Fox Chapel Area
School District

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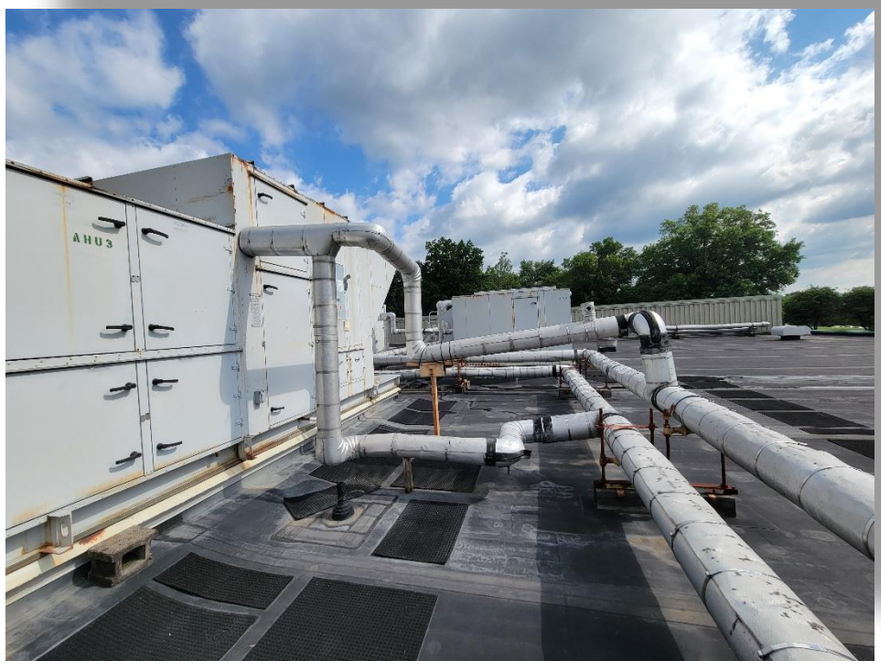
PROJECT UPDATE



HVAC UPGRADES

HARTWOOD ELEMENTARY SCHOOL

Prepared by:

H.F. LENZ
ENGINEERING

Mr. George A. McMillan IV, P.E.

Principal

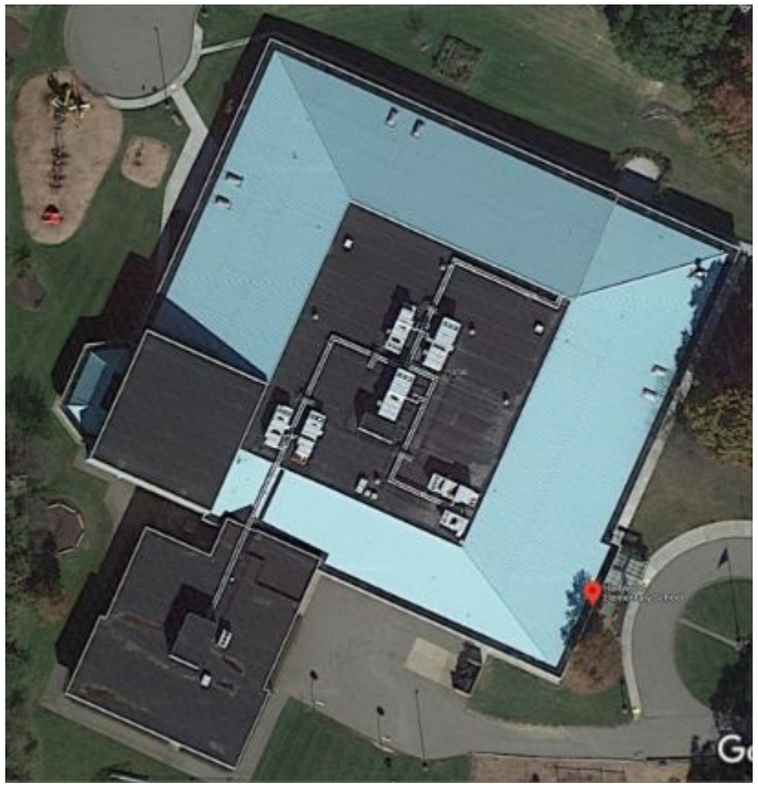
HFL File No. 2023-1023.01

February 5, 2024

Fox Chapel Area
School District

AGENDA

- **Project Goals**
- **Existing System Description**
- **Options Considered**
  - Hot Water System
  - Forced Air System
  - Geothermal
  - Water Source Heat Pump
- **Advantages/Disadvantages/Risk**
- **Energy Cost Reduction**
- **Project Cost**
- **Recommendation**
- **Questions**



