

**Driscoll School - Mechanical System Payback Summary (9/22/21 Update)**  
**(100% Renewable 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	\$499,273	\$3.22	27.3	765,614.6	-	\$66,150	\$565,423	-	\$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	\$245,046	\$1.58	20.6	577,151.3	188,463.2	\$63,150	\$308,196	\$257,227	\$0	\$0	\$390,000	\$4,811,408	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: Renewable Option 1 - WSHP Displacement System

## Alternative: Renewable 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:** Wed Sep 22 08:57:53 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
<b>Initial Investment Costs:</b>			
Capital Requirements as of Base Date	\$9,950,000	\$14,729,293	-\$4,779,293
<b>Future Costs:</b>			
Energy Consumption Costs	\$6,376,580	\$4,806,925	\$1,569,655
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)	\$20,539,579	\$10,948,879	\$9,590,701
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Total PV Life-Cycle Cost	\$30,489,579	\$25,678,172	\$4,811,408

### Net Savings from Alternative Compared with Base Case

PV of Non-Investment Savings \$8,539,206

- Increased Total Investment    \$3,727,799

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Net Savings                        \$4,811,408

## Savings-to-Investment Ratio (SIR)

SIR = 2.29

## Adjusted Internal Rate of Return

AIRR = 5.13%

## 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
<b>Electricity</b>				
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
<b>Total:</b>				
CO2	765,572.64 kg	577,119.73 kg	188,452.91 kg	9,421,871.67 kg
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