

Driscoll School - Mechanical System Payback Summary (9/22/21 Update)
(2021 Energy Rate Cost Update)

Option	System	Gross Capital Investment*	Annual Elec. Cons. (kWh)	Annual Elec. Cost	Annual Utility \$/s.f.	Annual kBTU/s.f. (EUI)	Annual CO2 Emissions (kg)	Annual CO2 Emissions Reduction (kg)	Annual Maint. Cost**	Combined Annual Expense	Combined Expense Savings***	3 Year Capital Needs Replacement Cost (Adiabatic Pad)	10 Year Capital Needs Replacement Cost (Dry Cooler)	15 Year Capital Needs Replacement Cost (Heat Pump Compressors, AHU Fan Motors, Pump Motors, Exhaust Fans, DCU's)	Total Life Cycle Savings****	Discounted Payback (Years)*****	LEED EAc2 Points
1	1. Displacement ventilation diffusers with passive heating radiation 2. Hot water coil heating/chilled water cooling VAV air handling units with energy recovery with terminal VAV boxes with CO2 controls providing displacement ventilation 3. High efficiency water-to-water source heat pump chiller plant with dry cooler 4. Supplemental electric hot water boiler plant	\$9,950,000	1,243,300	\$463,466	\$2.99	27.3	765,614.6	-	\$66,150	\$529,616	-	\$3,500	\$341,000	\$400,000	-	-	12

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3	1. Displacement ventilation diffusers with passive heating radiation 2. Hot water coil heating/chilled water cooling VAV air handling units with Tempeff energy recovery with terminal VAV boxes with CO2 controls providing displacement ventilation 3. High efficiency water-to-water source heat pump chiller plant with closed-loop geothermal wells	\$14,729,293	937,250	\$218,053	\$1.41	20.6	577,151.3	188,463.2	\$63,150	\$281,203	\$248,413	\$0	\$0	\$390,000	\$4,557,770	21	16

* Gross capital investment based upon updated project cost estimates provided by Gilbane Building Co. where site costs were based upon low site bids which are still in play.

*** Includes annual maintenance, ATC service contract, and water treatment service contract.

**** Combined expense savings is the difference between the combined annual expense of the baseline and system in comparison.

***** Total life-cycle savings is based on a 50 year study period.

***** Discounted payback years is based upon BLCC5 Life Cycle Analysis.

***** Discounted payback never reached within 50 year study period.

Note: Please note that we recommend adding a 30% safety factor to the calculated values for budgeting purposes to account for potential variances to the actual operation of the building. Per ASHRAE Standard 90.1-2010:

Neither the proposed building performance nor the baseline building performance are predictions of actual energy consumption or costs for the proposed design after construction. Actual experience will differ from these calculations due to variations such as occupancy, building operation and maintenance, weather, energy use not covered by this procedure, changes in energy rates between design of the building and occupancy, and the precision of the calculation tool.

NIST BLCC 5.3-20: Comparative Analysis

Consistent with Federal Life Cycle Cost Methodology in OMB Circular A-94

Base Case: Option 1 - WSHP Displacement System

Alternative: Option 3 - GSHP Displacement System

General Information

File Name: C:\Users\keith_lane.GGDMAIL\BLCC 5.3-20\projects\Driscoll School Updated Rates.xml
Date of Study: Mon Sep 20 15:32:11 EDT 2021
Project Name: Driscoll School
Project Location: Massachusetts
Analysis Type: OMB Analysis, Non-Energy Project
Analysis Purpose: Public Investment or Regulatory Analysis
Analyst: Keith Lane
Base Date: September 1, 2020
Service Date: September 1, 2020
Study Period: 50 years 0 months(September 1, 2020 through August 31, 2070)
Discount Rate: 3.4%
Discounting Convention: End-of-Year

Comparison of Present-Value Costs

PV Life-Cycle Cost

	Base Case	Alternative	Savings from Alternative
Initial Investment Costs:			
Capital Requirements as of Base Date	\$9,950,000	\$14,729,293	-\$4,779,293
Future Costs:			
Energy Consumption Costs	\$5,287,865	\$3,971,847	\$1,316,018
Energy Demand Charges	\$10,149,258	\$3,291,089	\$6,858,168
Energy Utility Rebates	\$0	\$0	\$0
Water Costs	\$0	\$0	\$0
Recurring and Non-Recurring OM&R Costs	\$2,385,264	\$2,273,882	\$111,383
Capital Replacements	\$1,628,477	\$576,982	\$1,051,494
Residual Value at End of Study Period	\$0	\$0	\$0
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Subtotal (for Future Cost Items)	\$19,450,864	\$10,113,801	\$9,337,063
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Total PV Life-Cycle Cost	\$29,400,864	\$24,843,094	\$4,557,770

Net Savings from Alternative Compared with Base Case

PV of Non-Investment Savings \$8,285,569

- Increased Total Investment \$3,727,799

Net Savings \$4,557,770

Savings-to-Investment Ratio (SIR)

SIR = 2.22

Adjusted Internal Rate of Return

AIRR = 5.07%

Payback Period

Estimated Years to Payback (from beginning of Service Period)

Simple Payback occurs in year 16

Discounted Payback occurs in year 21

Energy Savings Summary

Energy Savings Summary (in stated units)

Energy Type	----Average Base Case	Annual Alternative	Consumption---- Savings	Life-Cycle Savings
Electricity	1,243,300.0 kWh	937,250.0 kWh	306,050.0 kWh	15,301,243.1 kWh

Energy Savings Summary (in MBtu)

Energy Type	----Average Base Case	Annual Alternative	Consumption---- Savings	Life-Cycle Savings
Electricity	4,242.3 MBtu	3,198.0 MBtu	1,044.3 MBtu	52,210.0 MBtu

Emissions Reduction Summary

Energy Type	----Average Base Case	Annual Alternative	Emissions---- Reduction	Life-Cycle Reduction
Electricity				
CO2	765,572.64 kg	577,119.73 kg	188,452.91 kg	9,421,871.67 kg
SO2	2,126.22 kg	1,602.83 kg	523.39 kg	26,167.28 kg
NOx	666.96 kg	502.78 kg	164.18 kg	8,208.26 kg
Total:				
CO2	765,572.64 kg	577,119.73 kg	188,452.91 kg	9,421,871.67 kg
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