

Warren Town Highway Garage

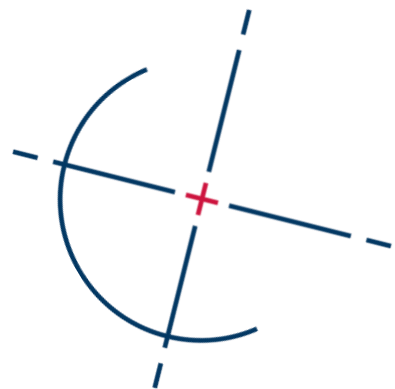
Warren, VT

MEP System Options



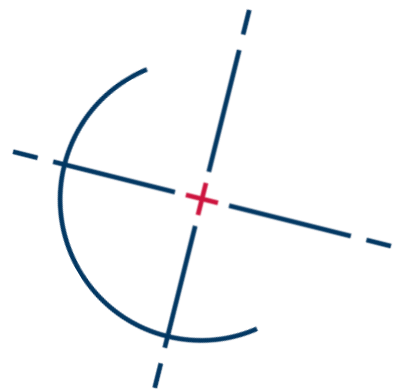
Mechanical

- **HVAC Selection Criteria**
 - **Maintenance/Reliability**
 - **Thermal Comfort**
 - **Energy Efficiency**
 - **First Cost**
 - **Sustainability**



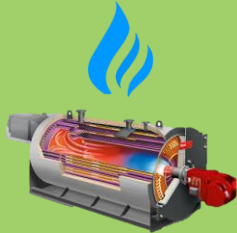
Mechanical

- **HVAC Plant Options**
 - **Option #1:**
 - **Air-to-Water Heat Pump with Backup Boiler**
 - **Option #2:**
 - **Geothermal Water-to-Water Heat Pump with Backup Boiler**
 - **Option #3:**
 - **Pellet Boiler**
 - **Option #4:**
 - **Air-to-Air Heat Pump, forced air heating**



Mechanical Option #1

HEAT PUMP



FOR BACK-UP ONLY



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PUMPS

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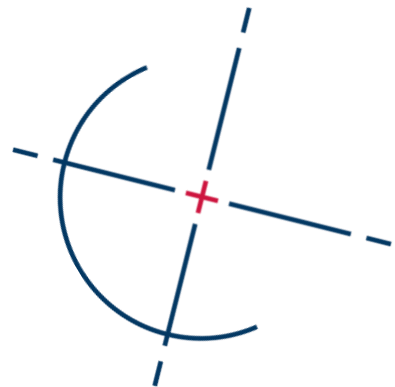
HOT WATER

Air-to-Water Heat Pump

- Provide **heating hot water** (130) for radiant floors, unit heaters, etc.

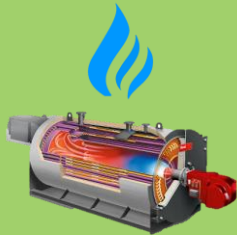
- **Air Source Heat Pump + Backup Boiler**

- Predominately heat w/o gas or fuel oil
- Less expensive than geothermal
- Most require gas backup heat source below 10F
 - Some newer models operate down to -30F



Mechanical Option #2

GEOTHERMAL HEAT
PUMP



FOR BACK-UP ONLY



Geothermal Heat Pump

- Utilize closed loop, 500' (+/-) geothermal bores as a heat sink
- Water-to-water heat pump to produce heating hot water

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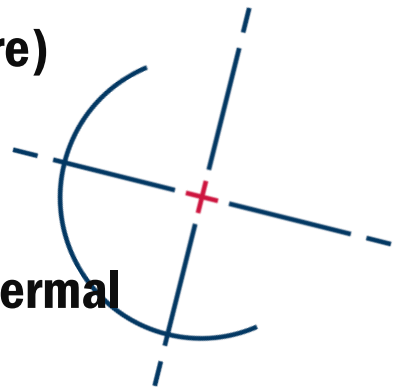


PUMPS

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HOT WATER

- **Geothermal Heat Pump + Backup Boiler**
 - Boiler only required in emergency (heat pump failure)
 - Federal incentives/rebates available
 - Most efficient but most expensive system
 - Heating only applications are challenging for geothermal



Mechanical Option #3

PELLET BOILER



Pellet Boilers

- Generates heating hot water for radiant floors
- Suggest two for redundancy
- Hopper for storage of pellets

