

6 Session 4: LCCA, Measuring and Verification

Cost Effective M&V for the Department of Defense

Presenter: Dr. Charles Culp. Texas A&M University, ESL.

Cost Effective M&V For the DoD

CERL Meeting

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Chicago



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M&V History

M&V Strategy

M&V Examples

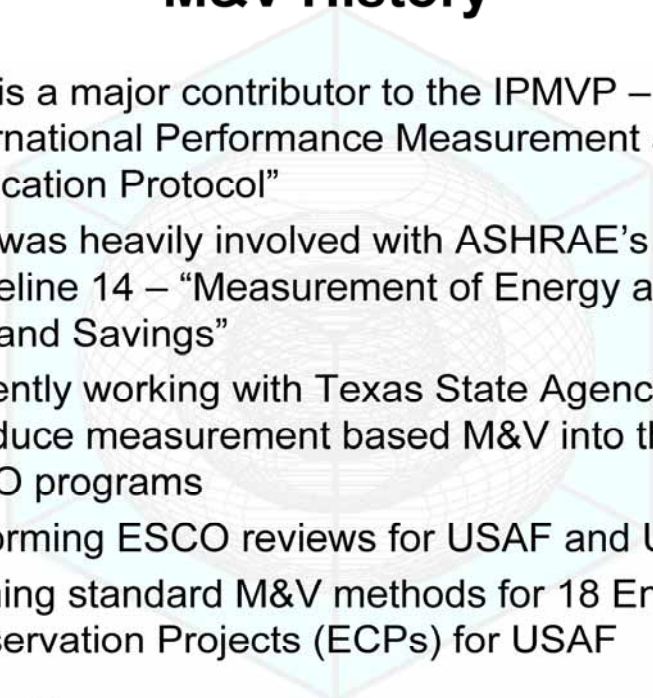


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M&V History

- 
- ESL is a major contributor to the IPMVP – “International Performance Measurement and Verification Protocol”
 - ESL was heavily involved with ASHRAE’s Guideline 14 – “Measurement of Energy and Demand Savings”
 - Currently working with Texas State Agencies to introduce measurement based M&V into their ESCO programs
 - Performing ESCO reviews for USAF and US Army
 - Defining standard M&V methods for 18 Energy Conservation Projects (ECPs) for USAF



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M&V History

- In the past, most USAF ESCO contracts were stipulated
 - This means that the USAF Installation agreed that the savings were met for the 20+ year contract at the time of contract signing
 - The USAF then assumed all risk for achieving savings
 - Finding many problems with accuracy of guarantees
 - If savings were not met, no budget existed to make up short-fall
- Projects in the DoD today are often stipulated



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M&V Strategies

- Standard M&V methods being introduced to accelerate ESCO growth in USAF
 - Less review required
 - Faster turnaround and approval
 - Targeted for the “80% solution”
- Growing pains being experienced as the USAF and ESCOs implement monitoring
 - M&V cost target ~ 5% of the savings
 - Saves USAF from experiencing 30%+ drop in savings



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M&V Strategies

- USAF ESCO contracts are evolving based on cost-effective measurement
 - This means that the USAF Installation and the ESCO share the risk of energy and savings performance
 - The USAF will typically assume the operational “amount of use” risk
 - The ESCO will typically have the equipment performance risk



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M&V Examples

- Standard M&V Plan (18) Guidelines
 - District Heating*
 - Lighting*
 - Constant Load Motors*
 - Variable Speed Drives*
 - Boiler Replacement*
 - Infrared Heating
 - Steam Traps
 - Chiller Replacement*
 - Cooling Tower Replacement
 - Plate Heat Exchanger
 - DX Heat Pump
 - EMCS*
 - FM Control Systems
 - Chiller Plant*
 - Building Envelope
 - Propane Air*
 - HVAC Controls
 - Thermal Storage



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* ~ 90% Complete

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M&V Example - Lighting

- Lighting
 - Key risks are:
 - Installing wrong or under / over lit fixtures / ballasts
 - Replacing the lamp / ballast with a low efficiency unit
 - Calculating the savings incorrectly due to:
 - Incorrect operating hours
 - Incorrect rate structure
 - Incorrect calculations
 - Incorrect demand calculations
 - M&V Plan is designed to prevent these risks from eroding savings



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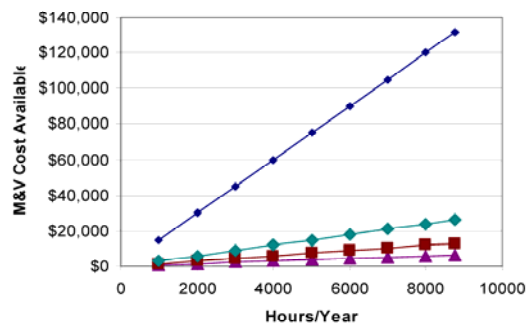
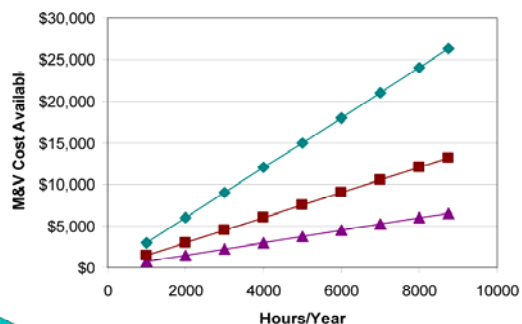
M&V Example - Lighting

1 MW Consumption (10,000 fixtures at 100 W/fixture)

Operation Hrs/yr	Consumption \$/yr @ \$.05/kWh	Savings / yr @ 30%	M&V \$ 5%	M&V \$ 10%	M&V \$ 20%
1000	\$50,000	\$15,000	\$750	\$1,500	\$3,000
2000	\$100,000	\$30,000	\$1,500	\$3,000	\$6,000
3000	\$150,000	\$45,000	\$2,250	\$4,500	\$9,000
4000	\$200,000	\$60,000	\$3,000	\$6,000	\$12,000
5000	\$250,000	\$75,000	\$3,750	\$7,500	\$15,000
6000	\$300,000	\$90,000	\$4,500	\$9,000	\$18,000
7000	\$350,000	\$105,000	\$5,250	\$10,500	\$21,000
8000	\$400,000	\$120,000	\$6,000	\$12,000	\$24,000
8760	\$438,000	\$131,400	\$6,570	\$13,140	\$26,280

