Better Buildings
U.S. DEPARTMENT OF ENERGY

Getting the Savings You Want: Strategies for Ensuring Real Energy Savings in New Construction and Existing Building Retrofits

May 28, 2015

U.S. DEPARTMENT OF ENERGY

Today's Presenters

- **Corey Zarecki**, Director of Envision® Engineering and Operations, Gundersen Health System
- **Paul Torcellini**, Principal Engineer – Commercial Buildings Research Group, National Renewable Energy Laboratory (NREL)
- **Christopher Lohmann**, Vice President of Alternative Energy Solutions, Energi

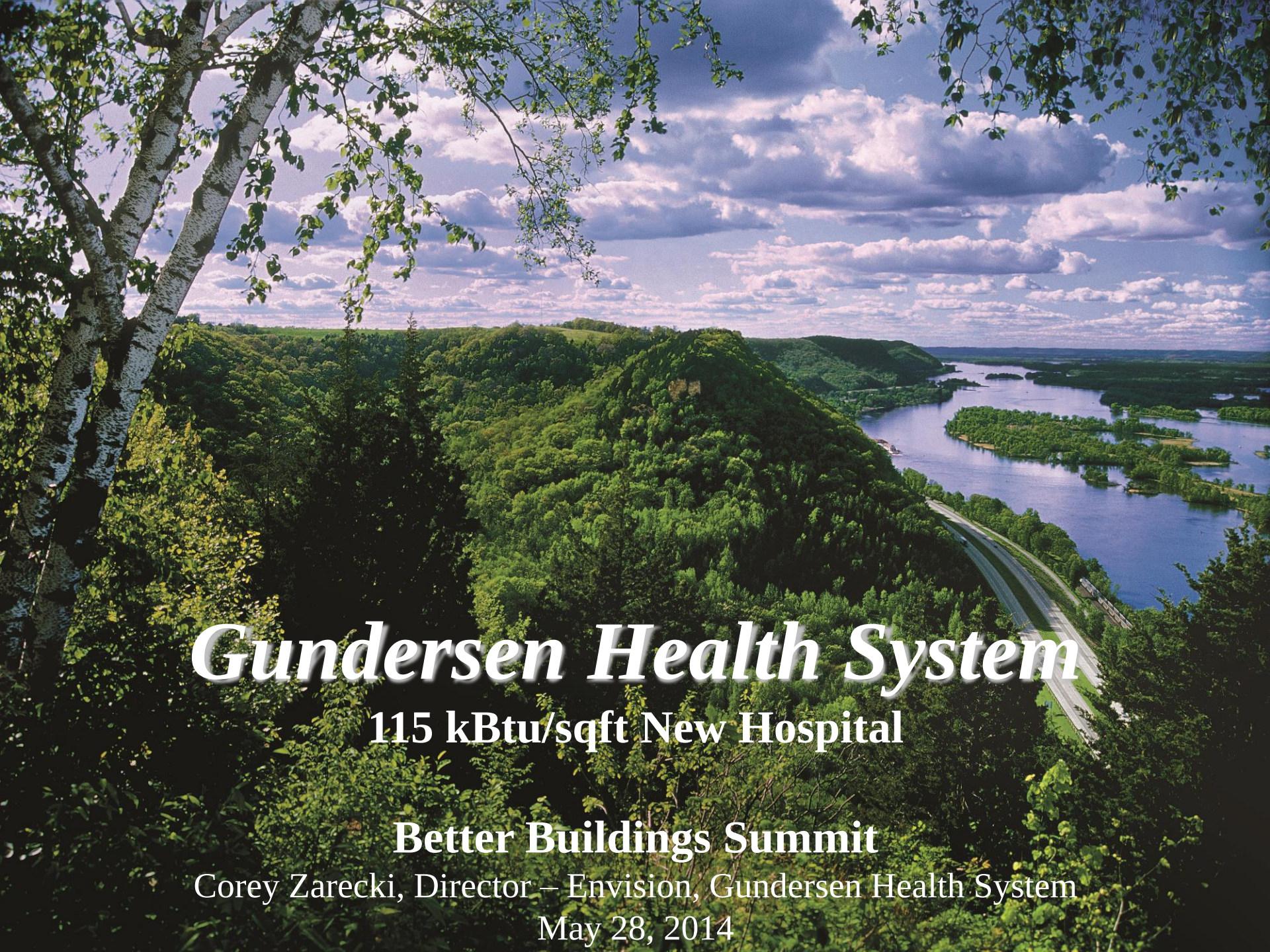
Overview and Agenda

- Welcome and Overview
- Setting Energy Design Goals, Gundersen Health System
- Performance-based Design Build Procurement, NREL
- Ensuring Energy Performance, Energi
- Q&A/ Discussion

Setting Energy Design Goals

Corey Zarecki, Gundersen Health Systems

U.S. DEPARTMENT OF ENERGY



Gundersen Health System

115 kBtu/sqft New Hospital

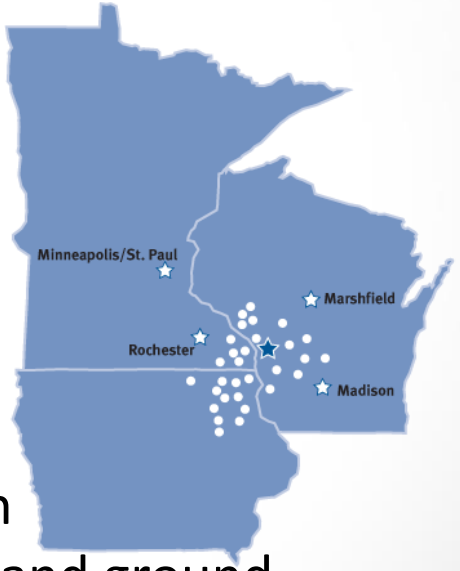
Better Buildings Summit

Corey Zarecki, Director – Envision, Gundersen Health System

May 28, 2014

About us…

- Mission: We distinguish ourselves through excellence in patient care, education, research, and improved health in the communities we serve
- GL Health System
  - Physician-led Integrated delivery system
    - ~750 providers and ~7,000 employees
  - 325 bed tertiary care hospital
  - 51 clinic locations
  - Western Campus of the University of Wisconsin School
  - Residency and medical education programs
  - Multiple Top 100 Hospital & Service Line recognition
  - A variety of affiliate organizations including EMS air and ground ambulance service, rural hospitals, nursing homes, hospice, etc.
  - Health Plan

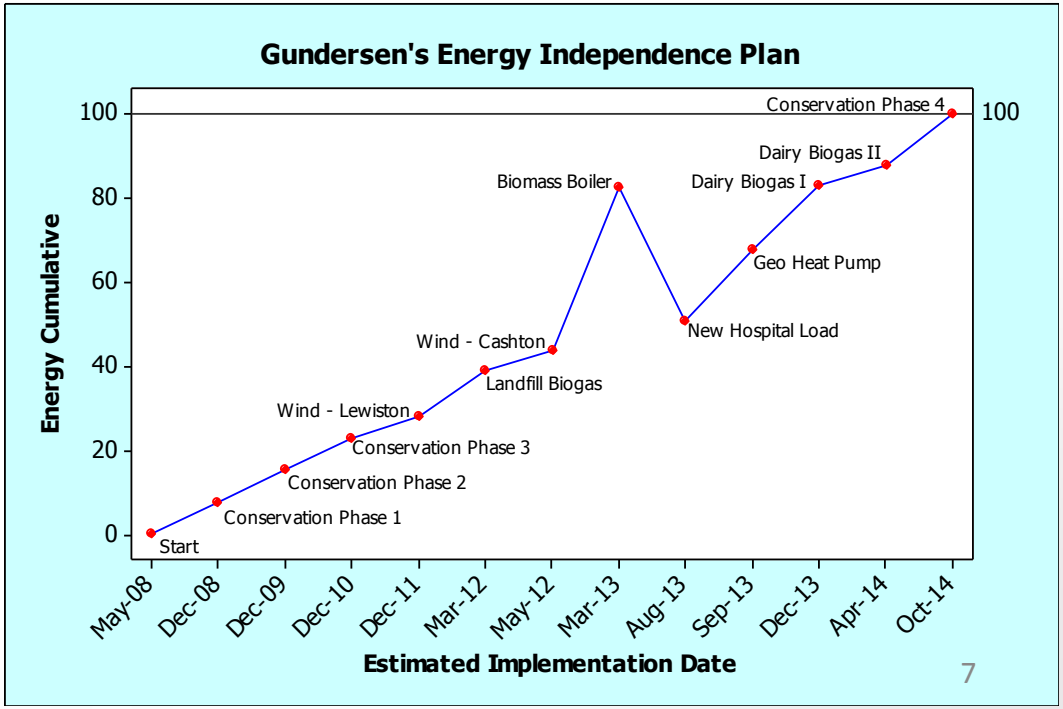


Envision®
GUNDERSEN
HEALTH SYSTEM

Primary Objective
Energy Independence in 2014

Produce more power than Gundersen consumes from fossil fuel source

- Makes our healthcare delivery more affordable to patients
- Benefits human health
- Strengthens our regional economy
- Improves our environment



About me…

- Corey Zarecki
  - 15 years in industry
    - 8 years in HVAC (Trane) and 7 years in the chemical industry
      - Various roles in engineering, process improvement, customer satisfaction, and leadership
  - Last 7 years at Gundersen Health System
    - Healthcare process improvement opportunities
      - Reduce cost/waste
      - Improve efficiency and quality
    - Energy

Envision® GUNDERSEN HEALTH SYSTEM

Why Health Care Providers Should Care About Clean Energy

Envision® GUNDERSEN HEALTH SYSTEM

- Pollutants from the burning of fossil fuels cause:
  - Birth defects[1]
  - Negative effects on the kidneys, lungs, and nervous system[1]
  - Cardiovascular deaths and stroke[2]
  - Increased carcinogens contributing to cancer risk

- According to the Department of Energy, hospitals are 2.5 times more energy intensive than other commercial buildings[3]
  - This is inconsistent with our mission… we are responsible for contributing to disease through our wasteful consumption.
  - US Hospitals spend $8 billion dollars on energy each year
- 2-sided green is possible: Environmental and Financial

[1]Source: American Lung Association , Emissions of Hazardous Air Pollutants From Coal - Fired Power Plants: EH&E Report 17505, March 7, 2011
[2]Source: American Heart Association Scientific Statement: DALLAS, May 10, 2010
[3]Source: http://www.energy.gov/news2009/7363.htm

