
VILLAGE CHURCH
Congregational · United Church of Christ
Wellesley † Weston
EMPOWERING
THE FUTURE

Chronology to geothermal decision

- **2014 capital campaign:** allotted $400K for environmental stewardship
- **2014 – 2021 research & projects:** Sealed the building envelope, partial lighting conversion, solar array, preparations for HVAC replacement.
- **2022 HVAC design:** HVAC at end of useful life. Preliminary geothermal high-level design and estimate completed ($70K cost for design).
- **2022 – 2023: decision process (part 1 – What are the options?)**
  - Slow start. Geothermal estimate 30% higher than oil & natural gas
  - HVAC degrading. Congregation wanted proposals to compare vendors and technical options.
  - 2022 Inflation Reduction Act: 40% of project costs covers by federal direct payment.
  - End of 2023 proposals received. Oil & natural gas options were “drop in” component replacement. Geothermal was an integrated design starting from core technical requirements through to a complete HVAC solution.
  - Determined further geothermal design work needed for fixed price proposal – cost: $120K

Background information

- 55,000 sq ft building
- HVAC was 30 years old. Two oil fired boilers. One boiler was a 40+ years old steam boiler converted to hot water. 7 roof top units. Past end of economically useful life.
- 50% of the heat was delivered hot water baseboard radiators and cast iron radiators in the sanctuary. No room to install larger air ducts so the geothermal solution is hybrid – both hot water baseboard radiators and forced hot air.
- Some zones were not air conditioned. Geothermal provides A/C to all zones.

COST COMPARISON: INITIAL OUTLAY

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Costs	Option 2: Geothermal
System, gross cost	$4,674,000
Contingency (3.5%)	$164,000
Interest	$240,000
Roof repairs	$25,000
Rebate: IRA 30%	$(1,451,000)
Rebate: IRA 10%	$(484,000)
Rebate: Mass Save	$(675,000)
TBD	—
TBD	—
NET	**$2,493,000**

Costs	Option 1: heat pump/nat gas
System, gross cost	$2,143,000
Contingency (3.5%)	$75,000
Interest	$68,000
Roof repairs	—
Rebate: IRA 30%	—
Rebate: IRA 10%	—
Rebate: Mass Save	$(80,000)
TBD	—
TBD	—
NET	**$2,206,000**

Notes:

- Quotes from GreenerU are stipulated sum (fixed)
- Pricing has been developed based on significant engineering effort to date
- There is some uncertainty as to IRA rebates due to the current political climate

Data from GREENER U

TOTAL COST OF OWNERSHIP

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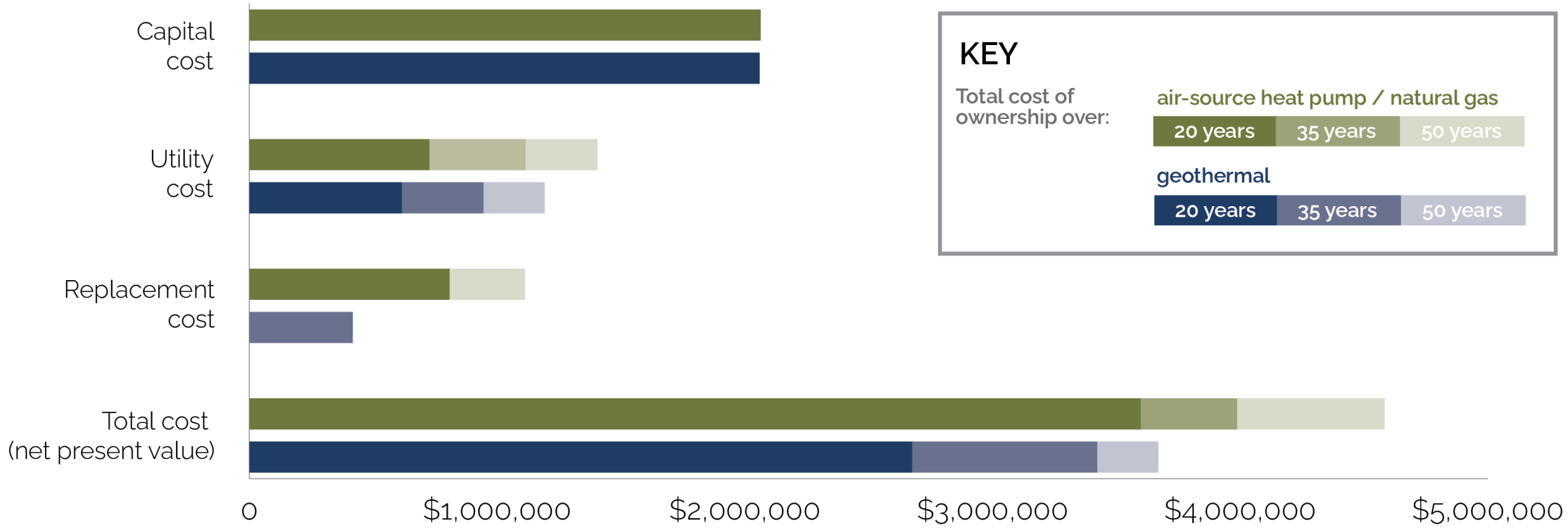

