Designing to the 2030 Challenge, LEED Energy Points and Energy Star

April 16, 2009

Brian A. Mirus, PE

- X-nth
  - Associate & Account Executive
    - Science & Technology Market Sector
    - Earth Group
- Florida Board of Professional Engineers
- American Society of Heating, Refrigerating, and Air Conditioning Engineers
- International Society of Pharmaceutical Engineers

xnth earth

experience sustainability.

Agenda

- Learning Objectives
- Climate Change
- Case Study & LEED Energy Points
- Commercial Building Energy Consumption Survey
- Energy Star
- 2030 Challenge
- Conclusions

Learning Objectives

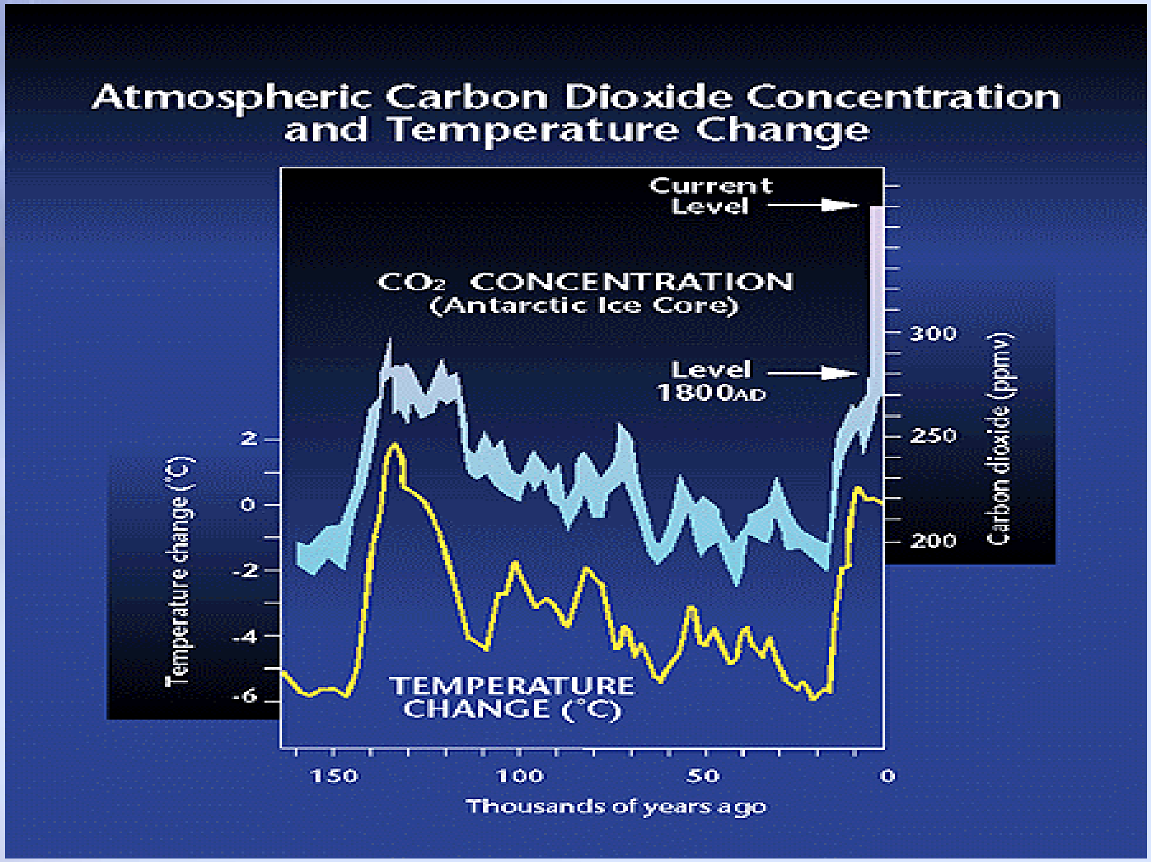
- Learn the basics of LEED energy models
- Learn what the 2030 Challenge and Energy Star programs are
- Learn why these programs are important – climate change
- Learn similarities and differences between LEED energy points, the 2030 Challenge and Energy Star
- Learn energy efficiency strategies to achieve all three standards

Climate Change

- United Nations Foundation Report: *Confronting Climate Change*
- www.unfoundation.org
- Greenhouse Gas Emissions (GHG's) must level off by 2015 to 2020 and then decline to avoid unmanageable climate change
- GHGs trap heat - includes water vapor, carbon dioxide, methane, nitrous oxide, ozone, chlorofluorocarbons (CFCs), etc.

