

# NYSERDA FLEX TECH ENERGY STUDY

Copake Town Hall

April 18, 2023



M/E 221428

We Listen... We Understand... We Deliver...

# AGENDA

- **Introductions**
- **Project Overview - Purpose**
- **Report Overview - What's included?**
- **Existing Conditions**
- **Analysis Performed**
- **Recommendations**
- **Next Steps**
- **Discussion / Questions**



ENGINEERING

# INTRODUCTIONS

- NYSERDA Representative
  - Vibhor Dutt – Project Manager, Efficiency Planning and Engineering, NYSERDA Independent Contractor
- Project Owner: Town of Copake
  - Jeanne Mettler – Supervisor
- Primary Energy Consultant / Engineer: M/E Engineering
  - Melanie Stachowiak – Partner
  - Andrea MacDonald – Energy Engineer



# PROJECT OVERVIEW – PURPOSE

- **Objective:**
  - Town of Copake is part of Climate Smart Communities Program
    - Commitment to local climate action
  - Identify energy conservation and carbon reduction measures
  - Evaluate clean heating and cooling technologies
- **Method: Level 1+ Energy Audit**
  - Review of existing conditions
  - Focus on upgrades that have the largest impact on building consumption
  - Energy analysis of possible measures
  - Recommendations for feasible upgrades
  - High level budgeting and cost analysis



# REPORT OVERVIEW – WHAT'S INCLUDED?

## **Executive Summary**

## **Project Summary Sheet**

## **Project Overview**

- Site Overview
- Building Envelope
- Electrical Systems
- Plumbing Systems
- Additional Observations

## **Energy Consumption/Utility Analysis**

## **Approach/Methodology**

## **Energy Efficiency Measures**

- EEM-1: HVAC Upgrades
- EEM-2: Envelope Measures
- EEM-3: Domestic Hot Water
- EEM-4: Lighting Upgrades
- EEM-5: Energy Recovery
- EEM-6: Indoor Air Quality

## **Additional Considerations**

- Existing Useful Life of Equipment
- Carbon Reduction
- Utility Cost Inflation
- Additional Energy Efficiency Measures
- Project Stage and Next Steps
- Incentive Programs

## **Appendix**

- Calculations
- Budget Pricing
- Photographs

# EXISTING CONDITIONS - ENVELOPE

- **Building Envelope:**
  - Metal panel walls and roof, limited insulation
  - Operable double-pane windows
  - Unfinished, fully ventilated attic
  - Air leakage from attic space through light fixtures, etc.