Data from GREENER U

SYSTEM COMPARISON: EMISSIONS

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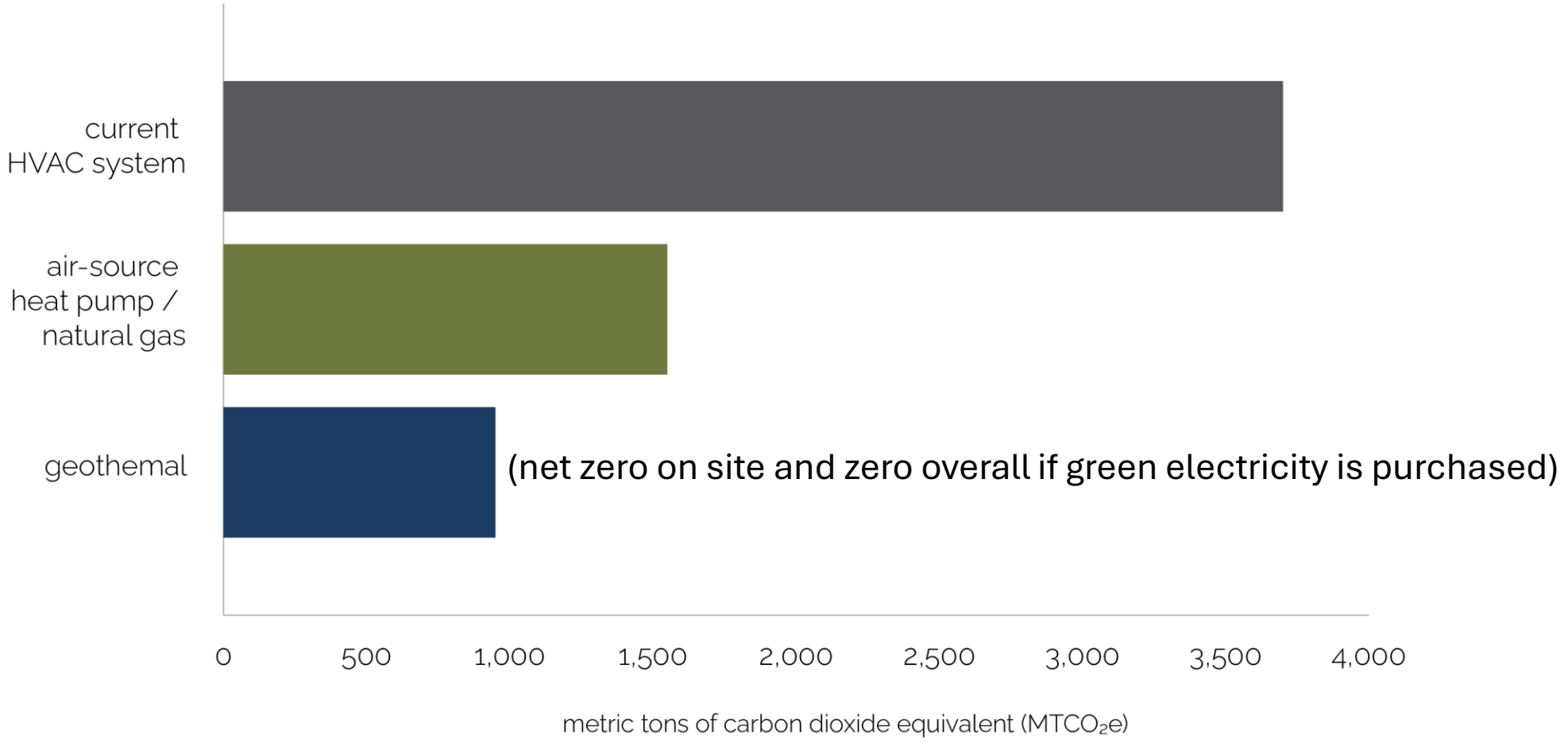