Cost Available for M&V

Savings Amount and M&V Cost



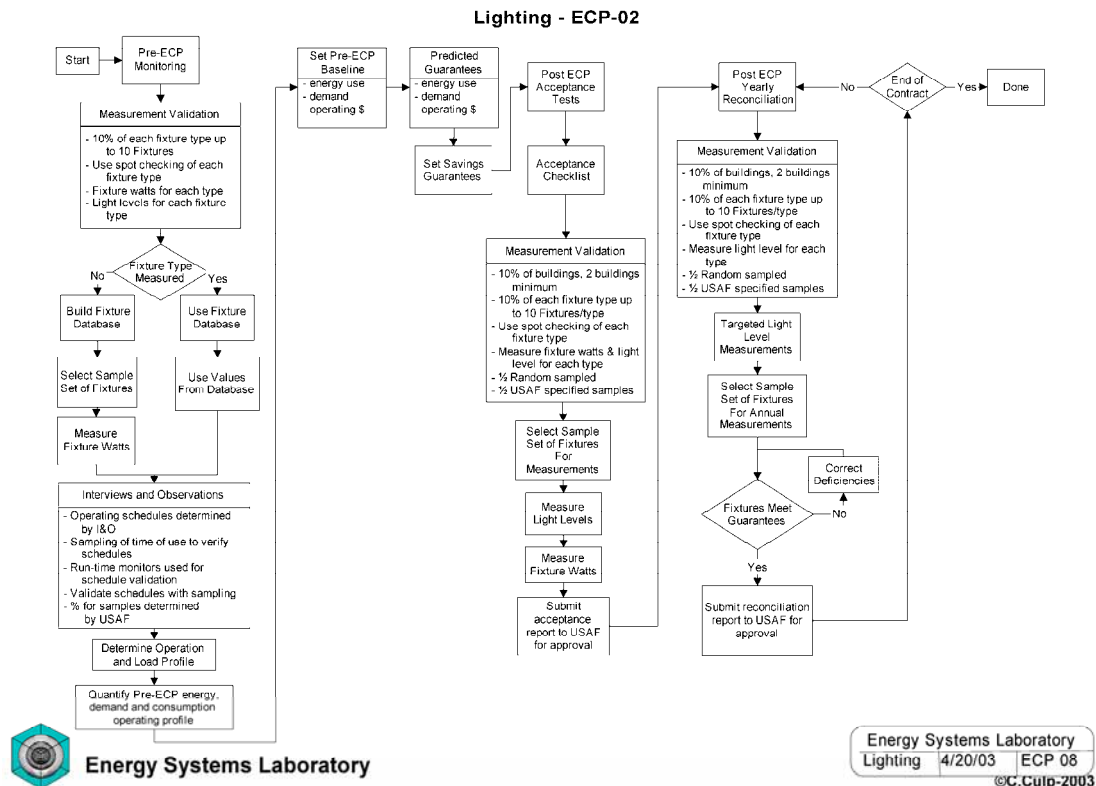
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▲ 5%
 ■ 10%
 ◆ 20% of Savings

▲ 5%
 ■ 10%
 ◆ 20% of Savings
 ◆ Savings

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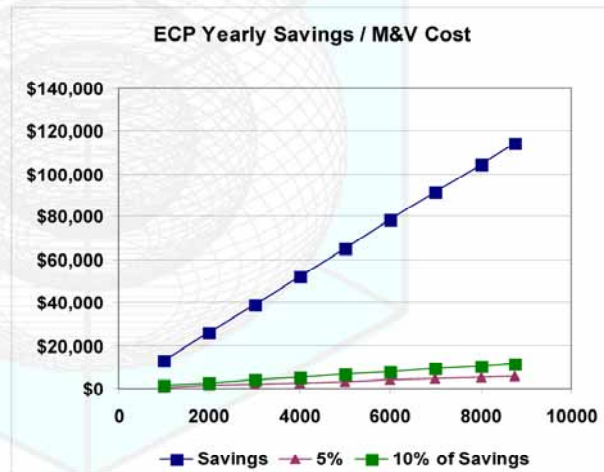


M&V Example - VSDs

- Variable Speed Drive Retrofit Example
 - Key risks are:
 - Disabling the VSD control and operating at 100%
 - Not repairing a dysfunctional control element or VSD Inverter
 - Results in \$0 savings for that motor application
 - M&V Plan designed to prevent these risks from eroding savings

M&V Example - VSDs

- Variable Speed Drive Retrofit Example
 - Can save substantial energy and maintain comfort
 - For a VSD Retrofit with 10 motors at 50 HP
 - Savings estimated at \$114,000 at 8760 hours per year
 - M&V target cost in the range of \$3,000 to \$12,000 per year (3% to 10%)

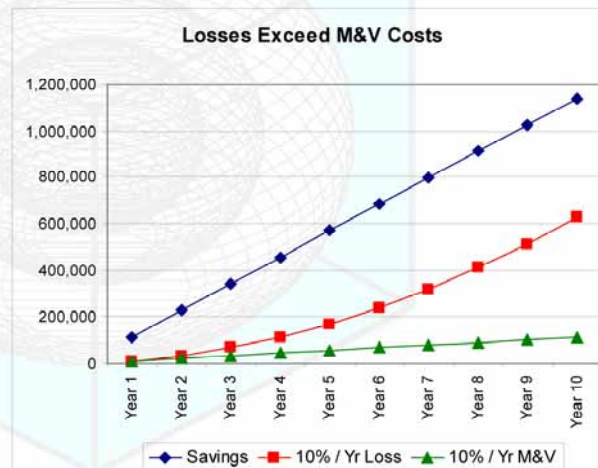


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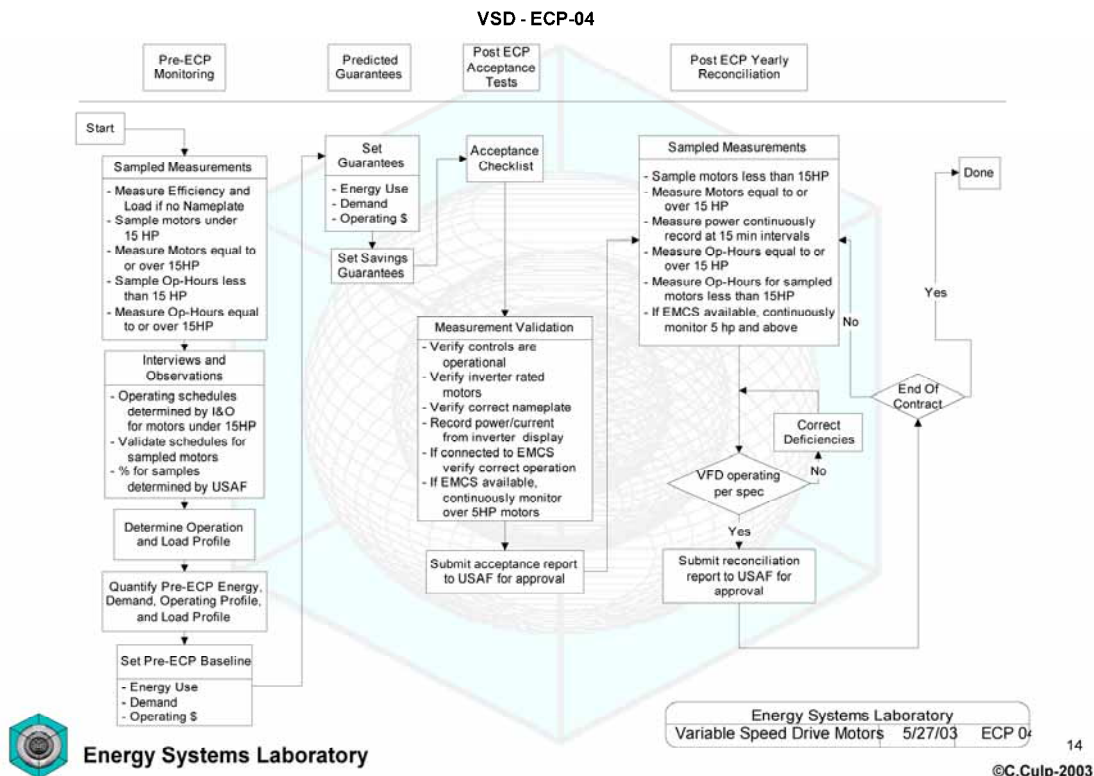
M&V Example - VSDs

