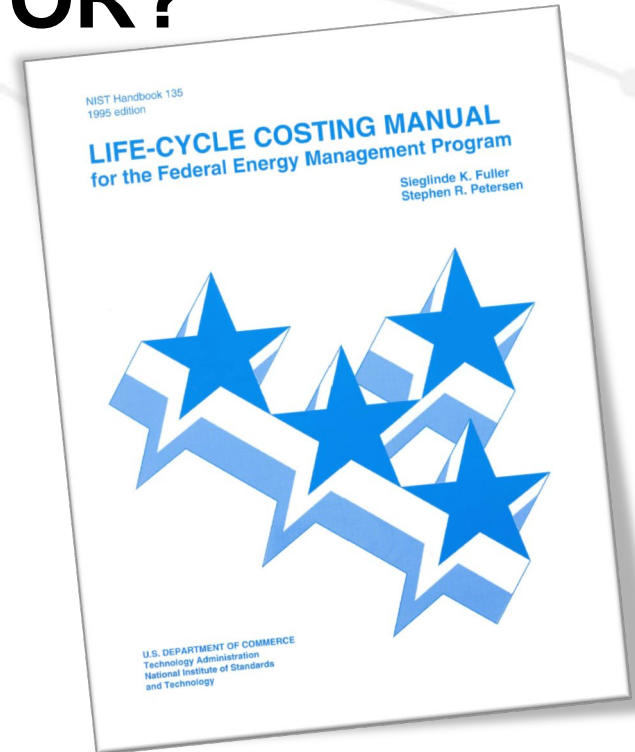# Utilities and Institutional Facilities
Life-Cycle Cost Analysis Excel Tool

Monica Witt and Matney Juntunen

August 8th, 2019

UNCLASSIFIED

LCCA: WHY A CALCULATOR?

- LANL engineers struggling to commit time to thorough LCCA

- Required by Engineering Standards Manual STD-342-100

- Hand calculations are now automated and graphed, saving several hours

- Spreadsheet can be used for whole projects and components of projects

NIST Handbook 135
1995 edition

LIFE-CYCLE COSTING MANUAL
for the Federal Energy Management Program

Sieglinde K. Fuller
Stephen R. Petersen

U.S. DEPARTMENT OF COMMERCE
Technology Administration
National Institute of Standards
and Technology

UTILITIES AND INSTITUTIONAL FACILITIES

We recognize the need for an easier way to perform LCCA at LANL.

NNSA
National Nuclear Security Administration

• Los Alamos
NATIONAL LABORATORY
— EST. 1943 —

CALCULATOR EXAMPLE:

Instructions:

This worksheet provides the LCCA comparison between two cases: Case A and Case B. The lifetime evaued is set at a maximum of 35 years. This worksheet is formatted to be printer-friendly, do not change this format. Only DOE projects may use this calculator (no OMB). The discount factors included for payback calcultions must be updated annually with the Annual Supplement to Handbook 135.

User must fill in each applicable yellow field input area. Notes are provided for clarity when inputting values. White areas are coded to provide Life-Cycle Cost Analysis (LCCA), do not interfere with these calculations.

The following result can be concluded from this worksheet: General project identificaiton information, cash flow comparisons (visual and numerical), savings-to-investment ratio, and discount payback period.

Terminology Clarifications:

"Year in lifetime" refers to the year at which the cost takes place.

For costs not listed that occur annually, add to highlighted space in "General & Cash Flow" tab where "all" is listed. For costs not listed that occur once, add to highlighted space in "General & Cash Flow" tab where the year must be specified. Specify the year at which the cost takes place in the provided space.

"One-Time Other Costs" refers to investment and operational costs that do not occur annually. For these values, the user will also list the "year in lifetime" in the corresponding input cell. Examples of these costs include replacements such as roofing, mechanical equiptment, etc.

"Lower-First-Cost Option" refers to the cost in a category belonging to the option with the lowest initial investment. "Higher-First-Cost Option" refers to the cost in a category belonging to the option with the highest initial investment.

Citations:

Life-Cycle Costing Manual for the Federal Energy Management Program, NIST Handbook 135, 1995 Edition:
https://www.nist.gov/publications/life-cycle-costing-manual-federal-energy-management-program-nist-handbook-135-1995

Energy Price Indices and Discount Factors LCCA 2019, Annual Supplement to Handbook 135 :
https://www.nist.gov/publications/energy-price-indices-and-discount-factors-life-cycle-cost-analysis-150-2019-annual

Author: Utilities & Infrastructure Facility Operations, Los Alamos National Laboratory.
Matney Juntunen

Initial Investment Calculator:

Instructions:	Fill in the following values if applicable to the project. The initial investment should include all costs which allow the project to begin its lifetime. Note: Costs are in Thousands.