Climate Change

- Carbon dioxide is not the strongest GHG… but it is in larger concentrations

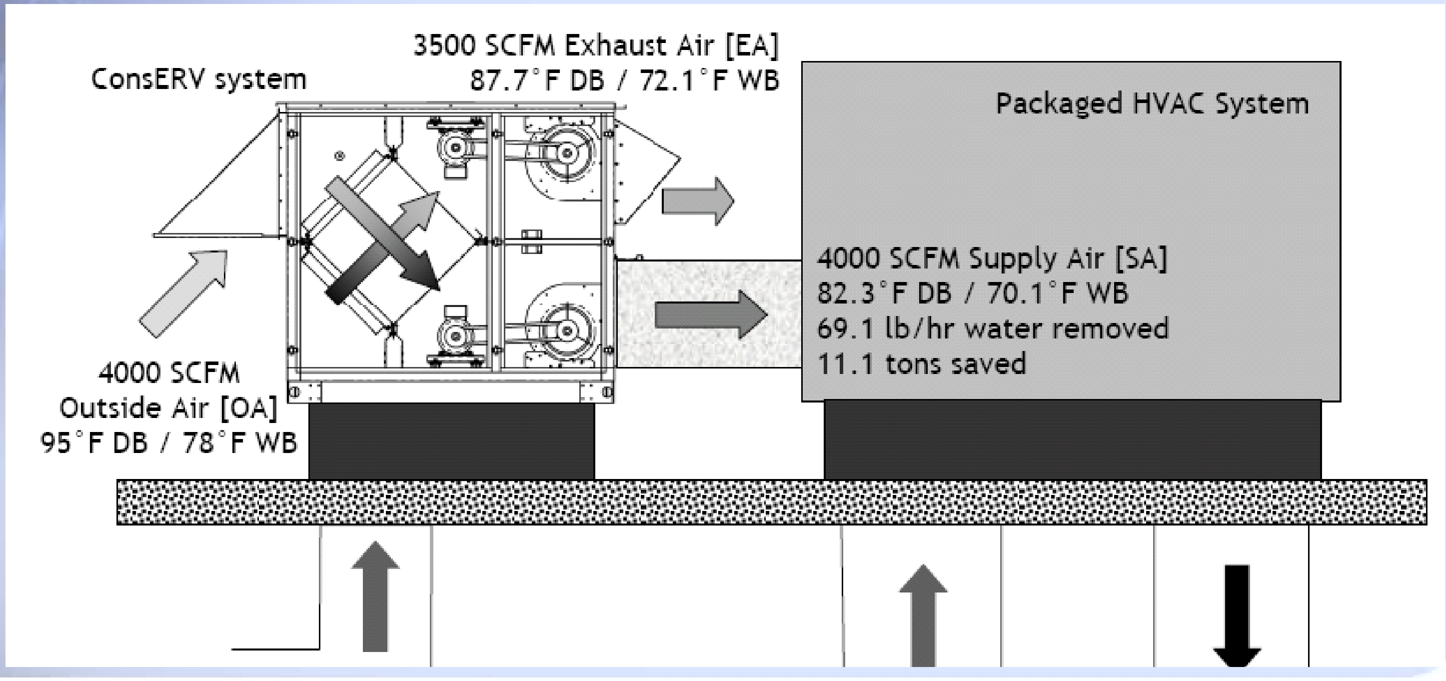


Case Study

- 5 story 166,750 sq ft office building in Orlando, FL seeking LEED Core & Shell
- Tilt up concrete walls with R-11 batt
- Glass with 0.21 Solar Heat Gain Coefficient and 0.9 Assembly U-value
- Reflective built-up roof w/4” insulation
- 0.9 watts per sq ft lighting power density with occupancy sensors
- Packaged DX Variable Air Volume air conditioning system with Energy Recovery Ventilators

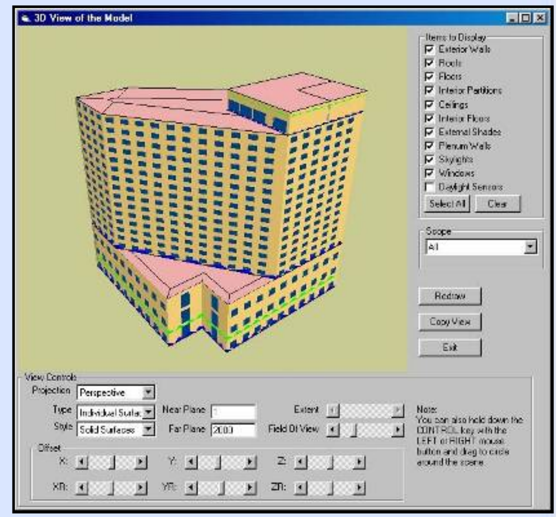
Energy Recovery Ventilator

- Reject heat from incoming outside air to exhaust air during cooling mode, capture heat from exhaust air and transfer to outside air during heating mode



LEED Energy & Atmosphere Credit 1 (EAc1) Optimize Energy Points

- Typically use ASHRAE 90.1-2004 Appendix G
- Create energy model of "code" / baseline building
- Create energy model of actual design
- Energy cost difference between them divided by baseline energy costs equates to LEED points



EAc1 Baseline

TABLE 5.5-2 Building Envelope Requirements For Climate Zone 2 (A,B)

Opaque Elements	Nonresidential Assembly Maximum	Nonresidential Insulation Min. R-Value	Residential Assembly Maximum	Residential Insulation Min. R-Value	Semiheated Assembly Maxi-mum	Semiheated Insulation Min. R-Value
Roofs						
Insulation Entirely above Deck	U-0.063	R-15.0 ci	U-0.063	R-15.0 ci	U-0.218	R-3.8 ci
Metal Building	U-0.065	R-19.0	U-0.065	R-19.0	U-0.167	R-6.0
Attic and Other	U-0.034	R-30.0	U-0.027	R-38.0	U-0.081	R-13.0
Walls, Above-Grade						
Mass	U-0.580	NR	U-0.151[a]	R-5.7 ci[a]	U-0.580	NR
Metal Building	U-0.113	R-13.0	U-0.113	R-13.0	U-0.184	R-6.0
Steel-Framed	U-0.124	R-13.0	U-0.124	R-13.0	U-0.352	NR
Wood-Framed and Other	U-0.089	R-13.0	U-0.089	R-13.0	U-0.292	NR

Fenestration	Nonresidential Assembly Max. U (Fixed/ Operable)	Nonresidential Assembly Max. SHGC (All Orientations/ North-Oriented)	Residential Assembly Max. U (Fixed/ Operable)	Residential Assembly Max. SHGC (All Orientations/ North-Oriented)	Semiheated Assembly Max. U (Fixed/ Operable)	Semiheated Assembly Max. SHGC (All Orientations/ North-Oriented)
Vertical Glazing,% of Wall						
0-10.0%	U_{fixed}-1.22 U_{oper}-1.27	$SHGC_{all}$-0.25 $SHGC_{north}$-0.61	U_{fixed}-1.22 U_{oper}-1.27	$SHGC_{all}$-0.39 $SHGC_{north}$-0.61	U_{fixed}-1.22 U_{oper}-1.27	$SHGC_{all}$-NR $SHGC_{north}$NR
10.1-20.0%	U_{fixed}-1.22 U_{oper}-1.27	$SHGC_{all}$-0.25 $SHGC_{north}$-0.61	U_{fixed}-1.22 U_{oper}-1.27	$SHGC_{all}$-0.25 $SHGC_{north}$-0.61	U_{fixed}-1.22 U_{oper}-1.27	$SHGC_{all}$-NR $SHGC_{north}$NR
20.1-30.0%	U_{fixed}-1.22 U_{oper}-1.27	$SHGC_{all}$-0.25 $SHGC_{north}$-0.61	U_{fixed}-1.22 U_{oper}-1.27	$SHGC_{all}$-0.25 $SHGC_{north}$-0.61	U_{fixed}-1.22 U_{oper}-1.27	$SHGC_{all}$-NR $SHGC_{north}$NR
30.1-40.0%	U_{fixed}-1.22 U_{oper}-1.27	$SHGC_{all}$-0.25 $SHGC_{north}$-0.61	U_{fixed}-1.22 U_{oper}-1.27	$SHGC_{all}$-0.25 $SHGC_{north}$-0.61	U_{fixed}-1.22 U_{oper}-1.27	$SHGC_{all}$-NR $SHGC_{north}$NR