- Variable Speed Drive Retrofit Example
 - Lost savings often accumulate at 10%-20% / year
 - For a VSD Retrofit with 10 motors at 50 HP
 - Losses from not performing M&V could exceed \$600,000 in first 10 years
 - M&V Costs at 10% per year are \$114,000 over the 10 years
 - Automating M&V can further reduce cost of M&V



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M&V Example - EMCSs

- Energy Management and Control Systems
 - Usually under-used as a Start/Stop Control
 - Operators need better training to effectively use full capabilities
 - Full capabilities allow
 - Optimum Start
 - Chiller Resets
 - Boiler Resets
 - AHU Controls
 - Box Controls
 - These are low sustainability measures which require on-going M&V

M&V Example - EMCSs

- Energy Management and Control Systems
 - Key risks are:
 - Underestimating occupancy schedules
 - Not re-enabling temporary overrides
 - Occupant discomfort resulting in overrides
 - Disabling controls, overriding schedules and operating at 100%
 - Not repairing a dysfunctional control elements
 - M&V Plan designed to prevent these risks from eroding savings



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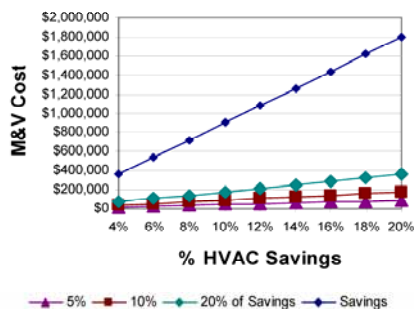
M&V Example - EMCSs

Energy Management and Control System

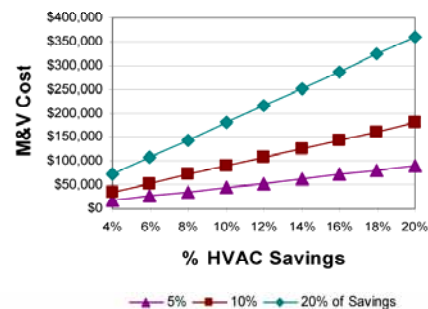
~6,000,000 sq ft - 40 Buildings at ~\$1.50 / sqft

HVAC Savings %	Savings \$/yr Estimate	M&V \$ 5%	M&V \$ 10%	M&V \$ 20%
4%	\$360,000	\$18,000	\$36,000	\$72,000
6%	\$540,000	\$27,000	\$54,000	\$108,000
8%	\$720,000	\$36,000	\$72,000	\$144,000
10%	\$900,000	\$45,000	\$90,000	\$180,000
12%	\$1,080,000	\$54,000	\$108,000	\$216,000
14%	\$1,260,000	\$63,000	\$126,000	\$252,000
16%	\$1,440,000	\$72,000	\$144,000	\$288,000
18%	\$1,620,000	\$81,000	\$162,000	\$324,000
20%	\$1,800,000	\$90,000	\$180,000	\$360,000

EMCS M&V Cost per Year

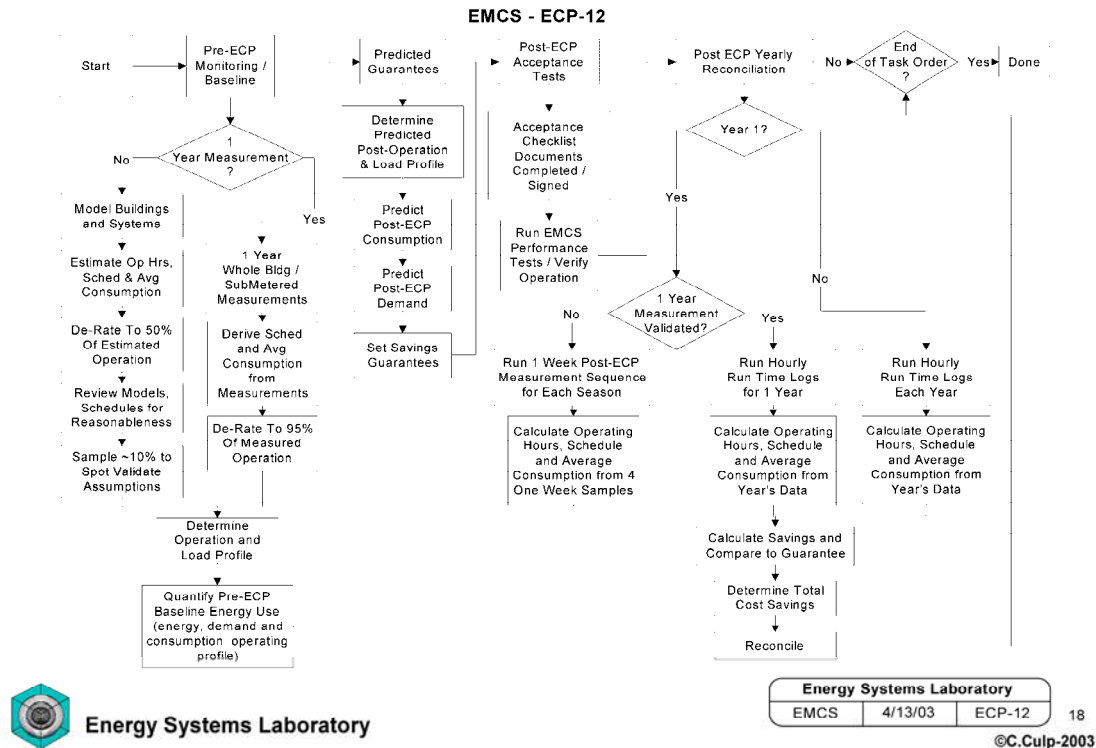


EMCS M&V Cost per Year



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Summary

- Measurement and Verification is needed to sustain savings
- M&V must be cost effective over the life of the contract
- M&V must be straightforward and address the key short and long term risks of losing savings

A Tool for M+V Cost Estimating

Presenter: Mr. David Underwood. ERDC CERL.