The Cost of Energy

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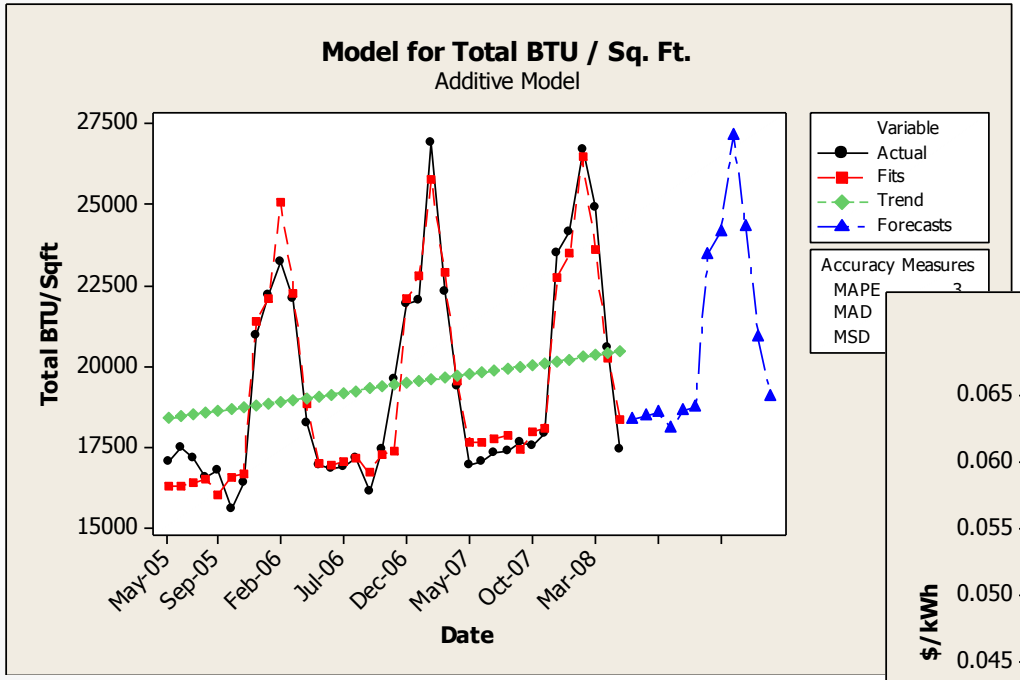
Energy Use Increasing ~4%

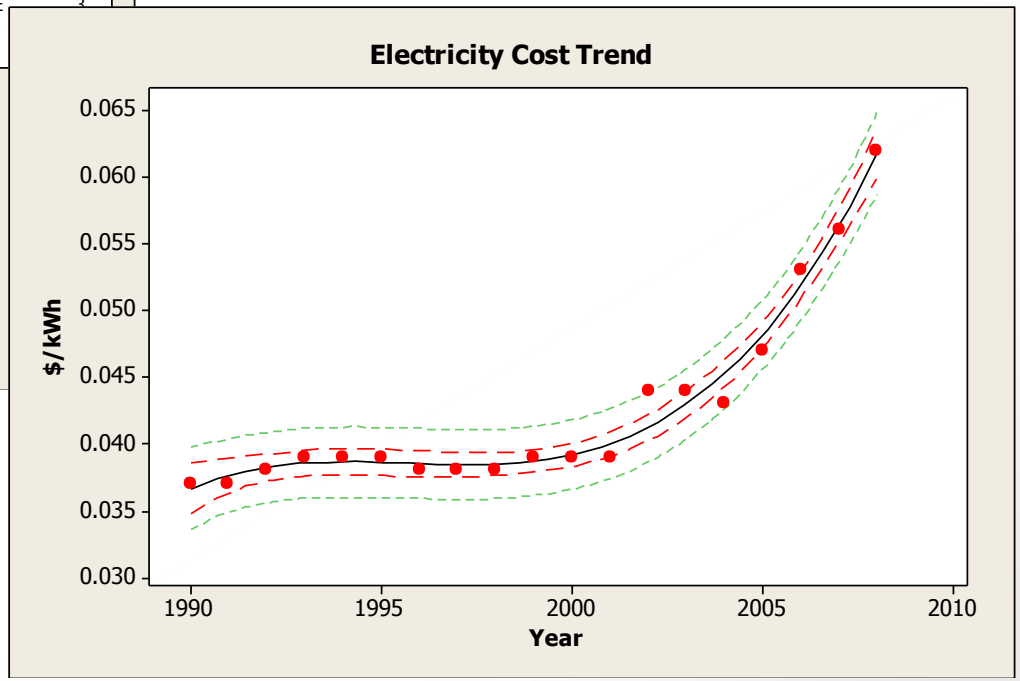


Energy Bill in 2008

$5,300,000

Price Increasing

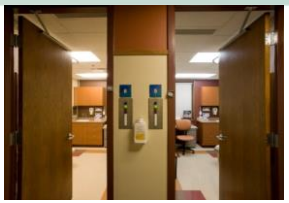
>$350,000



The need for affordable healthcare compels us to address this trend

Envision®

Gundersen's Vision for Energy & Environmental Stewardship



- **Energy Management**
  - Energy Efficiency
  - Renewable Energy
- **Waste Management**
- **Recycling**
- **Sustainable Design**



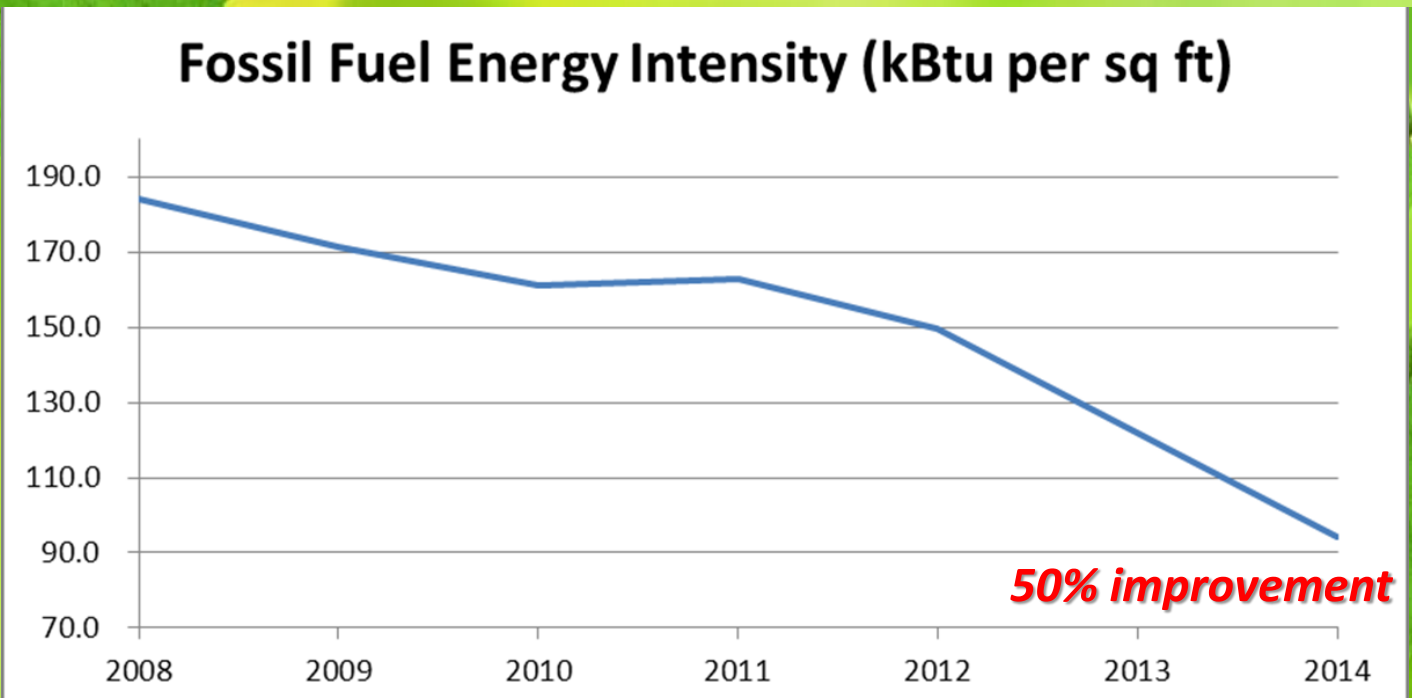





GUNDERSEN REACHES FIRST DAYS OF ENERGY INDEPENDENCE

OCTOBER 2014

LEARN MORE ▸



$2M annual savings from energy efficiency improvements

New Hospital Description

New Construction: 433,000 sf

Renovation: 70,000 sf

182 New Inpatient Rooms

Departments

- TEC , Imaging
- Intervention Suite (ORs)
- ICU/CCU
- Cath and Inter Radiology
- Labor/Delivery, Peds ICU
- Med / Surg
- Inpatient Pharmacy
- Morgue, Support Services