EAc1 Baseline

TABLE 9.5.1 Lighting Power Densities Using the Building Area Method

Building Area Type[a]	Lighting Power Density (W/ft^2)
Automotive Facility	0.9
Convention Center	1.2
Court House	1.2
Dining: Bar Lounge/Leisure	1.3
Dining: Cafeteria/Fast Food	1.4
Dining: Family	1.6
Dormitory	1.0
Exercise Center	1.0
Gymnasium	1.1
Health Care-Clinic	1.0
Hospital	1.2
Hotel	1.0
Library	1.3
Manufacturing Facility	1.3
Motel	1.0
Motion Picture Theater	1.2
Multi-Family	0.7
Museum	1.1
Office	1.0

EAc1 Baseline

TABLE G3.1.1A ***Baseline* HVAC System Types**

Building Type	Fossil Fuel, Fossil/Electric Hybrid, & Purchased Heat	Electric and Other
Residential	System 1 – PTAC	System 2 - PTHP
Nonresidential & 3 Floors or Less & <75,000 ft^2	System 3 – PSZ-AC	System 4 – PSZ-HP
Nonresidential & 4 or 5 Floors & <75,000 ft^2 or 5 Floors or Less & 75,000 ft^2 to 150,000 ft^2	System 5 - Packaged VAV w/ Reheat	System 6 - Packaged VAV w/PFP Boxes
Nonresidential & More than 5 Floors or >150,000 ft^2	System 7 - VAV w/Reheat	System 8 - VAV w/PFP Boxes

Notes:
Residential building types include dormitory, hotel, motel, and multifamily. Residential space types include guest rooms, living quarters, private living space, and sleeping quarters. Other building and space types are considered nonresidential.
Where no heating system is to be provided or no heating energy source is specified, use the "Electric and Other" heating source classification.
Where attributes make a building eligible for more than one *baseline* system type, use the predominant condition to determine the system type for the entire building.

TABLE G3.1.1B ***Baseline* System Descriptions**

System No.	System Type	Fan Control	Cooling Type	Heating Type
1. PTAC	Packaged terminal air conditioner	Constant Volume	Direct Expansion	Hot Water Fossil Fuel Boiler
2. PTHP	Packaged terminal heat pump	Constant Volume	Direct Expansion	Electric Heat Pump
3. PSZ-AC	Packaged rooftop air conditioner	Constant Volume	Direct Expansion	Fossil Fuel Furnace
4. PSZ-HP	Packaged rooftop heat pump	Constant Volume	Direct Expansion	Electric Heat Pump
5. Packaged VAV w/ Reheat	Packaged rooftop variable air volume with reheat	VAV	Direct Expansion	Hot Water Fossil Fuel Boiler
6. Packaged VAV w/PFP Boxes	Packaged rooftop variable air volume with reheat	VAV	Direct Expansion	Electric Resistance
7. VAV w/Reheat	Packaged rooftop variable air volume with reheat	VAV	Chilled Water	Hot Water Fossil Fuel Boiler
8. VAV w/PFP Boxes	Variable air volume with reheat	VAV	Chilled Water	Electric Resistance

EAc1 Baseline

TABLE G3.1.3.7 Type and Number of Chillers

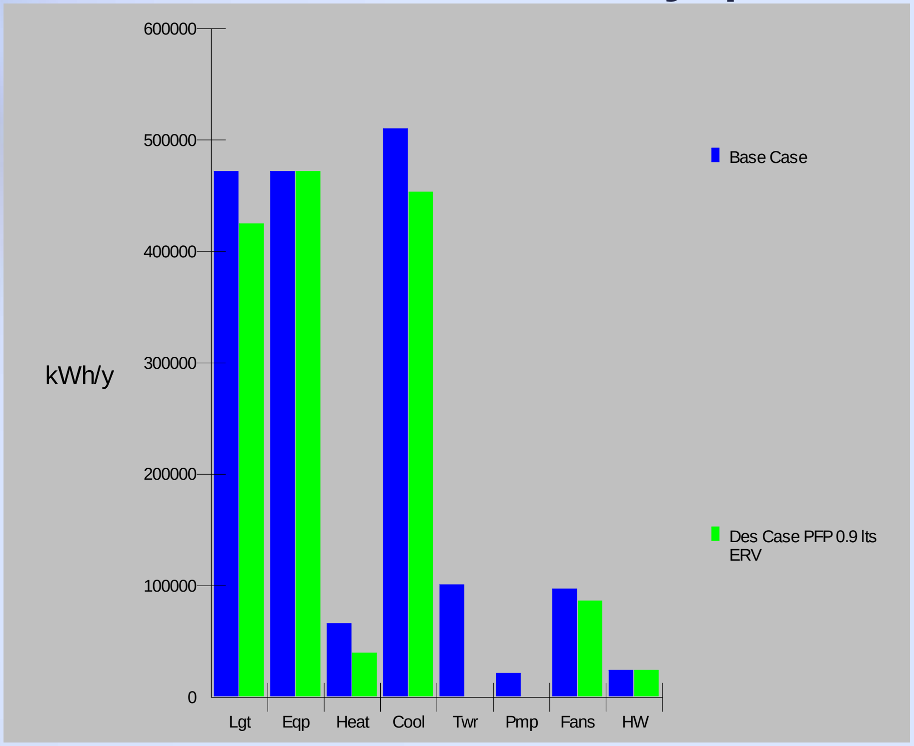
Building-Conditioned Floor Area	Number and Type of Chiller(s)
≤ 120,000 ft^2	1 screw chiller
> 120,000 ft^2, < 240,000 ft^2	2 screw chillers sized equally
≥ 240,000 ft^2	2 centrifugal chillers minimum with chillers added so that no chiller is larger than 800 tons, all sized equally

LEED Energy & Atmosphere Credit 1 (EAc1) Optimize Energy Points

- It is a lot easier to earn LEED points for a 149,000 sq ft commercial building than for a 151,000 sq ft building!
- Also easier with 239,000 sq ft instead of 241,000 sq ft
- Becomes more of an effort of “what can I compare to?” instead of how much energy the building will use
- **Can spend more time on the fictional “code” / baseline energy model than on the actual design model**

EAc1 Case Study Results

- Baseline = $176,000 & 2,080,817 kwh/yr
- Design = $149,000 & 1,759,264 kwh/yr
- 15% better = 2 mandatory points



