Sandia National Laboratories MESA Project – Progress in following the Labs 21 Approach

Laboratories for the 21st Century Conference
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Sandia is a multiprogram laboratory operated by Sandia Corporation, a Lockheed Martin Company, for the United States Department of Energy under contract DE-AC04-94AL85000.

Scope of Presentation

- Share the Process
  - Steps taken to include advanced resource efficiency in project
- LEED documentation
- Latest status
- Barriers, compromises, successes
- Lessons learned
- Advice

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- NM & CA Sites, about 6M GSF
- Multiprogram - primarily national defense and energy systems
  - > 1 M GSF of various laboratories
- Energy Use index, both sites, FY01
  - 546,650 BTU/SF/yr for "process" category
  - 197,750 BTU/SF/yr for all others
- Electric use intensity - NM site
  - 113 kWh/SF/yr for process
  - 28 kWh/SF/yr for all others (also includes labs)

LABS FOR THE 21ST CENTURY

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MESA Project

- Microsystems and Engineering Sciences Appli
complex
- ~380,000 SF:
3 buildings
(new 16,000 ft^2
cleanroom) &
2 CUBs
- Labs 21 Pilot P

Labs 21 Pilot Partner

Labs 21 Approach

LABS FOR THE 21ST CENTURY

- Adopt voluntary goals
- Whole building design
- LCC Analysis as a decision-making tool
- Full building commissioning
- Measure energy & water consumption for continuous improvement
- Use the Labs 21 checklist

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Do your Homework

- Energy and Water auditing
- Benchmarked energy use
- Establish a baseline
- Identify key opportunities first
- Work with the users to socialize concepts and technologies
- Potential for reduction

Conceptual Design Phase

- "Socializing" 30% reduction potential
- Technical Assistance request to FEMP
- LBNL extensive review and comment
- Language to establish commitments
- Clearly state Water Conservation objectives in NEPA/EA
- Ensured budget for commissioning

Process Water Efficiency

- Identify potential supplemental funding sources
- Identify where desired systems (HERO; recycle/reclaim) have been installed at similar facilities
- Broadcast the potential: 220 Mgal/yr w/o conservation; 80-100 Mgal/yr with conservation
- Preliminary design

Energy Programming Workshop

- Difficult to schedule
- June 2000, at outset of design criteria development
- Full day of education and brainstorming
- Labs 21 Support Team; project stakeholders
- Results, with summary letter to the Project Manager

Final Design Criteria

- Key Statements on page 1
  - Significant reduction in water and energy use
- Energy Performance Metrics
- Energy Metering Plan
- Full building commissioning
- Reduced Environmental Impact (aka Sustainable Design)

Sustainable Design Criteria

- Improved upon SD criteria from two previous projects
- Sustainable Design report
  - Organized according to LEED rating criteria
  - Decision-making tool
- SD charrette

Selecting the A/E

- Provided language for CBD announcement
- Resource efficient design was made a criterion for bidding A/E firms
- Invited awarded firm to the Rocky Mountain Labs 21 workshop
- Presentations during programming, to set the stage for charrette

Sustainable Design Charrette

- Approximately 40 people, 2 breakout groups (including Labs 21 support team)
- Design Intent document compiled and provided to the A/E
  - Agreed to performance metrics
  - Chillers & pumps, boilers, air handlers, lighting
- "Roadmap" for Sustainable Design

Schematic Design

- Persistence paid off – some funding for energy efficiency consultant OK'd
- LCC analysis of alternatives, but items in the Design Criteria already being dismissed
- Design progress meeting – confirmed that project would follow LEED rating criteria
- First SD Report submitted

Sustainable Design – documentation

- **Stefan Kesler, Carter & Burgess**
  - **Architect and accredited LEED designer**

Latest Status

- Nearing design completion, after 18 months design
- With all the preparation, have still logged over 200 comments
- MicroFab project is registered with USGBC

