

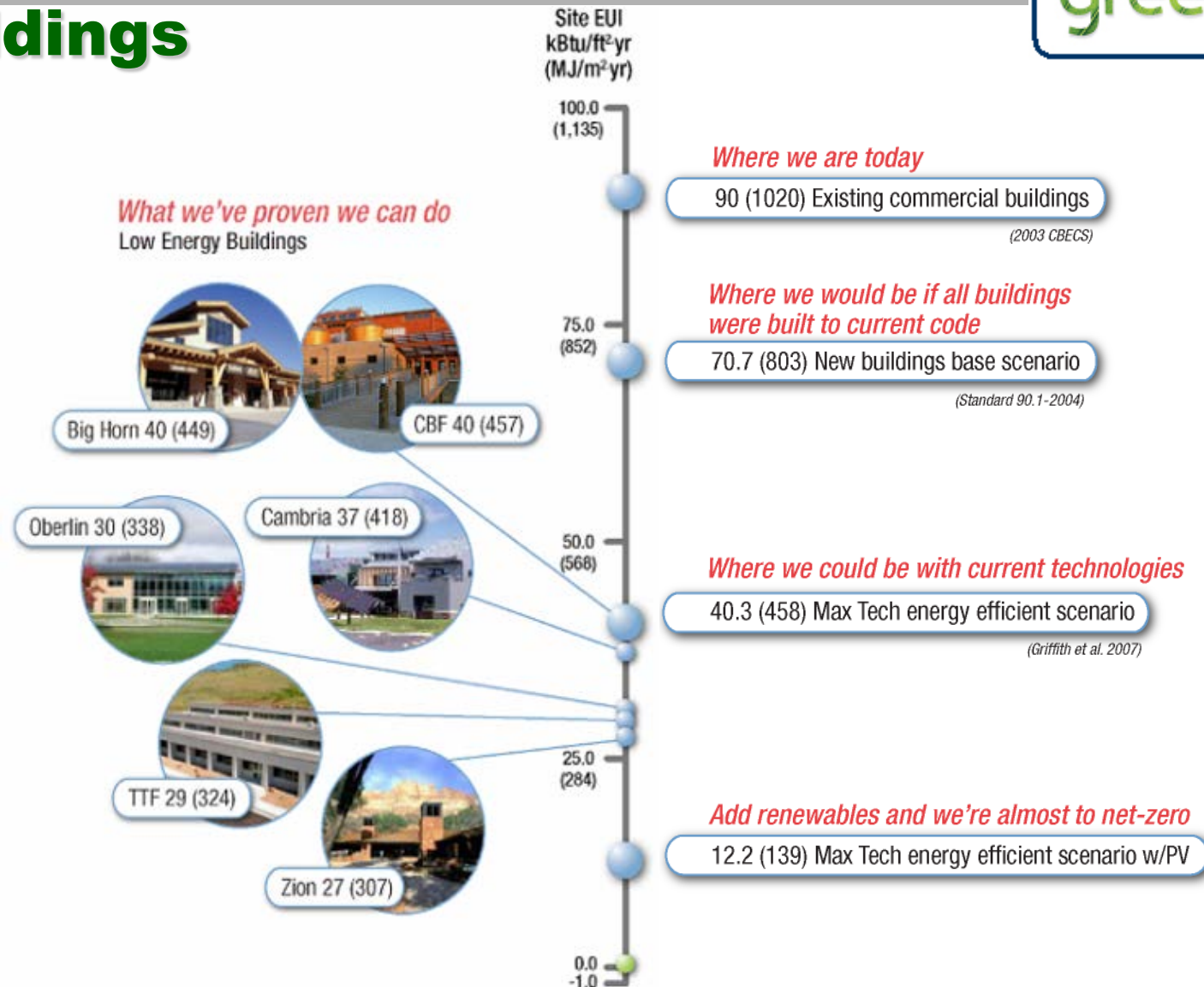


Integrating Energy Use Requirements into the Design-Build Acquisition Process

Shanti Pless

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Great Potential in Commercial Buildings



