

Cost and Benefits of LEED-NC

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Background

- ◆ 2006 research project funded by GEO
- ◆ Interviewed 11 LEED-NC certified projects (roughly 2/3 of all state LEED-NC projects)
- ◆ Published white-paper and summary report



Governor's
Energy Office

<http://www.colorado.gov/rebuild/>

Projects At-A-Glance

2003

- ◆ CH2M HILL North Building
- ◆ City of Boulder - North Boulder Recreation Center

**5 CERTIFIED
5 SILVER
1 GOLD**

2004

- ◆ CH2M HILL South Building
- ◆ CH2M HILL West Building



v2.1

2005

- ◆ Aspen Skiing Company - Snowmass Golf Clubhouse
- ◆ City of Fort Collins - Utilities Vehicle Storage
- ◆ Colorado College - Tutt Science Center
- ◆ Colorado Department of Labor & Employment - Addition
- ◆ Pikes Peak Regional Development Center
- ◆ Poudre School District - Fossil Ridge High School
- ◆ University of Denver - Ricketson Law Building

Background

◆ Governors' Executive Orders & Legislation

- Energy Performance Contracting to Improve State Facilities, Executive Order D-014-03 (July 16, 2003)
- Greening of State Government, Executive Order D-005-05 (July 15, 2005)
- Greening of State Government – Goals and Implementation, Executive Order D0011 07
- Greening of State Government – Detailed Implementation, Executive Order D0012 07
- Greening of State Government Buildings, Senate Joint Resolution 06-032 (May 8, 2006)
- High Performance Buildings Bill, SB51





Overview and Objectives

Help Answer:

- ◆ Is LEED-NC cost effective?
- ◆ What's it cost to build a high-performance, green building?
- ◆ What is the cost-premium for a LEED-NC certified building?
- ◆ How much to budget for a LEED-NC building?



Overview and Objectives

Help Answer:

- ◆ Of the four LEED-NC certification levels, do certain levels cost more to obtain?
- ◆ What are the factors that make some LEED-NC projects cost less than others?
- ◆ Why do some projects cost so much more, and how could costs be better managed in the future?

Process

- ◆ Commission study and assemble advisory committee
- ◆ Interview project teams
- ◆ Collect cost data
- ◆ Disaggregate soft and hard costs
- ◆ Normalize costs
- ◆ Identify benefits



Cost Basis

- ◆ As if building was not constructed to LEED-NC criteria
 - Some teams consider Cx, modeling, and other LEED items as business as usual
- ◆ “*LEED costs too much!*” - Depends on the frame of reference