# EXISTING CONDITIONS - MECHANICAL

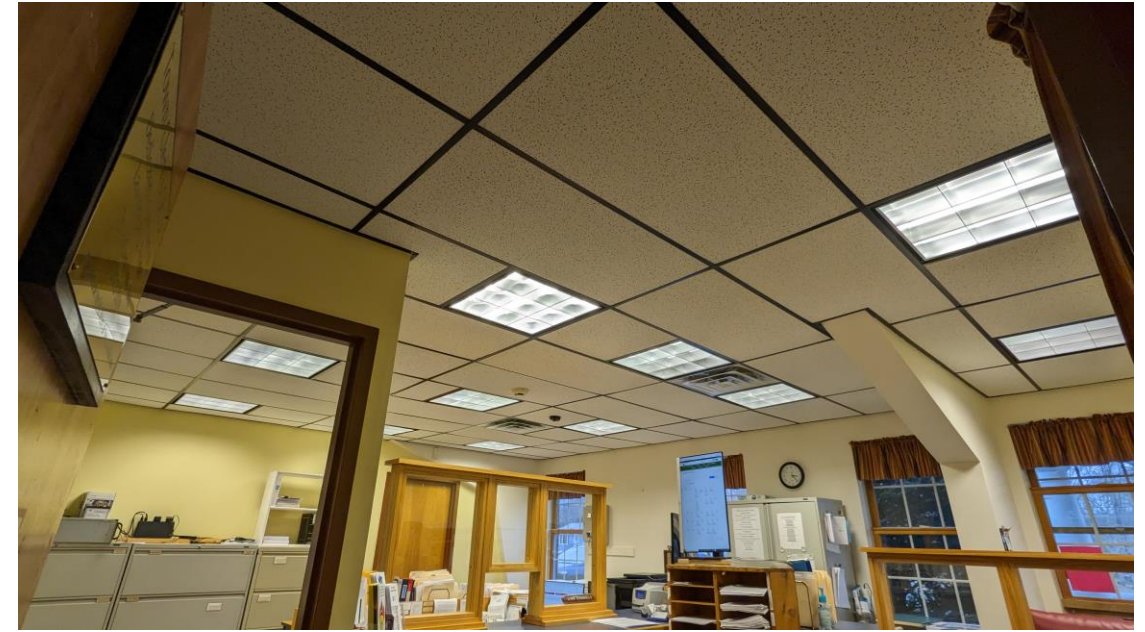
- **Mechanical Systems:**
  - Three air handlers in attic with furnace and split system AC
  - Duct-mount humidifiers
  - Units beyond expected useful life, one condensing unit inoperative
  - Utilize propane, a high-cost fossil fuel
  - Minimally efficient HVAC
  - AHUs and some ducts uninsulated (and in unconditioned attic)
  - Constant volume systems
  - Extensive flexible ductwork
  - Occupant comfort issues due in part to balancing, space heaters throughout





# EXISTING CONDITIONS - ELECTRICAL

- **Electrical Systems:**
  - T-8 fluorescent lighting
  - Minimal automatic controls
  - Exterior lighting controlled by photocells and timers
  - Propane generator
  - Roof-mounted solar PV





# EXISTING CONDITIONS – PLUMBING

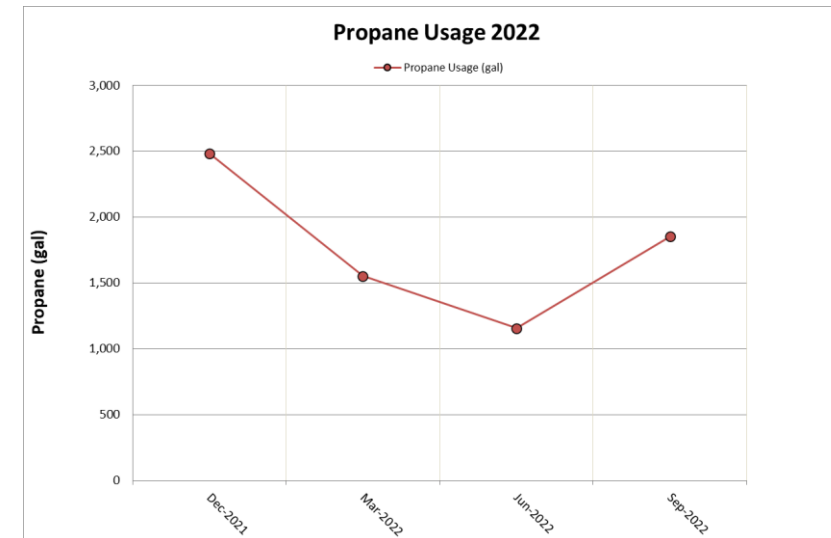
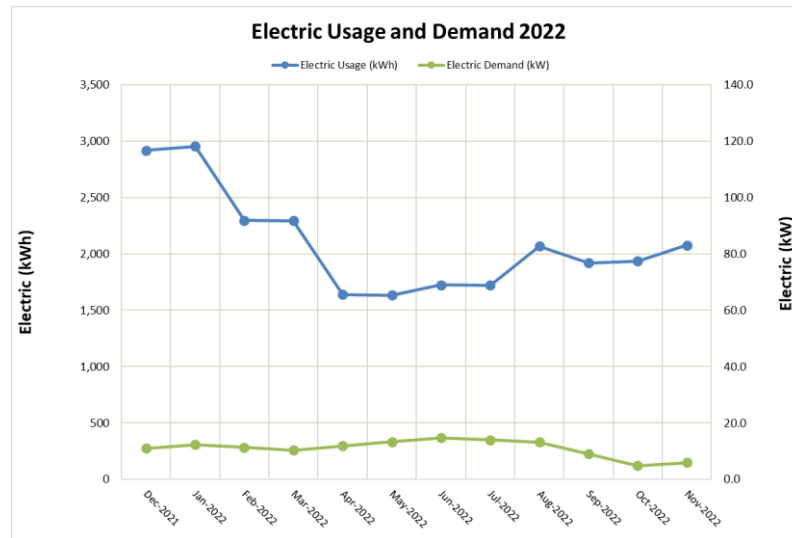
- **Plumbing Systems:**
  - Domestic hot water provided by 40-gallon propane water heater (residential)