Current State INITIAL INVESTMENT:

TOPIC	COST
All Materials:	
All labor:	
TAB:	
BAS Controls:	
Safety:	
Inspections:	
Building Outage:	
Parking Lot:	
Water Drainage:	
Other Contruction Costs:	
Gas Extension Calulations:	
Case A Initial Investment:	$ -

Smart Lab INITIAL INVESTMENT:

TOPIC	COST
ERS Materials/Labor:	$ 276.19
AHUs Materials/Labor:	$ 6.86
TAB:	$ 15.00
BAS Controls:	$ 15.00
Safety:	
Inspections:	
Building Outage:	
Parking Lot:	
Water Drainage:	
Other Contruction Costs:	
Gas Extension Calulations:	
LED Lighting:	$ 144.93
Lab ACH TAB and BAS:	$ 12.00
Case A Initial Investment:	$ 469.98

Note: Gasket = $13.72 per LF

Gasline and Water Calculations:

Gas Line Extension Calculations: Notes:

Linear measurement of extension (in feet):		For lines up to 10 inch diameter
Cost of line per linear foot:	$ 0.40	Includes cost of construction, quoted 5/28/19
Cost per tie-in:	$ 5.00	
Cost per reg station:	$ 5.00	
Number of tie-ins:		
Number of reg stations:		
Total Cost of Line Extension/Tie-Ins:	$ -	7/22/19

Annual Water Cost Calculations: Notes:

Number of Office Workers:		
(in kilo-gallons):	0.025	Quoted 5/28/19
Needed (in kilo-gallons):		
Cost of Water (per kgal)	$ 0.00340000	Cost in thousands, quoted 5/28/19 at $3.40 per kgal
Total Annual Cost of Water:	$ -	

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CALCULATOR EXAMPLE CONT:

Information Needed to Complete this Workbook:

Current Cost: (in Thousands)

CATEGORY	YEAR # IN LIFETIME	COST PER YEAR	Notes
Initial investment:	1	$ -	
Total Electricity:	Annual	$ 117.29	(Usually $0.08 per kW/h)
OM & R:	Annual		Lifetime of 6 years = zero OM&R
Total Natural Gas:	Annual	$ 48.85	(Usually $3.5 per million Btu)
Water:	Annual	$ -	
Resale value:			End of Life Expectancy
Salvage Value:			End of Life Expectancy

Smart Lab Cost: (in Thousands)

CATEGORY	YEAR # IN LIFETIME	COST PER YEAR	Notes
Initial investment:	1	$ 469.98	
Total Electricity:	Annual	$ 107.91	(Usually $0.08 per kW/h)
OM & R:	Annual		Lifetime of 6 years = zero OM&R
Total Natural Gas:	Annual	$ 21.98	(Usually $3.5 per million Btu)
Water:	Annual	$ -	
Resale value:			End of Life Expectancy
Salvage Value:			End of Life Expectancy

Cost of Gas vs. Electric LCC Analysis Calculator
- See Appendix C in NIST Handbook 135 for Guidance

PROJECT IDENTIFICATION — Notes

Project ID No:	103849	
Fiscal year:	2019	
Location:	TA-03-1420	DoE Region, LANL Building
Base Date (BD):	7/24/2019	MM/DD/YYYY (Start of study)
Service Date (SD):	12/17/2019	MM/DD/YYYY (Occupancy)
Design Feature to be Evaluated:	HVAC and lighting renovation	
List Constraints:		Attach page if needed

Energy/Water Conservation Study? (FEMP) No

OMB A-94? No — Office of Management and Budget circular not at LANL

BASE CASE AND ALTERNATIVES

Name and describe base case (lower initial investment) and alternatives to be analyzed. Include any relevent assumptions:

Comparing if the Smart Lab renovaiton should be implemented at CINT.