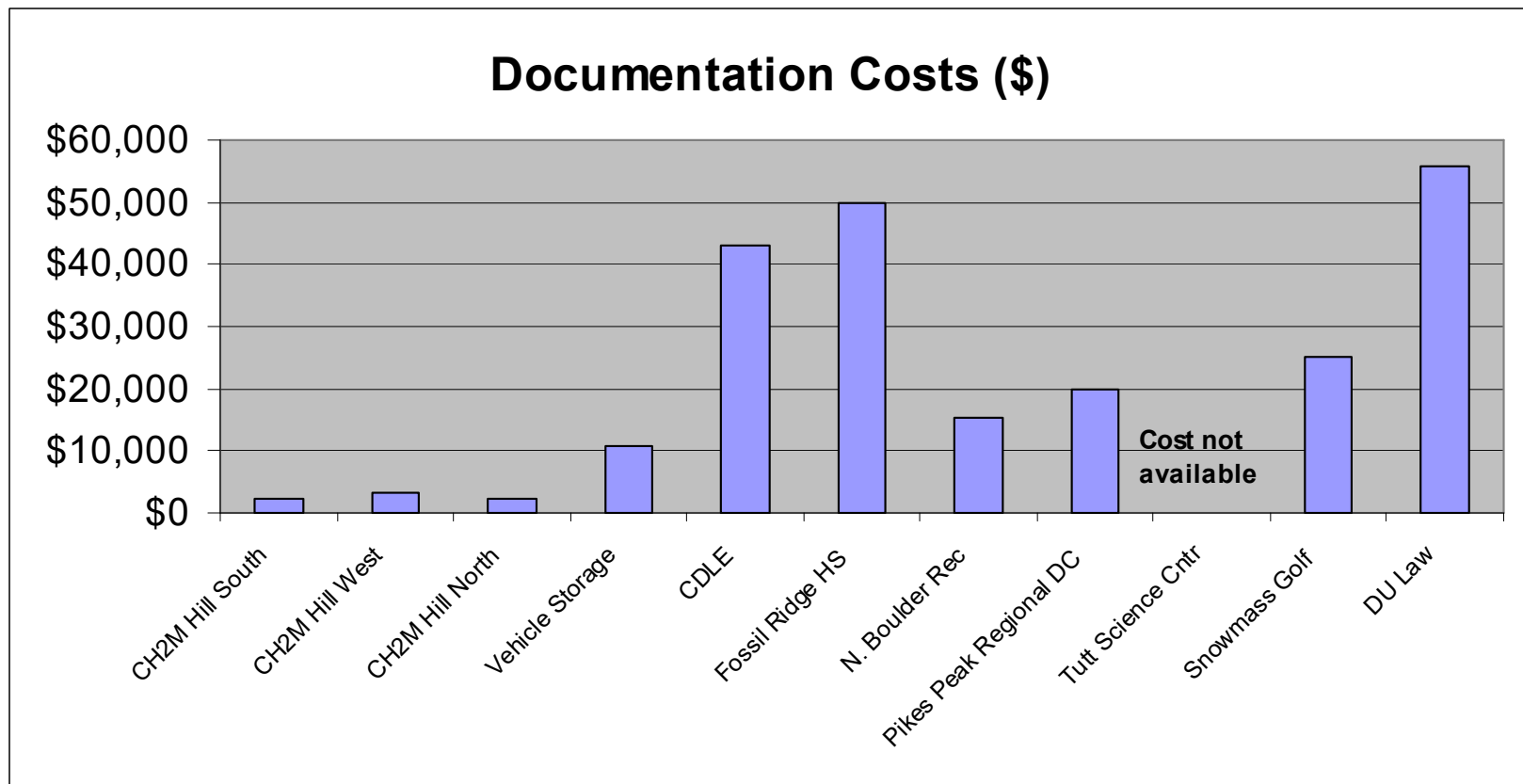
Soft Costs

- ◆ LEED Registration and Certification
- ◆ LEED Documentation
- ◆ Energy Analysis
- ◆ Commissioning

Soft Costs – Registration and Certification

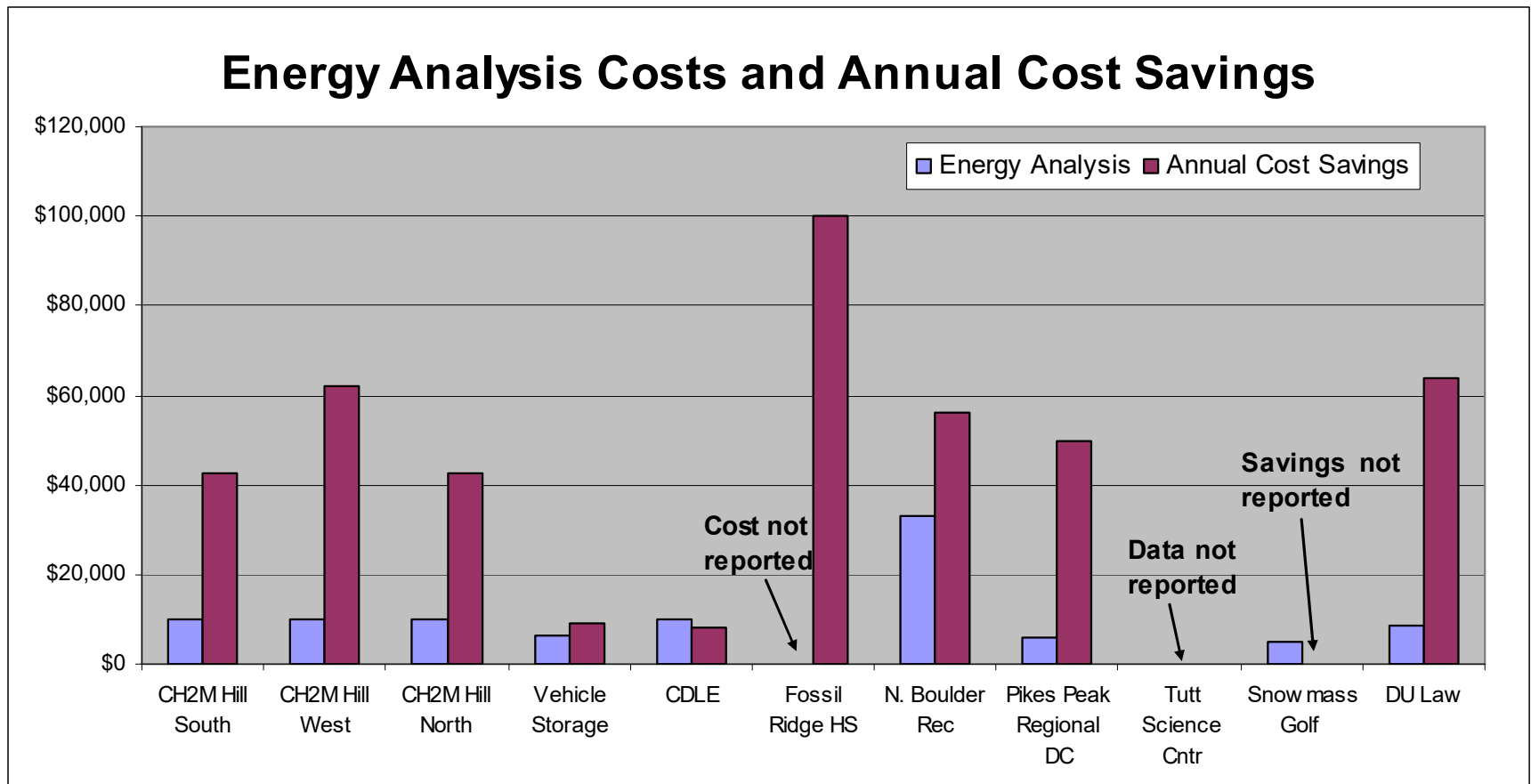
Fee	Less than 50,000 sf	50,000- 500,000 sf	Over 500,000 sf
# Projects	3	8	0
Registration	\$450	\$450	\$450
Certification			
Design Review	\$1250	\$0.025/sf	\$12,500
Construction Review	\$500	\$0.01/sf	\$5,000
TOTAL	\$2,200	\$2,200- \$17,950	\$17,950

