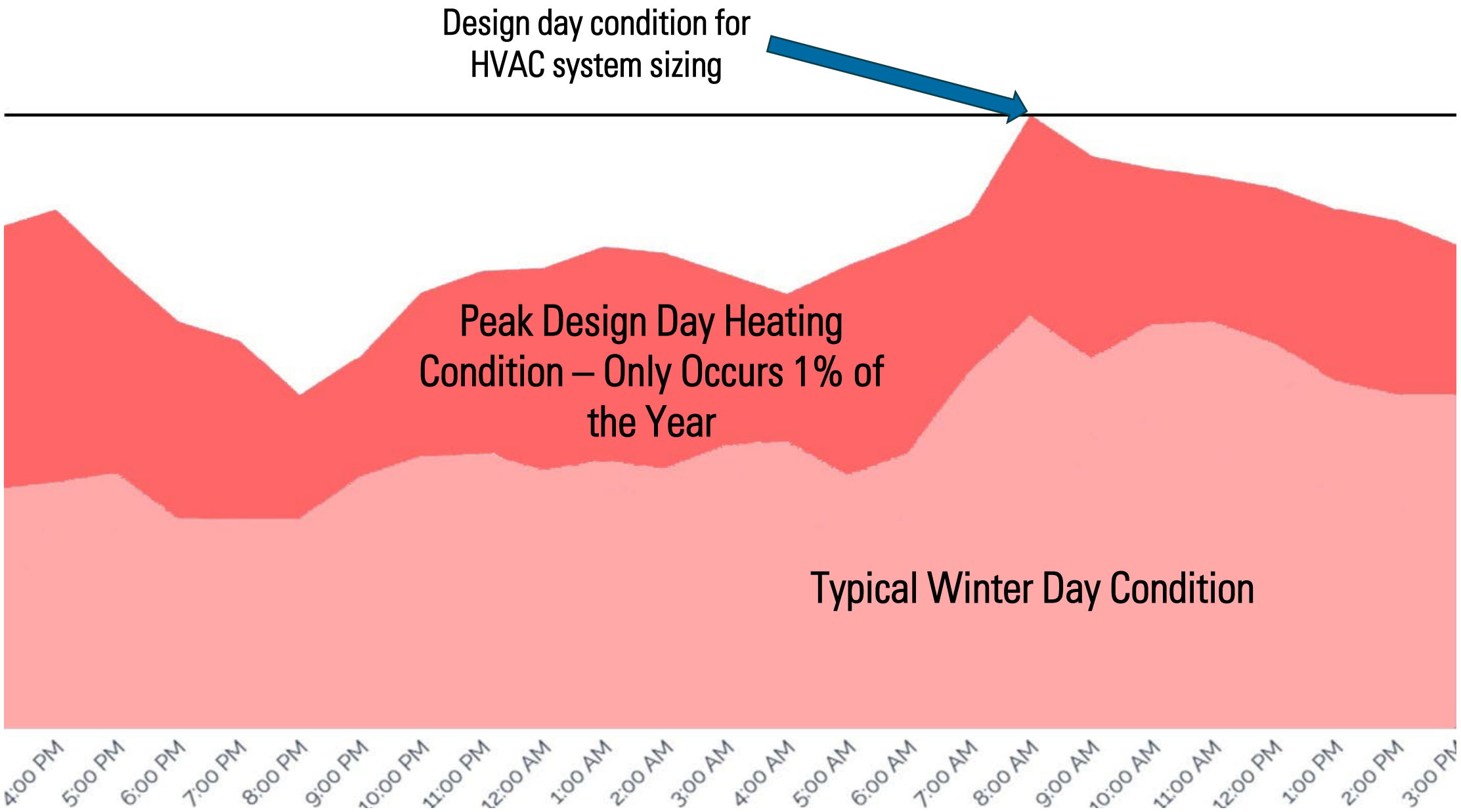


Peak Design Day Heating Condition –
Only Occurs 1% of the Year

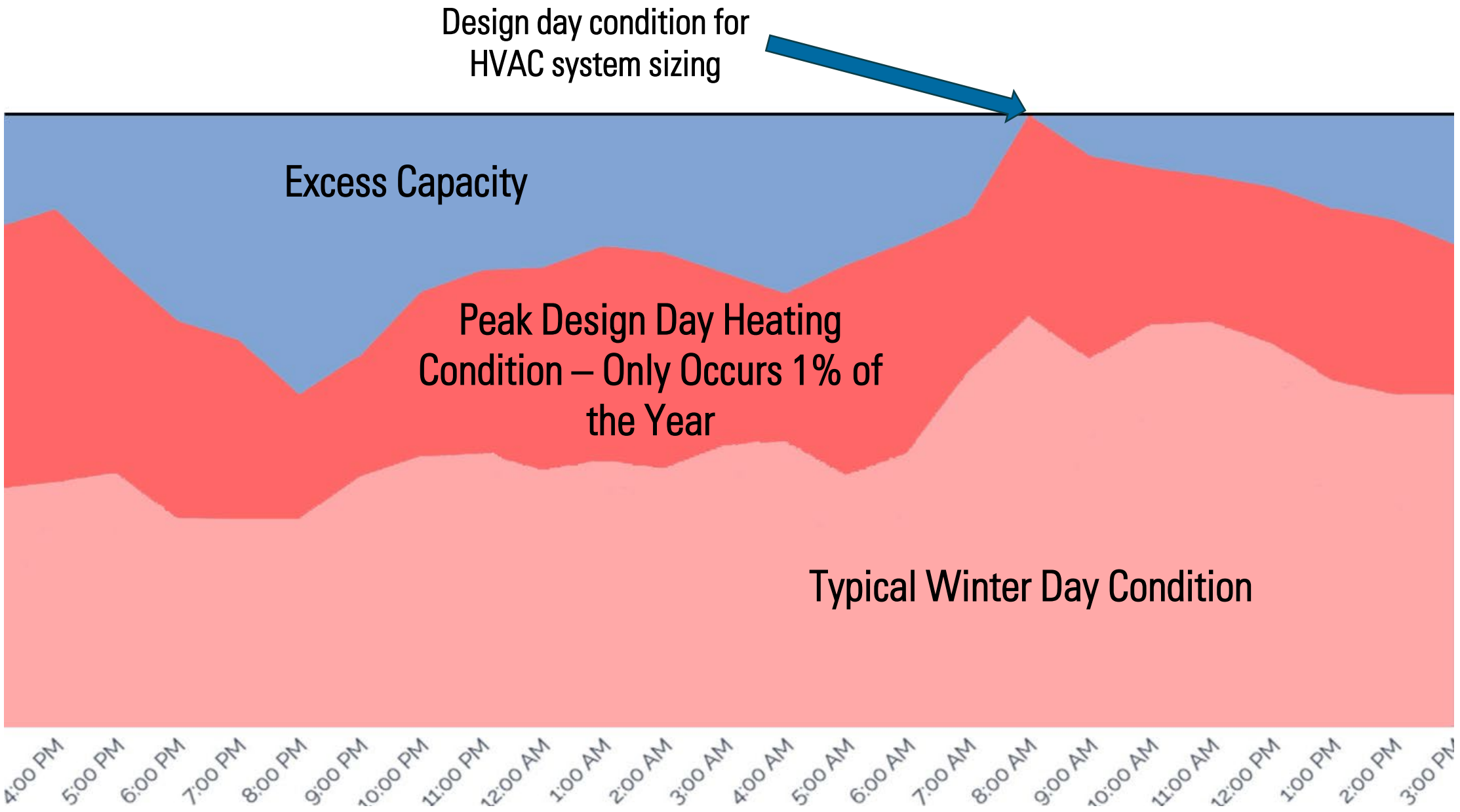
ENERGY