Data from GREENER U

EMPOWERING THE FUTURE: FIVE CATEGORIES

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CREATE AN ENDOWMENT FOR CHILDREN AND YOUTH MINISTRY

REPLACE AND MODERNIZE THE HVAC SYSTEM

EXPAND COMMUNITY OUTREACH INCLUDING VILLAGE TABLE

SECURE THE PROPERTY RESERVE

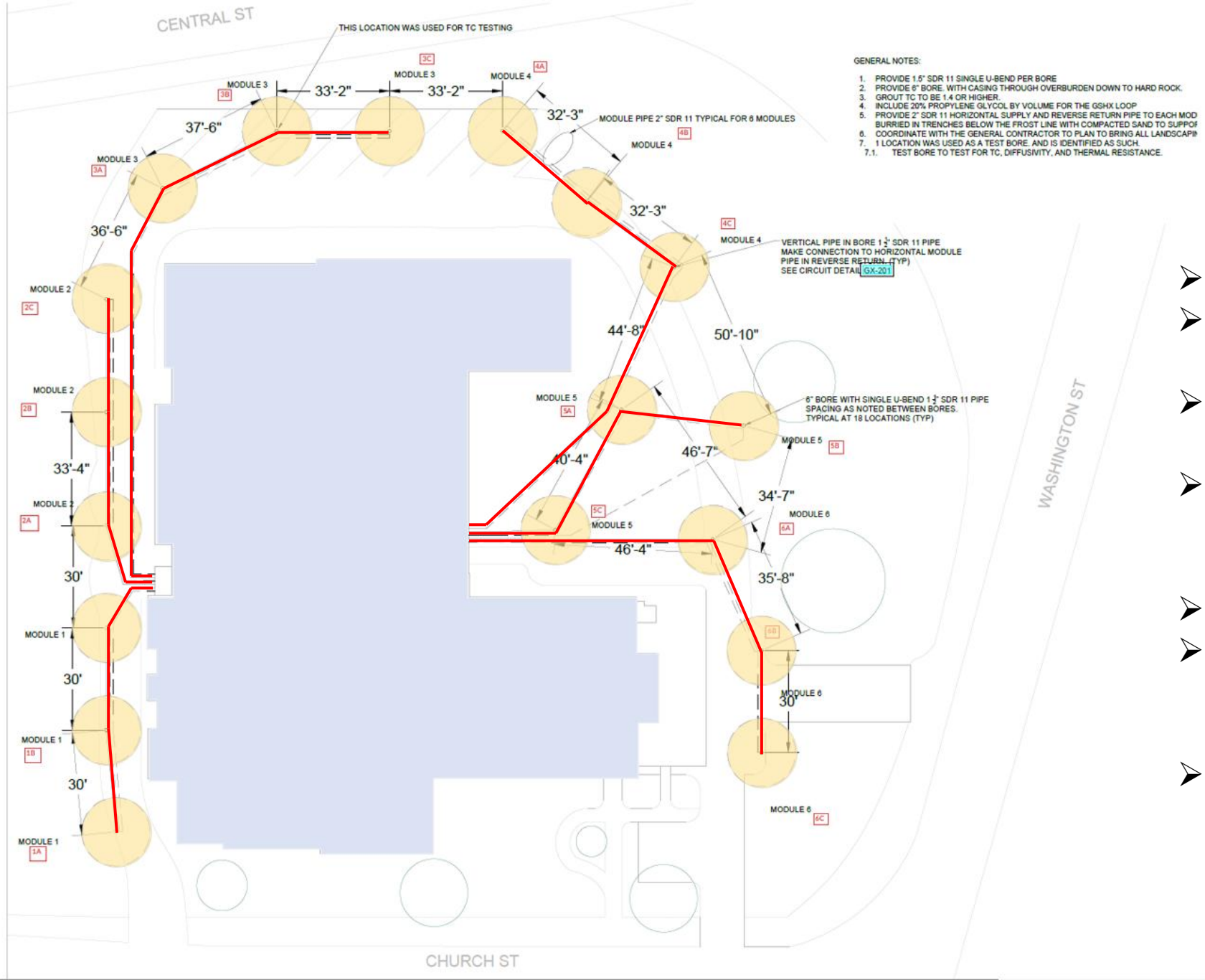
GREEN THE WESTON CAMPUS (SOLAR, INSULATED ROOF)

Decision process part 2 (fall 2024 – what option do we choose?)

- Sept: Estimates for natural gas options (boilers and air source heat pumps), oil option, and geothermal all equal at about $3M with federal direct payments & MassSave rebate.
- Geothermal involved a complete integrated design of all components. Natural gas and ASHP solutions were much more limited “drop in” component replacement.
- Sept – Nov: Weekly church council meetings and extensive engagement with the congregation.
- Dec 10 – congregation (85%) votes for geothermal option
- First production well drilled in December to verify hydrographic data and give the project “substantial start” in CY 2024.

