



# **THE LIFE-CYCLE COST ANALYSIS**

**PRESENTED TO:**

**THE STATE ENERGY MANAGERS ASSOCIATION**

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**1:00 PM**

# INTRODUCTIONS



**Darren Fancher, P.E., M.B.A.**

Mechanical Engineer

Department of Management Services

Real Estate Development and Management

[Darren.Fancher@dms.MyFlorida.com](mailto:Darren.Fancher@dms.MyFlorida.com)

**Daniel Whitfield, P.E., LEED AP**

Mechanical Engineer

Department of Management Services

Real Estate Development and Management

[Daniel.Whitfield@dms.MyFlorida.com](mailto:Daniel.Whitfield@dms.MyFlorida.com)

**FLORIDA LIFE-CYCLE COST ANALYSIS PROGRAM**

For Sustainable State Agencies



**FORMS & DOCUMENTS**

FORMS: #AE16(B), #AE16(C), #AE16(D), #AE16(E), #AE16(F), & #AE16(G)

INCORPORATED BY REFERENCE IN RULE 60D-4.006, F.A.C.

*Prepared For:*

**Florida Department of Management Services  
Capital Improvements**

Renovations to the Al Loftus Building - FHP Headquarters Troop E  
1/26/2010



DEPARTMENT OF MANAGEMENT  
**SERVICES**





## TOPICS FOR DISCUSSION

- What is a Life-Cycle Cost Analysis?
- Administrative Rule 60D-4 (“the life-cycle rule”)
- The Florida Life-Cycle Cost Analysis Program
- Real World Examples
- Public Response to Recent Efforts
- Final Thoughts