MACHINES



ENERGY MACHINES



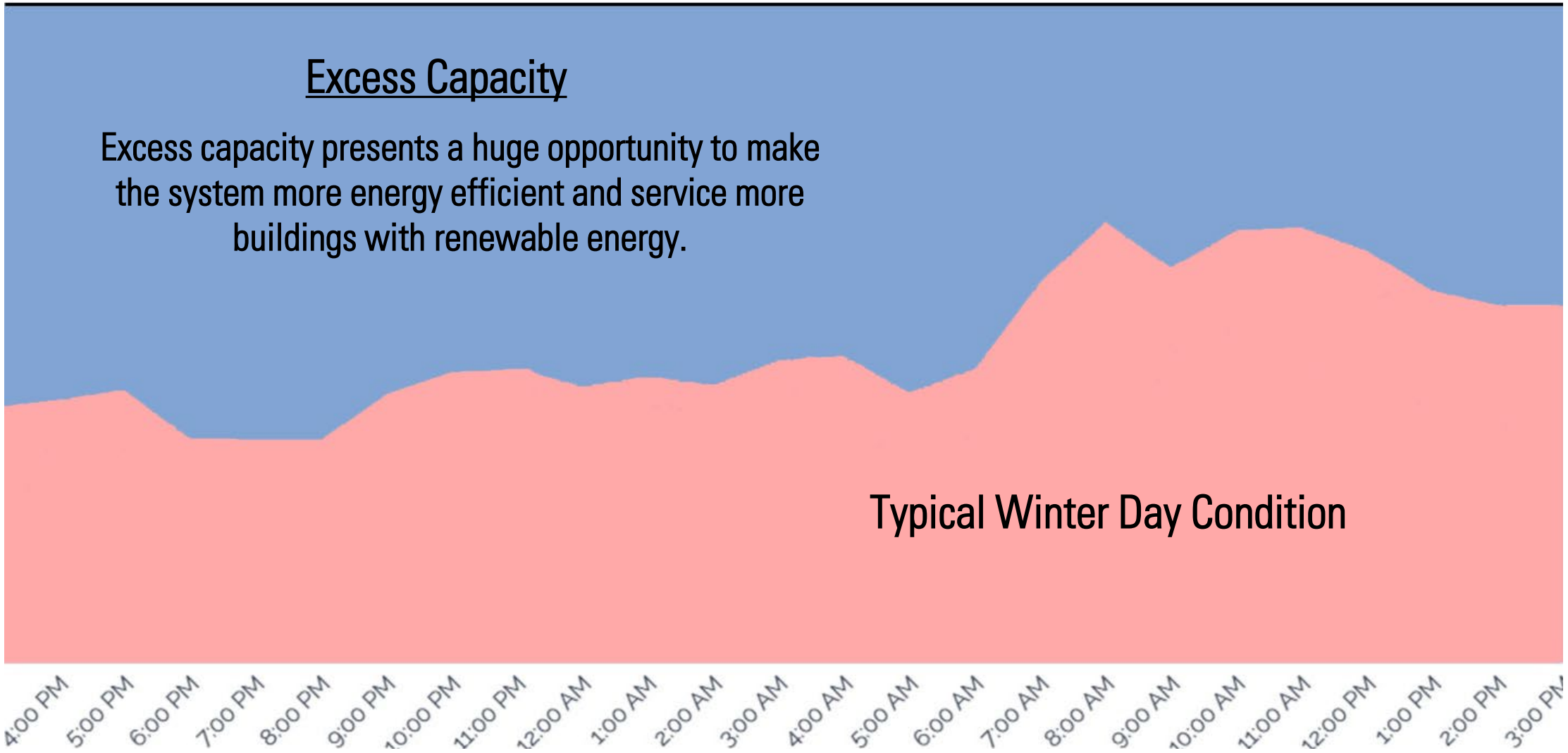
ENERGY MACHINES



ENERGY MACHINES

Excess Capacity

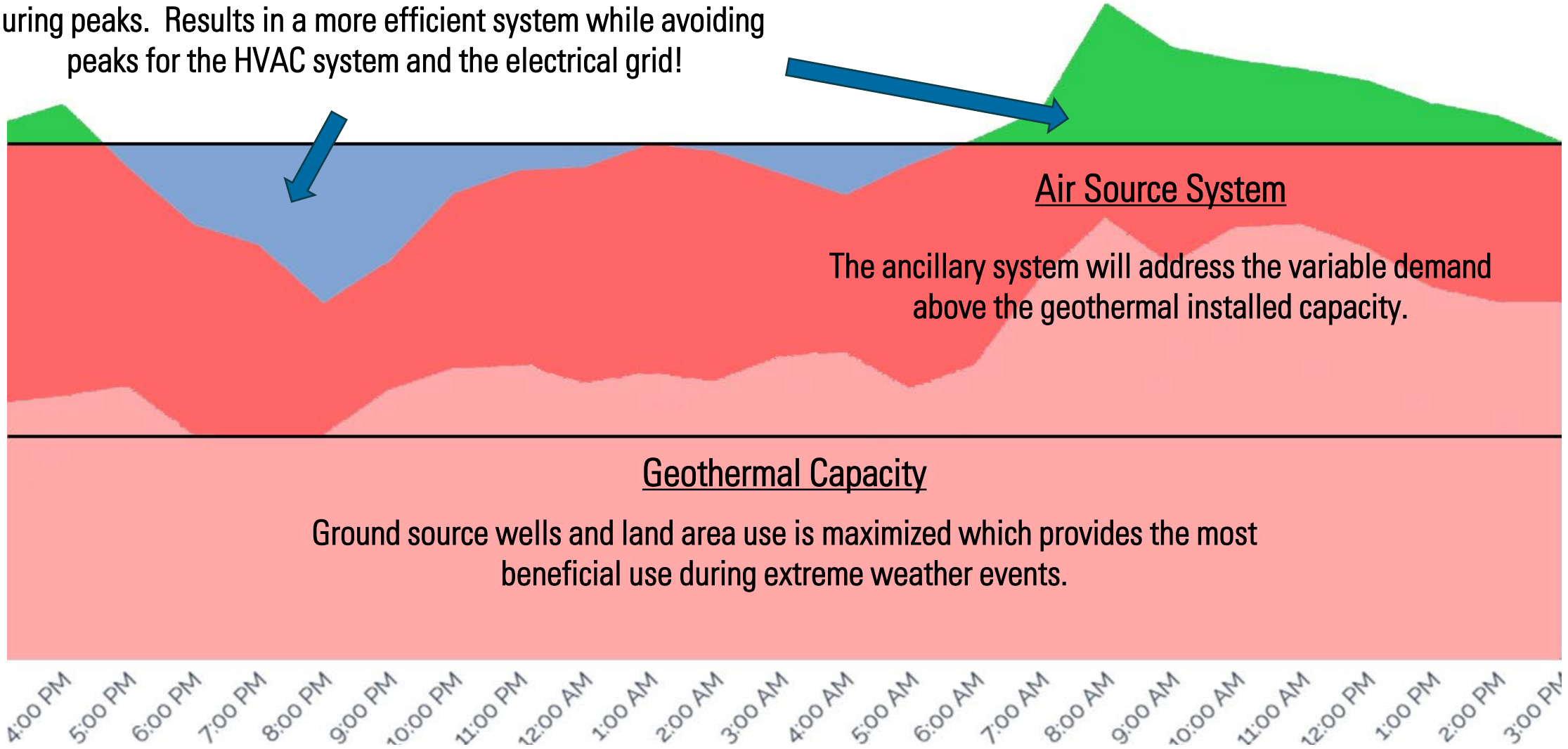
Excess capacity presents a huge opportunity to make the system more energy efficient and service more buildings with renewable energy.