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 90.1-2004
 - Design a building to use less than 25,000 BTU/sqft
 - Design a [NET] ZERO ENERGY BUILDING
- Influencing design process—the owner

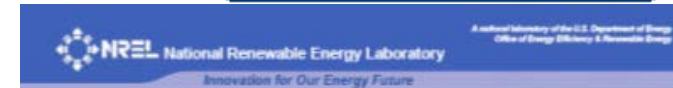
Definitions of NZEB's



- Net Zero Site Energy
- Net Zero Source Energy
- Net Zero Emissions
- Net Zero Energy Cost
- Boundaries and metrics

- ZEB:A – ZEB:D

The Definition used WILL impact
the ZEB design strategies!



Zero Energy Buildings: A Critical Look at the Definition

Preprint

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National Renewable Energy Laboratory

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U.S. Department of Energy

To be presented at ACEEE Summer Study

Conference Paper
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This rendering shows the proposed orientation of the National Renewable Energy Laboratory Research Support Facilities.

Getting to Net Zero

By Drury Crawley, Ph.D., Member ASHRAE, Shanti Pless, Associate Member ASHRAE, and Paul Torcellini, Ph.D., P.E., Member ASHRAE

As the futurist Stewart Brand observed, "Every building is a forecast. Every forecast is wrong." Making forecasts progressively less wrong over time—specifically, forecasts about high-performance buildings—is the purpose of the U.S. Department of Energy's (DOE) Zero Energy Buildings Database. The intent of this article is to provide an overview of the DOE's efforts toward realizing cost-effective net zero energy buildings (NZEBs).

The vision of NZEBs is compelling. These highly energy-efficient buildings will use, over the course of a year, renewable technology to produce as much energy as they consume from the grid. Building owners and tenants stand to realize attractive returns on their NZEB investments while reducing carbon footprints. And, while today's buildings are

voluntarily by building owners in the Zero Energy Buildings Database, we now have some early insight into these questions and into the drivers of net zero energy performance.

Just as important, we now have an influential community of industry leaders who are committed to pushing the boundaries of building performance and sharing the results. As part of the Net-Zero Energy Commercial Building Initiative, authorized by Congress in the Energy