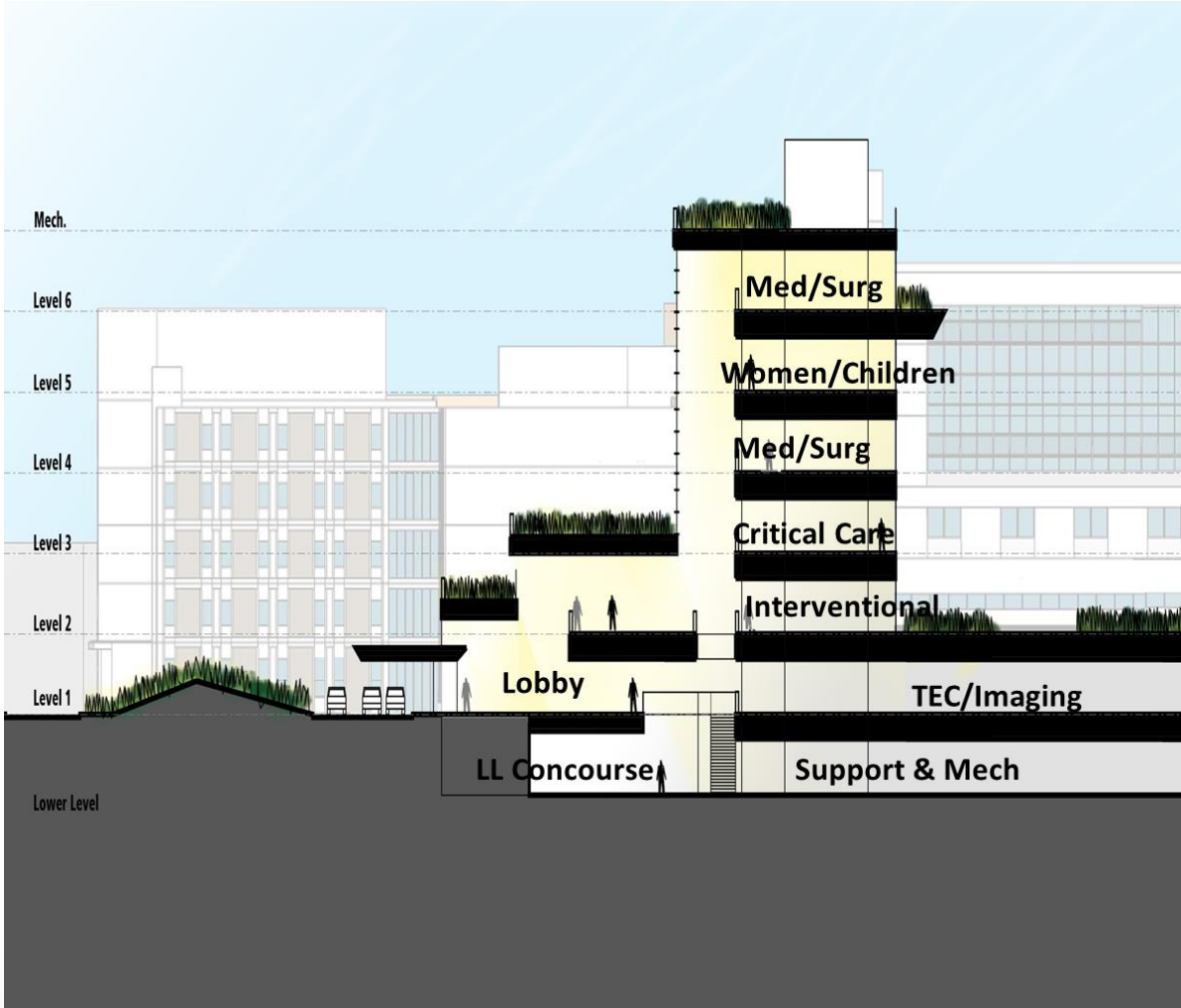
Patient/Visitor Rooftop Terrace

New Hospital Lobby

Rooftop Helicopter Pad

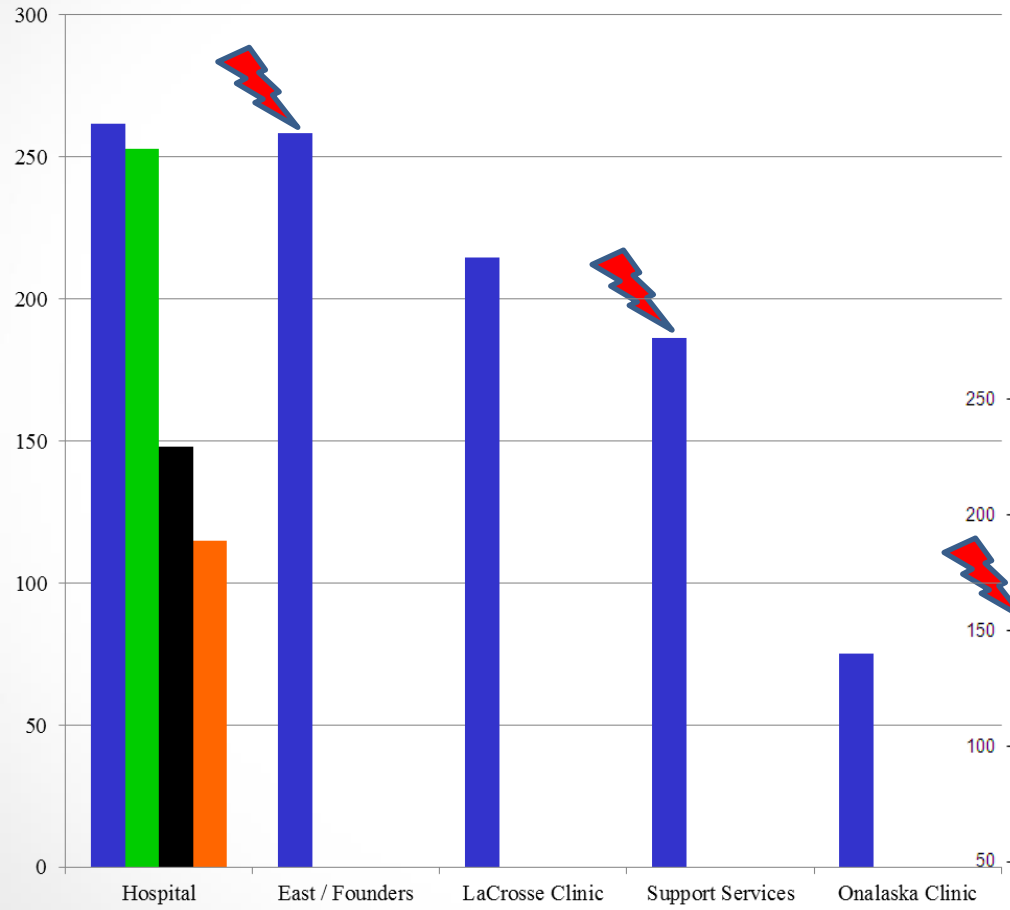
Ambulance Garage – 4-5 vehicles

Underground Access to Parking

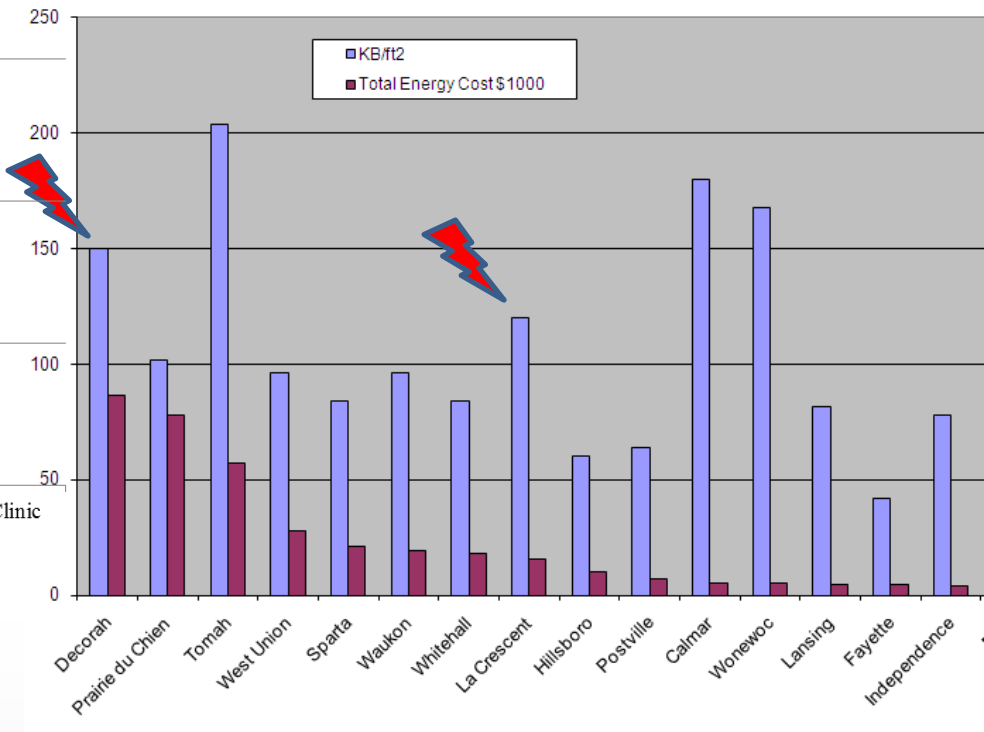


Don’t Assume New Buildings are Efficient

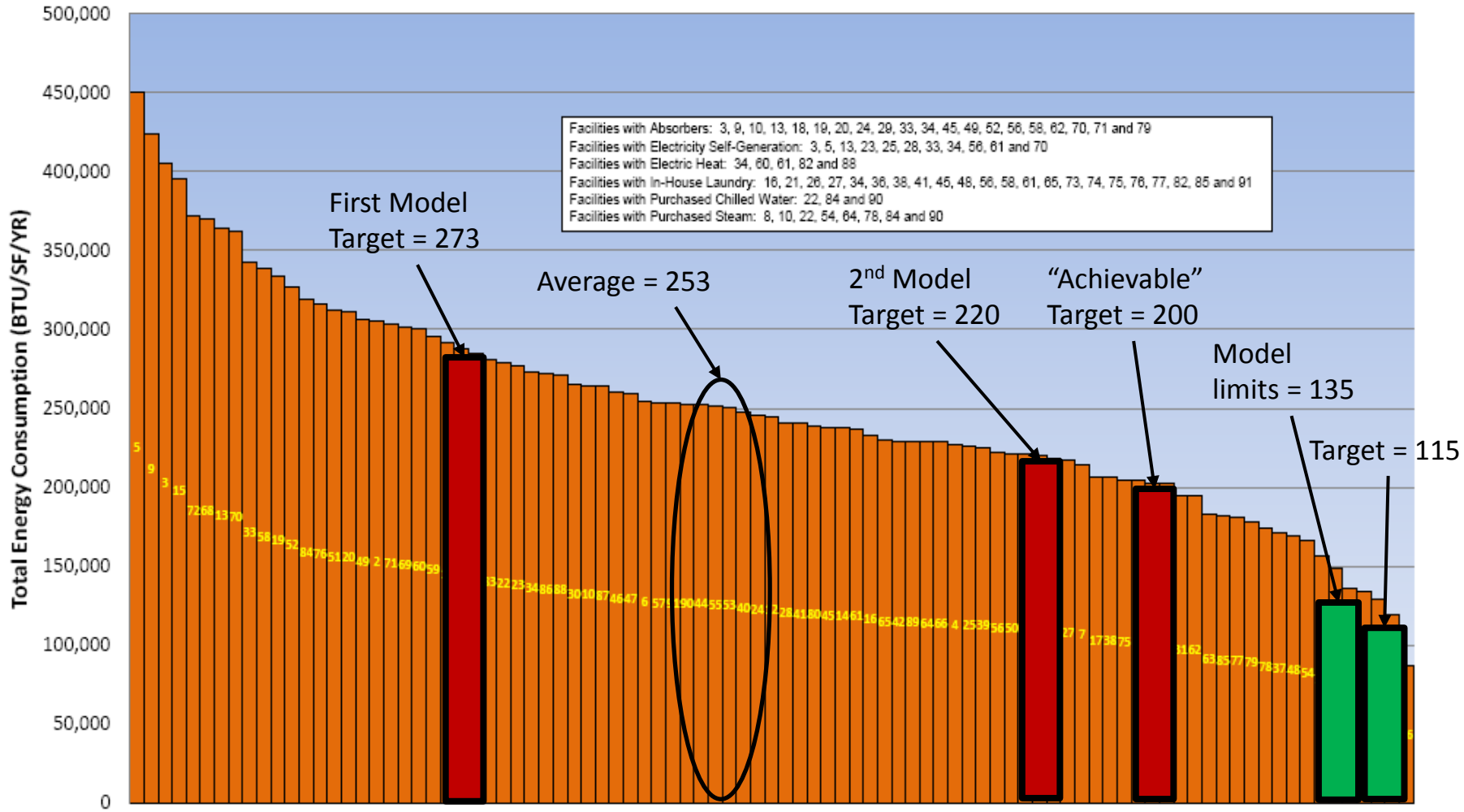
Envision® GUNDERSEN HEALTH SYSTEM



Several of our newest buildings were our worst performers



New Hospital Energy Target



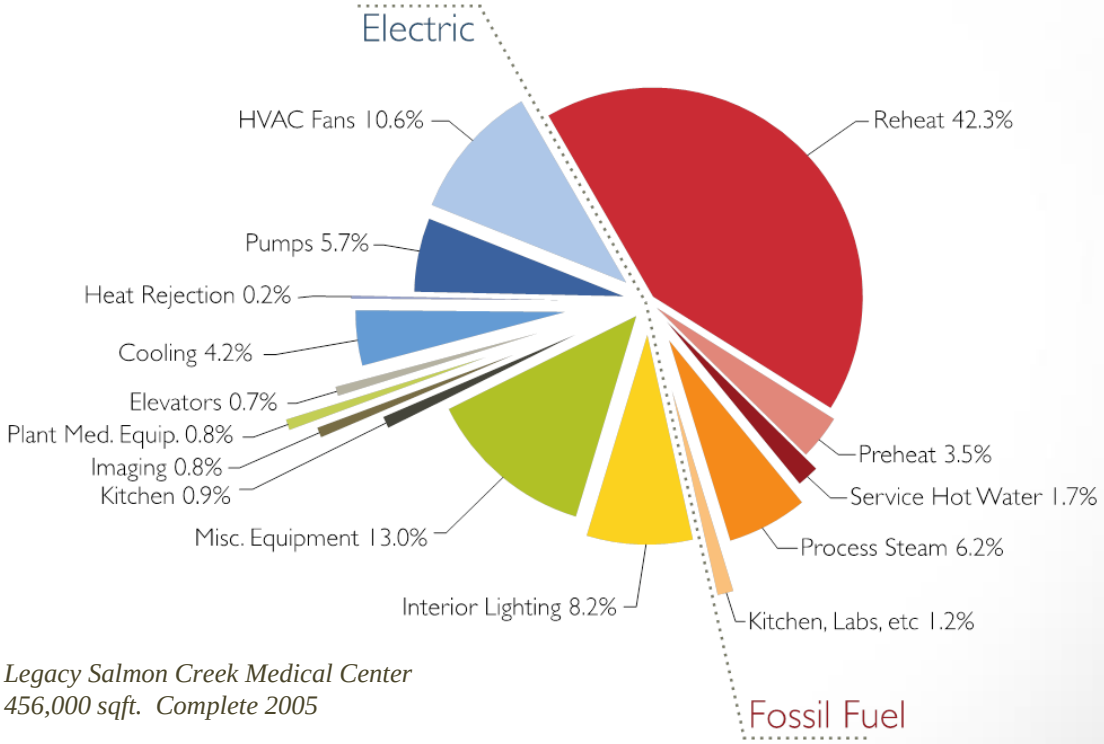
Why So Much Energy

- High ACH/OA

OR's	25/5
ER Waiting	12/2
Infection Iso.	12/2
Patient Rms	6/2

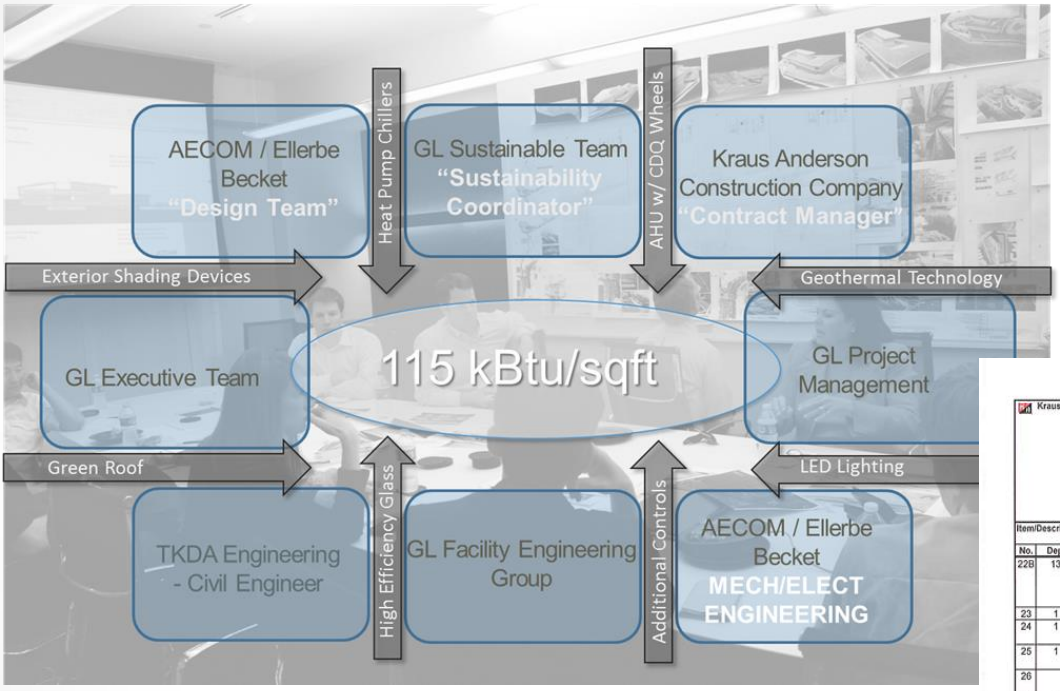
- Energy intensive equipment
- High filtration requirements
- Pressure Relationships
- 24/364 Operations

- Data centers
- Food service
- Sterilization
- Laundry services
- Over 4000 patients, visitor and staff entering & leaving the facility everyday



Legacy Salmon Creek Medical Center
456,000 sqft. Complete 2005

New Hospital Energy Target



Deciding Factors

- Payback
- Progress toward goal
- Maintenance costs
- Future flexibility
- Standardization

Kraus-Anderson Construction Company

Value Management Analysis / Alternate List
From Schematic Estimate 1B dated 7/27/09

Owner: Gundersen Lutheran Hospital
Program Manager: N/A
Project: Critical Care Tower
Location: La Crosse, WI
Designer: Ellerbe Becket Architects

Date: 4/20/09
Revision # 7/29/2009

Item/Description No.	Dept	Sec		Est. Cost	Resp Party	Pending	Accepted	Rejected	Date Acpt/Rjct	Remarks
22B	13		Modify the Lighting Pacakge as outlined by the fixture schedule to be provided by Hunt Electric (Second Floor Lobby)	$17,255	KA	$17,255				7/29/09 GL is developing standards for lighting. KA to send out list associated with this cost to EB and GL
23	1		Eliminate the Sunshades at the Exterior of the building	($333,500)	GL/EB	($333,500)				
24	1		Provide a static UPS sytem in lieu of fly wheel technology included in the base proposal	($200,000)				($200,000)	7/29/09	
25	1		Provide Open transition transfer switches in lieu of closed transition switches	($49,000)	GL	($49,000)				
26			**LEED Value Management**		KA					have 24 pts in base - need 26 minimum for base LEED certification.