Energy Star and the 2030 Challenge

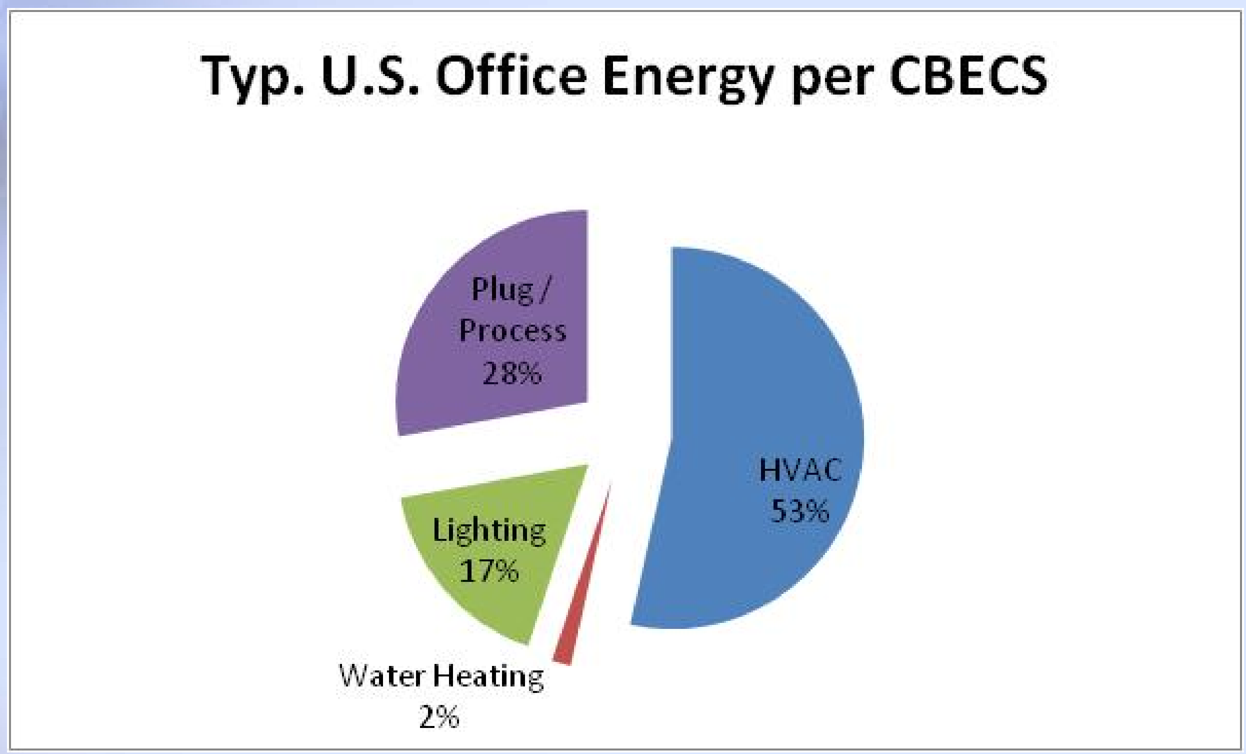
- Both use the Commercial Building Energy Consumption Survey (CBECS) as the baseline

Commercial Building Energy Consumption Survey (CBECS)

- Conducted every 4 years by the Energy Information Administration (EIA) (which is part of the U.S. Dept of Energy)
- National sample survey that collects energy information from various U.S. commercial buildings
- Can be sorted by building type, size, age, region, etc.
- **Current data from 2003**, 2007 data to be released mid 2009
- http://www.eia.doe.gov/emeu/cbecs/

Office Building Data from CBECS

- Typ. Office Building in the U.S. consumes 92.9 kBtu/sq ft of energy per year (includes gas and electric)

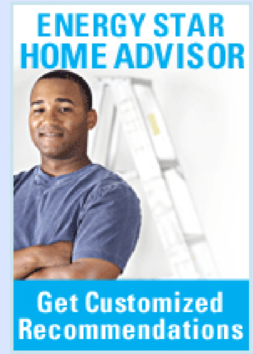


Office Building Data from CBECS

- Typ. Office Building in the U.S. consumes 92.9 kBtu/sq ft of energy per year (includes gas and electric)
- LEED Baseline for our case study uses 42.6 kBtu/sq ft per year
- One reason for difference – models are theoretical and owners rarely operate buildings exactly as they are intended…

ENERGY STAR

Products



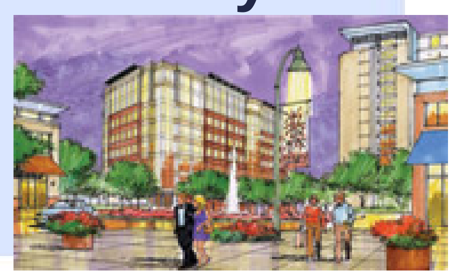
Home Improvement

Buildings & Plants

New Homes

Example Projects in 2008 that achieved "**Designed** to Earn the Energy Star"

- Discovery Tower, TX – Gensler (99)
- One Legacy Circle, TX – HKS, Inc. (96)
- NOAA National Center for Weather and Climate Protection, MD – HOK (81)
- Bishop Woods School, CT – JCJ (75)
- 32 Projects achieved in 2007
- **Can't earn the "full" Energy Star until you have actual utility data**



Building Types Eligible for an Energy Star Rating

- Office
- Courthouse
- Bank/Financial Institution
- K-12 School
- Supermarket/Grocery
- Retail (Big Box)
- Hospital
- Medical Office
- Hotel
- Residence Hall/Dormitory
- Warehouse (refrigerated/non-refrigerated)

Target Finder

- Uses 2003 CBECS (Commercial Buildings Energy Consumption Survey) National Average Source Energy Use and Performance Comparisons
- There is not a direct correlation between the Energy Star rating and ASHRAE 90.1 (LEED baseline).

actual operating building data ≠ energy model comparisons

Target Finder

- Looks at energy use intensity (EUI)
- Required data inputs (primary drivers of energy use)
  - ZIP code (30 year average climate conditions)
  - Building type, size & hours of operation
  - Number of occupants and computers
  - Simulated or actual energy consumption
- Generates a 1-100 weighted score based on all these factors
- 75 or higher = Energy Star