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GOALS

- ✔ Life-cycle equipment replacement
- ✔ Provide equipment/systems that are accessible and maintainable
- ✔ Optimize energy efficiency (convert multi-zone units to more energy-efficient system, upgrade controls & add LED lighting)
- ✔ Enhance the quality of the learning environment
- ✔ Meet the proposed construction schedule
- ✔ Maintain budget ($6.5M) plus soft costs

Important Notes:

- *This project is <u>not</u> intended to be a complete building renovation*
- *Equipment replacement is <u>not</u> intended to be one-for-one (size equipment appropriately)*

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HVAC SYSTEM OPTIONS:

Existing System (Hot water system): Multi-zone, RTU, VAV w/o reheat, electric cooling

- **Option 1 (Hot water system):** RTU, VAV and HW reheat, electric cooling

- **Option 2 (Forced air system):** RTU, VAV and HW reheat, electric cooling

- **Option 3 (Geothermal):** Well field, vertical cabinet w/ heat and cooling, injection heat from boiler, electric resistance heat, RTU w/ electric heat

- **Option 4 (Water source heat pump):** Water cooling tower, vertical cabinet w/ heat and cooling, injection heat from boiler, electric resistance heat, RTU w/ electric heat

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ADVANTAGES/DISADVANTAGES/RISKS

Option #1: Hot Water System

Advantages

- Life-cycle upgrade - Replaces outdated equipment
- Equipment accessibility
- Energy Efficient - 27% more energy efficient than the existing system
- Enhances the learning environment - Quiet operation, comfortable temperature, & individual control
- Maintain the existing project schedule
- Maintain the existing project budget
- Maintains the existing gas service
- Operates upon loss of power - Boilers & pumps continue to operate via the emergency generator to keep the building from freezing
- No major electrical system upgrades required
- System life expectancy of 20-25 years or more

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ADVANTAGES/DISADVANTAGES/RISKS

Option #1: Hot Water System

Disadvantages

- Lose heat if the boiler plant fails
- System contains glycol (antifreeze) to prevent the coils on the roof from freezing. Adds equipment and an increase in annual maintenance.

Risks

- Requires large (6" or larger) piping above the ceiling. Coordination with new and existing equipment will be challenging. Existing structure will need evaluated throughout the building.

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ADVANTAGES/DISADVANTAGES/RISKS

Option #2: Forced Air System

Advantages

- Life-cycle upgrade - Replaces outdated equipment
- Equipment accessibility
- Energy Efficient - 26% more energy efficient than the existing system
- Enhances the learning environment - Quiet operation, comfortable temperature & individual control
- Maintains the existing project schedule
- Maintains the existing project budget (Lowest cost options)
- Operates upon loss of power - Boilers & pumps continue to operate via the emergency generator to keep the building from freezing
- No major electrical system upgrades required
- System life expectancy of 20-25 years or more
- Eliminates the need for glycol (antifreeze) as there are no hot water coils on the roof
- Smaller boilers, pumps & HW piping required in the building
- Allows the building to continue to operate if the boiler plant fails

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ADVANTAGES/DISADVANTAGES/RISKS

Option #2: Forced Air System

Disadvantages

- Modifications to the existing natural gas service are required
- Life expectancy and maintenance of gas fired burner assembly

Risks

- None

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ADVANTAGES/DISADVANTAGES/RISKS

Option #3: Geothermal

Advantages

- Life cycle upgrade - Replaces outdated equipment
- Equipment accessibility
- Energy Efficient - 34% more energy efficient than the existing system