GENERAL INFORMATION:

Name of Analyst:	Matney Juntunen
Phone Number:	55-667-1975
Z-Number:	341830
Date of Study Completion:	8/2/2019 MM/DD/YYYY

KEY DATES — Notes

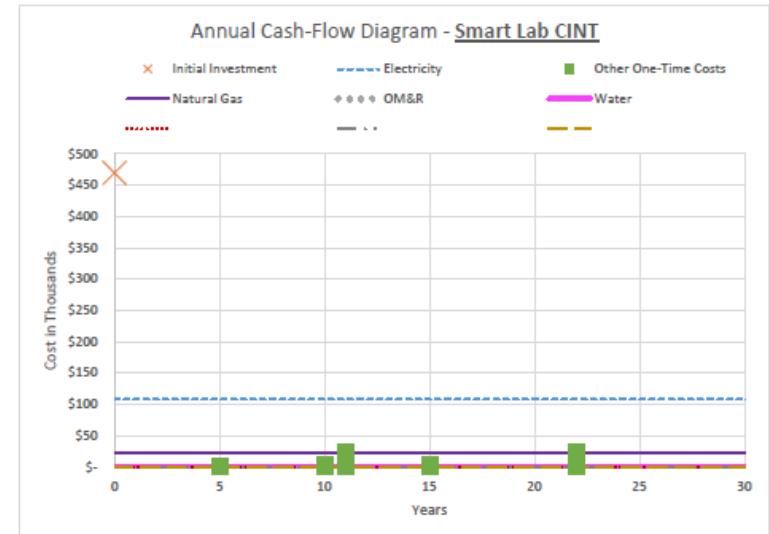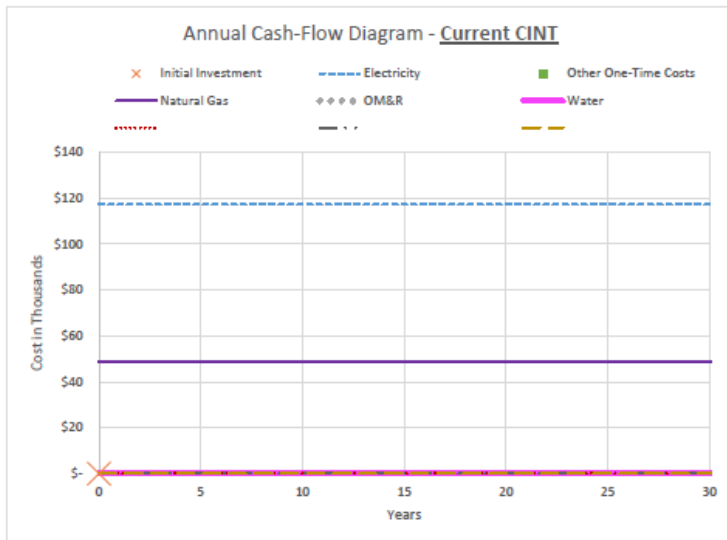|		
Years of Life:	25	Quantity (commonly 25-30 years)
BD:	7/24/2019	
SD:	12/17/2019	
End of Study:	8/2/2019	

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CALCULATOR EXAMPLE CONT:

Cash Flows Last Updated 7/23/2019

CASH FLOWS (IN THOUSANDS) FOR CASE A - Do Nothing

CATEGORY	YEAR # IN LIFETIME	COST PER YEAR		Notes
Initial investment:	1	$	-	
Total Electricity:	Annual	$	117.29	(Usually $0.08 per kW/h)
OM & R:	Annual	$	-	
Total Natural Gas:	Annual	$	48.85	(Usually $3.5 per million Btu)
Water:	Annual	$	-	
	Annual			
	Annual			
	Annual			
				Other One-Time Costs
Resale value:	0	$	-	End of Life Expectancy
Salvage Value:	0	$	-	End of Life Expectancy

CASH FLOWS (IN THOUSANDS) FOR CASE B - Smart Lab Changes

CATEGORY	YEAR # IN LIFETIME	COST		Notes
Initial investment:	1	$	469.98	
Total Electricity:	Annual	$	107.91	(Usually $0.08 per kW/h)
OM & R:	Annual	$	-	
Total Natural Gas:	Annual	$	21.98	(Usually $3.5 per million Btu)
Water	Annual	$	-	
	Annual			
	Annual			
	Annual			
MERV 8 Filters	5	$	0.9280	Other One-Time Costs
MERV 8 Filters	10	$	0.9280	(replacements, disposal, etc.)
MERV 8 Filters	15	$	0.9280	
Temp/Press Sensors	10	$	2.30	
Pump Replacement	15	$	3.95	
Bulb Recycle	11	$	1.67	
Bulb Recycle	22	$	1.67	
Bulb Replace	11	$	23.00	
Bulb Replace	22	$	23.00	
Resale value:	0	$	-	End of Life Expectancy
Salve Value:	0	$	-	End of Life Expectancy