# EXISTING CONDITIONS – UTILITIES

- **Utility Analysis:**
  - Facility uses significantly more energy than benchmark baseline
    - 95.0 kBtu/sf vs. 68.8 kBtu/sf EUI
  - High propane usage
  - High winter electric usage

Benchmarking				
Area Description	Percent of Area [%]	Area [sf]	Site Energy Usage [kBtu/yr]	Site EUI [kBtu/sf]
Office	67%	5,146	272,202	52.9
Courthouse	33%	2,534	256,481	101.2
Benchmark Baseline	100%	7,680	528,684	68.8
Existing Facility	100%	7,680	729,843	95.0
Savings of Recommended Measures			420,687	54.8
Revised Resulting Performance			309,156	40.3



# ANALYSIS PERFORMED

- Calculations based on NYS Technical Resource Manual v10.0
- Expected energy consumption and cost compared to existing building
- High-level budget costs for simple payback calculations
  - High-cost propane makes electrified heating measures more feasible
- HVAC Upgrades: Code-compliant, better than code, high performance
- Envelope Measures: Wall insulation, roof insulation, window replacement
- Domestic Hot Water Replacement: Better than code, high performance
- Lighting Upgrades – LED lighting and automatic controls
- Energy recovery for ventilation
- Indoor air quality discussion



# ANALYSIS PERFORMED – HVAC MEASURES: CODE-COMPLIANT

- EEM-1.1: Code compliant system - Fossil Fuel AHUs
  - One-for-one replacement of AHUs and split system condensing units, replace in kind
  - Propane furnace with DX coil
  - Split system condensing units
  - Code-minimum efficiency
  - Upgrade existing ductwork
  - Some savings due to somewhat improved cooling efficiencies and correction of ductwork deficiencies