Measurement & Verification: A Cost Estimating Tool

- Why
- What
- Availability

David Underwood
ERDC-CERL



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Why An M&V Cost Estimating Tool

- Research of past ESPCs indicated a lack of sufficient M&V planning
- M&V Cost typically rolled into a single Number with no documentation on specifics
- Available tools were seen as insufficient
- Contractors cost estimating methods don't tend to make M&V costing detail available



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What M&V Cost Tool Is

- Basically a database with a user interface
 - A set of linked Excel Spreadsheets, Macros, and examples
 - Default costs which can be changed
 - Reports with yearly, total life, and itemized costs
 - A resource for comparing various M&V scenarios
 - A resource for M&V equipment ordering



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What M&V Cost Tool Is

- Four Categories Based On Data Used For Analysis
 - Utility Billing
 - Short Term Data Acquisition (3 Types)
 - Long Term Data Acquisition (3 Types)
 - Calibrated Simulation



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“Hidden” Costs Included

- Labor
 - Data Sorting
 - Weather Data Purchasing and Processing
 - Modeling
 - Report Generation
 - Etc.
- Data Logger Maintenance and Removal

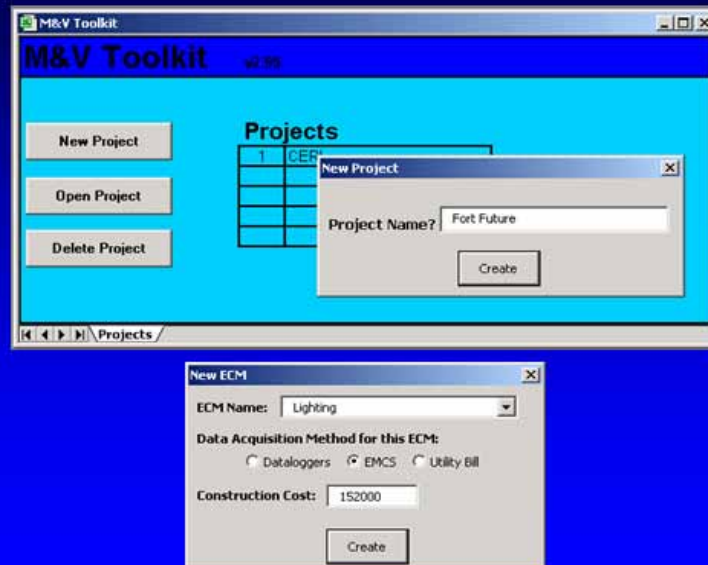


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Creating Projects & ECMs



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Reports

- Equipment
- Labor
- Travel
- Weather
- Yearly
- Total



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Data Logger Selection

Equipment Selection

Equipment Type:

Manufacturer:

Model #:

Serial #:

Quantity: Add Cancel

Equipment Details

Model #: MicroDataLogger Data Acquisition System
Serial #:

Characteristics: 4 channels; four universal input/output channels accept both analog and digital
Data Resolution: 12 bit digital or 1.2mV analog
Accuracy: (analog) +/-0.1% of full scale reading
Signal Output: varies by type of measurement
Power Requirements: 12 volt DC battery
Operating Temp: 32F to 122F
Dimensions: 5.8" x 4.4" x 1.6"



Name: **Versatile 4-Channel Data Logger**
Manufacturer: Electricitymetering.com
Address:
Phone: 877-766-5412
Fax: 403-256-3636
Web: www.electricitymetering.com
Contact:
Ext.:
E-mail: info@electricitymetering.com

Description: The MicroDataLogger Data Acquisition System is a battery powered, four-channel data and hand-held meter that records time-series data from virtually any sensor or transducer. The MicroDataLogger Data Acquisition System is a complete monitoring solution for many applications.

Special Requirements:

Price: \$645
Addtl. Cost 1: \$
Addtl. Cost 2: \$
Addtl. Cost 3: \$
Total Cost: \$645
Price as of: 7/1/2003

Done



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Equipment Associated Labor

Installation, Maintenance and Removal Costs

Select Equipment: Onicon, Inc. - System-10

Installation: Hours

Field Engineer 1:
Project PI:

Maintenance:

Field Engineer 1:
Project PI:
Parts costs, etc.
(% per year of purchase price):

Removal:

Field Engineer 1:
Project PI:

Save



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Some of the “Hidden Costs”

EMCS Data Manipulation Costs: Long M&V - EMCS

No. of Channels: 0
No. of Types: 0

Polling, QC and Data Entry Costs

Item	A. Unit	B. Supply	C. No. Per yr
Test Costs	Per Channel		
Polling Costs	Per Logger		
QC Database Load	Per Channel		
Test Cleaning	Per Channel		
Computer Maintenance	Per Month		
Other			

Ongoing Savings Analysis

Item	A. Unit	B. Supply	C. No. Per yr
Test Costs	Per Channel		
Polling Costs	Per Logger		
QC Database Load	Per Channel		
Test Cleaning	Per Channel		
Computer Maintenance	Per Month		
Other			

Data Recovery/Missing Data

Item	A. Unit	B. Supply	C. No. Per yr
Test Recovery	Per Channel		
Missing Data	Per Channel		
Other			

One Time Baseline/Post Retrofit Analysis

Item	A. Unit	B. Supply	C. No. Per yr
Test Recovery	Per Channel		
Missing Data	Per Channel		
Other			

Close-out, Data Transfer

Item	A. Unit	B. Supply	C. No. Per yr
Test Recovery	Per Channel		
Missing Data	Per Channel		
Other			

Input Data Reporting

Setup Costs: 1
Report Generation Costs: 12
Other: 0

Frequency (X per yr): 1

Cancel



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Report Generation

View Reports

Select which reports to view:

ECM Name: Lighting

Data Acquisition Method: Dataloggers

Reports:

☒ LongM&V ☒ Equipment Costs

☐ ShortM&V ☒ Labor Costs

☐ SimulationM&V ☒ Travel Costs

☐ UtilityM&V ☒ Weather Data Costs

☒ Annual Costs Summary

Open



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Reports

Cost Summary: Short M&V
Project: CERL
ECM: Lighting
Data Acquisition Method: Data Loggers