26A	1		Systems designed for Heat Recovery Heating Water at 140 degrees EWT, 120 degrees LWT	$298,430				$298,430	7/29/09	Should be taken in conjunction with item #26G. If taken together a payback period of 9 years is projected. This would not make the same energy savings contribution if the Bio Mass Boiler is implemented.
26B	1		Design Air Handling Unit to reduce the fan motor horsepower by reducing the velocity and pressure drop through the heating coil.	$1,000,000			$1,000,000		7/29/09	A payback period of 5.1 years has been projected.
26C	1		Revise the cooling coil design conditions to 42 degrees EWT and 56 degress LWT	($69,201)			($69,201)		7/29/09	
26D	1		Provide a Double Walled Heat Exchanger to heat domestic water with heat reclaimed from a heat recovery chiller. Instantaneous steam to hot water heaters provides hot water during chiller maintenance or failure	$55,000				$55,000	7/29/09	A 6.5 year payback period has been projected with this item.
26E	1		Provide dual flush water closet control valves, sensor faucets, and sensor urinal flush valves	$0			$0		7/29/09	Minimal cost for 1 pt ($3,000). In base cost - keep
26F	3		Provide a variable speed drive on one chiller to optimize chiller efficiency during part load conditions	$70,000				$70,000	7/29/09	A payback period of 9 years has been projected.
26G	1		Install a 250 ton heat recovery chiller operating as a boiler to maintain the condensor water set point, which will be used to heat the building and domestic hot water.	$401,366				$401,366	7/29/09	Should be taken in conjunction with item #26A. If taken together a payback period of 9 years is projected. This would not make the same energy savings contribution if the Bio Mass Boiler is implemented
26H	1		Install a water to water heat pump to reclaim heat between the exhaust releif air and the outdoor airflows	$330,000				$330,000	7/29/09	A payback perior of 76.8 years has been projected

responsibility:
GL - Gundersen Lutheran
KA - Kraus-Anderson
EB - Ellerbe Becket

New Hospital Energy Target

Chiller Plant Upgrades (8-10 kBtu/sqft)

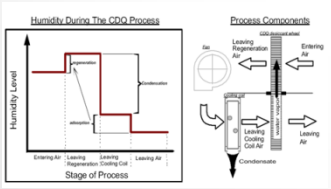
- New Chillers
- Tower optimization
- 14° delta T on Chilled water

Lighting (4-6 kBtu/sqft)

- Daylight harvesting
- Occupancy sensors
- LED where applicable

Fenestration (8-10 kBtu/sqft)

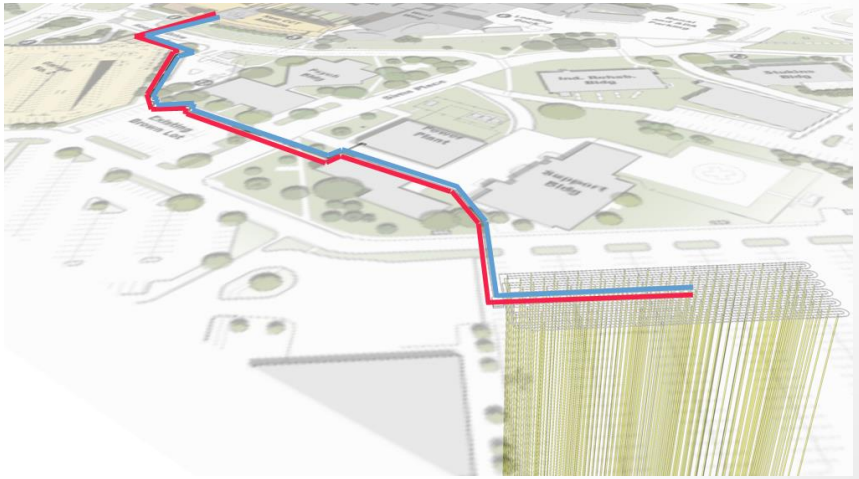
- Windows
- Walls
- Ceiling



Other (11-15 kBtu/sqft)

