GENERAL REQUIREMENTS

LIFE CYCLE COST ANALYSIS – ENERGY & WATER

6C.3.1 - 11

May 12, 2023

Northeast Metropolitan Regional Vocational High School
Life-Cycle Cost Estimate
Executive Summary

Included herein is a life cycle cost estimate for the proposed new Northeast Metropolitan Regional Vocational High School in accordance with the requirements of MGL Chapter 149 Section 44M and per MSBA design development guidelines. This estimate is provided for the HVAC and Plumbing systems.

STUDY INPUTS

- It is assumed that the District's initial cost will be paid in the form of a municipal bond over a period of 30 years. The interest rate used to determine annual payments is based on 3.5% for the initial municipal bond and 3.5% for the future partial system replacement. The actual rates may differ.
- The study length is based on 30 years, which is consistent with the finance period.
- The discount rate for the cost of money is set at 3.5%.
- The cost for a partial system replacement in year 20 is based on 20% of the initial system cost.
- The initial cost to the district for the HVAC and Plumbing systems is $17,488,178 after 50% MSBA reimbursement based on cost estimates. This cost is included in the overall bond financing for the project. This study does not include the total finance costs for the overall construction, only the HVAC and Plumbing portion.
- The estimated annual energy cost is $579,000 ($1.50 per SF) for the total electric utility cost including energy offsets from the projected electricity production from the utility company provide photovoltaic array. Actual costs may vary based on actual utility rates, building use, operation and climatic factors. An escalation rate of 3.5% is applied annually.
- Estimated annual maintenance costs are based on an estimated cost for an annual service contract by a local maintenance and service provider. Costs are based on $118,087 ($0.30 per SF) with a 3.25% annual escalation rate. Actual cost will depend on a final negotiated annual maintenance and service contract with a third party following the completion of construction.
- Salaries for maintenance and operations, supplies, or residual values have not been included.

STUDY RESULTS

- Cash flow details for principal and interest are provided based on equal payments. These payments are included in the general construction loan.
- The actual total life-cycle cash flow value for the 30-year period is $73,913,889 with a total present worth life cycle cost of $41,786,784.
- The portion of the life cycle cost related only to operating cost is $36,977,015 with a present worth value of $20,783,021 over the 30-year period.

Prepared by:
Bala Consulting Engineers

Sean P. Sullivan, P.E.
Associate, Senior Mechanical Engineer

Lifecycle Summary

Project: NEMT 90%CD
05/12/2023
Prepared By: BALA

NE Metro High School- LCCE for HVAC and Plumbing

30 year life-cycle cost estimate for HVAC system finance and operating costs.

Type of Analysis........ Public Sector Lifecycle Analysis
Type of Design Alternatives .... Independent
Length of Analysis........ 30 yrs
Discount Rate........ 3.50 %

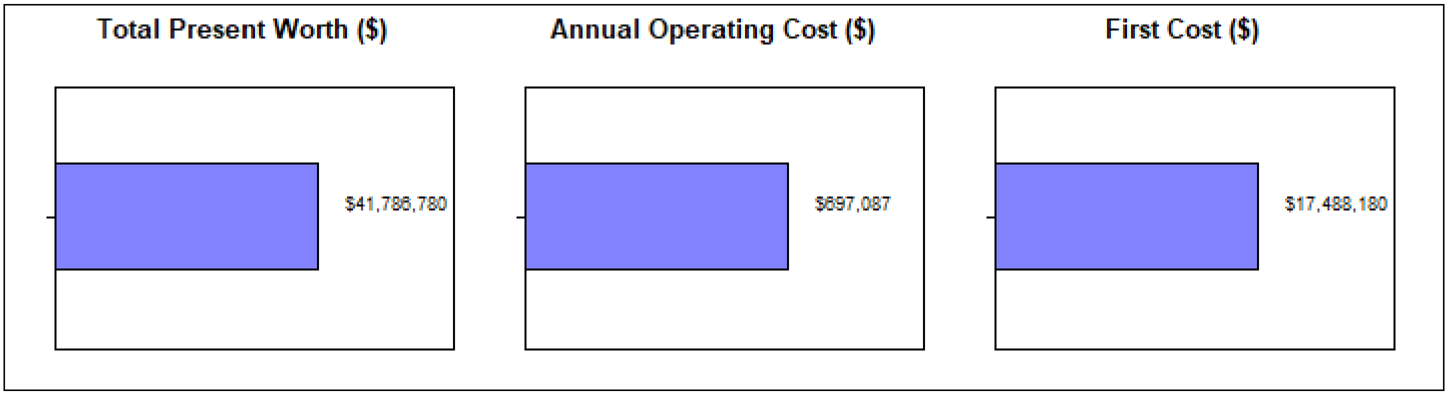


Table 1. Executive Summary

Economic Criteria	Best Design Case for Each Criteria	Value ($)
Lowest Total Present Worth	Life Cycle Cost Estimate for HVAC and Plumbing	$41,786,784
Lowest Annual Operating Cost	Life Cycle Cost Estimate for HVAC and Plumbing	$697,087
Lowest First Cost	Life Cycle Cost Estimate for HVAC and Plumbing	$17,488,178