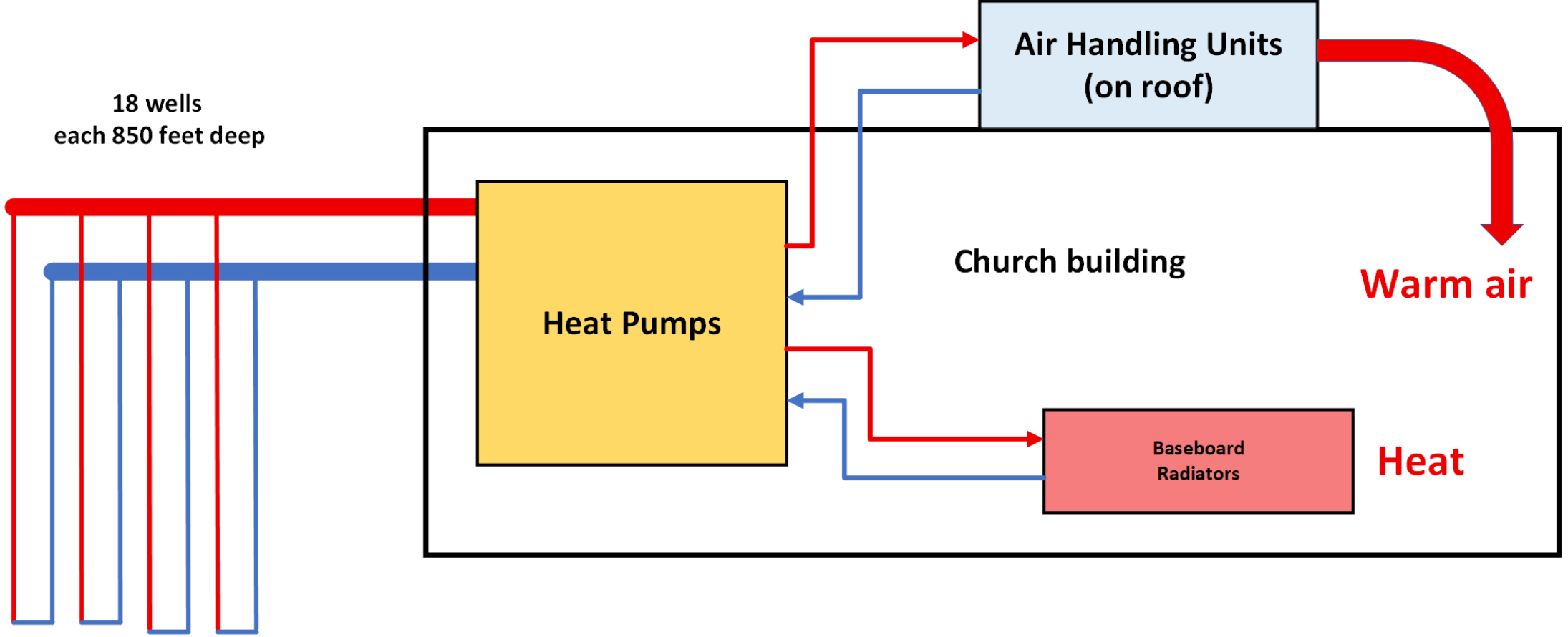
Thoughts on the decision process

- This was a 10-year journey for our church.
- When the focus shifted to geothermal, it took two years and $150,000 to reach a decision by the congregation.
- Project costs rose during 3-year decision cycle from an initial estimate of $1.7M to $3M due to more detailed design work, expansion of scope, and rising costs.
- Single source to our prime contractor would have saved 10% cost at least and a year of time, but that type of decision was not possible in a congregational church. Comparative bids and technologies were required.
- WVC would not have decided for geothermal were it not for the federal IRA direct payments (40% of project cost) and the MassSave rebate ($665,000).
- It was not a unanimous decision (85% = yes). Some members still had reservations.



Wellfield

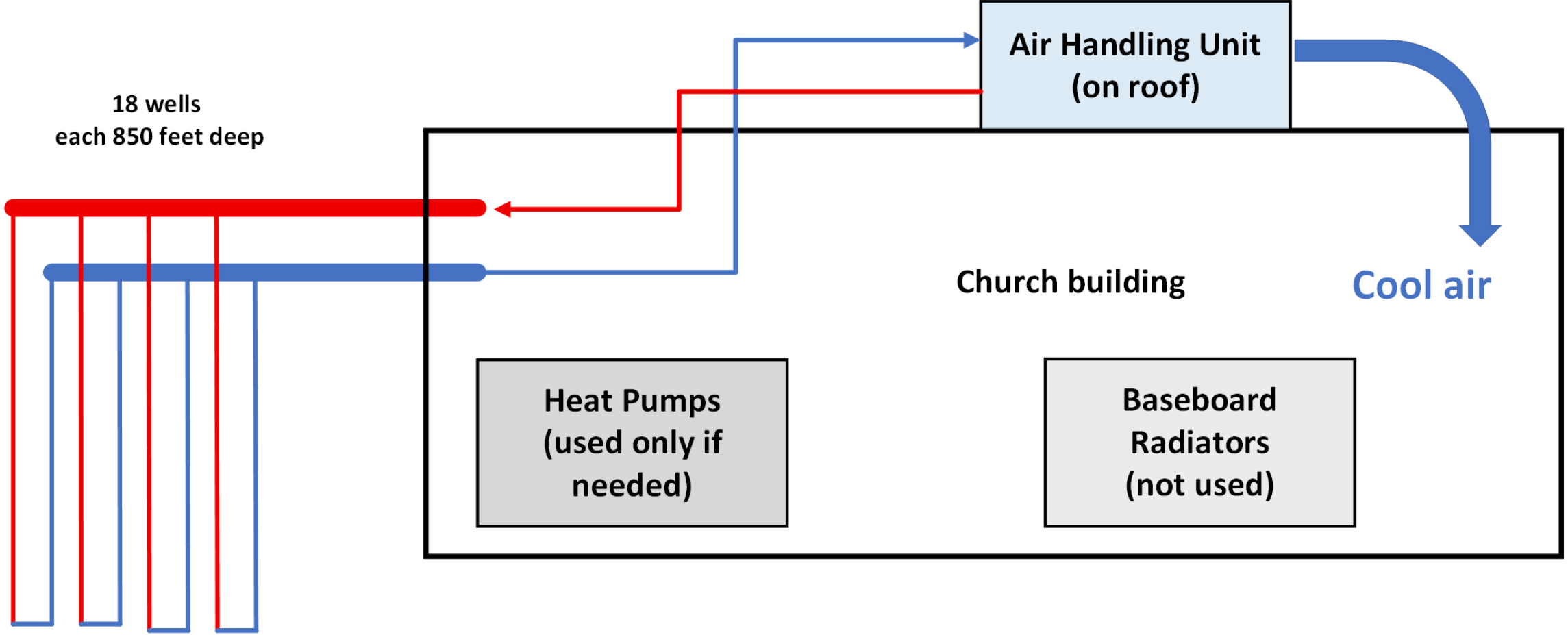
- 18 wells, each 850 feet deep
- Closed loop = 1 ½ inch pipes up and down each well
- Wells are filled with cement grout
- Approximately 25 feet of overburden, 825 feet of bedrock
- Over 6 miles of piping
- Field is divided into two 9 well sections to feed into the building.
- Located under the driveway. Nothing is visible on the surface.