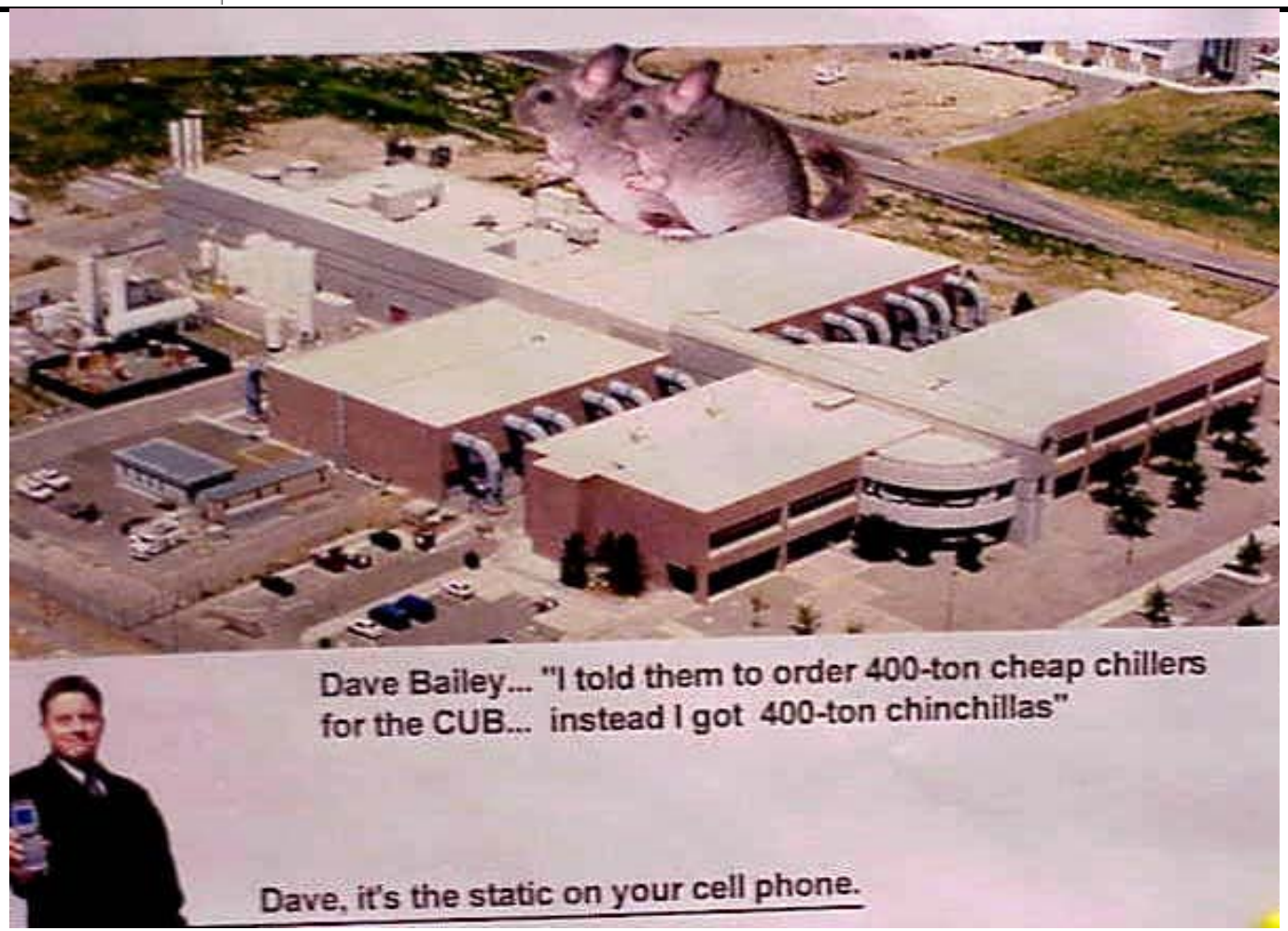
Lessons Learned

- Design Criteria – must ensure it is followed
- Schedule has been a major driver
- Need a Green champion on the project management team
- Negotiate design fees that recognize the huge effort involved

Successes

- Energy efficiency consultant
- HERO (High Efficiency Reverse Osmosis) system
- Good potential for LEED rating
- Chilled water system efficiency
  - Dual temperature loop, 15 ° T
  - VSD chillers
  - Plate-frame HX operation

Static or Real?