Installation	
Equipment Costs	\$1,800
Labor Costs	\$900
Administration Costs	\$100
Other Installation Costs	\$3,250
Travel Costs	\$3,600
Total	\$9,650

Maintenance	
Equipment Costs	\$180
Labor Costs	\$750
Administration Costs	\$70
Travel Costs	\$1,000
Total	\$1,700

Polling, QC and Data Entry	
Database Setup Costs	\$30
Polling Costs	\$900
QC, Database Load	\$900
Data Cleaning, Data Recovery	\$150
Computer Costs	\$300
Other	\$0
Total	\$2,480

Equipment Removal	

Total Summary

Equipment Costs: Long M&V
Project: CERL
ECM: Lighting
Data Acquisition Method: Data Loggers

Item	Cost/Item	No. Items	Total Cost
ENERNET Corporation - K20-2	\$2,490.00	1	\$2,490.00
BUCK-CORE - CT1-200	\$155.00	4	\$620.00
The Epley Laboratory - Model S-48	\$1,400.00	1	\$1,400.00
Total Cost			\$4,510.00

Equipment Detail



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Total Summary

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Detailed Category Reports

Labor Costs: Long M&V
Project: CERL
ECM: Lighting
Data Acquisition Method: Data Loggers

Installation	
Field Engineer 1	\$1,017.00
Project #1	\$116.96
Project #2	\$3,254.40
Field Engineer 1	\$1,017.00
Project #3	\$116.96
Project #4	\$116.96
Total	\$6,749.32

Maintenance	
Field Engineer 1	\$1,017.00
Project #1	\$116.96
Project #2	\$3,254.40
Field Engineer 1	\$1,017.00
Project #3	\$116.96
Project #4	\$116.96
Total	\$6,749.32

Polling, QC and Data Entry	
Data Base Support Worker	\$1,033.95
Project #1	\$1,301.76
Project #2	\$1,301.76
Data Base Support Worker	\$1,033.95
Project #3	\$1,301.76
Project #4	\$1,301.76
Total	\$6,275.98

Reporting	
Data Analyst	\$450.00
Project #1	\$150.00
Project #2	\$150.00
Data Analyst	\$450.00
Project #3	\$150.00
Project #4	\$150.00
Total	\$1,350.00

Labor Detail

Travel Costs: Long M&V
Project: CERL
ECM: Lighting
Data Acquisition Method: Data Loggers

Installation Travel Costs	
Transportation	\$1,000.00
Lodging	\$1,000.00
Meals	\$1,000.00
Other	\$1,000.00
Total	\$4,000.00

Maintenance Travel Costs	
Transportation	\$1,000.00
Lodging	\$1,000.00
Meals	\$1,000.00
Other	\$1,000.00
Total	\$4,000.00

Travel Detail

Weather Costs
Project: CERL
ECM: Cooling Tower VFD

Hourly Weather Data	
Setup Costs	\$100
Polling Costs	\$1,000
QC, Data Load	\$1,500
Data Cleaning, Data Recovery	\$50
Other	\$0
Total	\$3,310

Weather Detail

Annual Costs: Long M&V
Project: CERL
ECM: Lighting
Data Acquisition Method: Data Loggers
No. of years: 1

First Year Costs	
Installation	\$12,400
Maintenance	\$1,350
Polling, QC and Data Entry	\$2,480
Data Recovery/Missing Data	\$750
One Time Baseline/Post Retrofit Analysis	\$650
Ongoing Savings Analysis	\$1,500
Reporting	\$750
Data Transfer	\$204
Download & Profile	\$3,000
Total	\$24,984

Annual Costs	
Maintenance	\$1,350
Polling, QC and Data Entry	\$2,480
Data Recovery/Missing Data	\$750
Ongoing Savings Analysis	\$1,500
Reporting	\$750
Data Transfer	\$204
Download & Profile	\$3,000
Total (per year)	\$9,234

Annual Detail

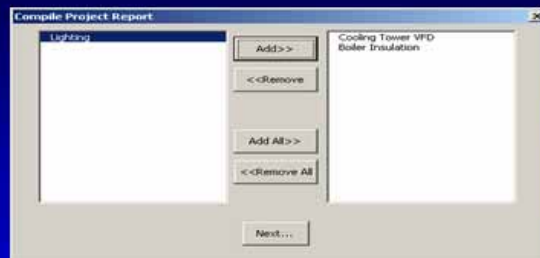


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Project Summary Reports



ECM	Data Acquisition Method	M&V Plan	No. Years	Total ECM Cost	Construction Cost	% M&V
Cooling Tower VFD	Cataloggers	Long M&V	3	\$75,454	\$100,000	7.1%
Boiler Insulation	Cataloggers	Long M&V	3	\$29,993	\$48,000	12.1%
SubTotal				\$105,447		
Weather Costs			3	\$11,238		
Travel Costs			3	\$4,300		
Total				\$120,985	\$148,000	10.8%



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Project Summary Reports By ECM

ECM	Equipment Cost
Cooling Tower VFD	\$645
Boiler Insulation	\$0
Total	\$645

ECM	Annual Travel Cost	Total Travel Cost
Cooling Tower VFD	\$325	\$3,295
Boiler Insulation	\$0	\$0
Total	\$325	\$3,295

ECM	Annual Labor Cost	Total Labor Cost
Cooling Tower VFD	\$5,598	\$31,444
Boiler Insulation	\$724	\$3,898
Total		\$35,342

ECM	Weather Cost
Setup Costs	\$82
Polling Costs	\$1,594
QC, Data Load	\$1,594
Data cleaning, Data Recovery	\$48
Other	\$0
Annual Total	\$3,318



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How To Get It

- **Web site:** <http://www.cecer.army.mil/mvtoolkit>
 - Cost Tool
 - Users Manual
 - Tutorial
 - Example Projects: Lighting. Future: Chiller Replacement, Boiler Replacement, EMCS. 3 Examples Each
 - Links to other M&V sites
- **Copy CD**
- **Give me a business card**



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Future Of The Tool

- **Examples Will Be Put On Web Site**
- **CERL Has No Plans For Future Development or Support**
- **Others Encouraged To Use It and Make Enhancements**



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NIST/FEMP BLCC5 Building Life-Cycle Cost Program

Presenter: Dr. Sieglinde Fuller, NIST.