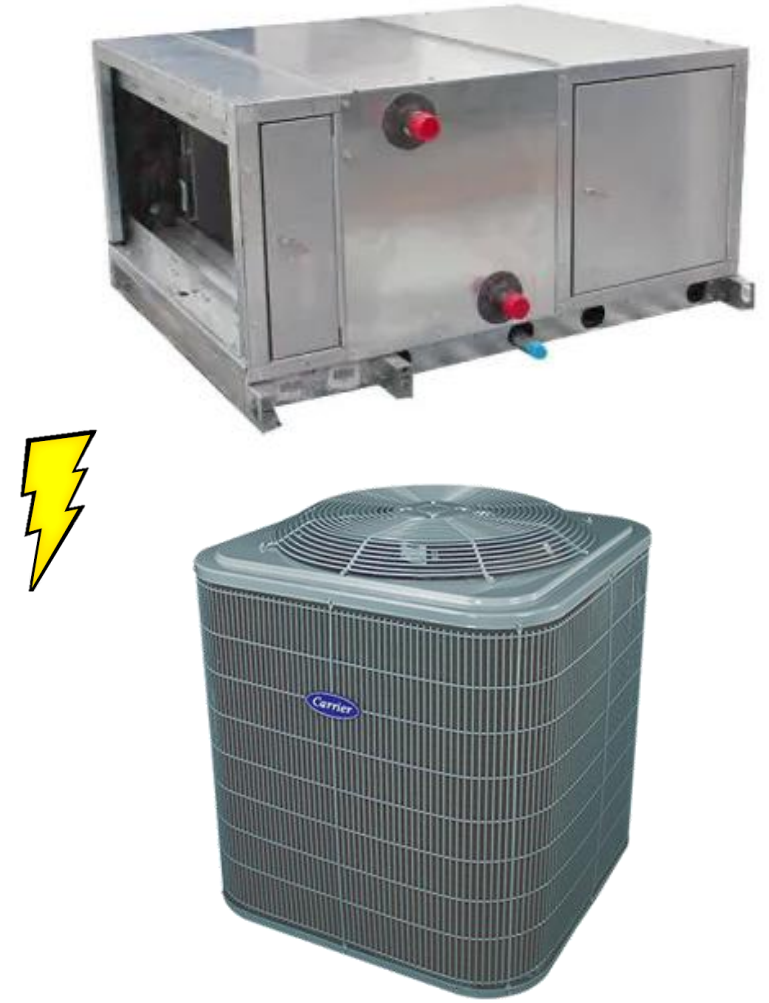
# ANALYSIS PERFORMED – HVAC MEASURES: BETTER THAN CODE

- EEM-1.2: Better than code - Fossil Fuel AHUs
  - One-for-one replacement of AHUs and split system condensing units
  - Propane furnace with DX coil
  - Split system AC condensing unit
  - High efficiency – condensing furnace, improved AC
  - Upgrade existing ductwork
  - Savings due to improved efficiencies and correction of ductwork deficiencies



# ANALYSIS PERFORMED – HVAC MEASURES: BETTER THAN CODE

- EEM-1.3: Better than code – Electrified AHUs, Air Source Heat Pumps, Split Systems
  - One-for-one replacement of AHUs and split system condensing units
  - AHU with DX coil and split system heat pump condensing unit
  - Electrified heating solution, high efficiency
  - Upgrade existing ductwork
  - Requires increased electrical for outdoor units
  - Reduced efficiency at peak heating
  - Savings due to improved efficiencies, electrification, and correction of ductwork deficiencies





# ANALYSIS PERFORMED – HVAC MEASURES: BETTER THAN CODE

- EEM-1.4: Better than code – Electrified, Distributed Variable Refrigerant Flow (VRF) System
  - Removal of existing AHUs, condensing units, and ductwork
  - Individual zone-level indoor fan coil units
  - Outdoor condensing units with heat recovery for simultaneous heating and cooling
  - Electrified heating solution, high efficiency
  - Requires minor renovation and increased electrical for outdoor units
  - Savings due to improved efficiencies, electrification, and elimination of ductwork deficiencies
  - Improves comfort conditions with zone-level controls