Soft Costs – Documentation



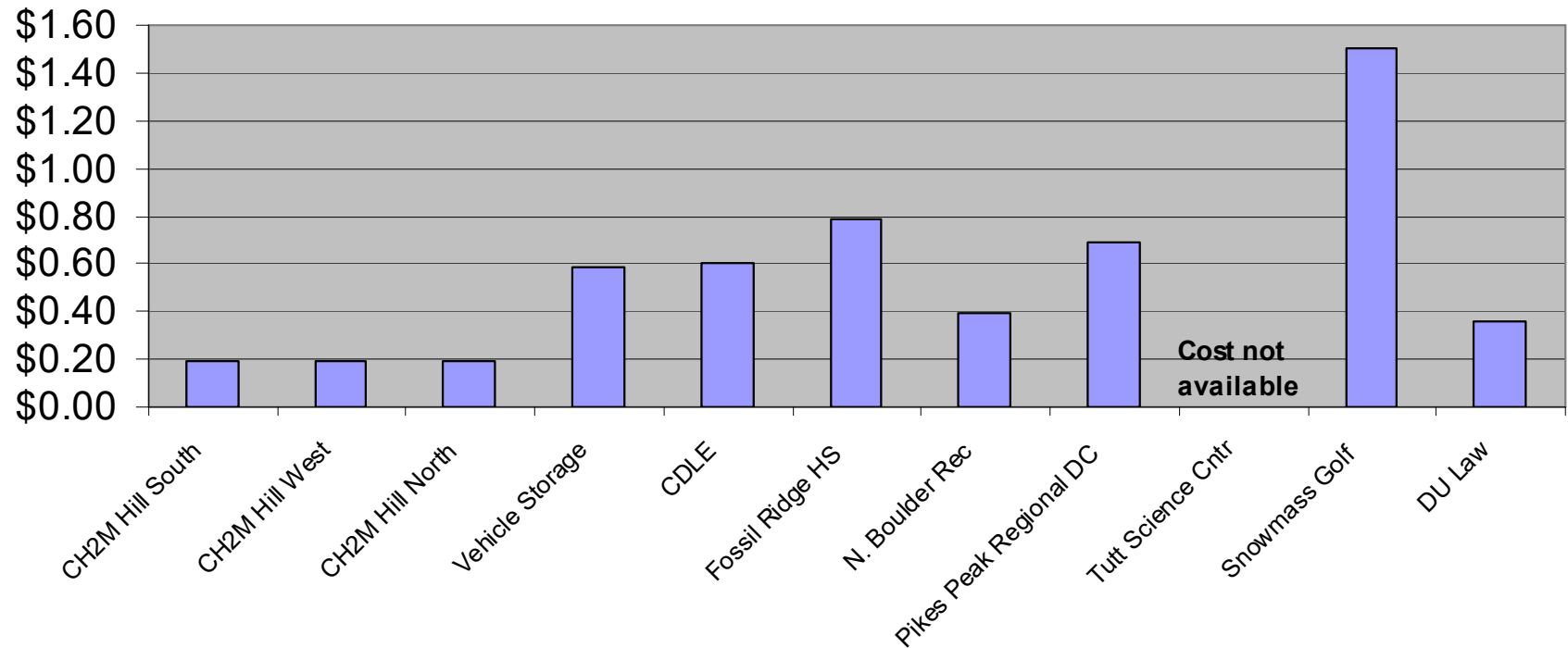
...Difficult to quantify

Soft Costs – Energy Analysis



Soft Costs – Commissioning Cost

Commissioning Costs (\$/sf)



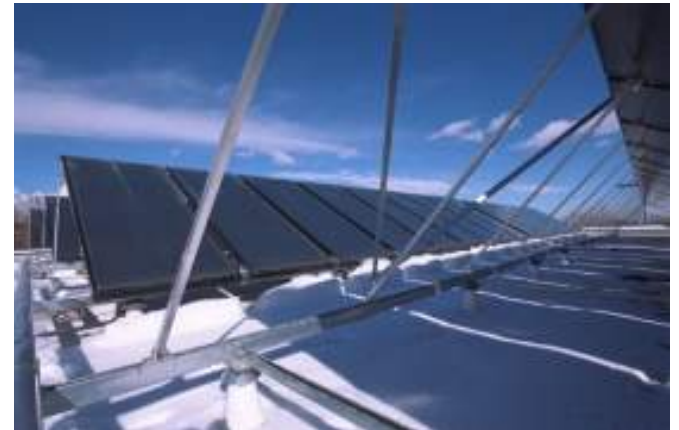
Hard Costs

- The information provided by the project teams related to hard costs and cost savings of specific LEED-related decisions is too limited to provide budgeting guidance per LEED credit/point or overall.



Site, Water and Energy & Atmosphere

- Majority earned site selection, public transportation access, bike racks, reduced site disturbance credits
- 79% earned water efficient landscaping credit
- 64% earned 20% water use reduction
- All projects achieved 20% energy cost savings or more
- Green power was purchased on 57% of projects
- No projects earned on-site renewable energy credit





Commissioning

- All but two projects were strong advocates of Cx; All projects are going to commission again
- Three projects pursue Cx as business as usual due to the perceived return on investment
- Two projects saw Cx costs recovered in the design phase through identification of cost savings opportunities
- All but one project incorporated enhanced Cx
- Commissioning contributed to the success of all projects

Materials and Resources



- 86% earned Construction Waste Management 50% diversion level point
- 3/4 earned both Recycled Content points
- All earned both points for local materials
- None earned rapidly renewable materials or certified wood points

Indoor Environmental Quality

- Construction IAQ – $\frac{3}{4}$ earned both points
- All earned low-emitting adhesives/sealants and carpet points
- $\frac{3}{4}$ earned paint point
- $\frac{3}{4}$ earned indoor pollutant control
- $\frac{3}{4}$ earned thermal comfort point
- Over $\frac{1}{2}$ earned 90% daylight/views
- None earned controllability of systems



Summary of Findings

- Cost premium of 1% to 6%
- Two projects complete within schedule and budget.
- Soft costs averaged \$1 per square foot (0.8% of construction costs) – Cx represents 60%
- NPV of energy savings offset LEED costs in 7 of 9 projects reporting energy data.