BLCC5



- Java Program
 - platform-independent, web-friendly
 - program-integrated help
- Annual Updates
 - energy price projections, discount rates
 - legislative requirements, user requests
- Technical Assistance
 - training
 - telephone and e-mail support
 - free download

BLCC5 Modules

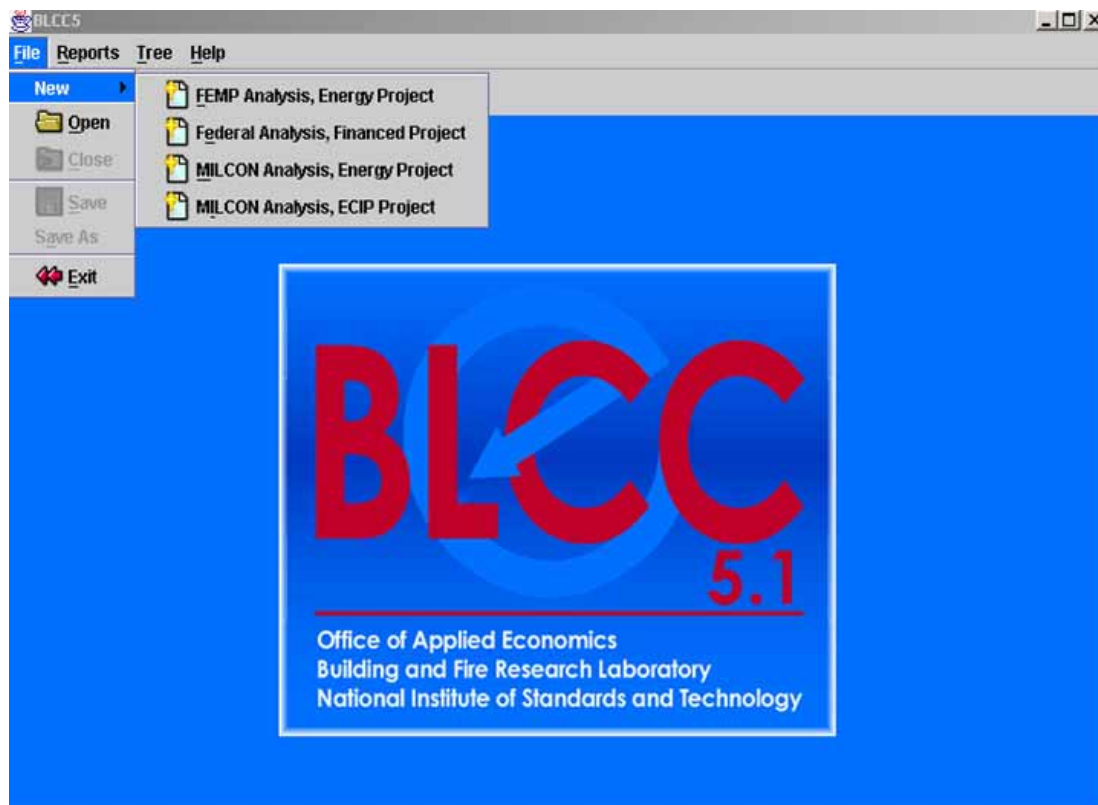
- FEMP – 10 CFR 436A
 - Energy and water conservation and renewable energy projects
- MILCON – DoD Criteria/Standards for LCCA
 - Energy and water conservation projects
 - ECIP projects
- OMB – Circular A-94
 - non-energy: cost effectiveness, lease/purchase,
 - internal govt. inv., asset sale analysis.
- ALTERNATIVE FINANCING - EO 13123
 - ESPC and UESC projects

BLCC5 - ESPC Example

Replace existing lighting system in a federal office building in Arizona with a new system financed through an ESPC

Amount financed:	\$380,560
Contract payments:	\$58,000
Study period:	20 years
Contract period:	10 years
Implementation period:	1 year

Determine whether the proposed system is cost-effective and whether the expected savings cover the contract payments.



Federal Analysis, Financed Project - C:\blcc5.1\projects\TeleW503-ex3.xml

File Reports Tree Help

Project: Teleworkshop

Alternative: Base Case

Alternative: Alternative

Contract Costs - Annually Recurring

Cost: Annual Contract Payment

Contract Costs - Non-Annually Recurring

Energy Costs

Cost: Electricity - new system

Cost: Electricity - Old System

Water Costs

Capital Component

Investment Cost

Replacement Costs

OM&R Costs - Annually Recurring

Cost: Routine O&M - New System

Cost: Routine OM&R - Old System

OM&R Costs - Non-Annually Recurring

General project information

Investment Cost

Initial Cost

Initial Cost Paid By Agency (Base Year \$): \$0.00

Initial Cost Financed (Base Year \$): \$380,560.00

Annual Rate of Increase: 2.30%

Expected Life (from Base Date): 20 years 0 months

Residual Value Factor (% of Total Investment): 10.00%

Cost Phasing of Initial Cost

Cost Adjustment Factor: 2.30%

Years/Months (from Date)	Date	Portion
0 years 0 months	March 1, 2003	100.0%

Tips

- Initial (investment) Costs Paid by Agency in base-year dollars are costs not included in annual Contract Payment (e.g., down-payment).
- Sum of Initial (investment) Cost Paid by Agency and Initial (investment) Cost

Start

11:23 AM

Federal Analysis, Financed Project - C:\blcc5.1\projects\TeleW503-ex3.xml

File Reports Tree Help

Project: Teleworkshop

Alternative: Base Case

Alternative: Alternative

Contract Costs - Annually Recurring

Cost: Annual Contract Payment

Contract Costs - Non-Annually Recurring

Energy Costs

Cost: Electricity - new system

Cost: Electricity - Old System

Water Costs

Capital Component

Investment Cost

Replacement Costs

OM&R Costs - Annually Recurring

Cost: Routine O&M - New System

Cost: Routine OM&R - Old System

OM&R Costs - Non-Annually Recurring

Energy Usage

Energy Cost

Delete

Energy Usage

Name: Electricity - new system

Annual Consumption: 363,000.00 kWh

Energy Usage Indices

From Date	Duration	Usage Index
March 1, 2003	1 year 0 months	0.0%
March 1, 2004	Remaining	100.0%

Changing usage pattern

Customized emissions calculations

Emissions

Location: Arizona

Tips

- Enter the base annual energy consumption of the specified energy type.
- Use Usage Indices to specify variable energy usage pattern.
- Enter region, state or end-use for emissions calculation.

Federal Analysis, Financed Project - C:\blcc5.1\projects\TeleWS03-ex3.xml

File Reports Tree Help

Project: Teleworkshop

- Alternative: Base Case
- Alternative: Alternative
 - Contract Costs - Annually
 - Cost: Annual Contract
 - Contract Costs - Non-Annually
 - Energy Costs
 - Cost: Electricity - new
 - Cost: Electricity - Old
 - Water Costs
 - Capital Component
 - Investment Cost
 - Replacement Costs
 - OM&R Costs - Annually
 - Cost: Routine O&M
 - Cost: Routine OM
 - OM&R Costs - Non-Annually

Energy Usage Energy Cost Delete

Energy Costs

Rate Schedule: Industrial

State: Arizona

Price/kWh: \$0.04200

Annual Demand Charge: \$3,000.00

Annual Utility Rebate: \$0.00

DOE Price Escalation Rates (Electricity) Editable escalation rates

Clear Rates Restore DOE Rates

From Date	Duration	Escalation
April 1, 2002	1 year 0 months	-5.40%
April 1, 2003	1 year 0 months	-2.22%
April 1, 2004	1 year 0 months	-1.61%
April 1, 2005	1 year 0 months	0.46%
April 1, 2006	1 year 0 months	1.91%
April 1, 2007	1 year 0 months	2.77%
April 1, 2008	1 year 0 months	2.77%

Tips

- Enter all dollar amounts in base-year dollars.
- Energy Usage Indices also apply to demand charges and utility rebates.
- If applicable, edit DOE price escalation rates.
- Use real rates of price escalation in constant-dollar analysis, nominal rates in current-dollar analysis.