Case Study LEED/ASHRAE Base Case

For every 1 kWh I use at my building, they produce 3.33 at the plant

Target Energy Performance Results (estimated)			
Energy	**Design**	**Target**	**Top 10%**
Energy Performance Rating (1-100)	95	75	90
Energy Reduction (%)	54	26	45
Source Energy Use Intensity (kBtu/Sq. Ft./yr)	142.2	229.2	171.7
Site Energy Use Intensity (kBtu/Sq. Ft./yr)	42.6	68.6	51.4
Total Annual Source Energy (kBtu)	23,713,157.0	38,211,182.7	28,629,393.1
Total Annual Site Energy (kBtu)	7,099,747.6	11,440,473.8	8,571,674.6
Total Annual Energy Cost ($)	$ 208,082	$ 335,301	$ 251,221
Pollution Emissions			
CO2 Emissions (tons/year)	1,385.0	2,231.9	1,672.4
CO2 Emissions Reduction (%)	54%	26%	45%

Facility Information Edit

Flagler 1700
Orlando, FL 32751
United States

Facility Characteristics Edit	
Space Type	**Gross Floor Area (Sq. Ft.)**
Office	166,750
Total Gross Floor	166,750

Estimated Design Energy Edit			
Energy Source	**Units**	**Estimated Total Annual Energy Use**	**Energy Rate ($/Unit)**
Electricity	kWh	2,080,817	$ 0.100/kWh

Source: Data adapted from DOE-EIA. See EPA Technical Description

Base Case Scores a 95????

- 2001 – larger DX equipment went from 8.5 EER to about 9.5 EER
- 1999 – ASHRAE & energy code Lighting Power Density (LPD) went from about 2 to 1.3 watts/sq ft for offices.
- 2001 – ASHRAE LPD went from 1.3 to 1 watt/sq ft for offices.   Most energy codes didn’t adopt to this until around 2003 / 2004
- Late 90’s and early 2000, ASHRAE & energy codes started requiring better glass (0.61 SHGC down to 0.25 SHGC in Florida)
- **2003 CBECS…**

REAL CHALLENGE IS
ZERO ENERGY!

Hypothetical Office Built in 2000

Target Energy Performance Results (estimated)			
Energy	**Design**	**Target**	**Top 10%**
Energy Performance Rating (1-100)	74	75	90
Energy Reduction (%)	26	26	45
Source Energy Use Intensity (kBtu/Sq. Ft./yr)	230.1	229.2	171.7
Site Energy Use Intensity (kBtu/Sq. Ft./yr)	68.9	68.6	51.4
Total Annual Source Energy (kBtu)	38,376,219.6	38,211,182.7	28,629,393.1
Total Annual Site Energy (kBtu)	11,489,886.1	11,440,473.9	8,571,674.6
Total Annual Energy Cost ($)	$ 336,749	$ 335,301	$ 251,221
Pollution Emissions			
CO2 Emissions (tons/year)	2,241.5	2,231.6	1,672.1
CO2 Emissions Reduction (%)	26%	26%	45%

Facility Information Edit

Flagler 1700
Orlando, FL 32751
United States

Facility Characteristics Edit	
Space Type	**Gross Floor Area (Sq. Ft.)**
Office	166,750
Total Gross Floor	166,750

Estimated Design Energy Edit			
Energy Source	**Units**	**Estimated Total Annual Energy Use**	**Energy Rate ($/Unit)**
Electricity	kWh	3,367,493	$ 0.100/kWh

Source: Data adapted from DOE-EIA. See EPA Technical Description

LEED Design (14% better than code)

Target Energy Performance Results (estimated)			
Energy	**Design**	**Target**	**Top 10%**
Energy Performance Rating (1-100)	98	75	90
Energy Reduction (%)	61	26	45
Source Energy Use Intensity (kBtu/Sq. Ft./yr)	120.2	229.2	171.7
Site Energy Use Intensity (kBtu/Sq. Ft./yr)	36.0	68.6	51.4
Total Annual Source Energy (kBtu)	20,048,713.3	38,211,182.7	28,629,393.1
Total Annual Site Energy (kBtu)	6,002,608.8	11,440,473.9	8,571,674.6
Total Annual Energy Cost ($)	$ 175,926	$ 335,301	$ 251,221
Pollution Emissions			
CO2 Emissions (tons/year)	1,171.0	2,231.9	1,672.4
CO2 Emissions Reduction (%)	61%	26%	45%

Facility Information Edit

Flagler 1700
Orlando, FL 32751
United States

Facility Characteristics	Edit
Space Type	**Gross Floor Area (Sq. Ft.)**
Office	166,750
Total Gross Floor	166,750

Estimated Design Energy			Edit
Energy Source	**Units**	**Estimated Total Annual Energy Use**	**Energy Rate ($/Unit)**
Electricity	kWh	1,759,264	$ 0.100/kWh

Source: Data adapted from DOE-EIA. See EPA Technical

LEED Design (14% better than code)

1,764,539 KWH per year, no gas

% Energy Reduction	EPA Rating	Source EUI (kBtu/SF/yr)	Site EUI (kBtu/SF/yr)
50%	93	156.4	46.8
60%	97	129.5	38.8
70%	99	108.8	32.6
80%	100	92.3	27.6
90%	100	92.3	27.6
100%	Not Available	Not Available	Not Available

Application

TARGET FINDER

PRINT | FREQUENTLY ASKED QUESTIONS | CONTACT US | HELP

Apply for the "Designed to Earn the ENERGY STAR" graphic

DESIGNED TO EARN THE ENERGY STAR

1. Complete and stamp your Statement of Energy Design Intent.
2. Complete the Application Letter (instructions and mailing address included).
3. Mail both documents to the US EPA to receive **"Designed to Earn the ENERGY STAR"** graphic and qualify project for the **ENERGY STAR Challenge.**

E-mail questions to: DesignedToEarn@energystar.gov

☐ ***By Express mail***

Re: Designed to Earn the ENERGY STAR
K. P. Butler
ENERGY STAR Commercial Building Design
US Environmental Protection Agency
1310 L Street, NW (902C)
Washington, DC 20005

☐ ***By USPS mail***

Re: Designed to Earn the ENERGY STAR
K. P. Butler
ENERGY STAR Commercial Building Design
U.S. Environmental Protection Agency
1200 Pennsylvania Avenue, NW (6202J)
Washington, DC 20460

Dear Ms. Butler:

As the Architect of Record, we are submitting a Statement of Energy Design Intent (SEDI) for the ***<INSERT building name>***, located in ***<INSERT city and state>***, owned by ***<INSERT owner name>***. We proudly submit this SEDI, which states our best estimate of the intended energy use for *all* specified systems, equipment, and strategies for this project. This project achieved an EPA rating of 75 or greater, and we understand that the Designed to Earn the ENERGY STAR special application graphic can only be displayed on the building plans for this project. As an ENERGY STAR partner, we also consent to adhere to EPA's Logo Identity Guidelines.