Annual Cash-Flow Diagram - Current CINT

Annual Cash-Flow Diagram - Smart Lab CINT

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CALCULATOR EXAMPLE CONT:

Case A Investment-Costs: (in Thousands)

CATEGORY	AMOUNT	Notes	Year in Lifetime	DISCOUNT FACTOR (SPV)	Notes	PRESENT VALUE
Initial Investment:	$ -		1		(Rates	$ -
Resale:	$ -		25		included in	$ -
Salvage:	$ -		25		NIST	$ -
		See previous			Handbook	$ -
		sheet values			135 Annual	$ -
		and parts			Supplement	$ -
					discount	$ -
					factors.	$ -
					Must	$ -
					discount to	$ -
					ending year of	

Total Investment-Related Costs: $ -

Case A Operation-Related Costs: (in Thousands)

CATEGORY	AMOUNT	Notes	Year in lifetime/end year of occurances	FACTOR (UPV or SPV)	Notes	PRESENT VALUE
Total Electricity:	$ 117.29		25	1.02	(Rates	$ 119.63
OM & R:	$ -		25		included in	$ -
Total Natural Gas:	$ 48.85		25	1.36	NIST	$ 66.43
Water:	$ -		25		Handbook	$ -
		See previous			135 Annual	$ -
		sheet values			Supplement	$ -
		and parts			discount	$ -
					factors.	$ -
					Must	$ -
					discount to ending year of	$ -

Total Operation-Related Costs: $ 186.07

Total Case A Present Value Life Cycle Costs: $ 186.07

Note: See Tables from the *Energy Price Indices and Discount Factors LCCA 2019, Annual Supplement to Handbook 135* to find discount factors.

UPV is for uniform/annual costs, while SPV is for single expense/one-time costs.

Case B Investment-Related Costs: (in Thousands)

CATEGORY	AMOUNT	Notes	Year in Lifetime	DISCOUNT FACTOR (SPV)	FACTOR TABLE NO.	PRESENT VALUE
Initial Investment:	$ 469.98		1	0.971	(Rates	$ 456.35
Resale:	$ -		25		included in	$ -
Salvage:	$ -		25		NIST	$ -
Bulb Replace	$ 23.00	See previous	11	0.722	Handbook	$ 16.61
Bulb Replace	$ 23.00	sheet values	22	0.522	135 Annual	$ 12.01
		and parts			Supplement	$ -
					discount	$ -
					factors.	$ -
					Must	$ -
					discount to	$ -
					ending year of	$ -
					occurance).	$ -
						$ -

Total Investment-Related Costs: $ 484.96

Case B Opoeration-Related Costs: (in Thousands)

CATEGORY	AMOUNT	Notes	Year in lifetime/end year of occurances	DISCOUNT FACTOR (SPV or UPV)	FACTOR TABLE NO.	PRESENT VALUE
Total Electricity:	$ 107.91		25	1.02	(Rates	$ 110.06
OM & R:	$ -		25		included in	$ -
Natural Gas:	$ 21.98		20	1.36	NIST	$ 29.90
Water:	$ -		25		Handbook	$ -
MERV 8 Filters	$ 0.93	See previous	5	0.863	135 Annual	$ 0.80
MERV 8 Filters	$ 0.93	sheet values	10	0.744	Supplement	$ 0.69
MERV 8 Filters	$ 0.93	and parts	15	0.642	discount	$ 0.60
Temp/Press Sensors	$ 2.30		10	0.744	factors.	$ 1.71
Pump Replacement	$ 3.95		15	0.642	Must	$ 2.54
Bulb Recycle	$ 1.67		11	0.722	discount to	$ 1.20
Bulb Recycle	$ 1.67		22	0.522	ending year of	$ 0.87
					occurance).	$ -
						$ -

Total Operation-Related Costs: $ 148.37

Total Case B Present Value Life Cycle Costs: $ 633.33

Note: See Tables from the *Energy Price Indices and Discount Factors LCCA 2019, Annual Supplement to Handbook 135* to find discount factors.

UPV is for uniform/annual costs, while SPV is for single expense/one-time costs.