ENERGY MACHINES

Thermal Storage

Thermal storage will charge with excess capacity and discharge during peaks. Results in a more efficient system while avoiding peaks for the HVAC system and the electrical grid!

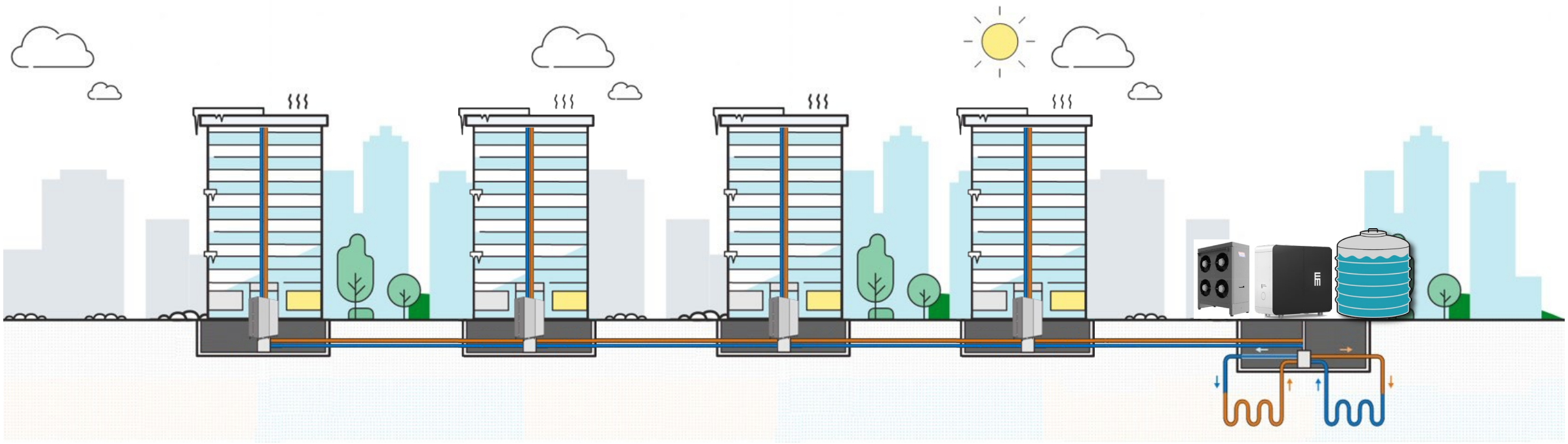


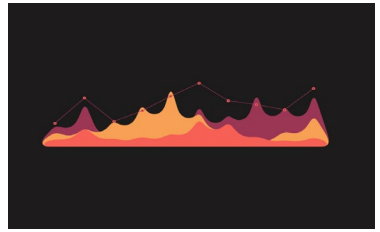
ENERGY MACHINES

Hybrid Thermal Network

- Increases the system's capacity
- Increases the system's efficiency
- Increases the system's resiliency

- Thermal storage – water
- Avoids electrical grid peaks!
- System Automation and Analytics





ENERGY MACHINES

Carbon-free Ventilation

ENERGY MACHINES

Outdoor air ventilation

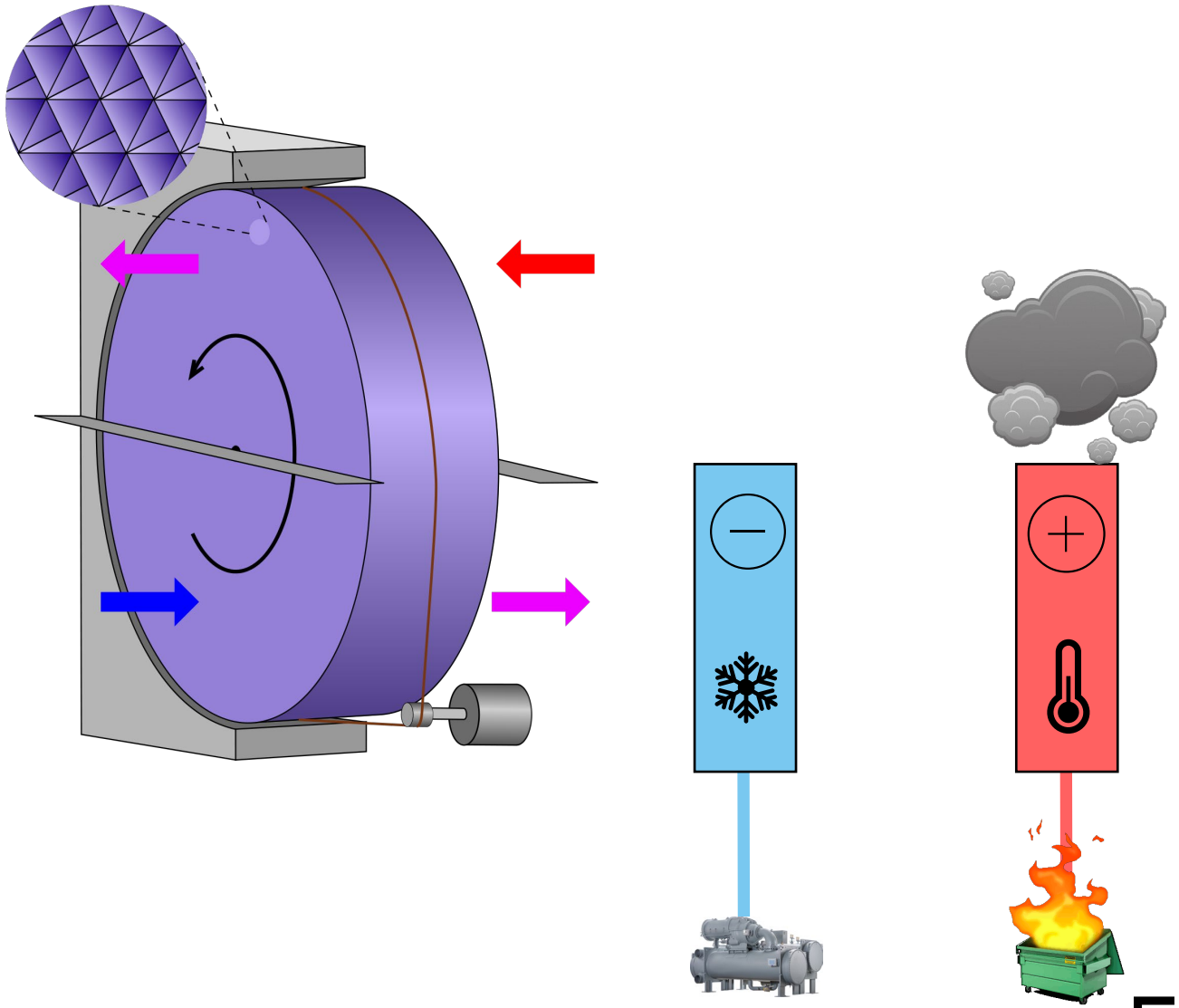
- ASHRAE Standard 241P / CDC
  Outdoor air changes per hour
  0.35 → variable amount