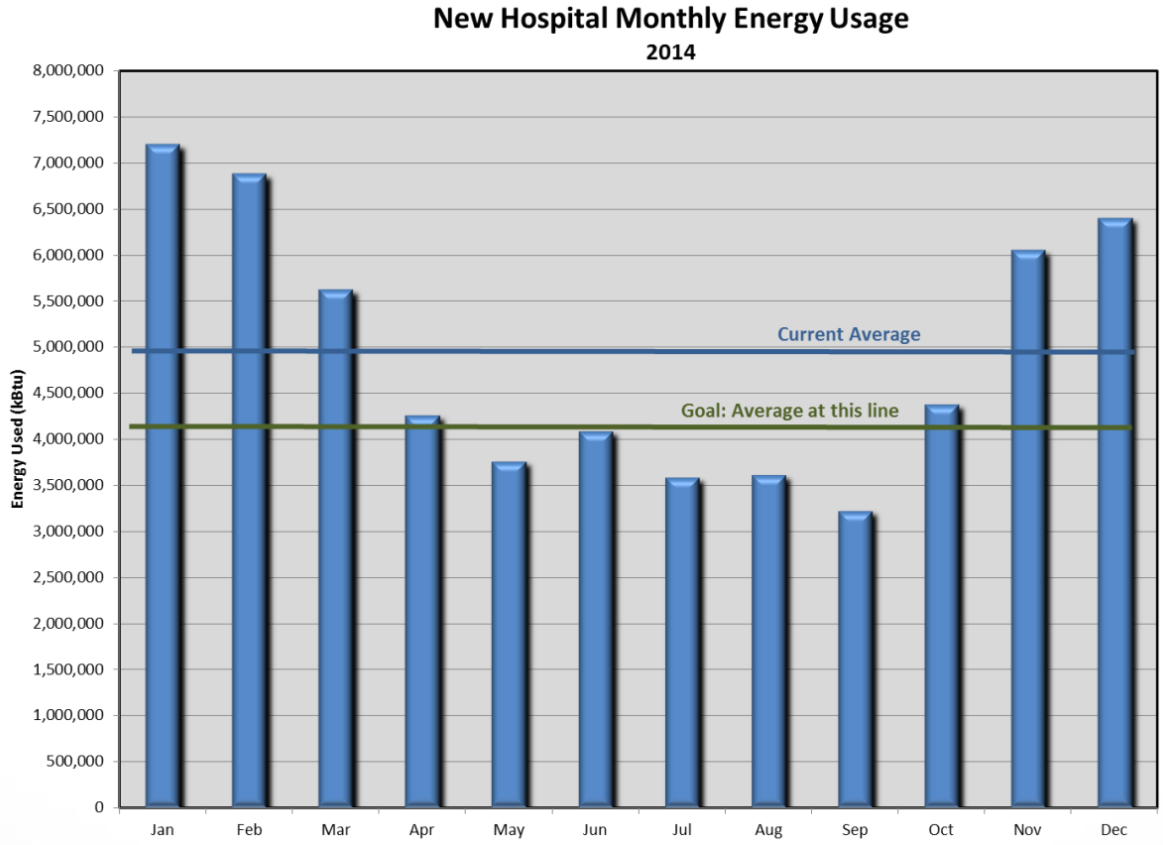
- OR Air Handlers w/ desiccant wheel
- VFD's
- Premium efficiency motors
- Scheduling (OR's, lobbies, offices, etc.)
- White roof

Geothermal Heat Pump (70-80 kBtu/sqft)



2014 EUI = 136 kBtu/sqft

Occupied New Hospital on January 19, 2014



Work in Progress

- Optimizing Geo Heat Pump
- DE lamping “Back of House” Space
- Increase Area’s to Schedule
- Temperature Guidelines and Control
- Not Allow Personal Devices

Cost of Achieving Energy Goal

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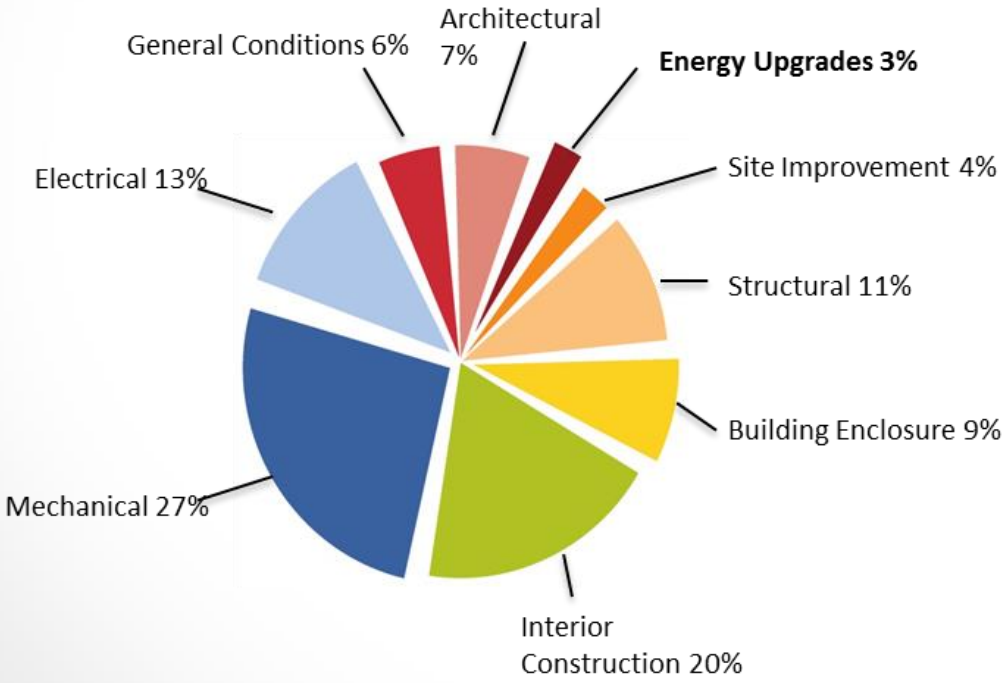
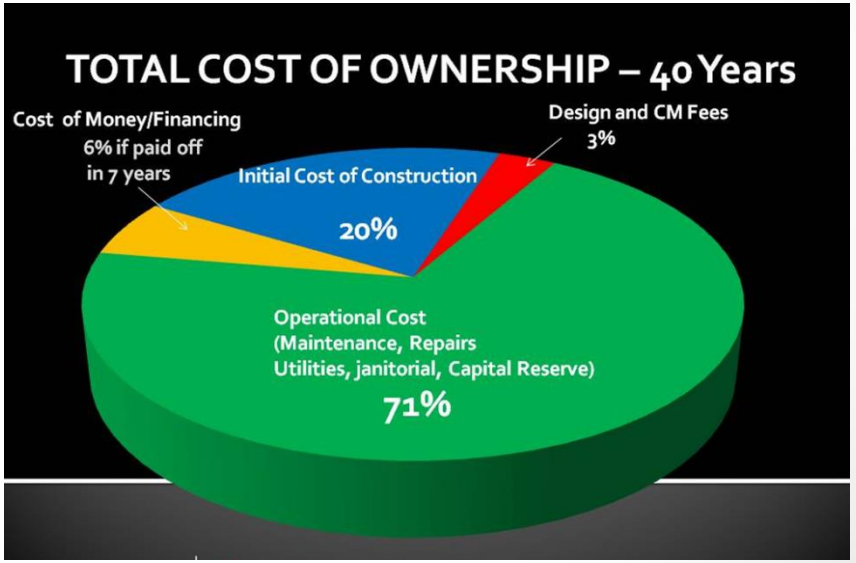




Life Cycle Cost Analysis 2 - David S. Haviland

Payback ~ 7 Years!

Energy Intensity (kBtu/sqft/yr)

Envision® GUNDERSEN HEALTH SYSTEM

~$700k Savings/year

Key Learnings

- BHAG and unknown leads to creative solutions
- Leadership support is key to success
- Owners interest is not in the best interest of Architect
- Scope creep
- Review energy model often
- Measurement
- Building thermal
- Precommissioning
- Hot water, not steam
- **Set a goal and stick to it!**

What Next….

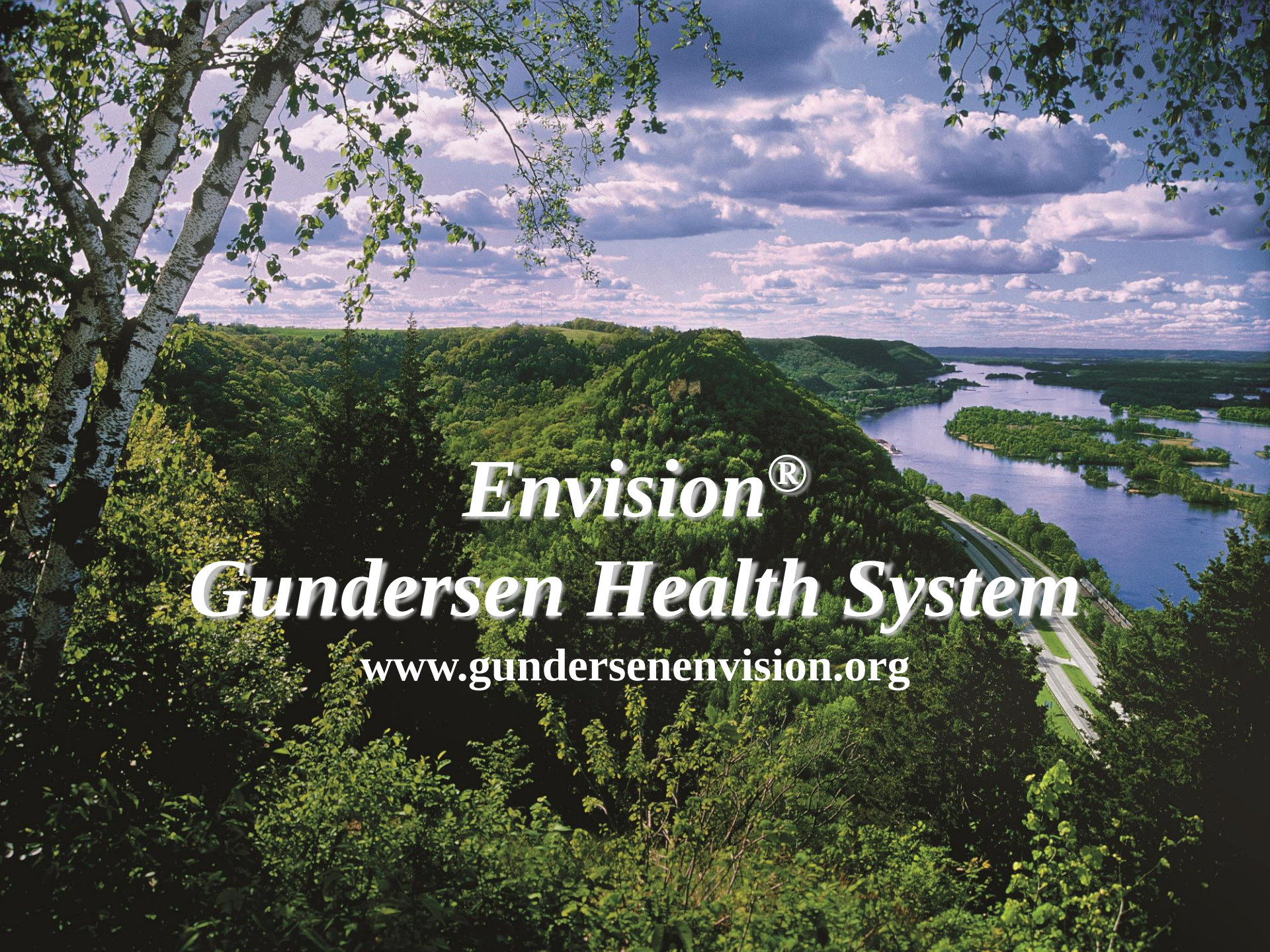
Envision® GUNDERSEN HEALTH SYSTEM

Zero Energy New Construction

Why Health Care Providers Should Care About Clean Energy

Envision® GUNDERSEN HEALTH SYSTEM

- Reduce the Cost of Healthcare
- Decrease Emissions Harmful to Health
- Decrease Emissions Harmful to Environment
- Provide Benefit to Regional Economy
- Achieve Energy Independence
- Use Renewable Resources
- Reduce our Dependence on Fossil Fuel
- Local Jobs
- Improve Patient Experience & Cost
- Partner with Public and Private Organizations
- Make Cost Effective and Sound Investments
- Hedge against inflation
- Power Security/Reliability
- Wisconsin imports ~$15B in fossil fuels each year……
  every bit of local production keeps dollars in our region


