



Crabtree, Rohrbaugh & Associates

**PEQUEA VALLEY
SCHOOL DISTRICT
BOARD MEETING**

June 10th, 2021

- **HVAC System Options Study**



Options for Consideration are as follows:

1. Geothermal Heat Pump System
2. Water Source Heat Pump System
3. Four Pipe Air Handlers with Separated DOAS

Several other system options were eliminated from consideration as follows:

1. Variable Refrigerant Flow (VRF) – Eliminated due to the general complexity, quantity of refrigeration in the piping system, and potential maintenance difficulties.
2. Unit Ventilators – Eliminated due to their general inability to provide consistent air quality as well as the negatives associated with having air come from a single outlet next to the students in the space – noise, drafts, hot/cold zones, etc.
3. 2-Pipe Options – Eliminated due to their inability to provide year-round comfort and humidity control.
4. Packaged DX Rooftop Variable Air Volume (VAV) System with Hot Water Heat

SYSTEM OPTION LIFECYCLE COST SUMMARY

- Estimating systems based on available recent bidding history as well as the current Means Cost Estimating books
- Annual Operational cost estimates listed include both estimated utility costs and estimated maintenance costs
- Utility costs used in the calculations (electricity and oil) are based on Pequea Valley SD utility bills.
- Maintenance costs are based on ASHRAE standards
- Geothermal well field based on conductivity test results at the existing High School
- A geothermal contractor provided a budget estimate of \$2 to \$2.2 million for the required well field
- These numbers are for comparative purposes only and do not represent the actual costs. They should be used for a general system comparison only.

Option	HVAC System	HVAC System Cost/SF	Misc. GC, PC, EC Costs	Total First Cost	Annual Maint. Cost	Annual Utility Cost	Annual Operational Cost
1	Geothermal Heat Pump System	\$38.00	\$8.00	\$10,626,000	\$65,672	\$167,635	\$233,307
2	Water Source HP System	\$30.00	\$8.00	\$8,778,000	\$70,172	\$189,831	\$260,003
3	Four Pipe Air Handlers with Separated DOAS System	\$34.00	\$6.00	\$9,240,000	\$83,963	\$181,906	\$265,869

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Simple Payback Calcs:

Option 1 verses Option 2 is a 69 year payback

Option 1 verses Option 3 is a 43 year payback

Option 3 verses Option 2 is a 78 year payback.

Based only on the above, Option 2 would be considered the best economic option.

It should be noted that geothermal fields are estimated at a 50 plus year lifecycle. This will allow the well field investment to be used for two to three system cycles. Most central plants require replacement in 20-25 years.

ADDITIONAL CONSIDERATION SUMMARY

There are other items that must also be considered when selecting systems. We have included a brief list of some other recommendations based on various criteria as follows.

Evaluation Criteria	Recommended System		
	1 st Choice	2 nd Choice	3 rd Choice
Lowest Annual Operating Cost	1	2	3
Lowest Total First Cost	2	3	1
Lowest Maintenance Cost	1	2	3
Longest System Lifecycle	1	3	2
Lowest Classroom Noise	3	1 & 2	---
Least Site Impact	2 & 3	1	---
Considered Most Sustainable	1	3	2
Lowest Exterior Equipment Noise	1	2	3

1. Geothermal Heat Pump System
2. Water Source Heat Pump System
3. Four Pipe Air Handlers with Separated DOAS

The selection process for the HVAC system should include a review of the economics, the above criteria, as well as other intangible factors.



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