- Much higher levels of outdoor air required!

ENERGY MACHINES

Disadvantages:

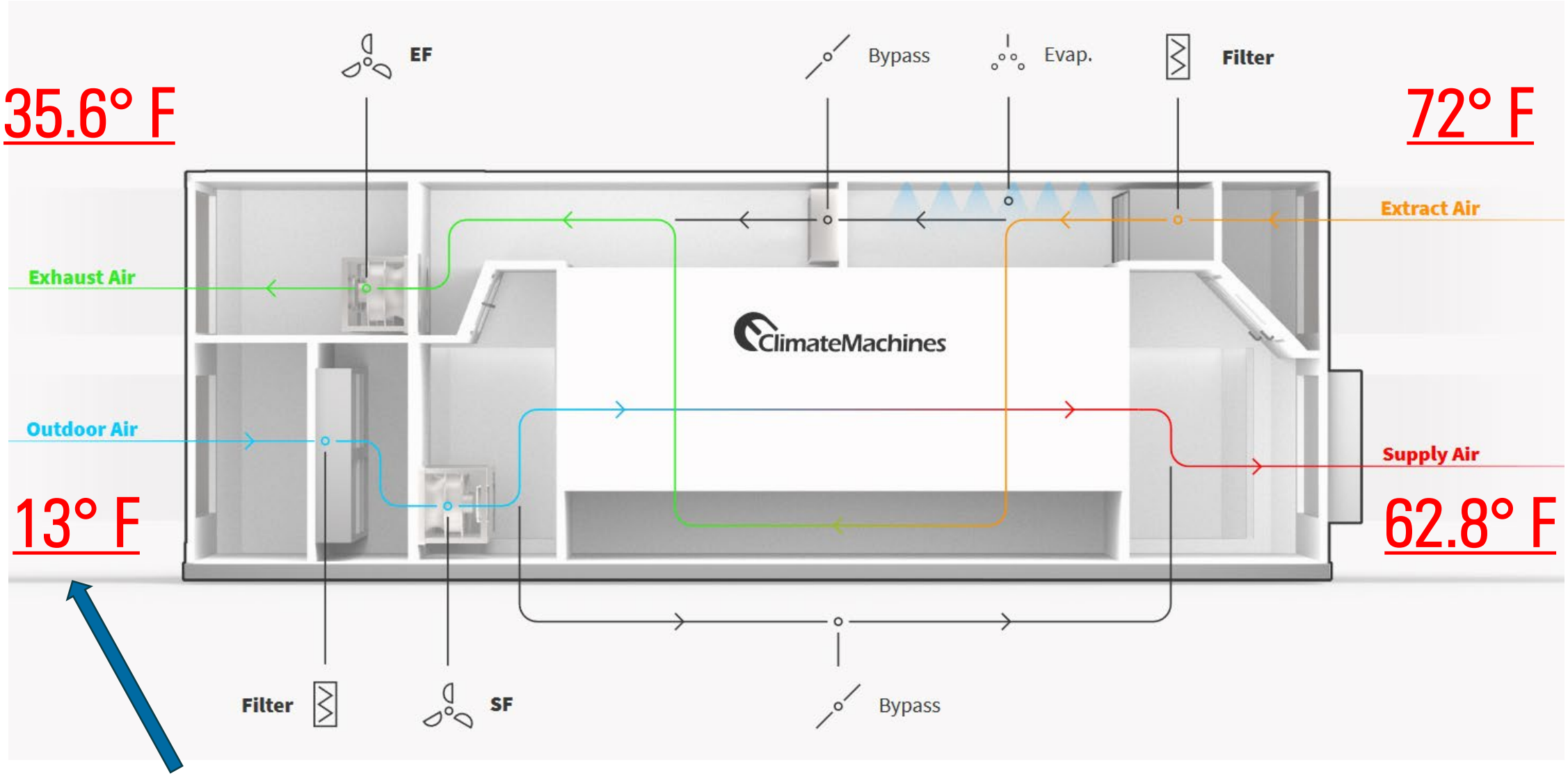
- Cannot use “compromised” exhaust air streams due to leakage between return and supply.
- Risk of mold formation in the summer
- Highly sensitive installation process with risk of dust degrading performance.
- High maintenance requirements.
- High heat recovery performance may not be achieved in real world operating conditions.