CALCULATOR EXAMPLE CONT:

Calculate Savings-to-Investment Ratio:

Operational-Related Costs:	Lower-First-Cost Option	Higher-First-Cost Option	Savings
Total Energy:	$ 186.07	$ 139.96	$ 46.10
OM & R:	$ -	$ -	$ -
Water:	$ -	$ -	$ -
Sum of Other Costs:	$ -	$ 8.41	$ (8.41)

Total Op. Savings (in Thousands): $ 37.69

Investment-Related Costs:	Higher-First-Cost Option	Lower-First-Cost Option	Savings
Initial Investment:	$ 456.35	$ -	$ 456.35
Resale+Salvage:	$ -	$ -	$ -
Sum of Other Costs:	$ 28.61	$ -	$ 28.61

Total Additional Investment (in Thousands): $ 484.96

Savings-to-Investments Ratio (SIR): 0.0777

SIR is often preffered to be greater than 1. This measure is relative to the base case.

Discount Payback Period Calculation:

Table DPP1: CALCULATION OF DIFFERENTIAL AMOUNTS (IN THOUSANDS)				
Category:	Lower-First-Cost Option	Higher-First-Cost Option	Differential Amount	Notes
Initial Investment:	$ -	$ 469.98	$ (469.98)	In dollars at time of Base Date (BD).
Total Energy:	$ 166.13	$ 129.89	$ 36.24	
OM & R:	$ -	$ -	$ -	
Water:	$ -	$ -	$ -	
Sum of Other Annual Costs:	$ -	$ -	$ -	Gas/Elec Cost includes natural gas.
Merv 8 Filters	$ -	$ 0.93	$ (0.93)	User fills in one-time cost of same type. Place name in category column, and cost in appropriate column.
Merv 8 Filters	$ -	$ 0.93	$ (0.93)	
Merv 8 Filters	$ -	$ 0.93	$ (0.93)	
Temp/Press Sensors	$ -	$ 2.30	$ (2.30)	
Pump Replacement	$ -	$ 3.95	$ (3.95)	
Bulb Recycle	$ -	$ 1.67	$ (1.67)	
Bulb Recycle	$ -	$ 1.67	$ (1.67)	
Bulb Replacement	$ -	$ 23.00	$ (23.00)	
Bulb Replacement	$ -	$ 23.00	$ (23.00)	
Resale/Salvage	$ -	$ -	$ -	

Note: The differential amounts above will be used in Table DPP3 below

CALCULATOR EXAMPLE CONT:

Table DPP2: DOE CALCULATIONS (IN THOUSANDS)

Column1	Column2	Column3	Column4	Column5	Column6	Column7	Column8
Service Year	Annual Energy Savings	Change in OM&R, Water, and Other	Change in Capital Replacements	Present Value (PV) Savings DOE	Cumulative PV Savings	Change in PV Initial Investment	PV net savings
2019	$ 36.245	$ -	$ -	$ 36.245	$ 36.245	$ (456.352)	$ (420.107)
2020	$ 35.701	$ -	$ -	$ 35.701	$ 71.946	$ (456.352)	$ (384.406)
2021	$ 35.339	$ -	$ -	$ 35.339	$ 107.284	$ (443.192)	$ (335.908)
2022	$ 35.701	$ -	$ -	$ 35.701	$ 142.985	$ (430.033)	$ (287.047)
2023	$ 36.245	$ -	$ (0.83)	$ 35.419	$ 178.404	$ (417.343)	$ (238.939)
2024	$ 36.607	$ -	$ -	$ 36.607	$ 215.011	$ (405.594)	$ (190.582)
2025	$ 37.513	$ -	$ -	$ 37.513	$ 252.525	$ (393.374)	$ (140.849)
2026	$ 38.057	$ -	$ -	$ 38.057	$ 290.582	$ (382.095)	$ (91.513)
2027	$ 38.238	$ -	$ -	$ 38.238	$ 328.820	$ (370.815)	$ (41.995)
2028	$ 38.419	$ -	$ (2.47)	$ 35.945	$ 364.765	$ (360.005)	$ 4.759
2029	$ 40.413	$ -	$ (18.35)	$ 22.058	$ 386.823	$ (349.666)	$ 37.157
2030	$ 41.319	$ -	$ -	$ 41.319	$ 428.142	$ (339.326)	$ 88.816
2031	$ 41.863	$ -	$ -	$ 41.863	$ 470.005	$ (329.457)	$ 140.548
2032	$ 42.044	$ -	$ -	$ 42.044	$ 512.049	$ (320.057)	$ 191.992
2033	$ 42.406	$ -	$ (3.23)	$ 39.181	$ 551.229	$ (310.657)	$ 240.572
2034	$ 42.406	$ -	$ -	$ 42.406	$ 593.636	$ (301.728)	$ 291.908
2035	$ 42.588	$ -	$ -	$ 42.588	$ 636.223	$ (292.798)	$ 343.425
2036	$ 42.950	$ -	$ -	$ 42.950	$ 679.173	$ (284.339)	$ 394.835
2037	$ 42.950	$ -	$ -	$ 42.950	$ 722.123	$ (275.879)	$ 446.244
2038	$ 43.131	$ -	$ -	$ 43.131	$ 765.254	$ (267.889)	$ 497.365
2039	$ 42.950	$ -	$ -	$ 42.950	$ 808.204	$ (260.369)	$ 547.835
2040	$ 43.131	$ -	$ (13.27)	$ 29.859	$ 838.063	$ (252.850)	$ 585.213
2041	$ 43.131	$ -	$ -	$ 43.131	$ 881.194	$ (245.330)	$ 635.864
2042	$ 43.131	$ -	$ -	$ 43.131	$ 924.325	$ (238.280)	$ 686.045
2043	$ 43.312	$ -	$ -	$ 43.312	$ 967.638	$ (231.231)	$ 736.407
2044	$ 43.312	$ -	$ -	$ 43.312	$ 1,010.950	$ (224.651)	$ 786.299
2045	$ 43.494	$ -	$ -	$ 43.494	$ 1,054.444	$ (218.071)	$ 836.373
2046	$ 43.675	$ -	$ -	$ 43.675	$ 1,098.119	$ (211.491)	$ 886.627
2047	$ 43.856	$ -	$ -	$ 43.856	$ 1,141.975	$ (205.382)	$ 936.593
2048	$ 44.037	$ -	$ -	$ 44.037	$ 1,186.012	$ (199.272)	$ 986.740
2049	$ 44.219	$ -	$ -	$ 44.219	$ 1,230.231	$ (193.632)	$ 1,036.598