Table 2. Design Cases Ranked by Total Present Worth

Design Case Name	Design Case Short Name	Total Present Worth ($)	Annual Operating Cost ($/yr)	First Cost ($)
Life Cycle Cost Estimate for HVAC and Plumbing		$41,786,784	$697,087	$17,488,178

Cash Flow Details

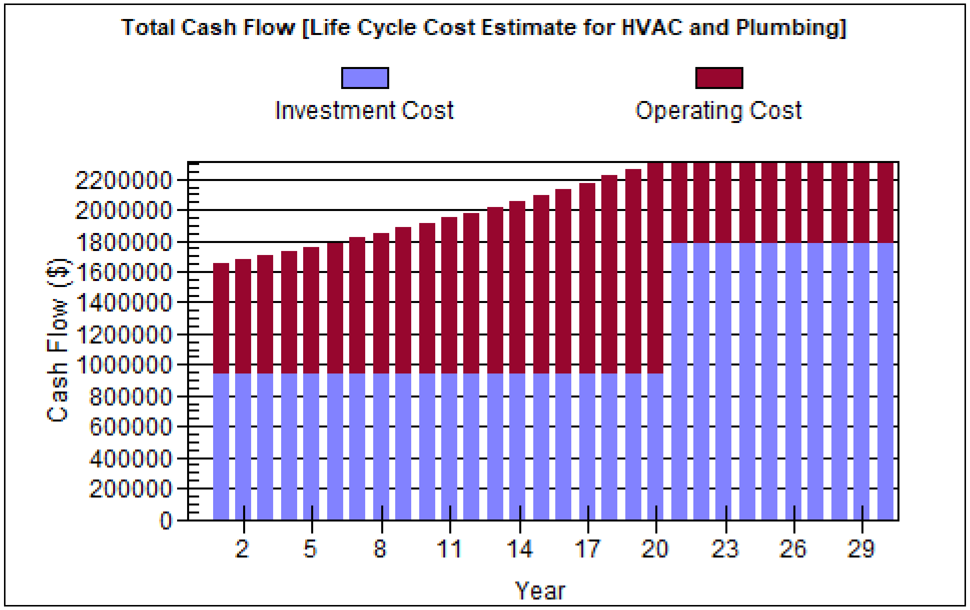
Project: NEMT 90%CD
Prepared By: BALA

05/12/2023

NE Metro High School- LCCE for HVAC and Plumbing

30 year life-cycle cost estimate for HVAC system finance and operating costs.

Type of Analysis .... Public Sector Lifecycle Analysis
Type of Design Alternatives .... Independent
Length of Analysis .... 30 yrs
Discount Rate .... 3.50 %



1A. Component Cash Flows [Life Cycle Cost Estimate for HVAC and Plumbing], Actual Value

Year	Date	Cash Investment ($)	Loan Principal ($)	Loan Interest ($)	Total Investment Cost ($)	Annual Operating Cost ($)	Non-Annual Operating Cost ($)	Total Operating Cost ($)	Total Cash Flow ($)
0	Initial	0	0	0	0	0	0	0	0
1	2022	0	338,769	612,086	950,856	721,190	0	721,190	1,672,045
2	2023	0	350,626	600,229	950,856	746,127	0	746,127	1,696,982
3	2024	0	362,898	587,957	950,856	771,926	0	771,926	1,722,782
4	2025	0	375,600	575,256	950,856	798,619	0	798,619	1,749,474
5	2026	0	388,746	562,110	950,856	826,235	0	826,235	1,777,091
6	2027	0	402,352	548,504	950,856	854,807	0	854,807	1,805,662

Year	Date	Cash Investment ($)	Loan Principal ($)	Loan Interest ($)	Total Investment Cost ($)	Annual Operating Cost ($)	Non-Annual Operating Cost ($)	Total Operating Cost ($)	Total Cash Flow ($)
7	2028	0	416,434	534,422	950,856	884,367	0	884,367	1,835,223
8	2029	0	431,009	519,846	950,856	914,951	0	914,951	1,865,806
9	2030	0	446,094	504,761	950,856	946,593	0	946,593	1,897,448
10	2031	0	461,708	489,148	950,856	979,330	0	979,330	1,930,186
11	2032	0	477,868	472,988	950,856	1,013,200	0	1,013,200	1,964,056
12	2033	0	494,593	456,263	950,856	1,048,242	0	1,048,242	1,999,098
13	2034	0	511,904	438,952	950,856	1,084,498	0	1,084,498	2,035,353
14	2035	0	529,820	421,035	950,856	1,122,008	0	1,122,008	2,072,863
15	2036	0	548,364	402,492	950,856	1,160,816	0	1,160,816	2,111,671
16	2037	0	567,557	383,299	950,856	1,200,967	0	1,200,967	2,151,823
17	2038	0	587,421	363,434	950,856	1,242,509	0	1,242,509	2,193,364
18	2039	0	607,981	342,875	950,856	1,285,488	0	1,285,488	2,236,344
19	2040	0	629,260	321,595	950,856	1,329,955	0	1,329,955	2,280,811
20	2041	0	651,284	299,571	950,856	1,375,962	0	1,375,962	2,326,817
21	2042	0	1,270,366	521,611	1,791,976	1,423,561	0	1,423,561	3,215,537
22	2043	0	1,314,829	477,148	1,791,976	1,472,807	0	1,472,807	3,264,784
23	2044	0	1,360,848	431,129	1,791,976	1,523,759	0	1,523,759	3,315,735
24	2045	0	1,408,477	383,499	1,791,976	1,576,474	0	1,576,474	3,368,451
25	2046	0	1,457,774	334,202	1,791,976	1,631,015	0	1,631,015	3,422,991
26	2047	0	1,508,796	283,180	1,791,976	1,687,444	0	1,687,444	3,479,420
27	2048	0	1,561,604	230,373	1,791,976	1,745,826	0	1,745,826	3,537,803
28	2049	0	1,616,260	175,716	1,791,976	1,806,230	0	1,806,230	3,598,206
29	2050	0	1,672,829	119,147	1,791,976	1,868,725	0	1,868,725	3,660,702
30	2051	0	1,731,378	60,598	1,791,976	1,933,384	0	1,933,384	3,725,361
Totals		0	24,483,449	12,453,426	36,936,880	36,977,015	0	36,977,015	73,913,889