About the Authors

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18 ASHRAE Journal

ashrae.org

September 2009

<http://www.nrel.gov/docs/fy06osti/39833.pdf>

ZEB Renewable Hierarchy



Energy efficiency FIRST

- Daylighting, CHP, passive solar

A. Footprint supply options

- Building mounted PV or wind

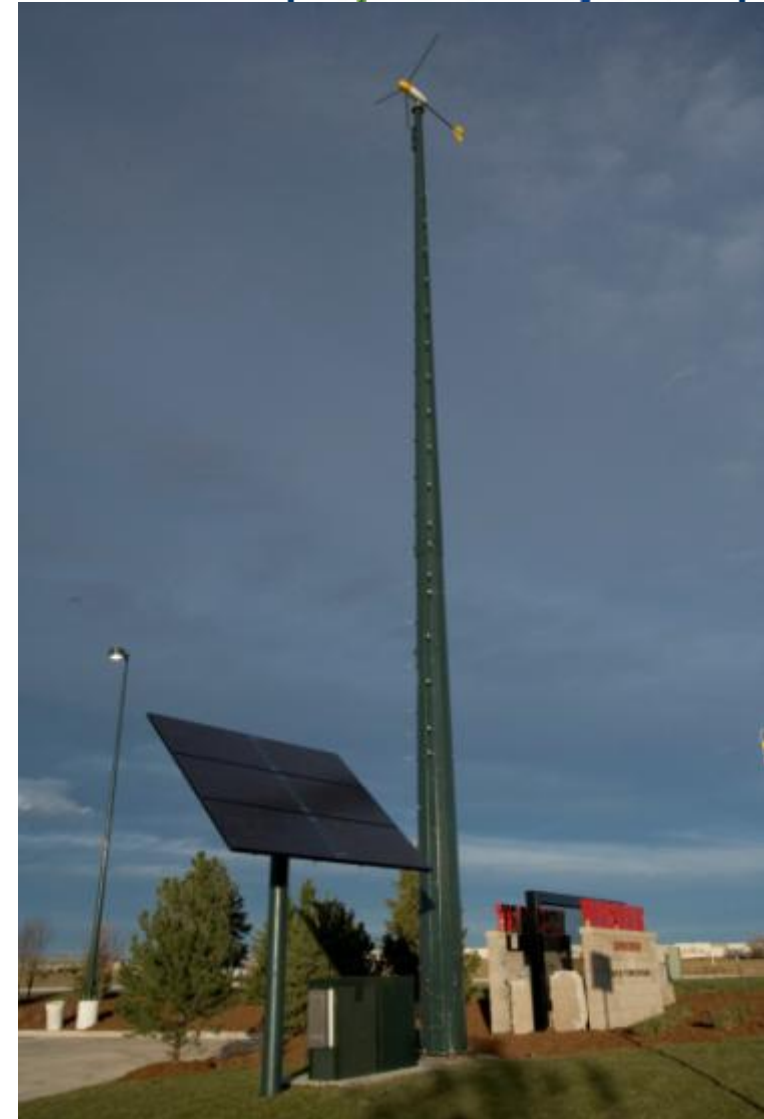
B. Site supply options

- Parking lot PV or wind

C. Imported supply options

- Wood chips, ethanol

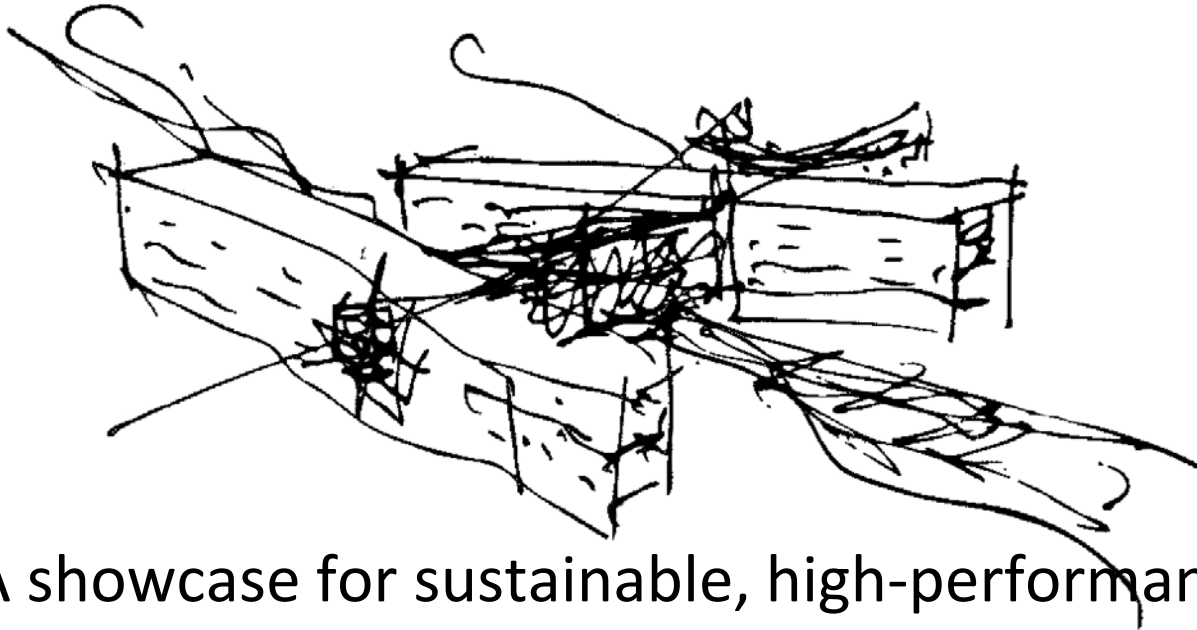
D. Purchase of renewable credits





NREL PIX

Research Support Facility Vision



Credit: RNL

- A showcase for sustainable, high-performance design
 - Incorporates the best in energy efficiency, environmental performance, and advanced controls using a “whole-building” integrated design process
- Serves as a model for **cost-competitive**, high-performance commercial buildings for the nation’s design construction, operation, and financing communities



2012 aerial, Photo by Sincere/Duncan Studios courtesy of JE Dunn Construction



RSF Problem Definition – RFP Objectives Checklist

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

Full Performance RFP → No drawings in RFP = No change orders!