End of Lifetime

Notes: Use tables Ca-4 through Ca-5 of the *Energy Price Indices and Discount Factors LCCA 2019, Annual Supplement to Handbook 135* (page 39) to calculate annual energy savings.
https://www.nist.gov/publications/energy-price-indices-and-discount-factors-life-cycle-cost-analysis-

Table DPP3: CALCULATE COMPONENTS OF DPP CALCULATION TABLE ABOVE

Year	Energy Savings	Fuel Index - Commercial Electricity (2019)	Fuel Index - Commercial Natural Gas (2019)	Other One-Time Cost Differentials	<-- Notes	SPV Factor Index DOE Discount Rate (2019)	UPV Factor Index DOE Discount Rate (2019)
2019	$ 36.24	1.00	1.00		User enters differential amount (Table DPP1, Column E) into correct year.	0.971	0.971
2020	$ 36.24	0.96	1.01			0.971	0.971
2021	$ 36.24	0.93	1.02			0.943	1.913
2022	$ 36.24	0.94	1.03			0.915	2.829
2023	$ 36.24	0.95	1.05	$ (0.93)		0.888	3.717
2024	$ 36.24	0.96	1.06			0.863	4.580
2025	$ 36.24	0.98	1.09			0.837	5.417
2026	$ 36.24	1.00	1.10		A negative value is shown inside parentheses, and must be entered as negative in the input section.	0.813	6.230
2027	$ 36.24	1.00	1.11			0.789	1.020
2028	$ 36.24	1.00	1.12	$ (3.23)		0.766	7.786
2029	$ 36.24	1.00	1.23	$ (24.67)		0.744	8.530
2030	$ 36.24	1.01	1.27			0.722	9.253
2031	$ 36.24	1.02	1.29			0.701	9.954
2032	$ 36.24	1.02	1.30			0.681	10.635
2033	$ 36.24	1.03	1.31	$ (4.88)		0.661	11.296
2034	$ 36.24	1.02	1.32			0.642	11.938
2035	$ 36.24	1.02	1.33			0.623	12.561
2036	$ 36.24	1.03	1.34			0.605	13.166
2037	$ 36.24	1.03	1.34			0.587	13.754
2038	$ 36.24	1.03	1.35			0.570	14.324
2039	$ 36.24	1.02	1.35			0.554	14.877
2040	$ 36.24	1.02	1.36	$ (24.67)		0.538	15.415
2041	$ 36.24	1.02	1.36			0.522	15.937
2042	$ 36.24	1.01	1.37			0.507	16.444
2043	$ 36.24	1.01	1.38			0.492	16.936
2044	$ 36.24	1.00	1.39			0.478	17.413
2045	$ 36.24	1.00	1.40			0.464	17.877
2046	$ 36.24	1.00	1.41			0.450	18.327
2047	$ 36.24	1.00	1.42			0.437	18.764
2048	$ 36.24	1.00	1.43			0.424	19.188
2049	$ 36.24	0.99	1.45			0.412	19.600