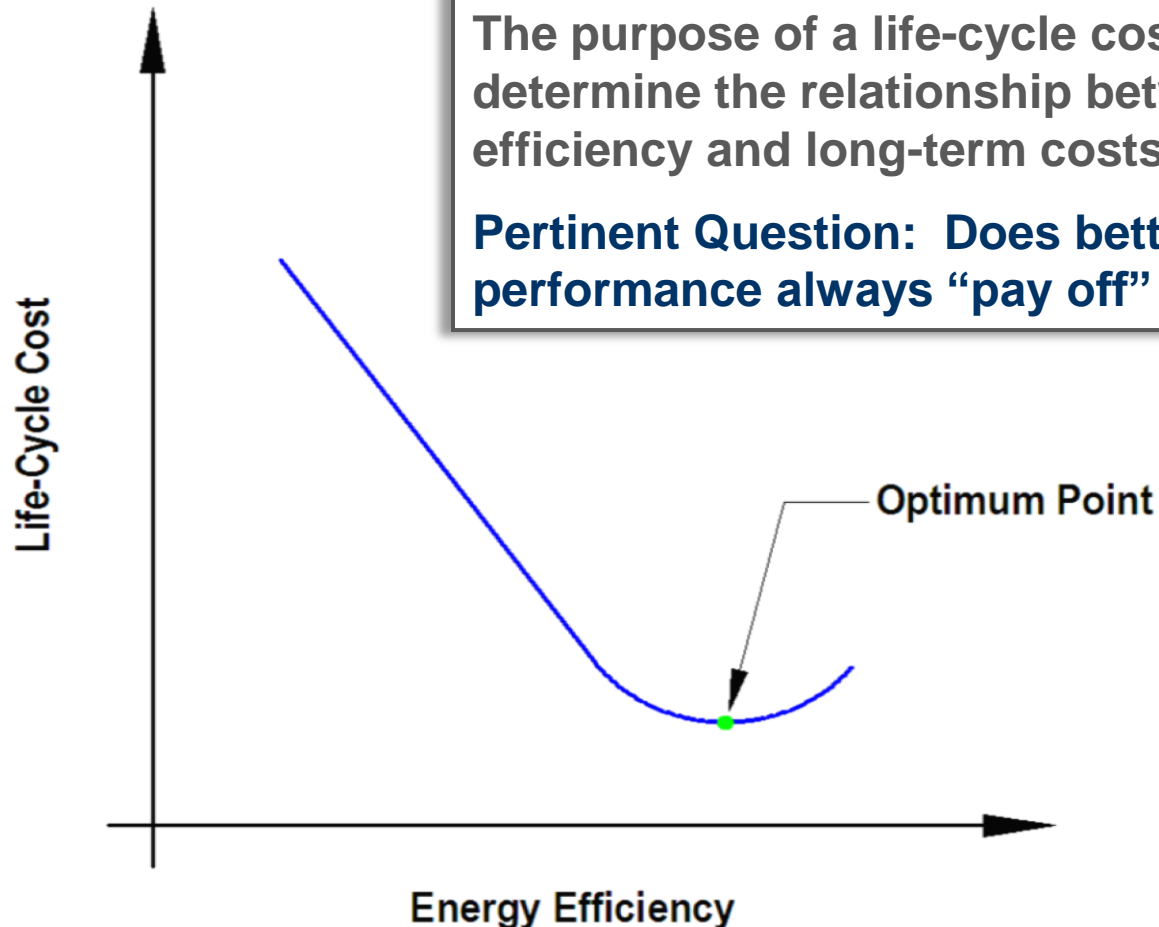


## WHAT IS A LIFE-CYCLE COST ANALYSIS?

- A life-cycle cost analysis is a comparison of all costs associated with a group of potential investments.
- For building systems, the total life-cycle cost is the sum of the following items over a preset time period:
  - Ownership cost
  - Operational costs
  - Maintenance costs
  - Replacement costs
- Operational costs are usually the largest component.
- The life-cycle method is the best way to ascertain the overall cost-effectiveness of potential options.



# WHAT IS A LIFE-CYCLE COST ANALYSIS?





## ADMINISTRATIVE RULE 60D-4

- Purpose
  - To implement the statutory mandate found in s. 255.255.
  - To develop procedures for analyzing life-cycle costs for alternative architectural and engineering designs.
- Applies to:
  - New construction projects (all agencies).
  - Renovation projects that include the replacement of major energy-consuming equipment (all agencies).
- Status
  - Filed March 17, 2010.
  - DMS seeks perpetual feedback from stakeholders.



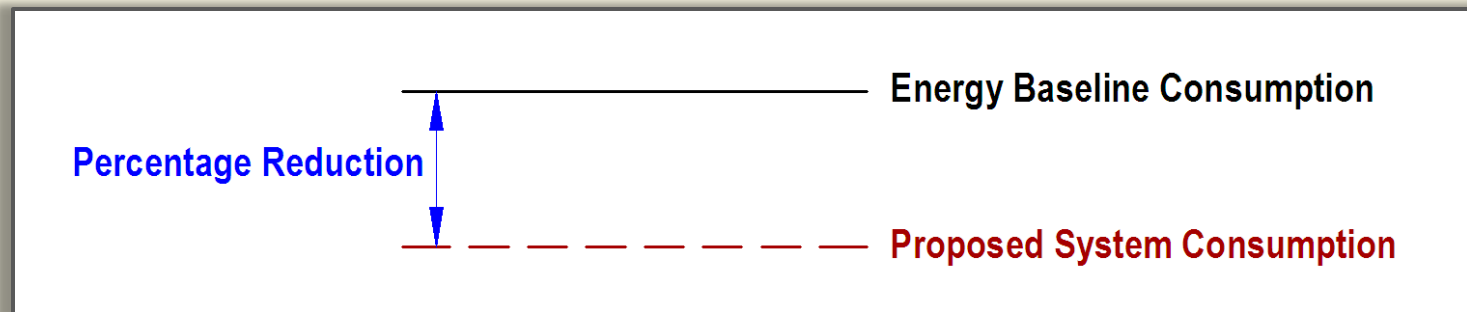
## ADMINISTRATIVE RULE 60D-4

- Alternative Designs
  - At least three (3) distinct design options must be considered.
  - “Alternative” is broadly defined to allow design flexibility.
  - Energy Performance Requirements:
    - New Construction: The alternatives must range from meeting to dramatically exceeding the minimum energy performance requirement of the sustainable rating system.
    - Renovations: The alternatives must meet or exceed the minimum energy performance requirement of the sustainable rating system.
  - Homogenous energy performance is not allowed.
  - A meaningful analysis of design options is required.
  - Must be developed by licensed professionals.



## ADMINISTRATIVE RULE 60D-4

- Performance Rating Method
  - Industry standard method of comparing proposed energy performance to that of a known baseline.
  - Common method among all of the sustainable rating systems currently allowed in statute.
  - This is an iterative process by design (i.e., effort is required).
  - This method is how energy performance is verified.