Envision®
Gundersen Health System
www.gundersenenvision.org

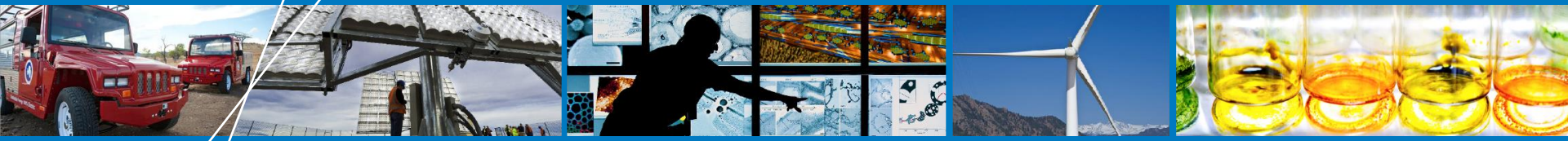
Performance-based Design Build Procurement

Paul Torcellini, NREL

U.S. DEPARTMENT OF ENERGY

NREL
NATIONAL RENEWABLE ENERGY LABORATORY

Performance Based Procurement: Getting the Savings You Want



Better Buildings Summit
Washington, DC
May 28, 2015

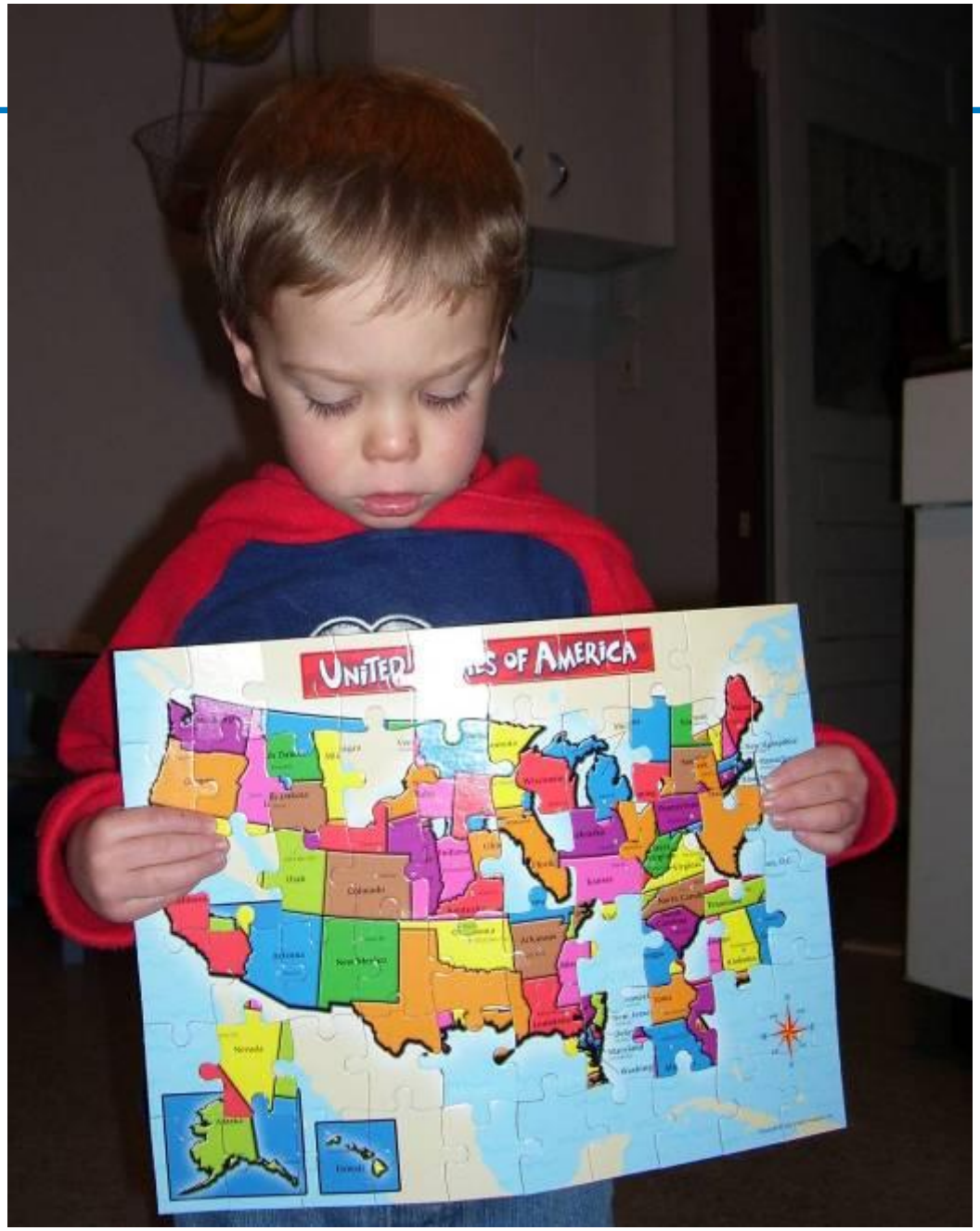
Paul A. Torcellini, Ph.D., P.E.
Principal Engineer

- RSF uses 50% less energy than if it were built to current commercial codes at no extra capital cost

NREL/17833

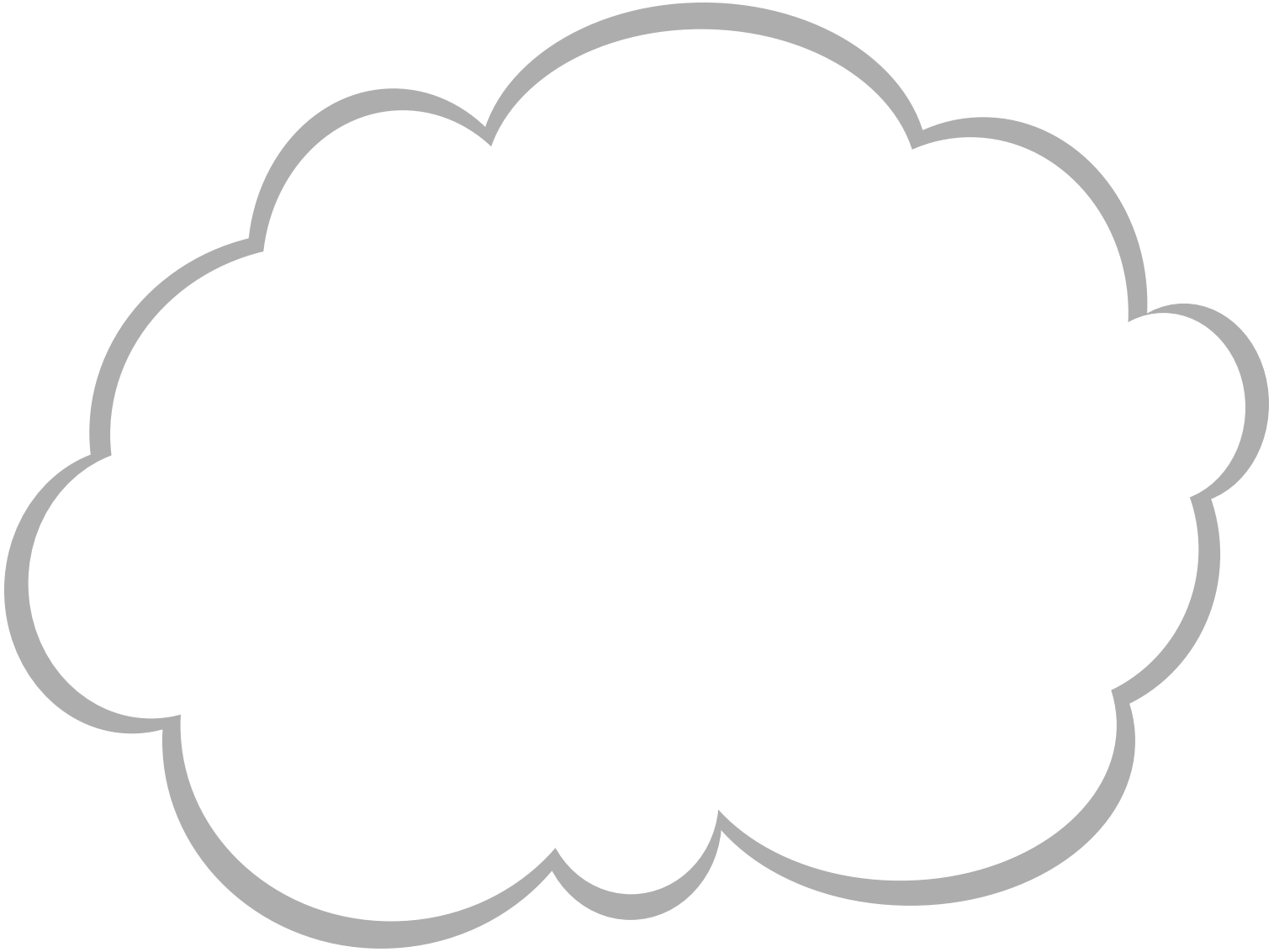
Many Pieces

- So many ways to assemble the pieces
- Design is about making decisions – need motivation to make the right decisions
- Who are the decision makers?