The estimated energy use has been included as part of the Contract Documents and/or Owner/Architect Contract. Our firm has also demonstrated the ability to design and specify buildings with enhanced energy performance by stating energy goals in the Supplementary General Conditions Section of the Specification. Our firm understands that after the facility is built and operating for more than one (1) year, the owner may wish to apply for the ENERGY STAR label for the building. Our firm, if requested by the owner, will assist with the application for the ENERGY STAR.

We agree to collaborate with EPA on a case study about the project's design energy use strategies and goals, to be posted on the ENERGY STAR Web site. I can be reached at **<Insert phone #>** and by e-mail **<Insert e-mail address>**.

We look forward to promoting our commitment to designing buildings that meet EPA's energy performance criteria to help lower energy demand and prevent greenhouse gas emissions.

Sincerely

DESIGNED TO EARN THE ENERGY STAR

STATEMENT OF ENERGY DESIGN INTENT
September 25, 2008

FACILITY INFORMATION

Facility Name and Location
Flagler 1700
Orlando, FL - United States 32751

Building
Owner/Company ______
Address ______

Contact Name ______
Phone ______
Email ______

Facility Characteristics
Office 166,750 Sq. Ft.
Total Gross Floor Area 166,750 Sq. Ft.

Design Energy (kBtu)[1]
Electricity 6,020,607

DESIGN ENERGY PERFORMANCE RESULTS

	DESIGN	ENERGY STAR
Energy		
EPA Energy Performance Rating (1 – 100)	100	75
Percent Energy Reduction (%)[2]	75	26
Site Energy Use Intensity (kBtu/sf/yr)	36.1	107.2
Total Annual Site Energy (kBtu)	6,020,607	17,869,314
Total Annual Energy Cost ($)	$ 141,163	$ 418,976
Pollution Emissions (tons/yr)		
CO_2	1,175	3,487

PROFESSIONAL VERIFICATION

Licensed Architect/Engineer
Prepared By ______
Firm Name ______

Professional Stamp
Signature & Date

2030 Challenge

- Created by Architecture 2030
  - Non-profit
  - Created by architect Ed Mazria in 2002
  - Mission is to rapidly reduce Greenhouse Gas Emissions (GHG's) from the building industry
  - Supported by AIA, USGBC, ASHRAE, etc.
  - www.architecture2030.org

2030 Challenge

- Reduce GHG emissions for new buildings and major renovations.
  - 50% lower than **CBECS** now
  - 60% by 2010 (LEED case study meets this)
  - 70% by 2015
  - 80% by 2020 (Energy Star Score = 100)
  - 90% by 2025
  - 100% by 2030 (can be an 80% reduction with a max of 20% green power or renewable energy credits)
- Should be an equal amount of existing building renovation as there is new construction sq ft

2030 Challenge Targets

A check mark indicates building types available in Target Finder.

2030 CHALLENGE Targets: National Averages

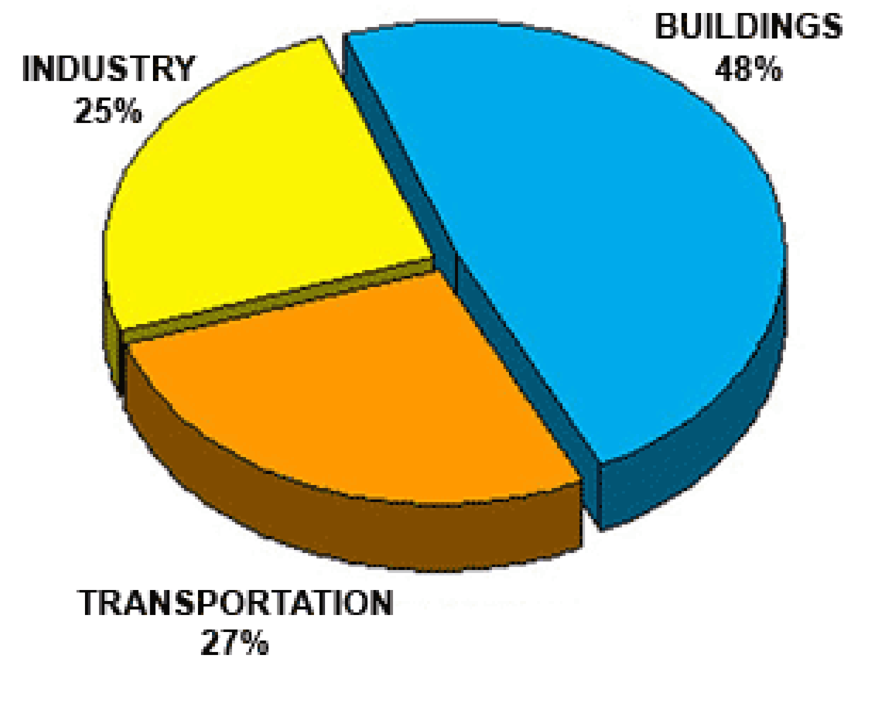
U.S. Average Site Energy Use and 2030 Challenge Energy Reduction Targets by Space/Building Type (CBECS 2003)[1]

From the Environmental Protection Agency (EPA): Use this chart to find the site fossil-fuel energy targets.