*Cassette Indoor Unit*



*Wall-Mount Indoor Unit*



*Ducted Indoor Unit*



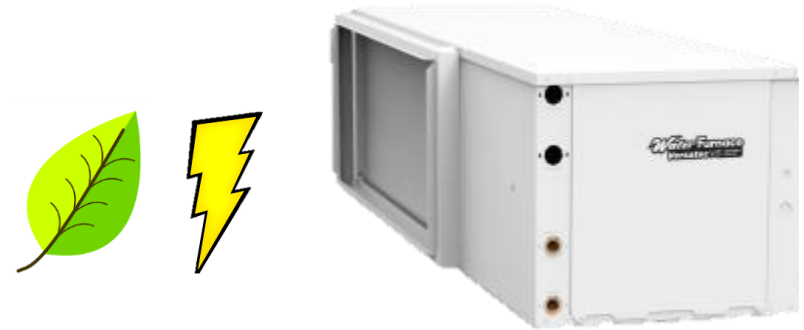
*Floor-Mount Indoor Unit*



*Outdoor Condensing Unit*

# ANALYSIS PERFORMED – HVAC MEASURES: HIGH PERFORMANCE

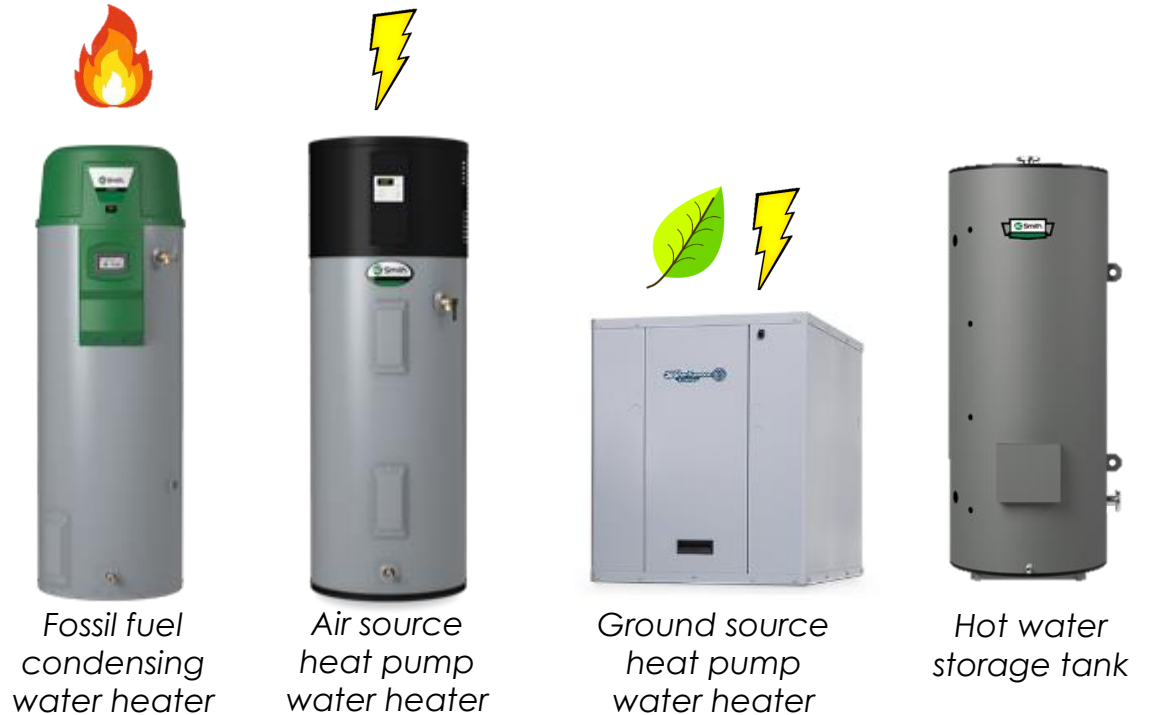
- EEM-1.5: High Performance – Electrified AHUs, Ground Source Heat Pumps
  - One-for-one replacement of AHUs
  - Water-to-air heat pump type AHUs with DX coil and integral compressor
  - Removal of existing condensing units
  - Electrified heating solution, premium efficiency
  - Upgrade existing ductwork
  - Requires increased electrical for indoor units
  - Geo-exchange well field with indoor pumps, estimated 8 wells at 400 feet deep
  - Savings due to improved efficiencies, electrification, and correction of ductwork deficiencies



# ANALYSIS PERFORMED – DOMESTIC HOT WATER MEASURES

- EEM-3.1: Better than Code – Fossil Fuel Fired
  - One-for-one replacement of DWH
  - High efficiency propane condensing hot water heater
  - Savings due to improved efficiencies
- EEM-3.2: Better than Code – Air Source Heat Pump
  - One-for-one replacement of DWH
  - Packaged air source heat pump water heater
  - High efficiency, electrified solution
  - Savings due to improved efficiencies and electrification
  - Requires increased electrical at unit, installation care with space cooling output