Heating mode:

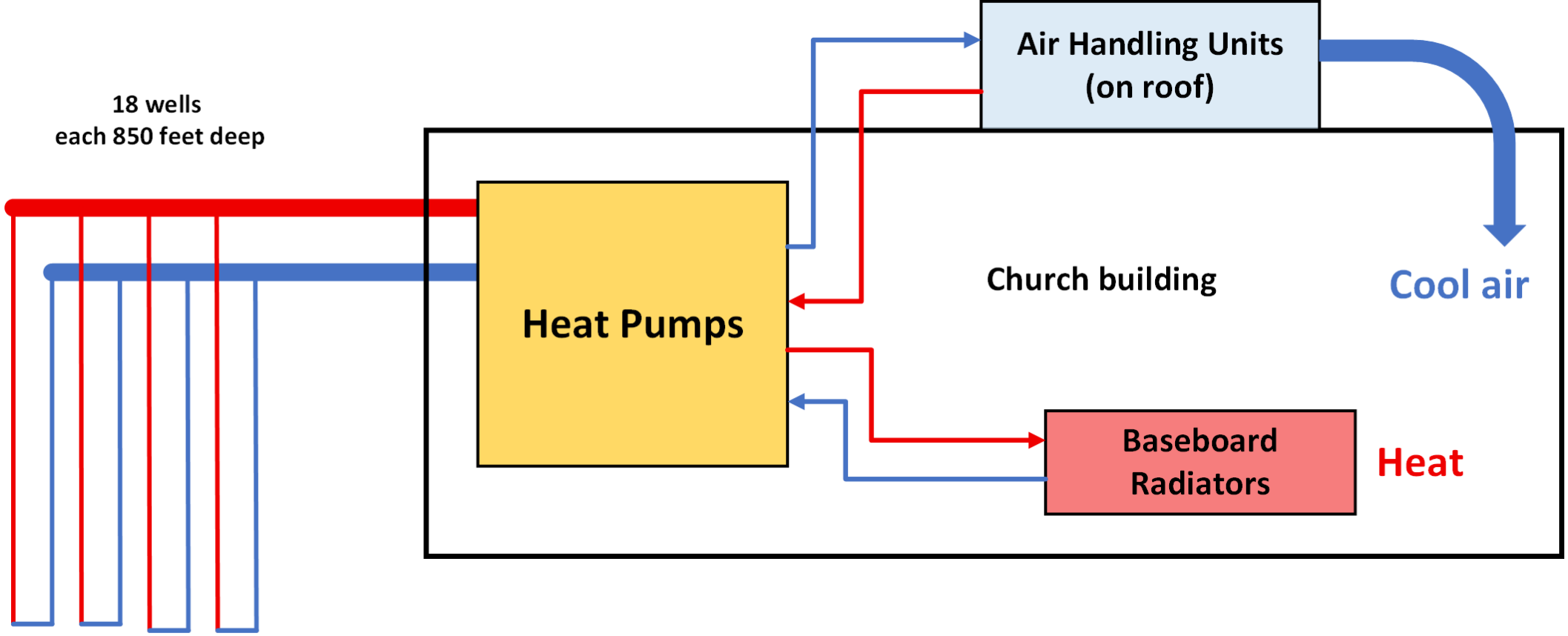
Heat pumps heat the loop from warm ground water. This sends hot water to the coils in the air handling units and to the baseboard radiators.

- ❑ The radiators are always the initial source of heat to a room or space. Air from the Air Handling Units (AHU) supplement the heat from the radiators.
- ❑ Radiators provide heat to 47 rooms and spaces each with individual controls.
- ❑ The AHU's provide fresh air, heating, & cooling to seven zones. CO2 is monitored in each space to ensure enough fresh air is provided.
- ❑ Two of the seven zones service the offices and classrooms. These zones have Variable Air Volume (VAV) units that can heat the air and change the volume of air going to individual rooms to control individual room temperatures. There are 18 VAV's.



Free Cooling mode:

Chilled water comes directly from the well field. The heat pumps and radiators are not used – dramatically reducing heating costs. Heat pumps can be used near the end of the summer during peak cooling loads.



Heating & Cooling mode:

Heat pumps provide hot water to the baseboard radiators and chilled water to the AHU's. Used in spring & fall when part of the building is hot and part is cold. Heat is "moved" from the cooling air to the radiators.

The "outside air economizer" mode is used when one zone needs cooling (e.g. the sanctuary for a service) and the rest of the building needs heating. This mode increase the air flow to the space to cool it.