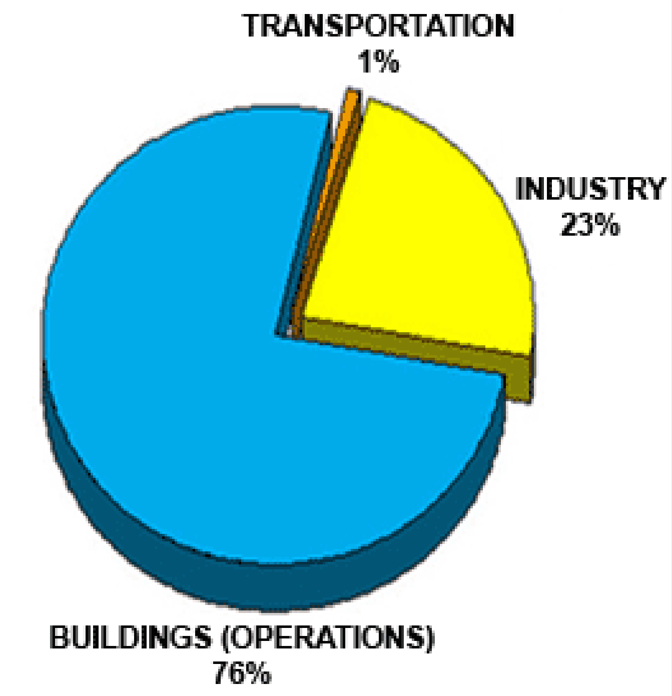
Primary Space/Building Type[2]	Available in Target Finder[3]	Average Source EUI[4] (kBtu/Sq.Ft./Yr)	Average Percent Electric	Average Site EUI[4] (kBtu/Sq.Ft./Yr)	2030 Challenge Site EUI Targets (kBtu/Sq.Ft./Yr)				
					50% Target	60% Target	70% Target	80% Target	90% Target
Administrative/Professional & Government Office	✓								
Bank	✓								
Clinic/other outpatient health		219	76%	84.2	**42.1**	33.7	25.3	16.8	8.4
College/university (campus-level)		280	63%	120	**60**	48	36	24	12
Convenience store (with or without gas station)		753	90%	241.4	**120.7**	96.6	72.4	48.3	24.1
Distribution/shipping center		90	61%	44.2	**22.1**	17.7	13.3	8.8	4.4
Fast food		1306	64%	534.3	**267.2**	213.7	160.3	106.9	53.4
Fire station/police station		157	56%	77.9	**39.0**	31.2	23.4	15.6	7.8
Hospital/inpatient health	✓								
Hotel, Motel or Inn	✓								
K-12 School	✓								
Medical Office	✓								
Non-refrigerated warehouse	✓								
Nursing home/assisted living		255	54%	124.3	**62.2**	49.7	37.3	24.9	12.4
Public Assembly		143	57%	66	**33**	26	20	13	7
Refrigerated warehouse	✓								
Religious worship		83	52%	45.9	**23.0**	18.4	13.8	9.2	4.6
Residence hall/Dormitory	✓								

The Building Sector

The Hidden Culprit

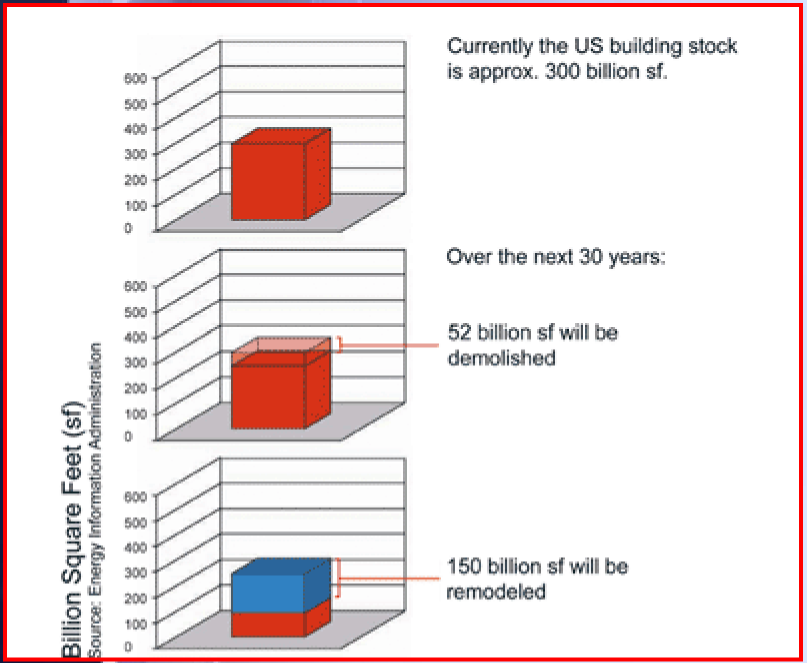


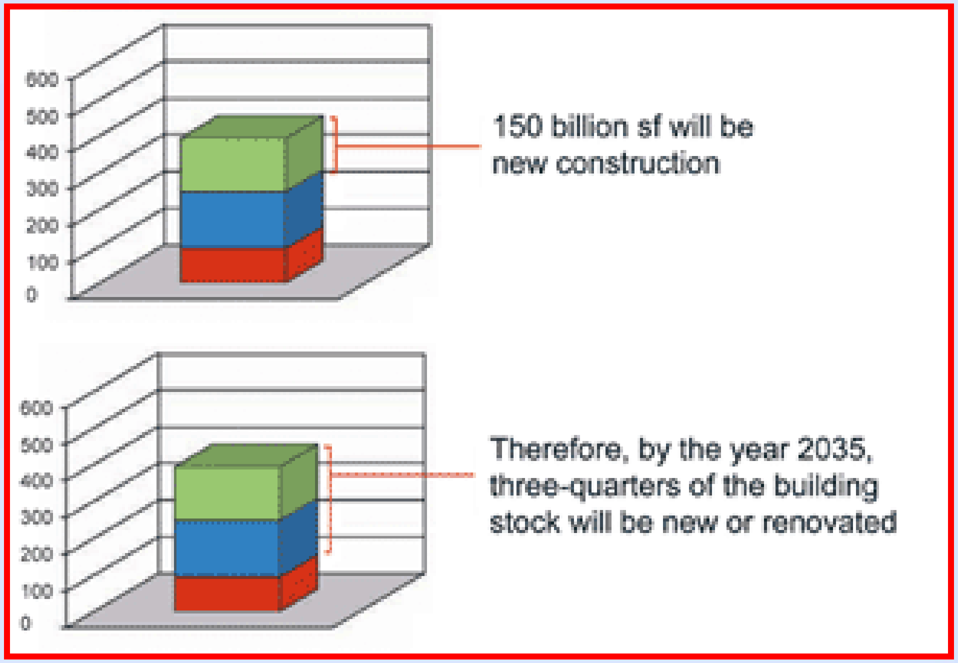
US Energy Consumption (Figure B)



US Electricity Consumption (Figure C)

Historical Opportunity





From architecture 2030

Architecture 2030 Comparison Chart

CODE / STANDARD	COMMERCIAL	RESIDENTIAL
ASHRAE 90.1-2004	30% below	
ASHRAE 90.1-2007	25% below	
ASHRAE 189 (in progress)	0	
IECC 2006	30% below	30% below
California Title 24 2005		15% - 20% below[13]
California Title 24 2008	10% below[14]	
Oregon Energy Code[15]	25% below	30% below
Washington Energy Code	25% below	25% - 30% below[16]
RESNET HERS Index		65 or less
LEED NC 2.2 / Homes	New - EA Credit #1: 6 pts Renovation - EA Credit #1: 8pts	HERS Index: 65
LEED 2009 (in progress)	New - EA Credit #1: 7 pts Renovation - EA Credit #1: 9pts	
GBI Standard (in progress)[17]	PATH A, 8.1.1.1: 150pts	
EECC Option[18] (prescriptive path)		EC - 154
NBI Option[19] (prescriptive path)	New - Core Performance w/ enhanced measures	