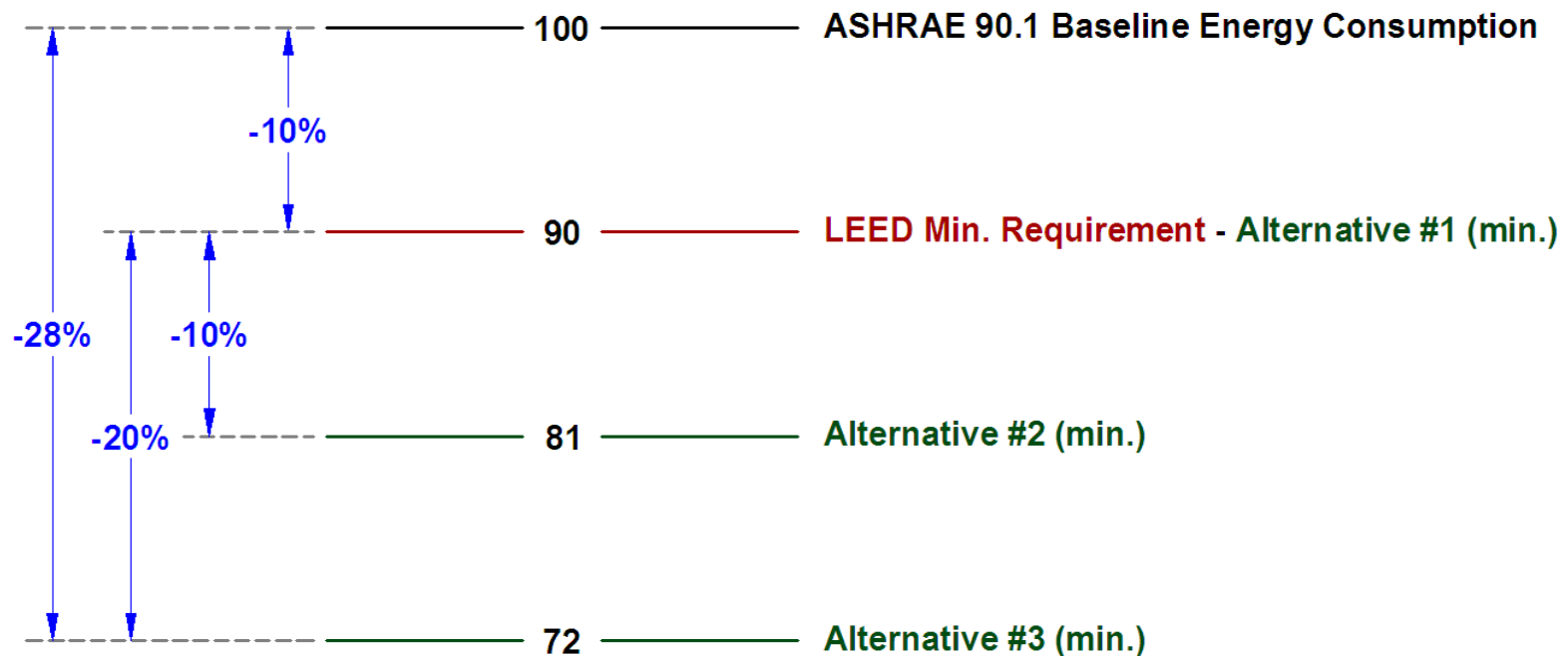






## ADMINISTRATIVE RULE 60D-4

- Example (new construction): Verifying energy performance when the LEED rating system is used.



**Next Step: Verify the financial performance of each alternative.**



## IMPLEMENTATION OF RULE 60D-4

- The Florida Life-Cycle Cost Analysis Program
  - A program developed by DMS to automatically calculate the 25-year total life-cycle cost for each alternative design.
  - The total cost to own, operate, maintain, and replace each candidate alternative over a 25-year period is developed.
  - Residual value is also considered in the analysis.
  - Incorporates DOE future energy price projections.
  - Incorporates net present value (NPV) methodology.
  - Addresses economic uncertainty (i.e., sensitivity analysis).
  - Developed to ascertain the cost-effectiveness of design options.





# IMPLEMENTATION OF RULE 60D-4

Only six distinct costs were required in this example to attain the total life-cycle cost.