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Home | Alerts (22) | Schedules | Charts | Notes | Users | Weather | Reports | Back | Forward | Logoff

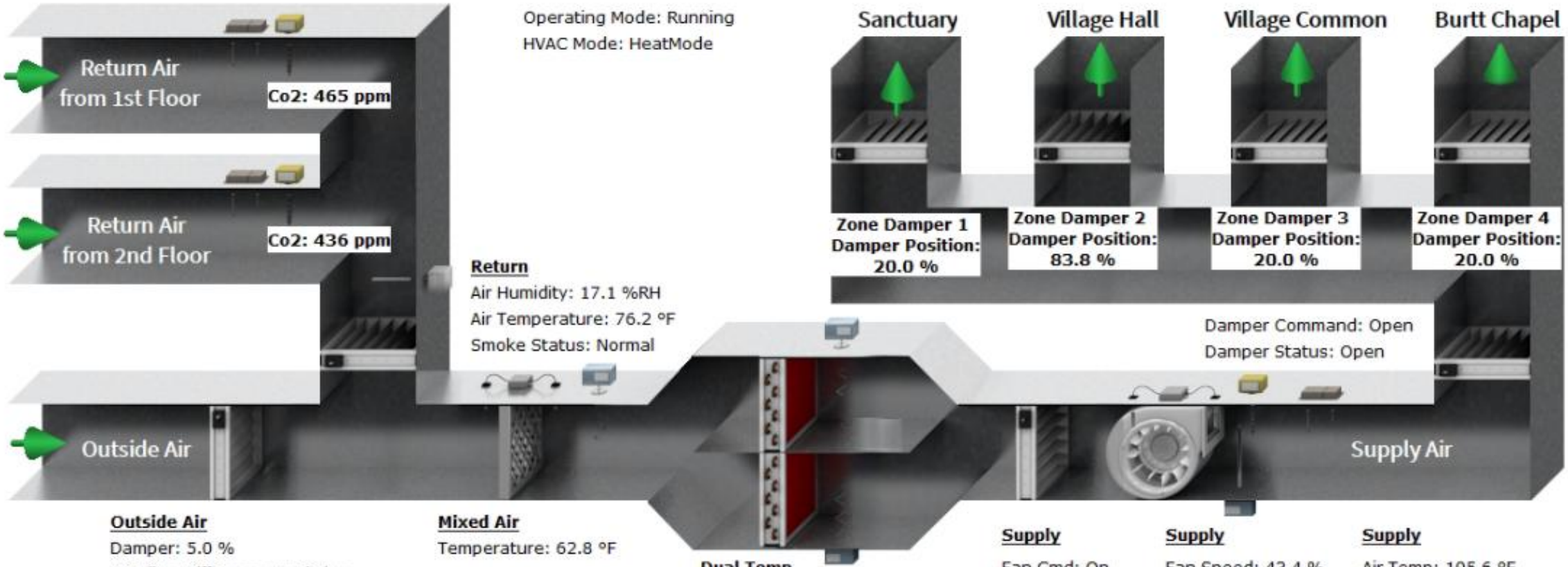
47 °F
40 %RH

18-Nov-25 2:48 PM EST

EDGE AUTOMATION

Quick View | Advanced | Operation | Points | Setpoints & Parameters | Fan Info | Zone Damper Settings | Co2 Info | Unit Alarms

AHU 2
Advanced



Outside Air
Damper: 5.0 %
OA Filter Diff Press: 0.1 in/wc
Dirty Filter Alarm: Clean

Mixed Air
Temperature: 62.8 °F

Dual Temp
Valve Upper: 100.0 %
Valve Lower: 100.0 %
Cond. Pan Switch Status: Normal
Freezestat Status: Alarm

Supply
Fan Cmd: On
Fan 1 Status: On
Fan 2 Status: On
Fan 3 Status: On
Fan 4 Status: On

Supply
Fan Speed: 43.4 %
Static: 0.4 in/wc
☐ Show Fan Info

Supply
Air Temp: 105.6 °F
Air Humidity: 0.1 %RH
Smoke Status: Normal
High Static: Normal
Supply Flow: 8302.1 cfm

System Reset: Auto

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Home | Alerts (22) | Schedules | Charts | Notes | Users | Weather | Reports | Back | Forward | Logoff

46 °F
40 %RH

18-Nov-25 2:44 PM EST

EDGE AUTOMATION

Quick View | Advanced | Points | Pump Information | Operation | Setpoints & Parameters | Heat Pump Information | BTU Meter Information