- EEM-3.3: High Performance – Ground Source Heat Pump
  - Water-to-water heat pump paired with storage tank
  - Best if paired with GSHP HVAC
  - Savings due to improved efficiencies





# ANALYSIS PERFORMED – OTHER MEASURES

- EEM-2: Envelope

- Add batt insulation to attic floor
- Add insulation to exterior wall (furr-out required)
- Window replacements
- Savings from better thermal barrier from outdoor conditions

- EEM-4: Lighting Upgrades

- Replace existing fluorescent lighting with LED
- Provide automatic occupancy/vacancy sensors throughout facility
- Savings due to decreased power demand of lighting and reduced lighting hours

- EEM-5: Energy Recovery

- Small static plate enthalpy recovery unit at each air handler
- Savings due to preconditioned ventilation air

*Energy Recovery Unit Cross-section*



- EEM-6: Indoor Air Quality

- Provide units with increased static pressure
- Provide CO<sub>2</sub> sensing for ventilation air
- Provide distributed equipment for more precise zoning and contagion compartmentalization
- Review ventilation requirements when upgrading equipment

# ANALYSIS PERFORMED - RESULTS

Measure Summary											
EEM No.	Energy Efficiency Measure Description	Electricity Savings			Fossil Fuel Savings		Total Savings			Payback Analysis	
		Annual Electric Savings [kWh]	Electric Peak Demand Savings [kW]	Annual Electric Cost Savings [\$]	Annual Fossil Fuel Savings [MMBtu]	Annual Fossil Fuel Cost Savings [\$]	Total Energy Consumption Savings [MMBtu]	Total Annual Cost Savings [\$]	Total EUI Savings [kBtu/sf]	Est. EEM Cost [\$]	Simple Payback [yrs]
EEM-1.1	HVAC Upgrades: Code Compliant - Fossil Fuel AHUs	549	0.7	\$74	23.3	\$952	25.1	\$1,025	0.89	\$57,236	55.8
EEM-1.2	HVAC Upgrades: Better Than Code - Fossil Fuel AHUs	886	0.9	\$119	79.5	\$3,254	82.5	\$3,373	2.93	\$65,370	19.4
EEM-1.3	HVAC Upgrades: Better Than Code - Electrified AHUs ASHP Split	(31,610)	(12.5)	(\$4,249)	249.6	\$10,217	141.7	\$5,968	5.03	\$87,788	14.7
EEM-1.4	HVAC Upgrades: Better Than Code - Electrified Distributed VRF	(11,900)	(2.7)	(\$1,600)	249.6	\$10,217	209.0	\$8,618	7.41	\$175,523	20.4
EEM-1.5	HVAC Upgrades: High Performance - Electrified GSHP AHUs	(13,039)	(6.9)	(\$1,753)	249.6	\$10,217	205.1	\$8,464	7.27	\$228,884	27.0
EEM-2	Envelope Upgrades	1,910	0.4	\$257	68.5	\$2,804	75.0	\$3,061	2.66	\$56,673	18.5
EEM-3.1	DHW Upgrades: Better than Code - Fossil Fuel Fired	0	0.0	\$0	9.0	\$368	9.0	\$368	0.32	\$1,645	4.5
EEM-3.2	DHW Upgrades: Better than Code - ASHP	(1,578)	(0.2)	(\$212)	56.5	\$2,311	51.1	\$2,099	1.81	\$2,830	1.3
EEM-3.3	DHW Upgrades: High Performance - GSHP	(1,263)	(0.1)	(\$170)	56.5	\$2,311	52.1	\$2,141	1.85	\$7,426	3.5
EEM-4	Lighting Upgrades: LED Fixtures and Controls	29,563	7.4	\$3,974	(5.4)	(\$220)	95.5	\$3,754	3.39	\$21,448	5.7
EEM-5	Energy Recovery	40	(1.9)	\$5	57.2	\$2,340	57.3	\$2,346	2.03	\$9,780	4.2