Disadvantages

- Does not maintain current project budget
- Does not maintain current project schedule
- Additional general construction work required to accommodate installation of the vertical heat pumps
- Additional electrical construction work required (distribution system upgrades required) to accommodate installation of all-electric system
- Condensate drainage piping system required for the heat pumps (currently does not exist)
- System life expectancy of 15-20 years
- System contains glycol (antifreeze), which increase annual maintenance costs
- Does not operate on emergency power unless a large generator is added
- Classroom space used for equipment space
- Compressors located in Classroom - Noise
- Small gas boiler still required

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ADVANTAGES/DISADVANTAGES/RISKS

Option #3: Geothermal

Risks

- Major site disturbance to install well field
- Loss of floor space in each classroom to accommodate new vertical heat pump
- Longer construction duration
- Increases project “soft” costs – Professional fees, phasing, permitting, etc.

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ADVANTAGES/DISADVANTAGES/RISKS

Option #4: Water Source Heat Pump

Advantages

- Life cycle upgrade - Replaces outdated equipment
- Equipment accessibility
- Energy Efficient - 27% more energy efficient than the existing system

Disadvantages

- Does not maintain current project budget
- Does not maintain current project schedule
- Additional general construction work required to accommodate installation of the vertical heat pumps
- Additional electrical construction work required (distribution system upgrades required) to accommodate the installation of all-electric system
- Condensate drainage piping system required for heat pumps (currently does not exist)
- System life expectancy of 15-20 years
- System contains glycol (antifreeze), which increase annual maintenance costs
- Does not operate on emergency power unless a large generator is added
- Classroom space used for equipment space
- Compressors located in Classroom - Noise
- Small gas boiler still required

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ADVANTAGES/DISADVANTAGES/RISKS

Option #4: Water Source Heat Pump

Risks

- Loss of floor space in each classroom to accommodate new vertical heat pump
- Longer construction duration
- Increases project “soft” costs – Professional fees, phasing, permitting, etc.

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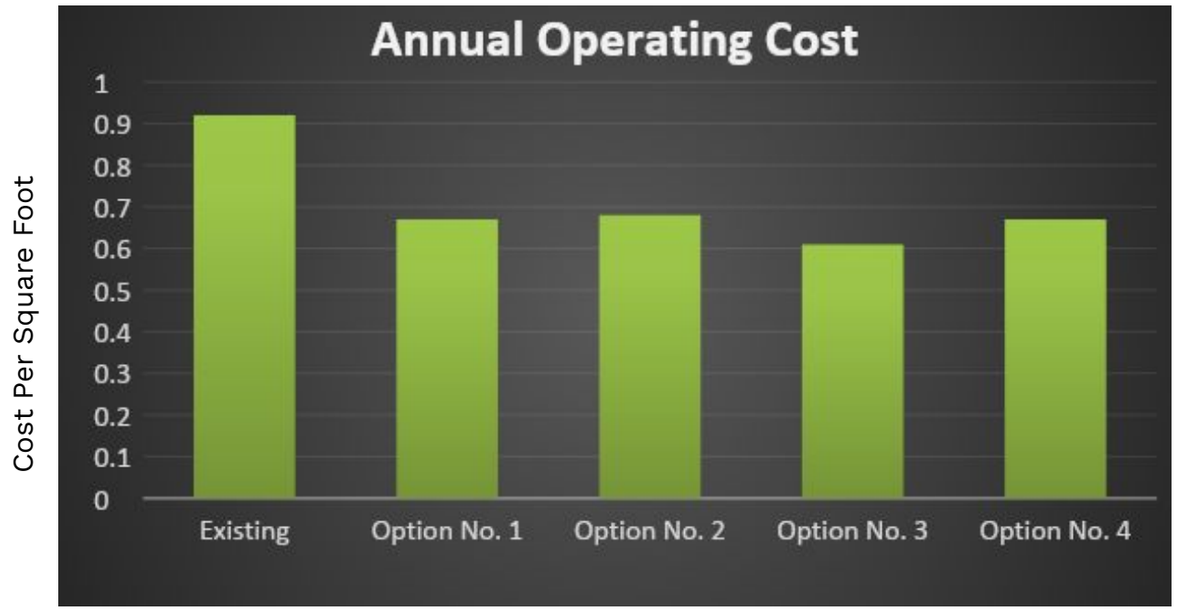
ENERGY COST REDUCTION