2030 Challenge vs. LEED Baseline / Energy Code and LEED Design

- Our case study LEED/ASHRAE baseline already complies with 2030 Challenge!
- LEED design case meets 2010 targets for 2030 Challenge
- Is the architecture 2030 comparison chart accurate?
- Factors that influence variation - Building size, energy utilized, location & climate, etc.

actual operating building data ≠ energy model comparisons

Conclusions – by Learning Objective

Learn the Basics of LEED Energy Models

- Look up baseline systems, lighting watts per sq ft, etc. in ASHRAE 90.1
- Can exercise in “what can I compare to?”
- Use properly as a design tool first, then worry about the LEED points…

TABLE G3.1.1A *Baseline* **HVAC System Types**

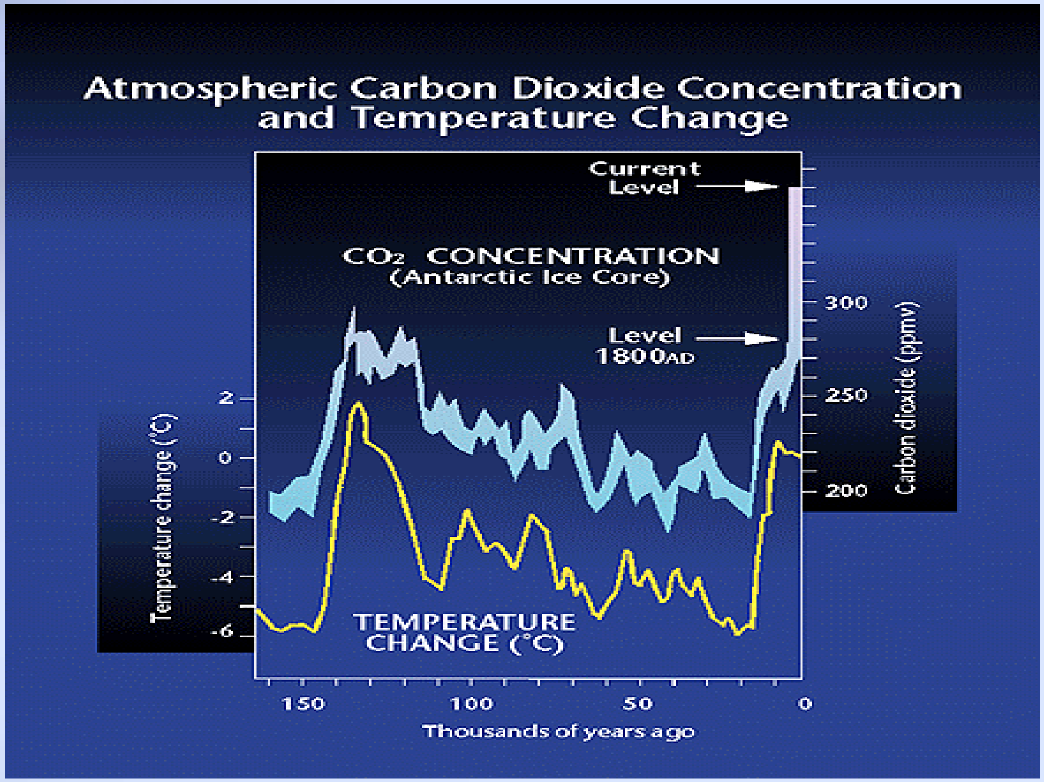
Building Type	Fossil Fuel, Fossil/Electric Hybrid, & Purchased Heat	Electric and Other
Residential	System 1 – PTAC	System 2 - PTHP
Nonresidential & 3 Floors or Less & <75,000 ft^2	System 3 – PSZ-AC	System 4 – PSZ-HP
Nonresidential & 4 or 5 Floors & <75,000 ft^2 or 5 Floors or Less & 75,000 ft^2 to 150,000 ft^2	System 5 - Packaged VAV w/ Reheat	System 6 - Packaged VAV w/PFP Boxes
Nonresidential & More than 5 Floors or >150,000 ft^2	System 7 - VAV w/Reheat	System 8 - VAV w/PFP Boxes

Learn what the 2030 Challenge and Energy Star Programs are

- Both use 2003 CBECS as the baseline
- Energy Star
  - Score 75 using Target Finder (about a 27% energy reduction from CBECS using our case study)
  - Full Energy Star based on actual operation
- 2030 Challenge
  - Uses Target Finder
  - 50% reduction from CBECS now up to 100% in 2030 (20% of this can be from green power / renewable energy credits)

Learn why these programs are important – climate change

- GHG's must level off by 2015 to 2020 and then decline to avoid unmanageable climate change



Learn similarities and differences between LEED energy points, 2030 Challenge and Energy Star

- LEED uses a fictional code baseline – key is “what can I compare to?”
- Some new code buildings can actually meet Energy Star due to recent energy code changes
- 2030 Challenge indicates you should be 30% better than LEED baseline / code… that is not really the case for all building types, shapes, sizes, locations, etc.

actual operating building data ≠ energy model comparisons

Learn energy efficiency strategies to achieve all three standards

- For 5 story 166,750 sq ft office case study in Orlando – mandatory LEED EAc1 points, Energy Star & 2010 levels of 2030 Challenge all achieved with:
  - Tilt up concrete walls with R-11 batt
  - Glass with 0.21 Solar Heat Gain Coefficient and 0.9 Assembly U-value
  - Reflective built-up roof w/4” insulation
  - 0.9 watts / sq ft LPD with occupancy sensors
  - Packaged DX Variable Air Volume air conditioning system with Energy Recovery Ventilators

Final level of 2030 Challenge???

- 100% reduction – actually an 80% reduction with 20% green power
- Case study LEED design already had a 60% reduction
- Remaining 40% needs to be half on site renewable power and half purchased green power

Final level of 2030 Challenge???

- 482 KW Photovoltaic solar power system
  - 41,000 sq ft of panel – doesn't fit on our roof
  - $4,500,000 first cost ($27 / sq ft)
- $8,800 per year in green power costs
  - at today's rate of about 1 cent / kwh

Questions???