1B. Present Worth Cash Flows [Life Cycle Cost Estimate for HVAC and Plumbing]

Year	Date	Total Investment Cost ($)	Total Operating Cost ($)	Total Present Worth ($)
0	Initial	0	0	0
1	2022	918,701	696,802	1,615,503
2	2023	887,634	696,517	1,584,151
3	2024	857,617	696,233	1,553,851
4	2025	828,616	695,950	1,524,566
5	2026	800,595	695,668	1,496,263
6	2027	773,522	695,386	1,468,907
7	2028	747,364	695,105	1,442,469

Cash Flow Details

Project: NEMT 90%CD
Prepared By: BALA

05/12/2023

Year	Date	Total Investment Cost ($)	Total Operating Cost ($)	Total Present Worth ($)
8	2029	722,091	694,824	1,416,915
9	2030	697,672	694,545	1,392,217
10	2031	674,079	694,265	1,368,345
11	2032	651,284	693,987	1,345,271
12	2033	629,260	693,709	1,322,970
13	2034	607,981	693,432	1,301,413
14	2035	587,421	693,156	1,280,577
15	2036	567,557	692,880	1,260,437
16	2037	548,364	692,605	1,240,969
17	2038	529,820	692,331	1,222,151
18	2039	511,904	692,057	1,203,961
19	2040	494,593	691,784	1,186,377
20	2041	477,868	691,511	1,169,379
21	2042	870,132	691,240	1,561,371
22	2043	840,707	690,968	1,531,675
23	2044	812,277	690,698	1,502,975
24	2045	784,809	690,428	1,475,237
25	2046	758,269	690,159	1,448,429
26	2047	732,627	689,891	1,422,518
27	2048	707,853	689,623	1,397,475
28	2049	683,916	689,355	1,373,271
29	2050	660,788	689,089	1,349,877
30	2051	638,443	688,823	1,327,266
Totals		21,003,764	20,783,021	41,786,786

Design Case Inputs

Project: NEMT 90%CD 05/12/2023
Prepared By: BALA

Type of Analysis .... Public Sector Lifecycle Analysis
Length of Analysis .... 30 yrs
Income Taxes .... Not Considered

General Information :

Design Case Name .... Life Cycle Cost Estimate for HVAC and Plumbing
Design Case Short Name ...
Description:
30 year life-cycle cost estimate for HVAC system finance and operating costs.

Investment Costs :

Cost Item	Cost ($)	Year Incurred	Esc Rate (%/yr)	Salvage Value ($)	Useful Life (yrs)
Proposed Mech System Initial Cost	$ 9,000,000	0	0.00	$ 0	30
Proposed Mech System Initial Cost	$ 8,488,178	0	0.00	$ 0	30
Mech System Replacement Cost	$ 6,995,271	20	0.00	$ 0	10

Loans :

Loan Item	Start Year	Investment In Start Year ($)	Percent Financed	Term Of Loan (Years)	Interest Rate (%/yr)	Payment Method
Municipal Bond Financing for HVAC	0	$ 24,483,449	100	30	3.50	Equal Payments
Replacement Cost Financing	20	$ 24,483,449	100	10	3.50	Equal Payments

Annual Operating Costs :

Cost Item	Cost ($)	Start Year	Number Of Years	Esc Rate (%/yr)
Annual Energy Costs	$ 579,000	1	30	3.50
Annual Maintenance Costs	$ 118,087	1	30	3.25

There are no non-annual operating cost inputs

Study Title	NE Metro High School- LCCE for HVAC and Plumbing	
Study Description:		

30 year life-cycle cost estimate for HVAC system finance and operating costs.

Type of Analysis	Public Sector Lifecycle Analysis	
Type of Design Alternatives	Independent	
Base Year	2022	
Currency Symbol	$	
Length of Analysis	30	yrs
Discount Rate	3.50	%