ENERGY MACHINES

Winter

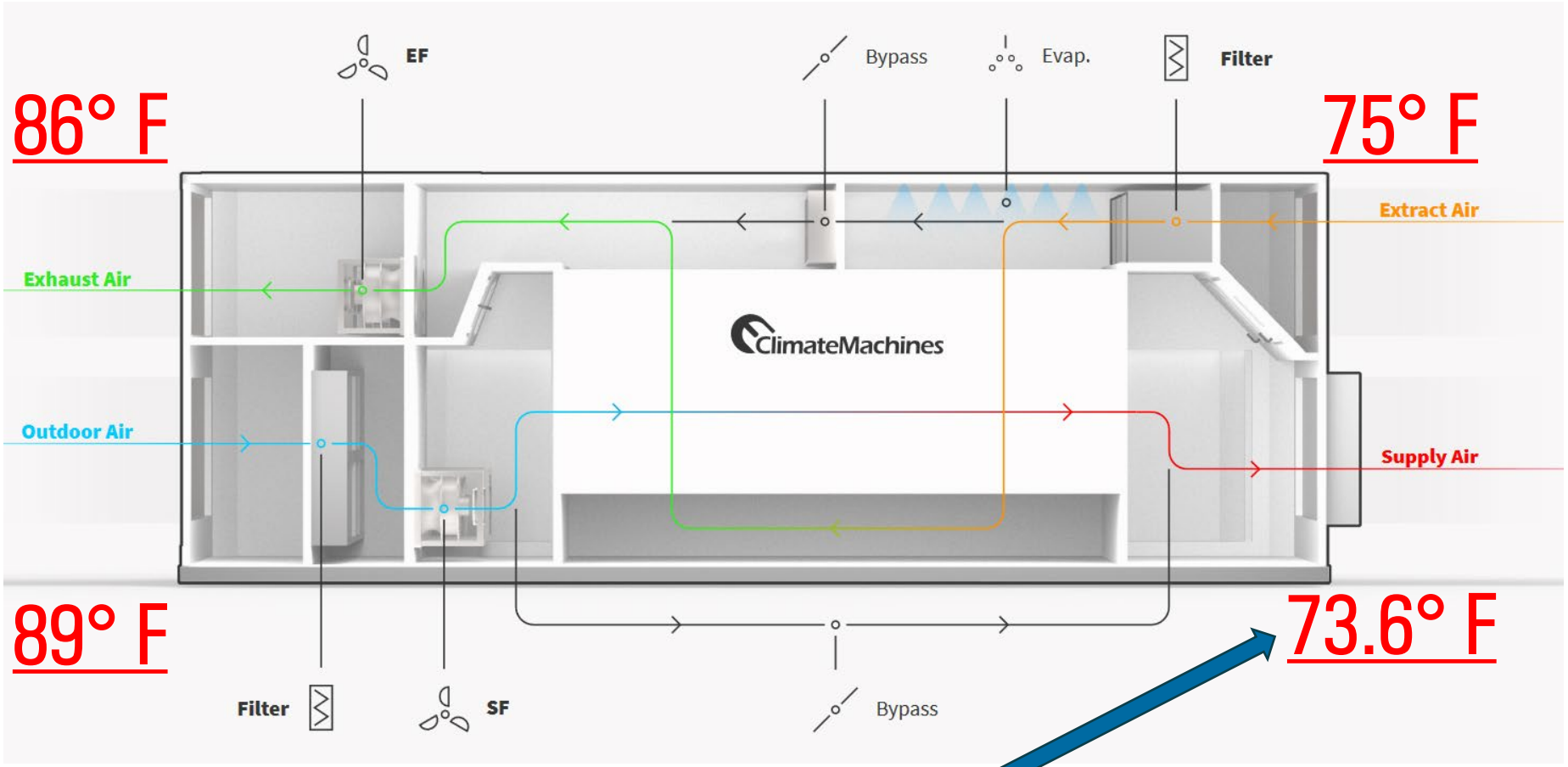
105,000 CFM with No Winter Peak

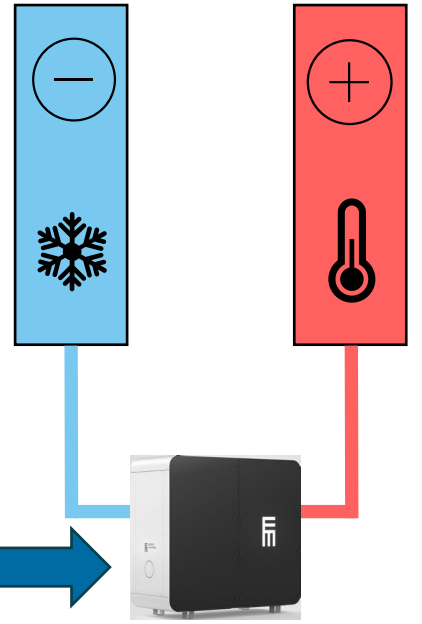


OA could have been 0°F if there was no constraint on roof space.