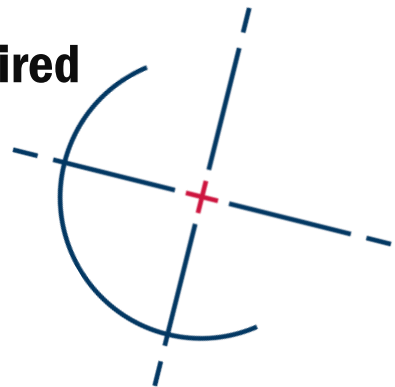
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PUMPS

= HOT WATER

- Backup boiler is not a necessity but sometimes desired
- Efficiency Vermont rebates available (modest)
- Most efficient but most expensive system

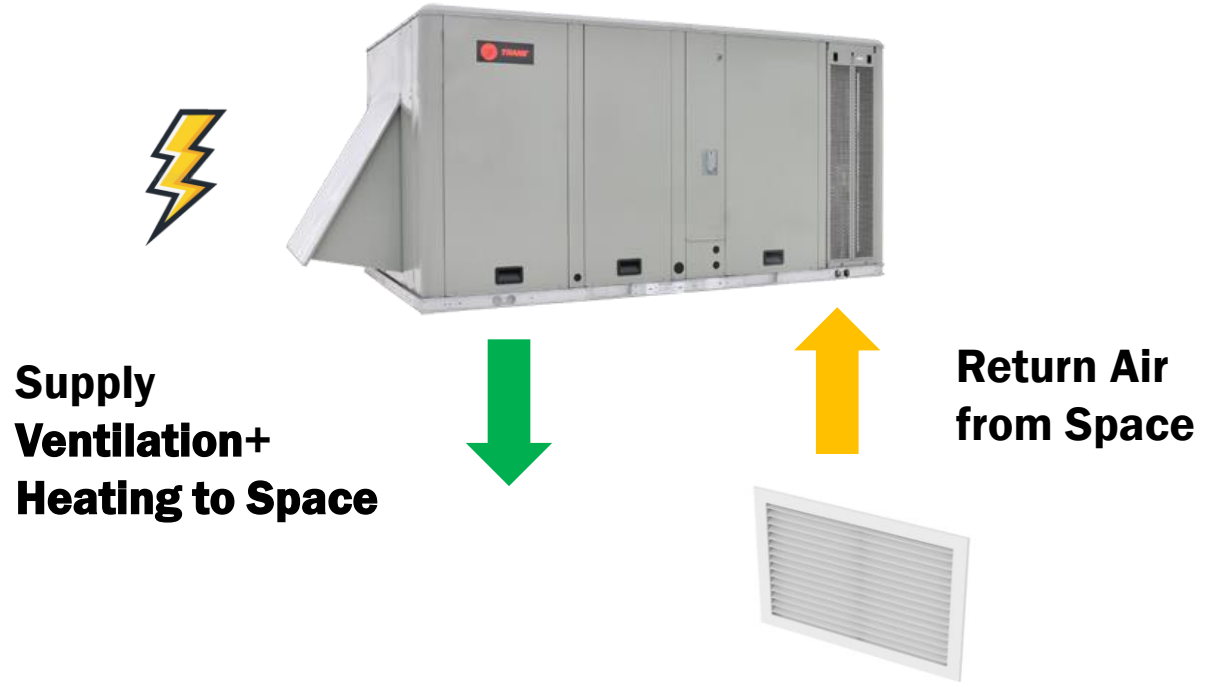


Mechanical Option #4

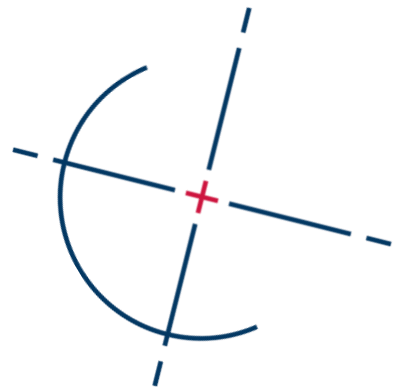


**GAS BACKUP RECOMMENDED
FOR LOW AMBIENT HEATING**

Air Source Heat Pump (ASHP) Air-Air



- Forced hot air type distribution
- Requires gas backup heat source below 10F
- “Budget Friendly” option – would not include radiant floors