**FLCCA COMPUTATION SHEET**  
SPECIFY ALTERNATIVE DESIGN NUMBER HERE:  
SPECIFY ANALYSIS PERIOD HERE (YEARS):

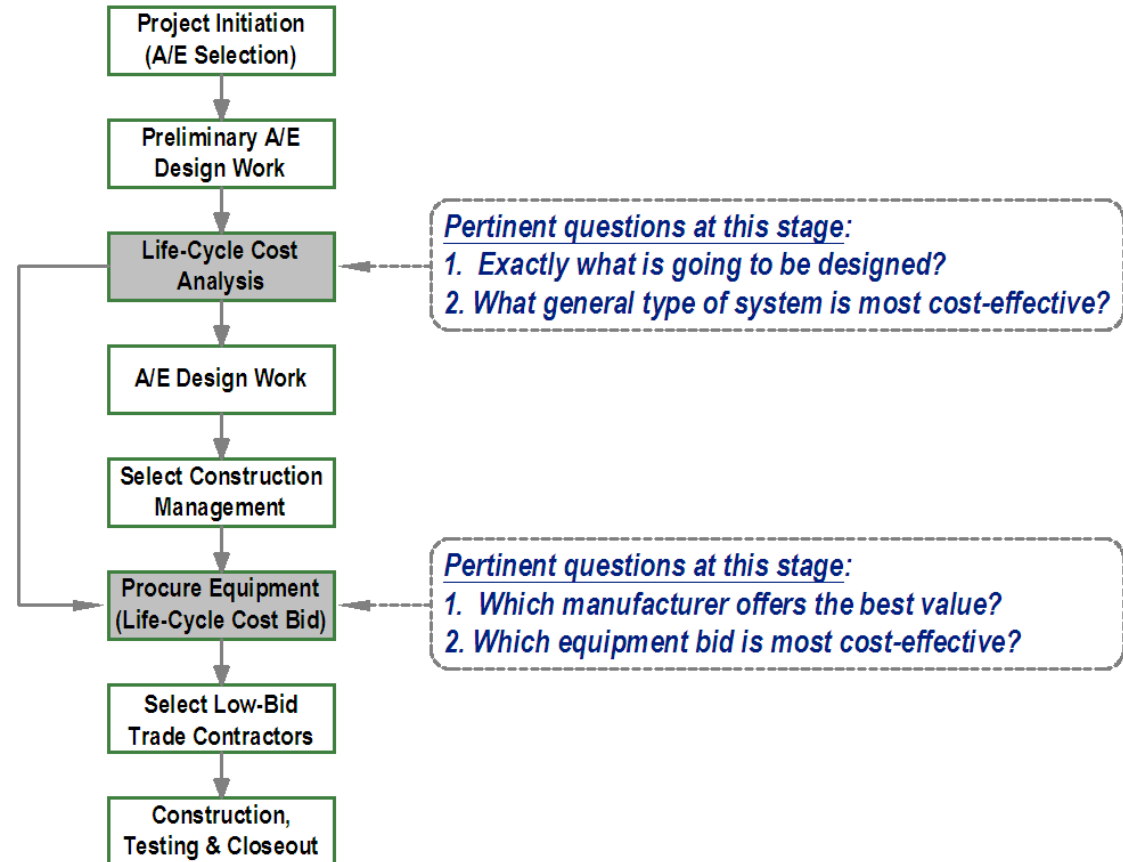
NOTE: DATA CAN ONLY BE ENTERED IN THE GREEN CELLS (POSITIVE WHOLE NUMBERS ONLY). THE DOE ESCALATION RATES USED IN THIS SPREADSHEET FOR "OTHER FUELS" ARE:

ACTUAL YEAR (MODIFY AS NEEDED)	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
RELATIVE YEAR	1	2	3	4	5	6	7	8	9	10	11	12	13
<b>LIFE-CYCLE OWNERSHIP COST:</b>													
NON-FINANCED OWNERSHIP COST													
TOTAL CONSTRUCTION COST	\$109,000												
FINANCED OWNERSHIP COSTS (AS APPLICABLE)													
ANNUALIZED CONSTRUCTION COSTS	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
ANNUALIZED INVESTMENT GRADE AUDIT COSTS	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
ANNUALIZED MEASUREMENT & VERIFICATION COSTS	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
ANNUALIZED FINANCING COSTS	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
MISCELLANEOUS ANNUALIZED COSTS (EFFECTIVE)	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
<b>COMBINED OWNERSHIP COSTS</b>													
TOTAL ANNUAL OWNERSHIP COSTS	\$109,000	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
DOE REAL DISCOUNT RATE (2008)	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%
ANNUAL PRESENT VALUE OWNERSHIP COSTS	\$109,000	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
<b>TOTAL PRESENT VALUE LIFE-CYCLE OWNERSHIP COSTS</b>	\$109,000												
<b>LIFE-CYCLE OPERATING COST:</b>													
ELECTRICAL COSTS													
ANNUAL ELECTRICAL COST (INITIAL YEAR)	\$18,341												
DOE ELECTRIC PRICE FORECAST	0.95	0.96	0.97	0.99	1.00	1.02	1.02	1.03	1.05	1.07	1.08	1.09	1.10
ANNUAL ENERGY COST (ALL YEARS)	\$18,341	\$18,341	\$18,341	\$18,341	\$18,341	\$18,341	\$18,341	\$18,341	\$18,341	\$18,341	\$18,341	\$18,341	\$18,341
NATURAL GAS COSTS													
ANNUAL NATURAL GAS COST (INITIAL YEAR)	\$1.00	0.99	1.04	1.06	1.08	1.07	1.08	1.10	1.12	1.14	1.17	1.21	1.24
DOE NATURAL GAS PRICE FORECAST	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00
ANNUAL ENERGY COST (ALL YEARS)	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00
OTHER FUEL COSTS (EFFECTIVE FUEL HERE IF APPLICABLE)													
ANNUAL FUEL COSTS (INITIAL YEAR)	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00
DOE ENERGY PRICE FORECAST	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00
ANNUAL ENERGY COST (ALL YEARS)	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00
WATER COSTS													
ASSUMED REAL ESCALATION RATE (L + FLAT RATE)	1.00%	1.00%	1.00%	1.00%	1.00%	1.00%	1.00%	1.00%	1.00%	1.00%	1.00%	1.00%	1.00%
ANNUAL WATER COST	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00
<b>COMBINED OPERATING COSTS</b>													
TOTAL ANNUAL OPERATING COSTS	\$18,341	\$18,341	\$18,341	\$18,341	\$18,341	\$18,341	\$18,341	\$18,341	\$18,341	\$18,341	\$18,341	\$18,341	\$18,341
DOE REAL DISCOUNT RATE (2008)	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%
ANNUAL PRESENT VALUE OPERATING COSTS	\$18,341	\$18,341	\$18,341	\$18,341	\$18,341	\$18,341	\$18,341	\$18,341	\$18,341	\$18,341	\$18,341	\$18,341	\$18,341
<b>TOTAL PRESENT VALUE LIFE-CYCLE OPERATING COSTS</b>	\$18,341												
<b>LIFE-CYCLE MAINTENANCE COST:</b>													
TOTAL ANNUAL MAINTENANCE COSTS	\$14,400	\$14,400	\$14,400	\$14,400	\$14,400	\$14,400	\$14,400	\$14,400	\$14,400	\$14,400	\$14,400	\$14,400	\$14,400
DOE REAL DISCOUNT RATE (2008)	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%
ANNUAL PRESENT VALUE MAINTENANCE COSTS	\$14,400	\$14,400	\$14,400	\$14,400	\$14,400	\$14,400	\$14,400	\$14,400	\$14,400	\$14,400	\$14,400	\$14,400	\$14,400
<b>TOTAL PRESENT VALUE LIFE-CYCLE MAINTENANCE COSTS</b>	\$14,400												
<b>LIFE-CYCLE REPLACEMENT COST:</b>													
TOTAL REPLACEMENT COSTS (AS APPLICABLE)	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
DOE REAL DISCOUNT RATE (2008)	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%
PRESENT VALUE REPLACEMENT COSTS	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
<b>TOTAL PRESENT VALUE LIFE-CYCLE REPLACEMENT COSTS</b>	\$0												
<b>RESIDUAL VALUE (ENTER POSITIVE VALUES):</b>													
TOTAL RESIDUAL VALUE (AS APPLICABLE)	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
DOE REAL DISCOUNT RATE (2008)	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%
PRESENT VALUE RESIDUAL VALUE	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
<b>TOTAL PRESENT VALUE RESIDUAL (NEGATIVE COSTS)</b>	\$0												
<b>TOTAL LIFE-CYCLE COST:</b>	\$2,288,115												