When energy performance is required...

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www.GreenGov2012.org



- Force “integrated” design
 - Design decisions based on early energy modeling
 - Make optimal use of “free” energy sources
 - Data center waste heat recovery
 - Evaporative cooling in dry climate
 - Daylighting
 - Radiant heating and cooling integrated into building structural elements
- Architectural amenities budget applied to integrated envelope efficiency solutions
 - Near real time value engineering



A value engineering process that adds value

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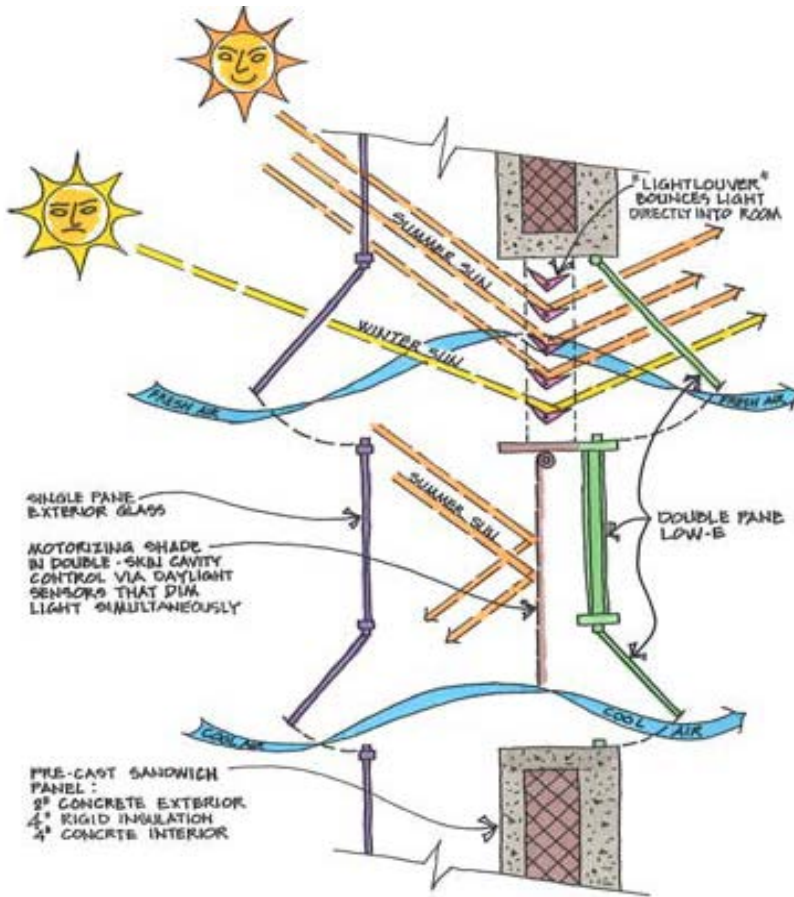