Use **Tables od Section A** of the *Energy Price Indices and Discount Factors LCCA 2019, Annual Supplement to Handbook 135* (page 8) to find SPV and UPV factors.

CALCULATOR EXAMPLE CONT:

Table DPP2: DOE CALCULATIONS (IN THOUSANDS)

Column1 Service Year	Column2 Annual Energy Savings	Column3 Change in OM&R, Water, and Other	Column4 Change in Capital Replacements	Column5 Present Value (PV) Savings DOE	Column6 Cumulative PV Savings	Column7 Change in PV Initial Investment	Column8 PV net savings
2019	$ 36.245	$ -	$ -	$ 36.245	$ 36.245	$ (456.352)	$ (420.107)
2020	$ 35.701	$ -	$ -	$ 35.701	$ 71.946	$ (456.352)	$ (384.406)
2021	$ 35.339	$ -	$ -	$ 35.339	$ 107.284	$ (443.192)	$ (335.908)
2022	$ 35.701	$ -	$ -	$ 35.701	$ 142.985	$ (430.033)	$ (287.047)
2023	$ 36.245	$ -	$ (0.83)	$ 35.419	$ 178.404	$ (417.343)	$ (238.939)
2024	$ 36.607	$ -	$ -	$ 36.607	$ 215.011	$ (405.594)	$ (190.582)
2025	$ 37.513	$ -	$ -	$ 37.513	$ 252.525	$ (393.374)	$ (140.849)
2026	$ 38.057	$ -	$ -	$ 38.057	$ 290.582	$ (382.095)	$ (91.513)
2027	$ 38.238	$ -	$ -	$ 38.238	$ 328.820	$ (370.815)	$ (41.995)
2028	$ 38.419	$ -	$ (2.47)	$ 35.945	$ 364.765	$ (360.005)	$ 4.759
2029	$ 40.413	$ -	$ (18.35)	$ 22.058	$ 386.823	$ (349.666)	$ 37.157
2030	$ 41.319	$ -	$ -	$ 41.319	$ 428.142	$ (339.326)	$ 88.816
2031	$ 41.863	$ -	$ -	$ 41.863	$ 470.005	$ (329.457)	$ 140.548
2032	$ 42.044	$ -	$ -	$ 42.044	$ 512.049	$ (320.057)	$ 191.992
2033	$ 42.406	$ -	$ (3.23)	$ 39.181	$ 551.229	$ (310.657)	$ 240.572
2034	$ 42.406	$ -	$ -	$ 42.406	$ 593.636	$ (301.728)	$ 291.908
2035	$ 42.588	$ -	$ -	$ 42.588	$ 636.223	$ (292.798)	$ 343.425
2036	$ 42.950	$ -	$ -	$ 42.950	$ 679.173	$ (284.339)	$ 394.835
2037	$ 42.950	$ -	$ -	$ 42.950	$ 722.123	$ (275.879)	$ 446.244
2038	$ 43.131	$ -	$ -	$ 43.131	$ 765.254	$ (267.889)	$ 497.365
2039	$ 42.950	$ -	$ -	$ 42.950	$ 808.204	$ (260.369)	$ 547.835
2040	$ 43.131	$ -	$ (13.27)	$ 29.859	$ 838.063	$ (252.850)	$ 585.213
2041	$ 43.131	$ -	$ -	$ 43.131	$ 881.194	$ (245.330)	$ 635.864
2042	$ 43.131	$ -	$ -	$ 43.131	$ 924.325	$ (238.280)	$ 686.045
2043	$ 43.312	$ -	$ -	$ 43.312	$ 967.638	$ (231.231)	$ 736.407
2044	$ 43.312	$ -	$ -	$ 43.312	$ 1,010.950	$ (224.651)	$ 786.299
2045	$ 43.494	$ -	$ -	$ 43.494	$ 1,054.444	$ (218.071)	$ 836.373
2046	$ 43.675	$ -	$ -	$ 43.675	$ 1,098.119	$ (211.491)	$ 886.627
2047	$ 43.856	$ -	$ -	$ 43.856	$ 1,141.975	$ (205.382)	$ 936.593
2048	$ 44.037	$ -	$ -	$ 44.037	$ 1,186.012	$ (199.272)	$ 986.740
2049	$ 44.219	$ -	$ -	$ 44.219	$ 1,230.231	$ (193.632)	$ 1,036.598