Summary of Findings



- Energy savings was most easily quantifiable benefit
- Cost savings not available:
 - commissioning
 - water reduction
 - waste management tipping fee reductions
 - downsizing systems and equipment
 - reduced maintenance and repair costs, and
 - improved productivity

Summary of Findings

LEED-NC v2.1 Project	LEED Cost Premium [\$/SF]	NPV Energy Cost Savings [\$/SF]	Net LEED Savings [\$/SF]
Aspen Skiing Co. Snowmass Golf Clubhouse	\$20.00	no data	
CH2M Hill North Building	\$1.90	\$4.30	\$2.40
CH2M Hill South Building	\$1.90	\$4.30	\$2.40
CH2M Hill West Building	\$1.90	\$4.30	\$2.40
City of Boulder N. Boulder Rec. Center	\$8.70	\$10.40	\$1.70
City of Fort Collins Vehicle Storage	\$8.20	\$6.70	(\$1.50)
Colorado College Tutt Science Center	\$9.20	no data	
Colorado Dept of Labor & Employment Addition	\$3.30	\$2.30	(\$1.00)
Pikes Peak Regional Development Center	\$0.90	\$5.10	\$4.20
Poudre School District Fossil Ridge HS	\$1.00	\$4.00	\$3.00
University of Denver Law Building	\$0.70	\$3.50	\$2.80

NPV assumes 6% discount rate over 20 years

Summary of Findings

LEED-NC v2.1 Project	Constr- uction Cost [\$/SF]	LEED Soft Costs [\$/SF]	LEED Hard Costs [\$/SF]	LEED Total Cost Premium [\$/SF]	LEED Cost Premium [%]
Aspen Skiing Co. Snowmass Golf Clubhouse	\$370	\$4.50	\$15.50	\$20.00	5.4%
CH2M Hill North Building	\$156	\$0.30	\$1.60	\$1.90	1.2%
CH2M Hill South Building	\$156	\$0.30	\$1.60	\$1.90	1.2%
CH2M Hill West Building	\$156	\$0.30	\$1.60	\$1.90	1.2%
City of Boulder N. Boulder Rec. Center	\$188	\$1.20	\$7.40	\$8.70	4.6%
City of Fort Collins Vehicle Storage	\$129	\$1.80	\$6.40	\$8.20	6.4%
Colorado College Tutt Science Center	\$200	\$5.50	\$3.70	\$9.20	4.6%
Colorado Dept of Labor & Employment Addition	\$100	\$1.90	\$1.30	\$3.30	3.3%
Pikes Peak Regional Development Center	\$112	\$0.90	Note 1	\$0.90	0.8%
Poudre School District Fossil Ridge HS	\$122	\$1.00	Note 2	\$1.00	0.8%
University of Denver Law Building	\$230	\$0.70	Note 1	\$0.70	0.3%

Note 1: Did not track LEED hard costs

Note 2: No LEED Hard Cost since LEED does not alter design practice

All cost premiums relative to construction cost; City of Boulder & Aspen Skiing premiums relative to project cost

Summary of Conclusions

- ◆ Life-cycle cost analysis (LCCA) is a valuable tool
- ◆ A few projects noted improved indoor air quality through low-VOC materials
- ◆ Most projects enhanced daylight levels and views
- ◆ All projects noted greater occupant satisfaction and the public relations value of LEED.
- ◆ Most of the project teams would/are pursuing LEED on future projects.



Summary of Conclusions

- ◆ Is LEED-NC cost effective? *Yes*
- ◆ What is the cost-premium for a LEED-NC certified building? *1% to 6% more*
- ◆ How much to budget for LEED soft costs?
\$1 per square foot, more for more complex systems
- ◆ Do certain LEED levels cost more than others to obtain? *Not enough data to draw conclusion*



Summary of Conclusions

- Two of the projects noted that they were able to achieve LEED certification and complete on schedule and under the original budget.





Guidelines for Success – Managing Cost



- ◆ Appoint a owner champion, establish internal team
- ◆ Set clear energy, water and environmental targets
- ◆ Include high-performance design criteria in RFQs, RFPs, contracts and specifications
- ◆ Select a team experienced in application of high performance design and LEED
- ◆ Establish contracts that encourage team collaboration
- ◆ Use integrated design

Guidelines for Success (cont)

- ◆ Stick to your performance goals
- ◆ Base design and construction decision-making on LCCA
- ◆ Evaluate costs and conduct value engineering only from a whole building perspective
- ◆ Ensure proper equipment sizing
- ◆ Identify funding sources
- ◆ Seek out similar exemplary projects



Areas for Future Research

- ◆ Confirming predicted energy savings – measure effectiveness of Cx
- ◆ Examine benefits beyond energy – Cx O&M, water, productivity
- ◆ Quantify effect of LEED-NC v2.2 regarding changes to Cx EA p1



Thank you!

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