FIGURE #1
NREL

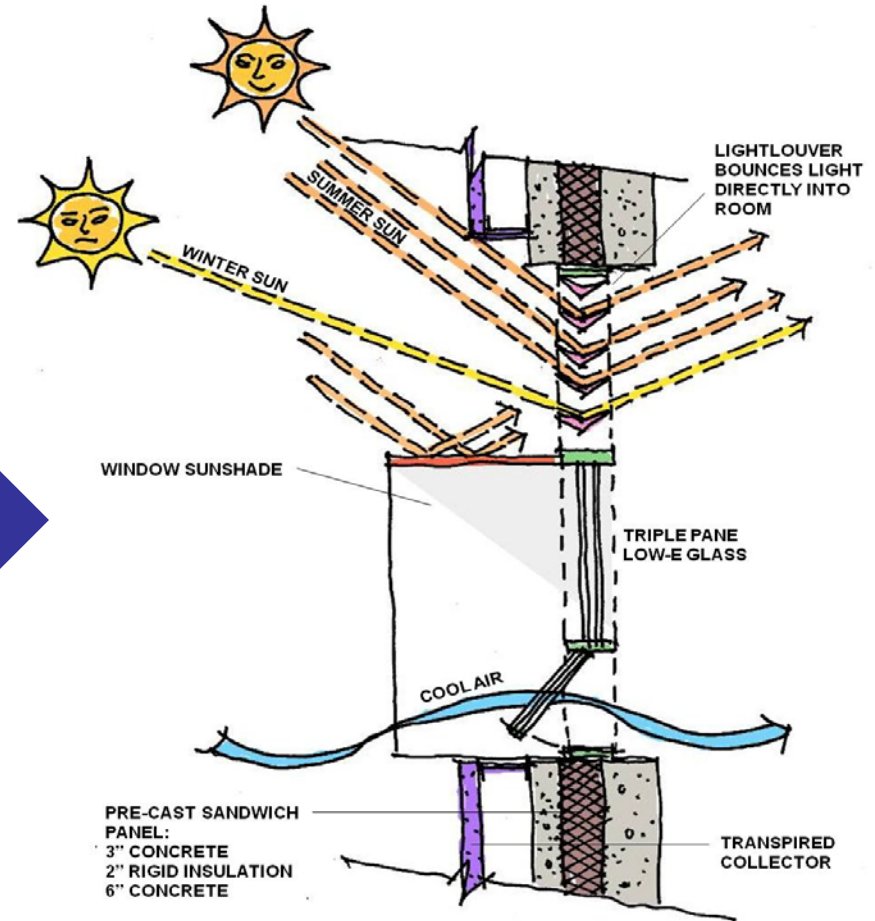
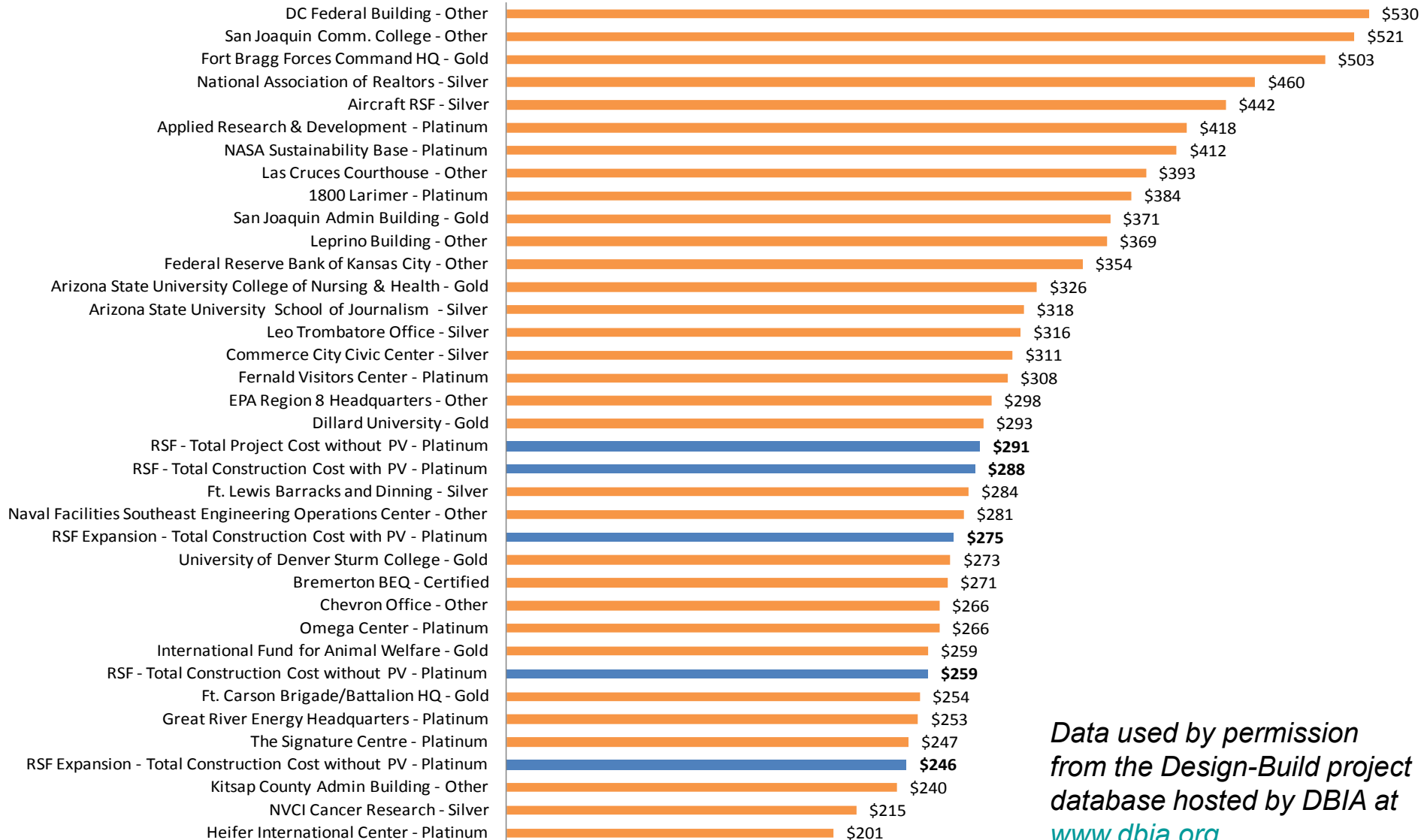