End of Lifetime

Notes: Use tables Ca-4 through Ca-5 of the *Energy Price Indices and Discount Factors LCCA 2019, Annual Supplement to Handbook 135* (page 39) to calculate annual energy savings.
https://www.nist.gov/publications/energy-price-indices-and-discount-factors-life-cycle-cost-analysis-

Discount Payback Period Result: FEMP Project		
First Positive Savings:	$	4.759
PAYBACK PERIOD:		10
FISCAL YEAR OF DISCOUNT PAYBACK:		2029

Note: Discount payback period measures the time of recovery to meet initial investment costs.

CALCULATOR EXAMPLE CONT:

SUMMARY OF LIFE-CYCLE COST ANALYSIS

PROJECT IDENTIFICATION

Project Name:	103849
Fiscal year:	2019
Location:	TA-03-1420
Base Date (BD):	7/24/2019
Service Date (SD):	12/17/2019
Design feature to be Evaluated:	HVAC and lighting renovation
List Constraints:	0
Energy/Water Conservation Study? (FEMP)	Yes

BASE CASE AND ALTERNATIVES

**Name and describe base case and alternatives to be analyzed. Include any relevent assumptions:**

Comparing if the Smart Lab renovaiton should be implemented at CINT.
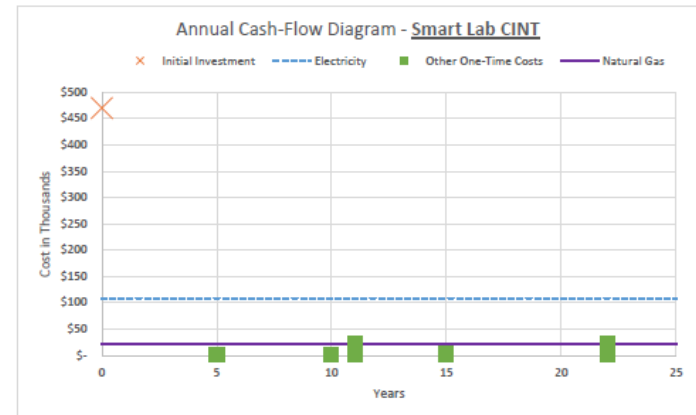
GENERAL INFORMATION:

Name of Analyst:	Matney Juntunen
Phone Number:	55-667-1975
Z-Number:	341830
Date of Study Completion:	8/2/2019

KEY DATES

Years of Life:	25
BD:	7/24/2019
SD:	12/17/2019
End of Study:	8/2/2019

Annual Cash-Flow Diagram - Current CINT
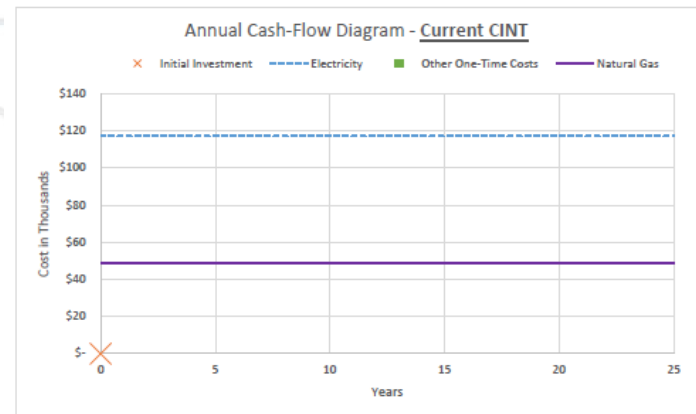
Current CINT Present Value Life Cycle Costs: $ 186.07

Annual Cash-Flow Diagram - Smart Lab CINT

Total Smart Lab Present Value Life Cycle Costs: $ 633.33

SAVINGS-TO-INVESTMENT RATIO:

Savings-to-Investments Ratio (SIR): 0.0777

DISCOUNT PAYBACK PERIOD: FEMP

Discount Payback Period:	10
Fiscal year of Discount Payback:	2029