System Mode: Heat Only

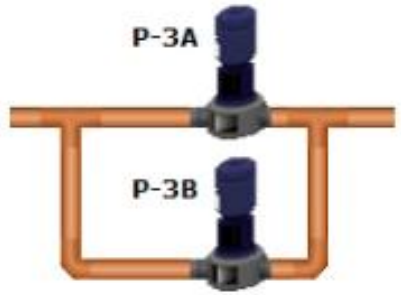
WSHP
Quick View

Ground Water Source Heat Pump

System Mode: Heat Only
Alarm: Normal
Run Percentage: 29.35

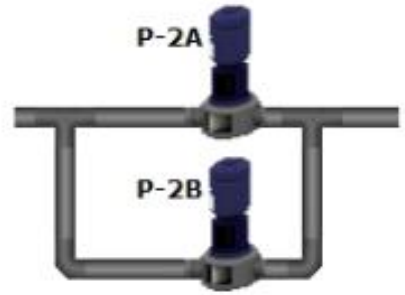
Ground Water Loop

Supply Temp: 46.5 °F



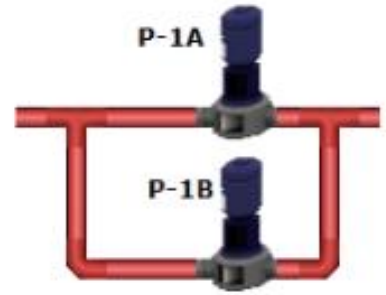
Dual Temp Loop

Effective Water Setpoint: 42.0 °F
Dual Temp Supply Temp: 106.0 °F



Hot Water Loop

Effective Water Setpoint: 110.0 °F
Hot Water Supply Temp: 106.0 °F



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Home | Alerts (22) | Schedules | Charts | Notes | Users | Weather | Reports | Back | Forward | Logoff

46 °F
40 %RH

18-Nov-25 2:44 PM EST

EDGE AUTOMATION

Quick View | Advanced | Points | Pump Information | Operation | Setpoints & Parameters | Heat Pump Information | BTU Meter Information

System Mode: Heat Only

WSHP
Advanced

Glycol Alarm: 0.0 %
Refrigerant Level: 4 ppm

Bypass Valve
Command: Closed
Valve 1 Status: Closed
Valve 2 Status: Closed
Free Cooling: Active

Ground Water
Supply Temp: 46.5 °F
Energy Rate: 383488.06 BTU/hr
Return Temp: 45.6 °F
Flow: 258.72 gal/min

From Ground

To Ground

P-3A
P-3B

Chillmaster Heat Pump
System Mode: Heat Only
System Status: Operational
Command: On
Alarm: Normal
Alarm Indicator: Normal
Run Percentage: 29.35
Shutdown Switch: Off
Dual Temp Supply: 106.0 °F
Dual Temp Return: 101.9 °F
Hot Water Supply: 106.0 °F
Hot Water Return: 105.0 °F

Minimum Flow Valve: 100.0 %

Minimum Flow Valve: 0.0 %

Dual Temp
Supply Temperature: 106.0 °F
Return Temperature: 101.9 °F
Energy Rate: 383488.06 BTU/hr
Flow: 81.84 gal/min
Pressure: 3.68 psi

P-2A
P-2B

Pump 2A
Command: On
Speed: 100.0 %
Status: On
Alarm: Normal
Lead Pump: PumpP2ALead

Pump 2B
Command: Off
Speed: 20.0 %
Status: Off
Alarm: Normal

To AHU1 & AHU2

From AHU1 & AHU2

Changeover Valve Position: Hot Water

From Building

To Building

P-1A
P-1B

Hot Water
Supply Temperature: 106.0 °F
Return Temperature: 105.0 °F
Energy Rate: 60543.88 BTU/hr
Flow: 96.77 gal/min
Pressure: 0.06 psi

Minimum Flow Valve: 0.0 %

Pump 1A
Command: On
Speed: 100.0 %
Status: On
Alarm: Normal
Lead Pump: PumpP1ALead

Pump 1B
Command: Off
Speed: 20.0 %
Status: Off
Alarm: Normal

Pump 3A
Command: On
Speed: 100.0 %
Status: On
Alarm: Normal
Lead Pump: PumpP3ALead

Pump 3B
Command: On
Speed: 100.0 %
Status: Off
Alarm: Normal

Geothermal heat pump units

- 3 cabinets with 2 heat pumps in each for a total of 6.
- Any of the 6 units can be serviced or replaced while the others are operating.
- On the coldest winter day, 3 pumps can maintain the temperature at setpoint in the building. More pumps operate in order to heat the building up from the night setback temperature.

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Home | Alerts (32) | Schedules | Charts | Notes | Users | Weather | Reports | Back | Forward | Logoff