ENERGY MACHINES

Summer

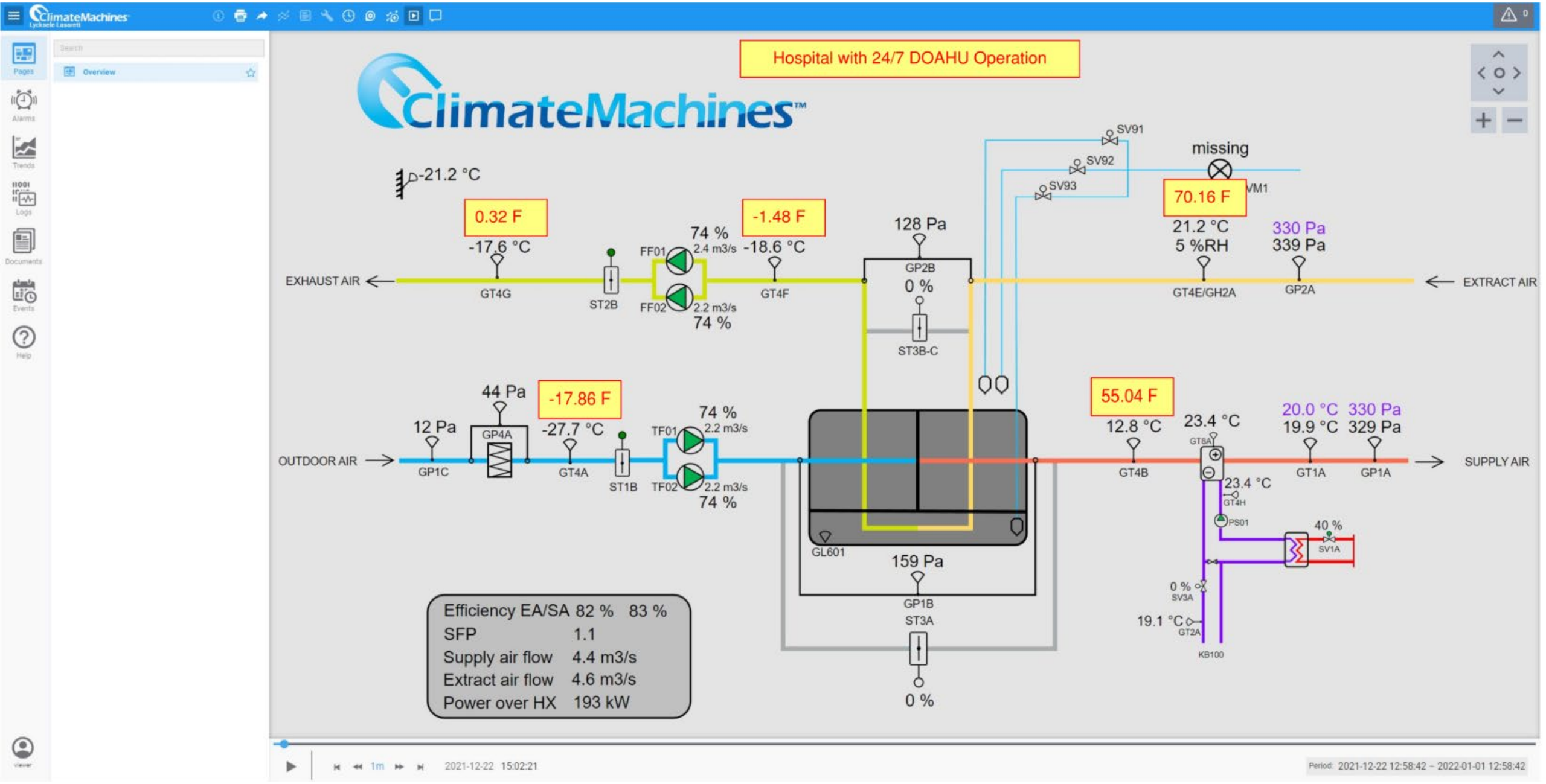




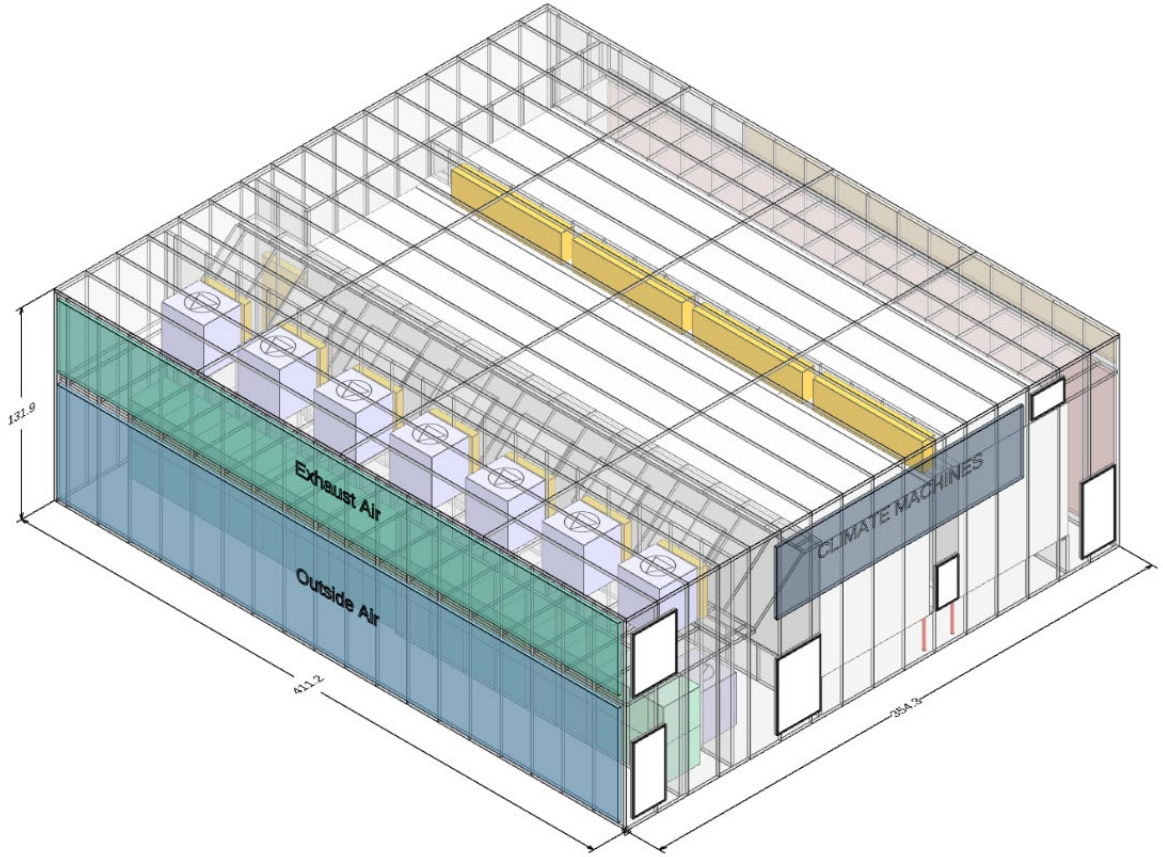
105,000 CFM with > 100% Sensible Eff

COP 9+

ENERGY MACHINES


ClimateMachines
Lycksele Lasarett
Pages
Overview
Alarms
Trends
Logs
Documents
Events
Help
Hospital with 24/7 DOAHU Operation
ClimateMachines™
-21.2 °C
0.32 F
-17.6 °C
GT4G
EXHAUST AIR
ST2B
FF01
FF02
74 %
2.4 m3/s
2.2 m3/s
74 %
-1.48 F
-18.6 °C
GT4F
128 Pa
GP2B
0 %
ST3B-C
SV91
SV92
SV93
missing
VM1
70.16 F
21.2 °C
5 %RH
GT4E/GH2A
330 Pa
339 Pa
GP2A
EXTRACT AIR
44 Pa
GP4A
-17.86 F
-27.7 °C
GT4A
12 Pa
GP1C
OUTDOOR AIR
ST1B
TF01
TF02
74 %
2.2 m3/s
2.2 m3/s
74 %
55.04 F
12.8 °C
GT4B
23.4 °C
GT8A
20.0 °C
19.9 °C
GT1A
330 Pa
329 Pa
GP1A
SUPPLY AIR
23.4 °C
GT4H
PS01
40 %
SV1A
0 %
SV3A
19.1 °C
GT2A
KB100
GL601
159 Pa
GP1B
ST3A
0 %
Efficiency EA/SA 82 % 83 %
SFP 1.1
Supply air flow 4.4 m3/s
Extract air flow 4.6 m3/s
Power over HX 193 kW
1m
2021-12-22 15:02:21
Period: 2021-12-22 12:58:42 – 2022-01-01 12:58:42

Carbon-free ventilation



- Winter loads are the most carbon intensive for OA ventilation.
- Reduction in demand peaks.
- Fixed plate heat exchanger core allows for energy recovery from otherwise unusable air streams.

ENERGY MACHINES

This is an energy machine

Water / Thermal Network

345 Hudson NY

Location: **New York City, USA**
Sector: **Office**
Building built: **1931**
Floor area: **1M sq ft**

Winner of NYSERDA's Empire Building Challenge for low-carbon retrofits Heating and cooling are recycled throughout building and neighboring properties via heat pumps, high-efficiency air handling, and flexible system control

COP > 9
Property to be decarbonized by 2032
Building owner saves >$440,000 annually in CO2 tax penalties

ENERGY MACHINES

ENERGY MACHINES

ENERGY MACHINES

Visit the Heat Recovery Program website to apply

Questions? Email

HeatRecovery@nyserda.ny.gov

NEW YORK STATE | NYSERDA