Chilled Water Plant, kW/ton

	LT & MT chillers (min pump eff)	LT & MT chillers (VSD), (min pump eff.)	LT & MT chillers, (higher pump eff.)	LT & MT (VSD) chillers, (higher pump eff.)
Chiller, tons	1600	1600	1600	1600
Chiller, kW/Ton (NPLV)	0.3955	0.3535	0.3955	0.3535
ChW pump kW	62.1	62.1	56.6	56.6
ChW Pp kW/ton	0.0388	0.039	0.0354	0.0354
Tower pump kW	108.6	108.6	71.6	71.6
Twr Pp kW/ton	0.0679	0.0679	0.0447	0.0447
Tower fan kW*	29.8	29.8	29.8	29.8
Twr fan kW/ton	0.0187	0.0187	0.0187	0.0187
Aux kW/ton	0.1254	0.1254	0.0988	0.0988
Plant kW/ton	0.521	0.479	0.494	0.452

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Barriers, Compromises

- Reluctance to hire an energy efficiency consultant
- Deviation from design criteria
- Unwillingness to try new strategies
- Lack of good data, technical knowledge
- Abandoned the CFM/kW metrics
- Compromise on the MT Chiller

Conclusions

- It's been worth it
- Start early and stay involved
- Do your homework
- Follow the Labs 21 approach and use the tools that are being developed
- Aggressive goals can be met
- Report your successes and build on those

Sustainable Design Status

- Progress Reporting to SNL
  - Scoring and Sustainable Design Summary
  - Materials
  - Daylighting
  - LEED Point Talley

LEED Scoring and Sustainable Design Summary

Example:

F A B	L A B	W I F	Water Credit 3: Water Use Reduction

INTENT: Maximize Water Efficiency

Y	Y	Y	Water Credit 3.1

REQUIREMENT: Use 20% less than EPAct '92

RESULTS: 33% less due to …

Materials

- **Life Cycle Assessment (LCA)**

Oriented Strand Board

Local Gypsum

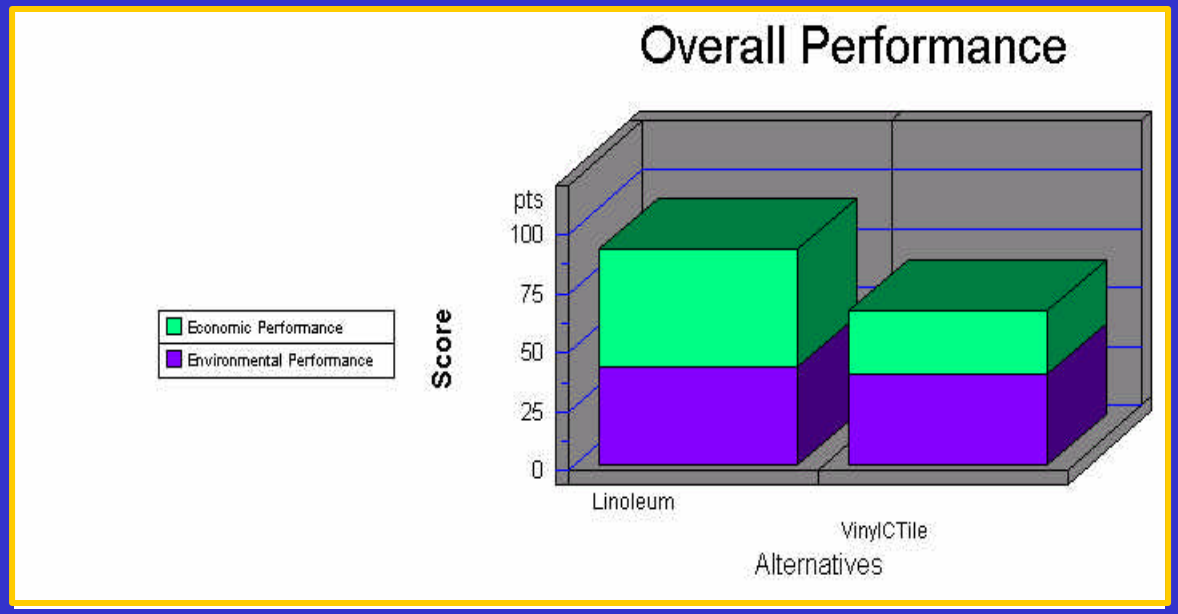
Cellulose Insulation

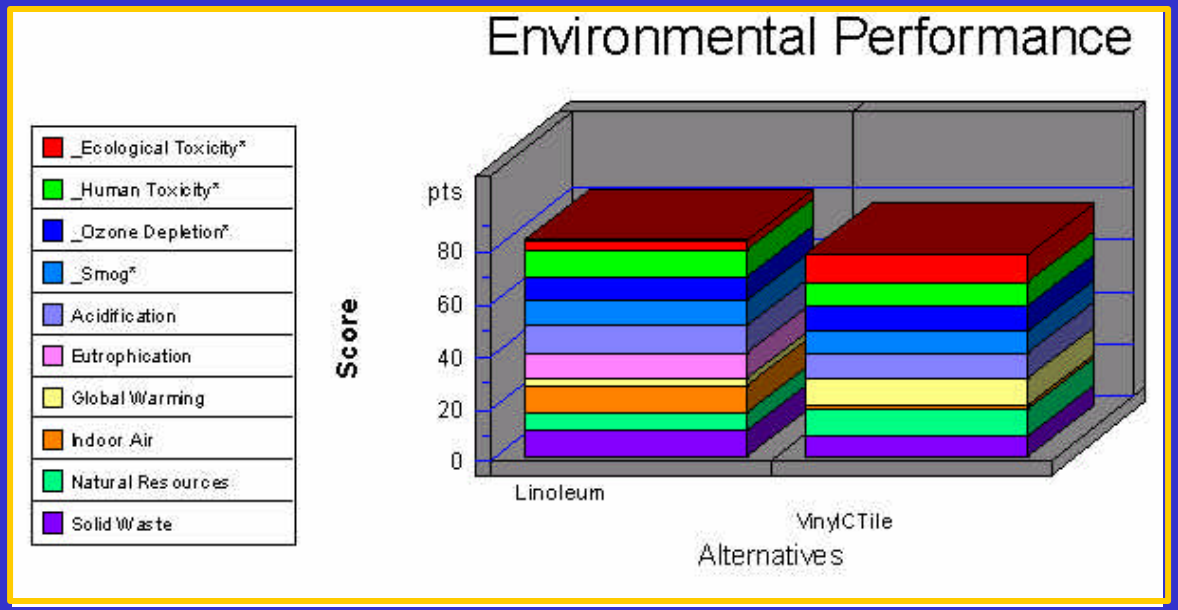
Vinyl Composition Tile

Aluminum Wall Panels

Materials

- LCA
  - BEES 2.0





Materials

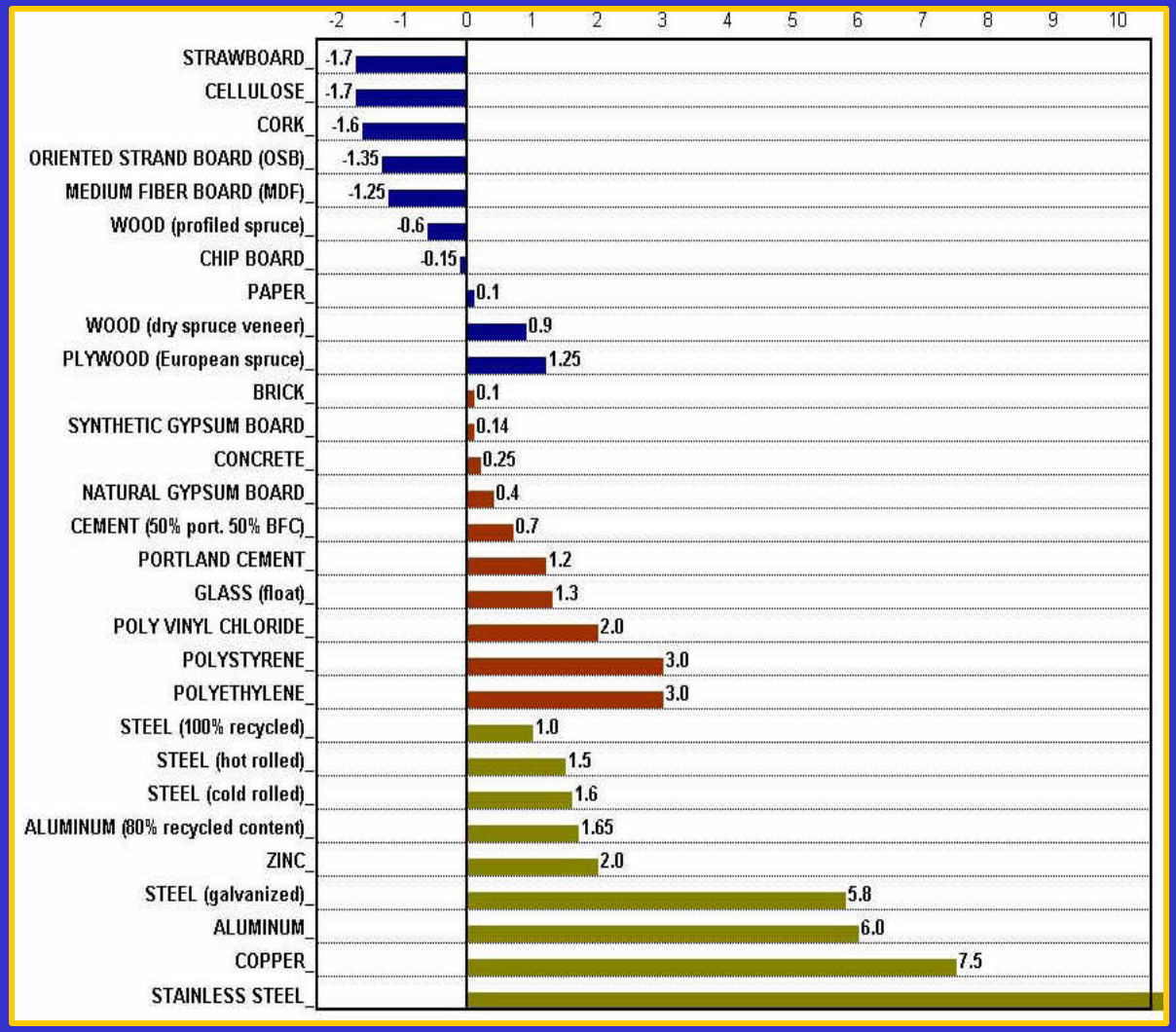
- LCA
  - Embodied Energy

Material	kWh/lb
Aluminum, virgin	53.05
extruded	55.83
Aluminum, Recycled	2.25
extruded	4.80
Steel, recycled	2.80
reinforcing, sections	2.47
Steel, virgin, general	8.88
Insulation	
cellulose	0.91
fiberglass	8.41