# LIFE-CYCLE COST ANALYSIS WORKFLOW



*The results of the life-cycle cost study can be incorporated into a separate bid package for major energy-consuming equipment.*





# EXAMPLE: FDLE CHILLER REPLACEMENT

Cost Category	Option #1	Option #2	Option #3
Chiller Bid Price (both chillers)	\$451,004.00	\$321,475.45	\$395,338.00
Extended Warranty & Service	\$54,948.00	\$60,960.00	\$47,160.00
Total First Cost (bid price + warranty)*	\$505,952.00	\$382,435.00	\$442,498.00
Annual Operating Cost	\$111,809.41	\$147,401.37	\$106,100.40
Life-Cycle Operating Cost (present value)	\$1,946,601.86	\$2,566,257.84	\$1,847,207.94
Total 25-Year Life-Cycle Cost (present value)**	\$2,452,553.86	\$2,948,693.29	\$2,289,705.94

\*The Total First Cost = Chiller Bid Price + Extended Warranty & Service

\*\*The Total 25-Year Life-Cycle Cost = Total First Cost + Life-Cycle Operating Cost



**Analysis:** Choosing Option #3 instead of Option #2 cost \$60,000 more up front, but will save \$658,000 (present value) in life-cycle costs. Further analysis also indicates that even if Option #2 was offered (hypothetically) by its manufacturer at no cost, Option #3 would still demonstrate the lowest total life-cycle cost.

# EXAMPLE: FHP HEADQUARTERS - MIAMI



## SENSITIVITY ANALYSIS RESULTS

ALTERNATIVE DESIGN:	TOTAL LIFE-CYCLE COST					
	#1	#2	#3	#4	#5	#6
D=3%; E=1 (DOE CRITERIA)	\$1,350,567	\$1,124,593	\$1,337,549	\$1,191,007		
D=4.5%; E=1	\$1,186,457	\$1,002,109	\$1,191,267	\$1,057,272		
D=6%; E=1	\$1,057,180	\$905,688	\$1,076,111	\$951,778		
D=3%; E=1.5	\$1,420,778	\$1,170,493	\$1,395,469	\$1,235,966		
D=3%; E=2	\$1,441,464	\$1,184,016	\$1,412,533	\$1,249,212		
D=4.5%; E=1.5	\$1,246,524	\$1,041,377	\$1,240,819	\$1,095,736		
D=6%; E=2	\$1,122,162	\$948,169	\$1,129,717	\$993,389		

## ADDITIONAL INFORMATION

ALTERNATIVE DESIGN:	#1	#2	#3	#4
TOTAL INSTALLED COST	\$287,847	\$333,876	\$391,361	\$318,180
ANNUAL ENERGY CONSUMPTION (kBtu)	1,728,200	1,089,500	1,432,100	1,106,700



**Option #2 represents a 37% percent reduction in annual energy consumption and it will pay back the added cost within 3 years.**



# PUBLIC RESPONSE TO DMS EFFORTS



“The Florida Life Cycle Cost Analysis Program requires state agencies to make informed **value-based decisions regarding the true taxpayer cost** of owning and operating state-funded facilities. The SEMP establishes a comprehensive program that includes measuring and reporting real-time energy consumption of state buildings.”

*United States Green Building Council (USGBC)  
South Florida Chapter*



**USGBC South Florida**  
sustain • balance • conserve

“This tool affords the engineering community the opportunity to **design projects for the long-term** and it is something that the sustainability movement has diligently advocated for in Tallahassee.”

“We have the legislation, and it finally has teeth, **now go do the right thing!**”

*Joe Souza, Chair (2010-2011)*

*Technical, Energy, and Government Activities Committee*

*American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE)*

*Florida West Coast Chapter*





## FINAL THOUGHTS

- Recent DMS efforts are tools to help agencies recognize cost-effective energy-savings potential.
- Life-cycle system type selections are among the most important design decisions you will make for a building.
- Life-cycle equipment purchases can be the most effective purchasing decisions you will ever make.
- Learn more about sustainability and cost-effectiveness at the [DMS Website](#).
- Cost-Effective Solutions ARE Effective Solutions.





# ENERGY INITIATIVES & PROGRESS REPORT



Thank You