Screen-specific help

Federal Analysis - Financed Project - c:\program files\blcc5\projects\TeleWS02-ex3.xml

File Reports Tree Help

Project: Teleworkshop

- Alternative: Base Case
- Alternative: Alternative
 - Contract Costs - Annually
 - Cost: Annual Contract
 - Contract Costs - Non-Annually
 - Energy Costs
 - Cost: Electricity - new
 - Cost: Electricity - Old
 - Water Costs
 - Capital Component
 - Investment Cost
 - Replacement Costs
 - OM&R Costs - Annually
 - Cost: Routine O&M
 - Cost: Routine OM
 - OM&R Costs - Non-Annually

Annually Recurring Contract-Related Cost Usage Indices Delete

Annually Recurring Contract-Related Cost

Name: Annual Contract Payment

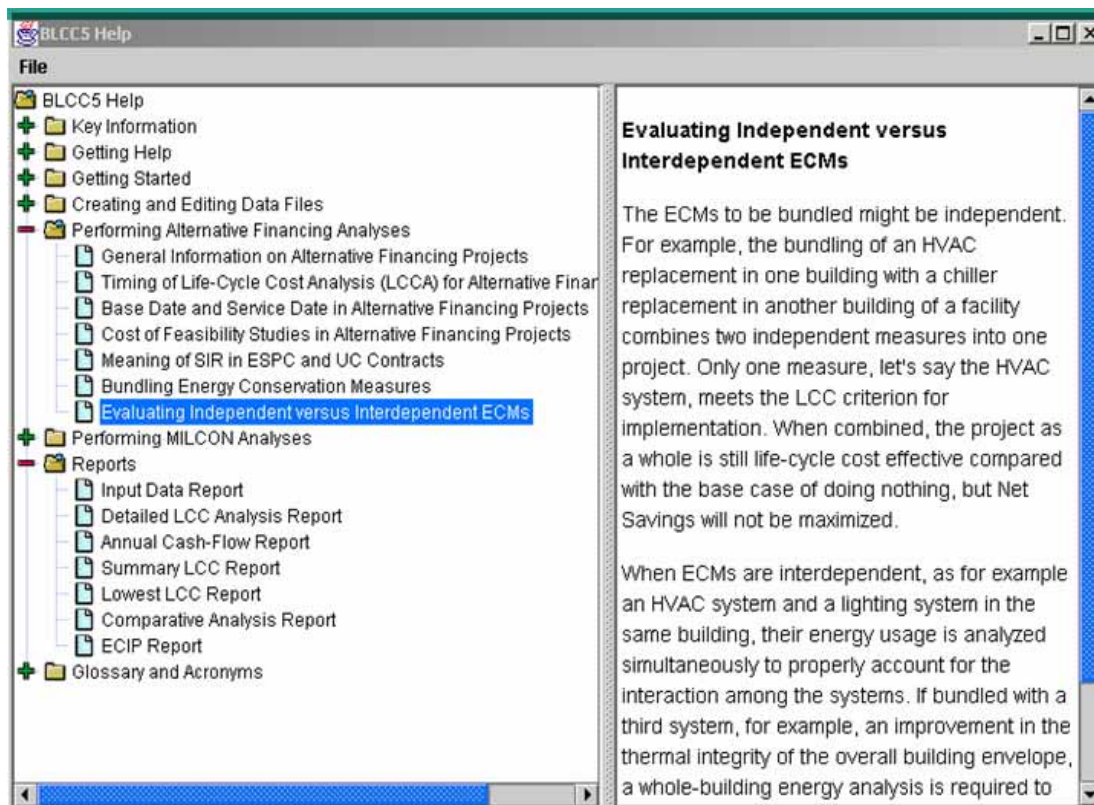
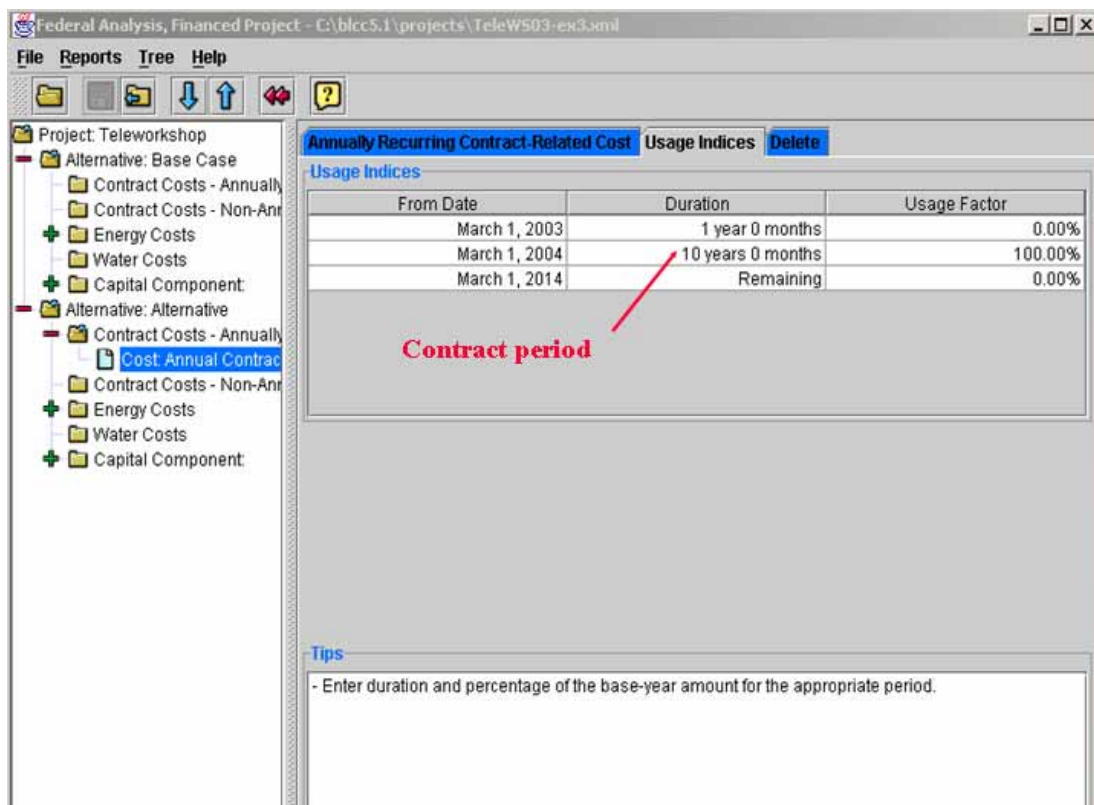
Amount: \$58,000.00

Annual Rate of Increase: 0.00%

Contract Costs

Tips

- Enter amount in base-year dollars.
- Use real rates of increase in constant-dollar analysis, nominal rates in current-dollar analysis.
- Use Usage Indices to specify variable pattern of occurrence.