Used by permission: Paul Torcellini/NREL

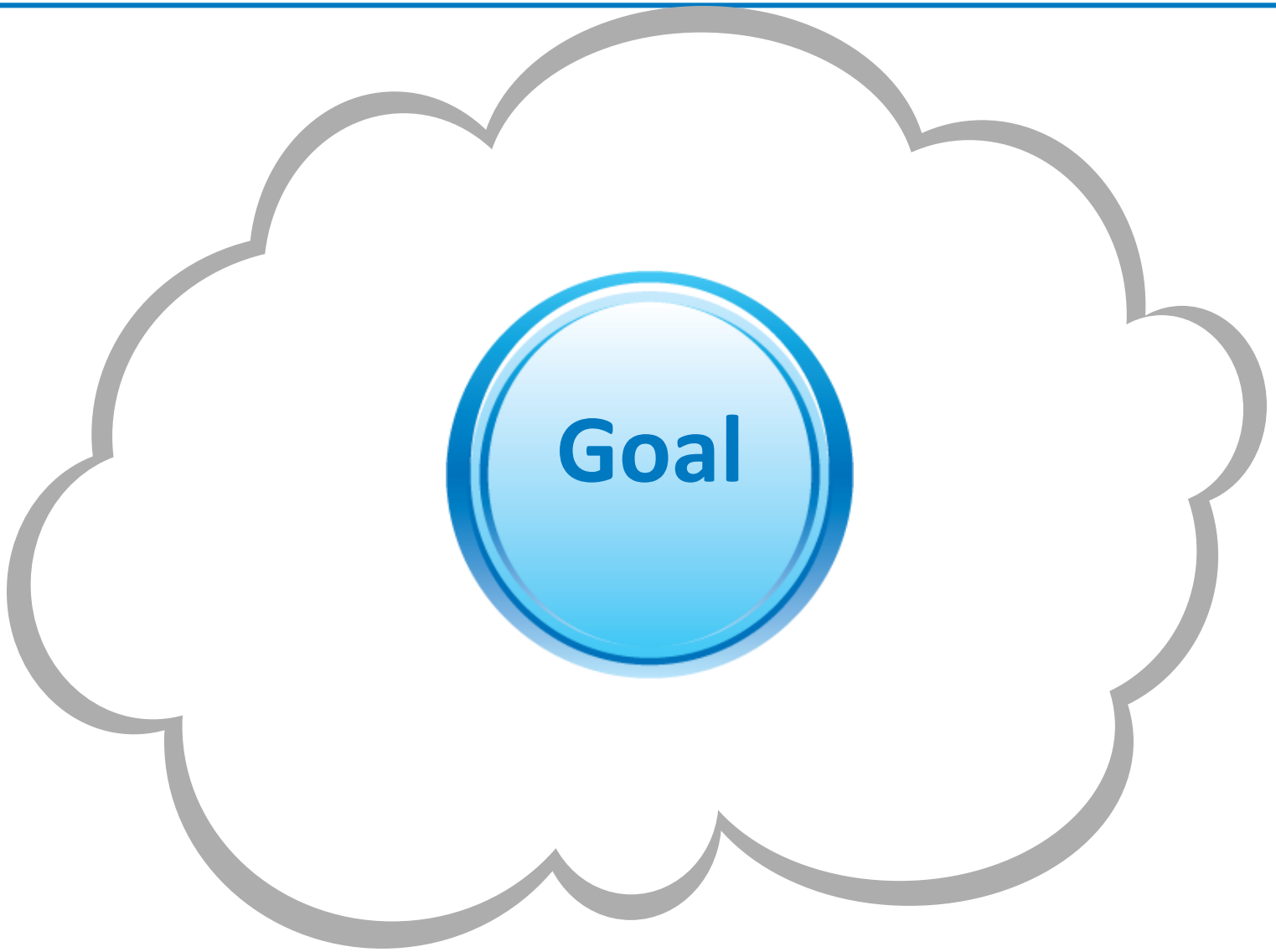
Vision



Setting Goals

- **Measurable goals are better**
- **From bad to good…**
  - I want a green building
  - Design a LEED <rating> building
  - Design a building to use 30% less energy than ASHRAE 90.1-2013
  - Design a building to use less than 25,000 BTU/sqft
  - Design a [NET] ZERO ENERGY BUILDING

- **Influencing purchasing decision—the owner**
- **Effective goal setting applies to any project: new or retrofit**
- **Goal setting is independent of owner type**

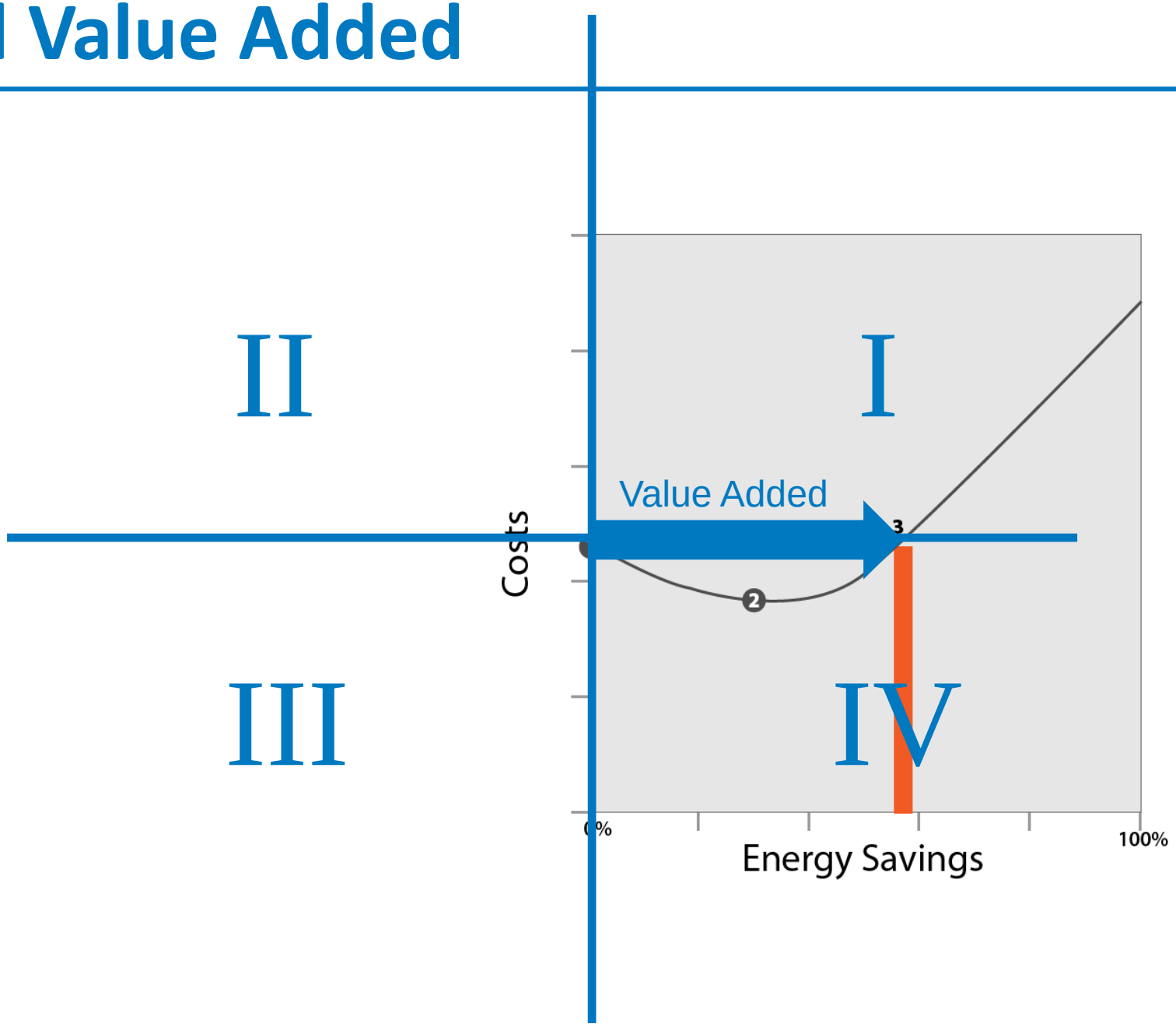

Goal


Goal


Goal

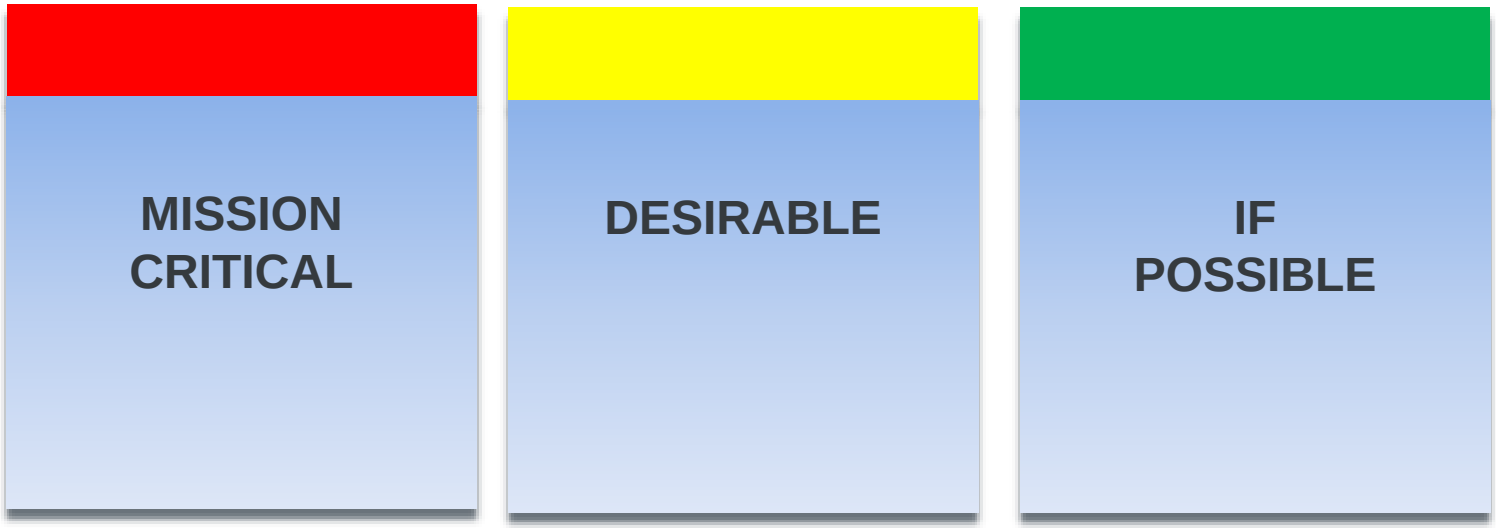

Goal

Real Value Added



Owner Defines Desires

- Creating a list of what the building could accomplish.