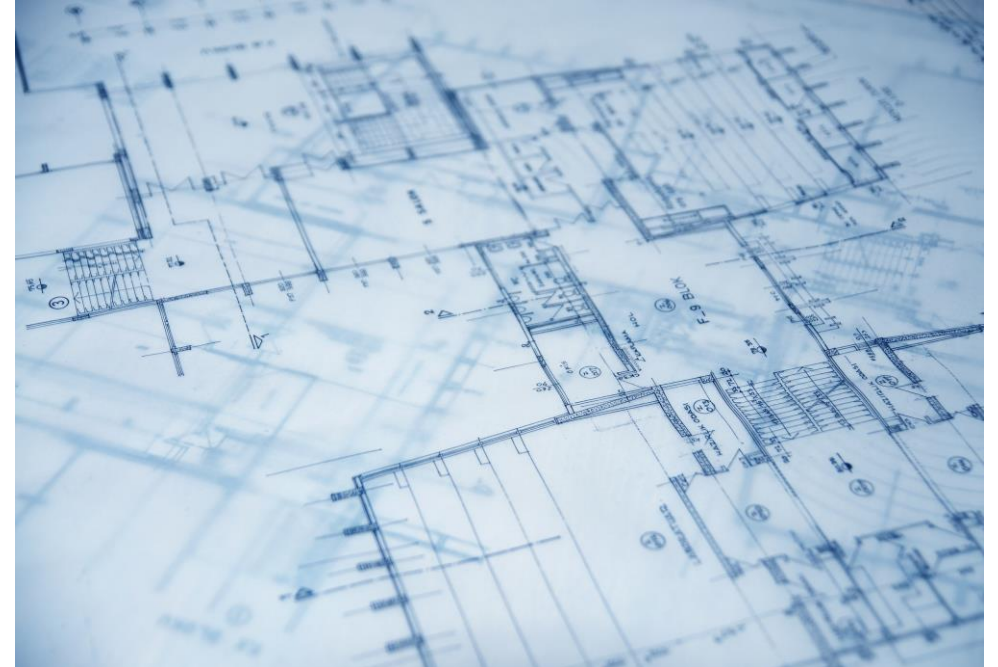
# RECOMMENDATIONS

- HVAC:
  - Simple, lower cost solution: ASHP
    - One-for-one replacement
    - Electrified heating solution
    - Minimal disturbance to occupants
    - Traditional systems for maintenance purposes
  - Better, high efficiency solution: VRF
    - Better energy, cost, and carbon savings
    - Electrified heating solution
    - Improved comfort conditions due to zoned-system
- Envelope:
  - Minimally, insulate attic floor with batt overlay
  - Seal penetrations
  - Ensure HVAC equipment, ductwork, and lighting fixtures are insulated
- Domestic hot water
  - Air-source heat pump
  - Simple installation and may be replaced at any time
  - Install in area capable of handling cold air output
- Lighting:
  - Provide LED lighting and occupancy controls
  - Select DLC or Energy Star lighting (or similar) for high quality LEDs
- Energy Recovery:
  - ASHP: Provide individual units at AHUs
  - VRFs: Provide larger unit in attic



# NEXT STEPS

1. **Interim:** Provide temporary cooling equipment
  - Portable floor-mounted units
  - Utilize operable windows for heat rejection and/or natural cooling
2. **Design:** Select measures to move forward with and engage design firm to produce construction documents
  - ~6 weeks design period
3. **Bidding:** Issue documents for competitive bidding process to ensure cost-effectiveness
  - ~2 weeks bid period
4. **Construction:** Select contractor and start construction
  - Timing dependent on contractor and equipment availability



# Discussion

We would be glad to answer  
any questions

[www.meengineering.com](http://www.meengineering.com)