NIST BLCC 5.1-02: Lowest LCC
 Consistent with Federal Life Cycle Cost Methodology and Procedures, 10 CFR, Part 436, Subpart A

General Information

File Name: C:\blcc5.1\projects\TeleWS03-ex3.xml
 Date of Study: Fri Dec 20 16:07:37 EST 2002
 Analysis Type: Federal Analysis, Financed Project
 Project Name: Teleworkshop
 Project Location: Arizona
 Analyst: SKF
 Comment: Replace existing lighting system with new lighting/daylighting system
 Base Date: March 1, 2003
 Study Period: 20 years 0 months (March 1, 2003 through February 28, 2023)
 Discount Rate: 5.6%
 Discounting Convention: End-of-Year

Lowest LCC
Comparative Present-Value Costs of Alternatives
 (Shown in Ascending Order of Initial Cost, * = Lowest LCC)

Alternative	Initial Cost (PV)	Life Cycle Cost (PV)
Base Case	\$0	\$1,025,226
Alternative	\$0	\$700,797 *

Comparative Analysis Report

Comparison of Present-Value Costs

PV Life-Cycle Cost

	Base Case	Alternative	Savings from Alternative
Initial Investment Costs Paid By Agency:			
Capital Requirements as of Base Date	\$0	\$0	\$0
Future Costs:			
Recurring and Non-Recurring Contract Costs	\$0	\$412,058	-\$412,058
Energy Consumption Costs	\$787,356	\$240,057	\$547,300
Energy Demand Charges	\$153,381	\$47,125	\$106,257
Energy Utility Rebates	\$0	\$0	\$0
Water Costs	\$0	\$0	\$0
Recurring and Non-Recurring OM&R Costs	\$84,489	\$21,727	\$62,762
Capital Replacements	\$0	\$0	\$0
Residual Value at End of Study Period	\$0	-\$20,170	\$20,170
Subtotal (for Future Cost Items)	\$1,025,226	\$700,797	\$324,429
Total PV Life-Cycle Cost	\$1,025,226	\$700,797	\$324,429

File				
Comparison of Contract Payments and Savings from Alternative (undiscounted)				
Year Beginning	Savings in Contract Costs	Savings in Energy Costs	Savings in Total Operational Costs	Savings in Total Costs
Mar 2003	\$0	\$0	\$0	\$0
Mar 2004	-\$58,000	\$52,960	\$58,820	\$820
Mar 2005	-\$58,000	\$52,792	\$58,787	\$787
Mar 2006	-\$58,000	\$53,521	\$59,654	\$1,654
Mar 2007	-\$58,000	\$54,819	\$61,093	\$3,093
Mar 2008	-\$58,000	\$56,222	\$62,640	\$4,640
Mar 2009	-\$58,000	\$57,421	\$63,987	\$5,987
Mar 2010	-\$58,000	\$58,969	\$68,031	\$10,031
Mar 2011	-\$58,000	\$58,729	\$65,601	\$7,601
Mar 2012	-\$58,000	\$59,352	\$66,381	\$8,381
Mar 2013	-\$58,000	\$60,463	\$67,654	\$9,654
Mar 2014	\$0	\$61,729	\$65,145	\$65,145
Mar 2015	\$0	\$63,238	\$66,732	\$66,732
Mar 2016	\$0	\$64,778	\$68,352	\$68,352
Mar 2017	\$0	\$66,195	\$72,602	\$72,602
Mar 2018	\$0	\$67,709	\$71,450	\$71,450
Mar 2019	\$0	\$69,147	\$72,974	\$72,974
Mar 2020	\$0	\$70,454	\$74,368	\$74,368

Savings exceed costs

File				
Energy Savings Summary				
Energy Savings Summary (in stated units)				
Energy Type	-----Average Base Case	Annual Alternative	Consumption----- Savings	Life-Cycle Savings
Electricity	1,100,000.0 kWh	399,930.7 kWh	700,069.3 kWh	13,999,468.9 kWh
Energy Savings Summary (in MBtu)				
Energy Type	-----Average Base Case	Annual Alternative	Consumption----- Savings	Life-Cycle Savings
Electricity	3,753.4 MBtu	1,364.6 MBtu	2,388.7 MBtu	47,768.2 MBtu
Emissions Reduction Summary				
Energy Type	-----Average Base Case	Annual Alternative	Emissions----- Reduction	Life-Cycle Reduction
Electricity				
CO2	895,922.17 kg	325,667.71 kg	570,254.46 kg	11,403,527.89 kg
SO2	1,097.86 kg	399.07 kg	698.79 kg	13,973.87 kg
NOx	2,926.84 kg	1,063.91 kg	1,862.93 kg	37,253.58 kg
Total:				
CO2	895,922.17 kg	325,667.71 kg	570,254.46 kg	11,403,527.89 kg
SO2	1,097.86 kg	399.07 kg	698.79 kg	13,973.87 kg
NOx	2,926.84 kg	1,063.91 kg	1,862.93 kg	37,253.58 kg

Limitations

- No calculation of contract payments
- No monthly payments
- No import/export feature
- Emissions factors not editable
- No designated sensitivity analysis module
- Non-energy modules still to be added

Resources

- Energy Escalation Rate Calculator
- NIST Handbook 135
- FEMP/NIST LCC Workshops
 - Basic Workshop
 - Project-Oriented Workshop
 - Teleworkshop
- NIST Training Videos

Contacts

- **BLCC, associated programs and user guides:**
<http://www.eere.energy.gov/femp> - Technical Assistance - Analytical Software Tools
- **Handbook 132 and Annual Supplement:**
[1-800-DOE-EREC \(1-800-363-3732\)](tel:1800DOE-EREC)
- **Technical Assistance:**
NIST Office of Applied Economics
LCC Method: sieglinde.fuller@nist.gov, 301-975-6134
Software: amy.rushing@nist.gov, 301-975-6136