Mechanical System Comparisons

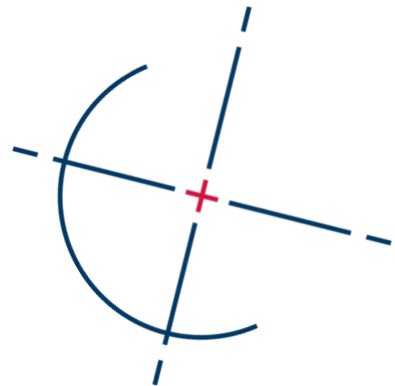
	Pros	Cons
Option #1: Air-to-Water Heat Pump	<ul style="list-style-type: none">• Pairs well with radiant floor heating• Less expensive than geothermal• Drastically reduce fossil fuel usage• Can also produce domestic hot water	<ul style="list-style-type: none">• More expensive than Option #3• Most available heat pumps of this type do not operate below 10F (+/-). There are some versions coming out with better low ambient performance but limited availability currently
Option #2: Geothermal Water-to-Water Heat Pump	<ul style="list-style-type: none">• Pairs well with radiant floor heating• Fossil fuels not required except in emergency (greatest reduction of fossil fuel usage of all (3) options)• Lowest energy usage• Can also produce domestic hot water	<ul style="list-style-type: none">• Most expensive option• Heating only applications not ideal for geothermal
Option #3 Pellet Boiler	<ul style="list-style-type: none">• Pairs well with radiant floor heating• Fossil fuels not required unless desired as a redundancy/backup	<ul style="list-style-type: none">• More maintenance intensive than other options• Less reliable fuel source, less suppliers than gas or oil
Option #4: Air-to-Air Heat Pump	<ul style="list-style-type: none">• Least expensive of all (3) options	<ul style="list-style-type: none">• Highest operating cost• Would not pair with radiant floor heating• Lowest thermal comfort

Mechanical



Miscellaneous Systems

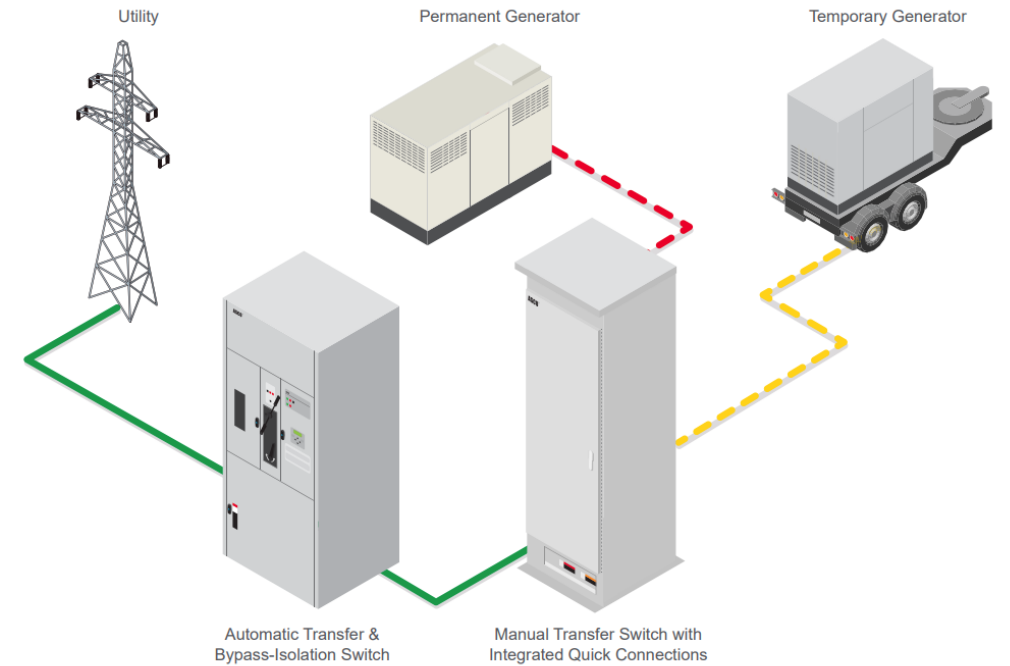
- **Radiant Floor Heating:**
 - Superior thermal comfort
 - Promotes faster drying of floor
 - Pairs well with heat pump systems that produce lower water temps
 - Consists of PEX tubing installed in concrete slab
- **Vehicle Exhaust System for maintenance bay**
- **Ceiling Fans**
 - Provides thermal comfort in the summer
 - Helps dry off trucks/equipment



Electrical

Emergency Power

- **Emergency generator**
 - **Diesel powered**
 - **Full vs. partial backup**



Electrical

Solar / PV

- What are the goals of introducing solar?
 - Reduce carbon footprint
 - Reduce utility costs
- At a minimum provide infrastructure for future install
- Desire to install panels as part of project?



Electrical

EV Charging

- Any desire for EV charging infrastructure beyond code?
 - Employees with EVs
 - Additional future-proofing above and beyond Code
- Code-required EV charging and EV-capable charging infrastructure will be installed as part of project.
- Town standards on manufacturer, billing, etc.



Questions?