There will be an energy cost reduction regardless of which option is selected:



- Existing System: $.92/sq.ft. x 72,400 sq.ft. = **$66,608**

- Hot Water System: $.67/sq.ft. x 72,400 sq.ft. = **$48,508**
- Forced Air System: $.68/sq.ft. x 72,400 sq.ft. = **$49,232**
- Geothermal: $.61/sq.ft. x 72,400 sq.ft. = **$44,164**
- Water Source Heat Pump: $.67/sq.ft. x 72,400 sq.ft. = **$48,508**

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ENERGY CONSUMPTION & ENVIRONMENTAL IMPACT

OPTION	ANNUAL ELECTRIC (KWH)	ANNUAL NATURAL GAS (MCF)	ANNUAL CO2 EMISSIONS (Metric Ton)	ANNUAL CO2 EMISSIONS SAVINGS (Metric Ton)
Existing System – Hot Water System	1,114,560**	2,403.3**	615	0
Option No. 1 – Hot Water System	1,093,092	1,998	583	32
Option No. 2 – Forced Air System	1,100,374	2,030	593	22
Option No. 3 – Geothermal	1,206,536	21	530	85
Option No. 4 – Water Source Heat Pump	1,238,386	787	586	29

** - Information from Existing Utility Bills
9/22 to 9/23

Options Ranked Based on Decreased Annual CO2 Emissions:

#1 – Option No. 3: Geothermal
#2 – Option No. 1: Hot Water System
#3 – Option No. 4: Water Source Heat Pump
#4 – Option No. 2: Forced Air System

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PROJECT COST

Thomas & Williamson Program Management

Hartwood Elementary School - HVAC Alterations | Fox Chapel Area School District

Value Engineering Summary

Schematic Design
12/26/2023

		Estimated Hard Cost: HVAC	Estimated Hard Cost: GC, PC & EC	Total Hard Cost	Design Finalization Contingency @ 10%	Total Project Cost (incl Soft Costs at 17.38%)
1	**Base Option - Option 1:** VAV System - RTU's on Central Boiler	$ 3,647,109	$ 2,334,897	$ 5,982,006	$ 598,201	$ 7,723,847
2	**Option 2:** VAV System - Gas-fired RTU's	$ 3,270,084	$ 2,464,296	$ 5,734,380	$ 573,438	$ 7,404,117
3	**Option 3:** Geothermal - Water-source heat pumps	$ 6,723,524	$ 2,334,897	$ 9,058,421	$ 905,842	$ 11,696,052
3R	**Option 3 - Revised** Geothermal - Water-source heat pumps Increased Well Field to 88-500 ft. Wells Switched to AireDale SchoolMate Added Generator	$ 8,864,079	$ 2,453,240	$ 11,317,319	$ 1,131,732	$ 14,612,696
4	**Option 4:** Water-source Heat Pumps Replaced well field with Boiler/Tower Loop AireDale SchoolMates Did not add 350 kW packaged generator	$ 5,156,306	$ 2,334,897	$ 7,491,203	$ 749,120	$ 9,672,492

Notes:

1. Costs indicated are for 2024 construction. Add 3.5% per year if the project is extended.
2. Professional fees will increase if Option No. 3 or 4 are selected.
3. The simple payback on investment for the increased construction cost for Option No. 3 or 4 does not support either option
4. Other costs may increase if project duration or scope is increased.

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RECOMMENDATION

H.F. Lenz Company, Thomas & Williamson, and Fox Chapel Area School Authority recommend that the District proceed with **Option No. 1, Hot Water Heating System** as it meets the goals for the project:

- ✔ Completes a life-cycle equipment replacement
- ✔ Provide equipment & systems that are accessible and maintainable
- ✔ Optimizes energy efficiency
- ✔ Enhances the quality of the learning environment
- ✔ Meets the proposed construction schedule
- ✔ Maintains the budget ($6.5M) plus soft costs

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