polystyrene	32.50

Transport	kWh/mile
Truck	0.3614
Freighter	0.0895

Materials

- LCA
  - Embodied CO_2

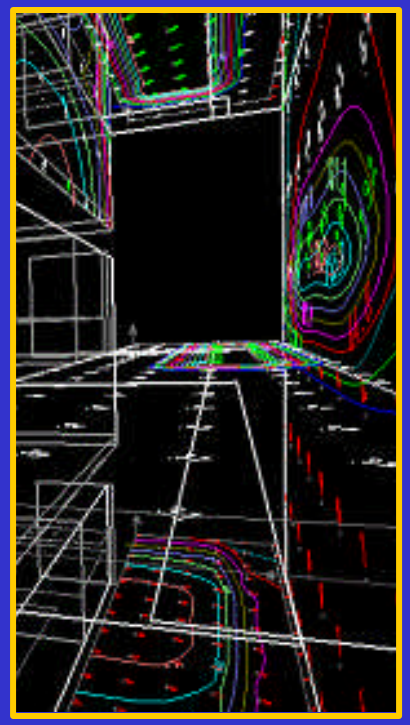


CO_2 Intensity Factor = Emitted Upstream/ Stored in Product

Daylighting

- Indoor Environmental Quality

Schematic Design



Analysis

Design Development

LEED Point Talley

FAB	LAB	WIF	LEED CATAGORY	POINTS POSSIBLE
8	8	9	SUSTAINABLE SITES	14
3	3	3	WATER EFFICIENCY	5
5	5	5	ENERGY AND ATMOSPHERE	17
7	7	7	MATERIALS AND RESOURCES	13
12	11	11	INDOOR ENVIRONMENTAL QUALITY	14
2	1	1	DESIGN PROCESS & INNOVATION	5
37	35	36	TOTAL SCORE	67

LEED Certified = 26 - 32 Points
LEED Certified Silver Level = 33 - 38 Points
LEED Certified Gold Level = 39 - 51 Points
LEED Certified Platinum Level = 52+ Point