- Critical: Project cannot succeed with out this element
- Desirable: What the owner wants
- If Possible: The wish list

Problem Definition: RFP Objectives

MISSION CRITICAL

Attain safe work performance/Safe Design Practices

LEED Platinum

ENERGY STAR "Plus"

HIGHLY DESIRABLE

800 staff Capacity

25kBtu/sf/year

Architectural integrity

Honor future staff needs

Measurable ASHRAE 90.1

Support culture and amenities

Expandable building

Ergonomics

Flexible workspace

Support future technologies

Documentation to produce a "How to" manual

"PR" campaign implemented in real-time

Allow secure collaboration with outsiders

Building information modeling

Substantial Completion by 2010

IF POSSIBLE

Net Zero/design approach

Most energy efficient building in the world

LEED Platinum Plus

ASHRAE 90.1 + 50%

Visual displays of current energy efficiency

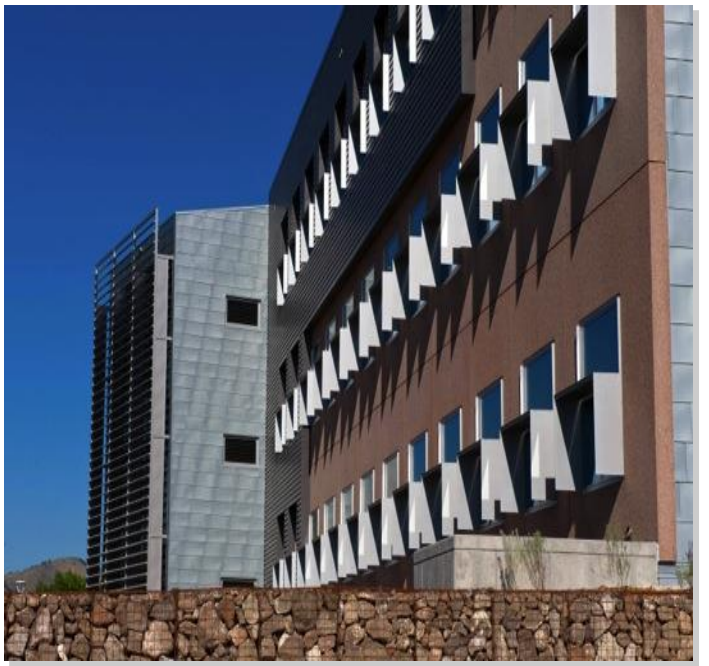
Support public tours

Achieve national and global recognition and awards

Support personnel turnover

Owner Role

- **Spend the time to get RFP right**
  - Design/build team will study to pass the test
- **Set up acquisition process to "force" integrated design**
  - Energy modeling guides conceptual design decisions
  - Architecture and envelope are also efficiency measures



NREL/17833

Owner Role

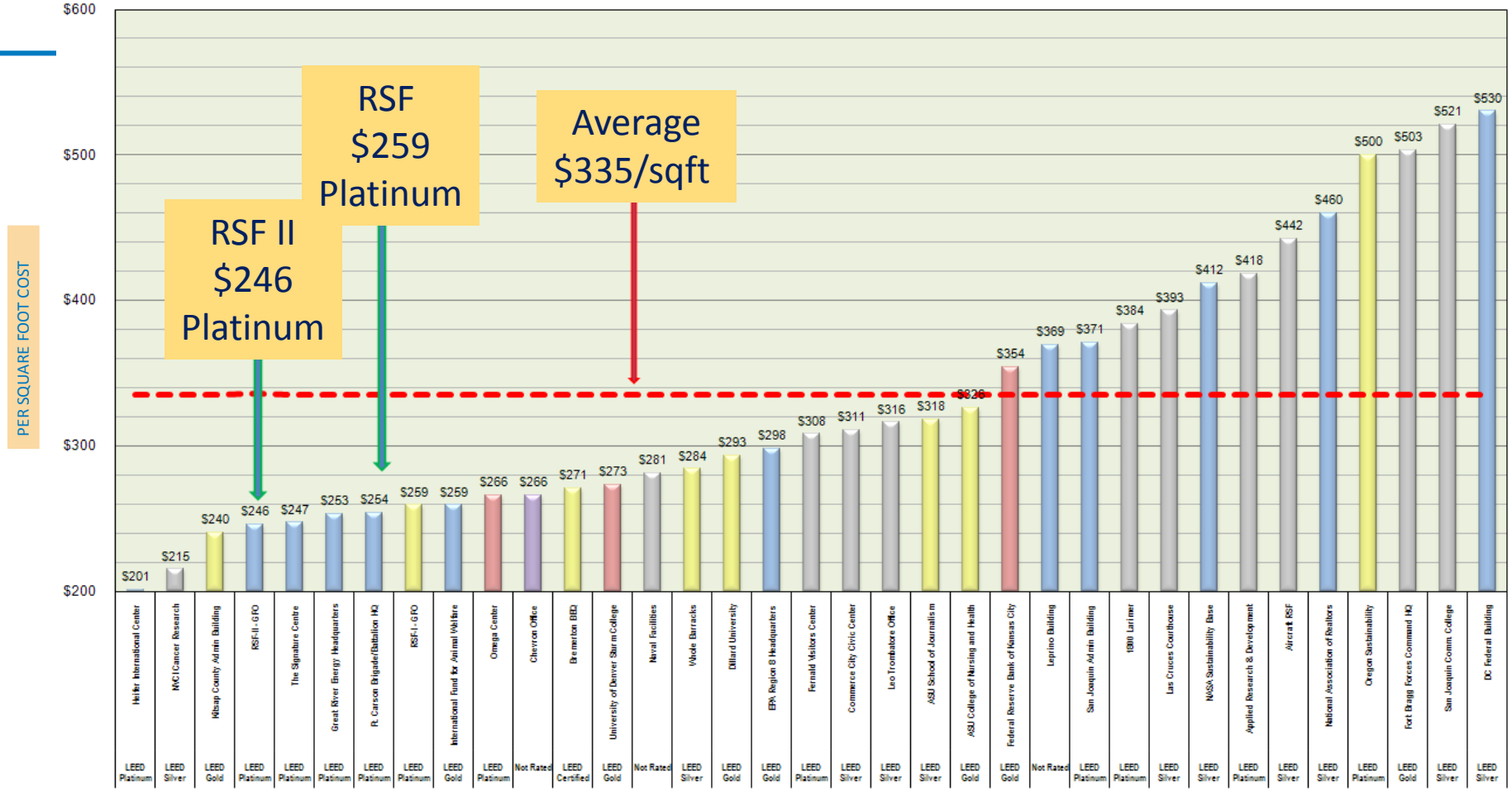
- **Unwavering commitment to problem statement**
  - Unleash power of design/build team of experts to meet your needs
    - true value engineering
  - Commit to your objectives and the prioritization and don't adjust

Clockwise from top:
NREL/18784, 24690, 17823

Process

- Owner made tough decisions up-front
  - Set budget
  - Sought maximum value for that budget
  - Prioritized goals
- Design-Build procurement process
  - Managed the team to the RFP and its substantiation criteria
  - Rewards
- Allowed design-build team to use creativity to maximize value--innovation
- Owner did not solve the problem (but knew the solution existed)

COMMERCIAL BUILDING CONSTRUCTION COST



LEGEND:

- NOT RATED
- LEED CERTIFIED
- LEED GOLD
- LEED SILVER
- LEED PLATINUM

PROJECTS AND LEED CERTIFICATION

SOURCES:

www.fayobserver.com
www.dbia.com
www.nasa.gov
www.eomega.org
www.oregonsustainabilitycenter.org
www.americas.rlb.com
http://greensource.construction.com
www.1800larimer.com
www.usgbc.org
www.smithgroup.com
www.cronkite.asu.edu

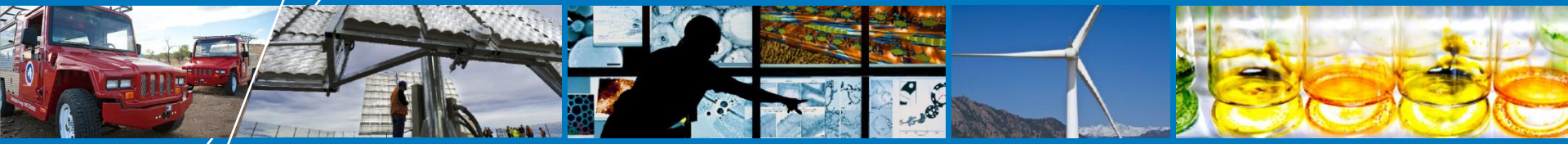
Moving to the Mainstream…

- Assistance available to implement process
- Works for any owner willing to set goals early and prioritize needs
- Fix the budget upfront
- Competitively procure for meeting prioritized needs

Resources…

- **www.nrel.gov/rsf**
  (full procurement information)
- **Design Build Institute of America (dbia.org)**
  - Training, conferences, workshops
- **Buildingdata.energy.gov**
  - https://buildingdata.energy.gov/cbrd/search/resources/?f[0]=im_field_collections%3A16
  - Energy Performance Based Acquisition

NREL
NATIONAL RENEWABLE ENERGY LABORATORY



Questions and Comments

Paul.Torcellini@nrel.gov

Insuring Energy Performance

Christopher Lohmann, Energi

U.S. DEPARTMENT OF ENERGY

energi®

Insuring North America's Energy Industry

Strategies for Ensuring Real Energy Savings in New Construction and Existing Building Retrofits

Energy Savings Warranties

Energi Insurance

Energi is a leading provider of specialty risk management solutions, including insurance and reinsurance, to niche sectors of the energy industry.

Energi's competitive strength lies in doing the hard work to truly understand the risks faced by operators and investors, and then developing proprietary mitigation, loss prevention, and operational risk management techniques to best serve them.

Energi is licensed to do business in all 50 states and Canada, and, through its strategic partners, can provide risk management services globally.

Alternative Energy Solutions

- Pioneered the development of performance warranty solutions for the alternative energy sector
- 24 master policies since January 2011, with steady geometric growth each year
- Over 100 projects insured, ranging from <$50k to >$70mm
- International: Canada office open Q2 2014, UK office open Q4 2014

AES Product Offerings

- **Energy Savings Warranty**
  Backstops savings guarantees offered to building or project owners
- **Output Performance Warranty**
  Provides payment of shortfalls in cash-flow due to underperformance of project

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Energi's Energy Savings Warranty

Guarantee energy savings of kWh, BTU's, Therms, etc.

Insurance policy pays shortfalls between Guaranteed Savings and Actual Savings

Takes the risk of savings being realized away from the building owner and capital provider

The Path to Precision

1. Project Screening

- Identify strong project proposals, designs, & teams

2. Design Review

- Check for errors & omissions
- Check for over- or under-sizing of equipment
- Demand full measurements and calculations over shortcuts and rules of thumb

3. Inspection

- Ensure all measures have been installed per the project design
- Ensure all measures all functioning as intended at commissioning

4. Real-Time M&V

- Monitor performance data remotely in near real-time
- Identify deviations from normal parameters and remedy issues *before they become problems that impact savings*

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Contact:
Chris Lohmann
VP Alternative Energy Solutions
clohmann@energi.com

www.energi.com

Questions? Stories?

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