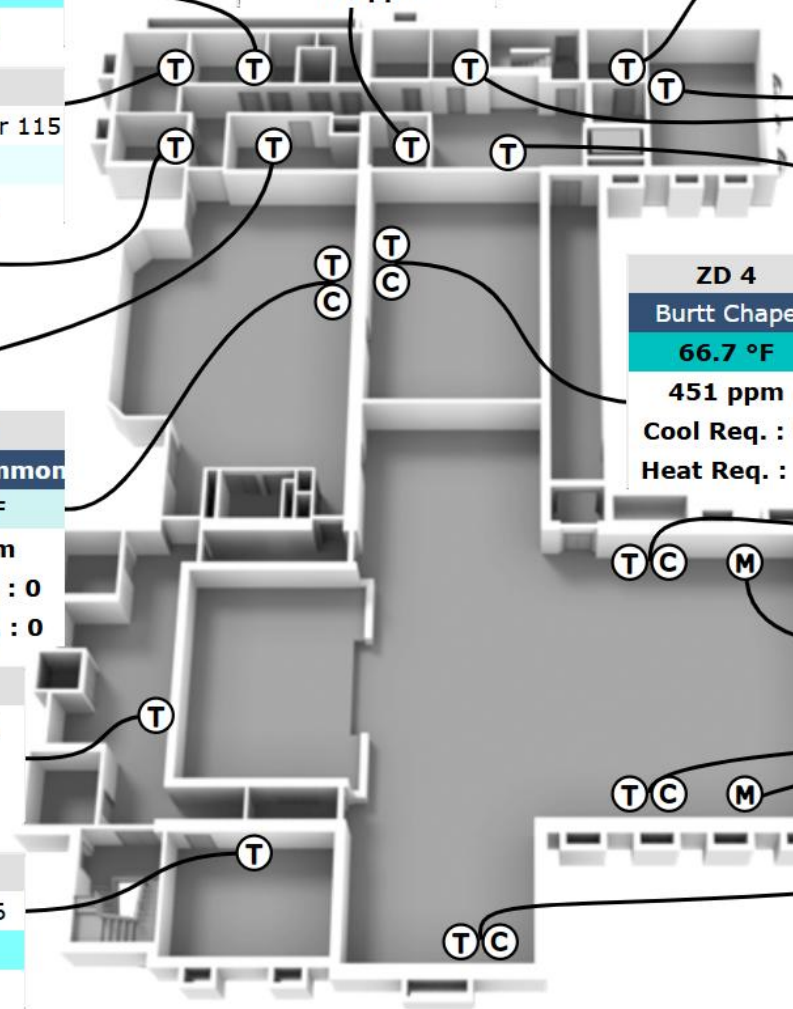
Outside Conditions
38 °F
61 %RH

19-Feb-26 8:46 PM EST

EDGE AUTOMATION

1st Floor A
1st Floor B
FloorPlanHome

First Floor Plan



V1_10
Mail/Copy 124
72.2 °F
555 ppm

V1_5
Associate Pastor 116
70.1 °F
484 ppm

V1_6
Pastoral Resident 120
64.9 °F
509 ppm

V1_8
Parlor 122
71.1 °F
479 ppm

V1_4
Associate Pastor 115
72.6 °F
485 ppm

V1_7
min & Resident 117/1
68.7 °F
484 ppm

V1_3
Facilities 114
68.0 °F
514 ppm

V1_9
North Lobby 123
70.9 °F
476 ppm

ZD 4
Burtt Chapel
66.7 °F
451 ppm
Cool Req. : 0
Heat Req. : 0

V1_11
VC Kitchen 127
71.8 °F
504 ppm

ZD 3
Village Common
70.5 °F
450 ppm
Cool Req. : 0
Heat Req. : 0

Unit Heater
Sanctuary
64.1 °F

North Temp
Sanctuary
64.3 °F

V1_1
West Lobby 102
70.9 °F
458 ppm

ZD 1
Sanctuary
63.4 °F
463 ppm
Cool Req. : 0
Heat Req. : 0

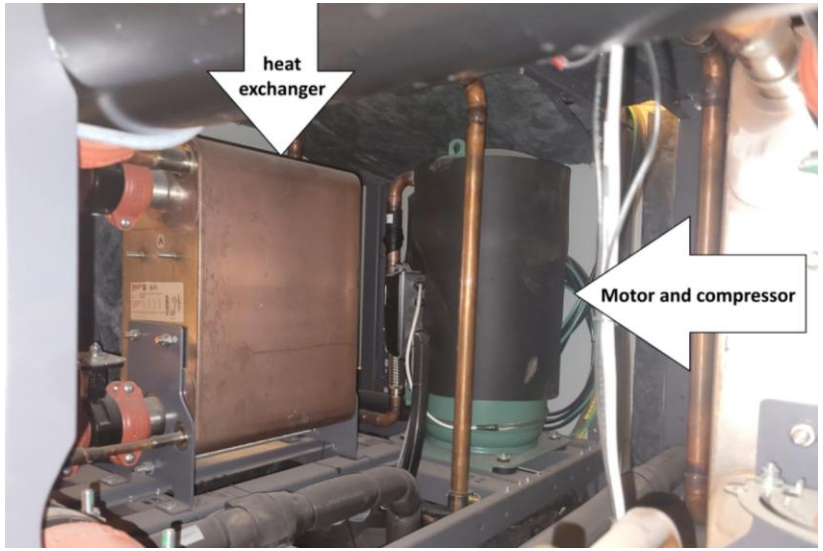
V1_2
Fam. Worship 106
68.2 °F
464 ppm

ZD 1
Transept
64.4 °F
445 ppm
Cool Req. : 0
Heat Req. : 0

South Temp
Sanctuary
64.1 °F

Observations/lessons

- Incorporate an allowance for unforeseen items – we had a leaking roof that required major repairs.
- Investing in design work before contract award allowed for a fixed price contract. Fixed price gave the congregation peace of mind.
- In our retrofit scenario, it took over 3 months after the geothermal system started operating to shake out issues with legacy equipment and “groom” the operation of the new building management system. We had many legacy radiator control valves, thermostats, and air handling components that no longer worked properly. These all needed to be fixed before we could complete balancing of the air distribution and get all rooms operating at the desired temperature. This was also was a significant cost.
- Our choice of GreenerU as the prime contractor was one of the best choices we made in the whole project.



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