FIGURE #1
NREL

\$/ft² Comparison



*Data used by permission
from the Design-Build project
database hosted by DBIA at
www.dbia.org*

NREL Energy Performance Based Design Build Projects

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- Each project has contractual energy goals
 - RSF, RSF Addition, Parking Garage, Café, Smart Grid Lab
- Based on energy models updated based on Cx and As-built conditions
- Superior performance voluntary incentive (\$) program to ensure actual energy use has a chance to meet predicted performance
- Each project has end use metering and public displays of energy performance as part of contractual performance requirements

NREL RSF 3rd Wing



- 33 kBtu/ft², 50% savings, LEED Platinum 3.0
 - Building 17% more efficient than the RSF
 - Cost savings of 5% (\$14/ft² cheaper)



1800 Car Staff Parking Garage



- 138 kBtu/parking stall
 - 0.5 kBtu/ft²
 - 175 kBtu/stall RFP goal
 - Does not include electric vehicle charging
- Net-zero energy
Site Entrance Building



NREL Cafeteria



- 30% savings over ASHRAE 90.1-2007
- LEED Gold 3.0 minimum
 - Platinum if possible
- Best in class commercial kitchen equipment



Energy Systems Integration Facility



- 25 kBtu/ft² Office wing
 - not including waste heat use
- 1.06 PUE Super computer, no mechanical cooling
- 30% Savings for all Labs
- LEED Gold minimum
 - Platinum if possible



Final Thoughts



World Class Efficiency is Possible within our Construction Budgets!

- Spend the time to get RFP right
 - Include absolute EUI requirements
- Set up acquisition process to “force” integrated design
 - Energy modeling guides conceptual design decisions
 - Architecture and envelope are also efficiency measures
- Unwavering commitment to problem statement
 - Unleash power of design/build team of experts to meet your needs
 - true value engineering

Thanks and Questions?



For additional information:

www.nrel.gov/rsf

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U.S. DEPARTMENT OF
ENERGY | Energy Efficiency &
Renewable Energy

BUILDING TECHNOLOGIES PROGRAM



**How-To Guide for Energy-
Performance-Based
Procurement**

An Integrated Approach for Whole
Building High Performance
Specifications in Commercial Buildings