SUSTAINABILITY TRACK
Session 6

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GSA

Phoenix, AZ
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Sustainable Building Technologies for a Carbon Conscious World

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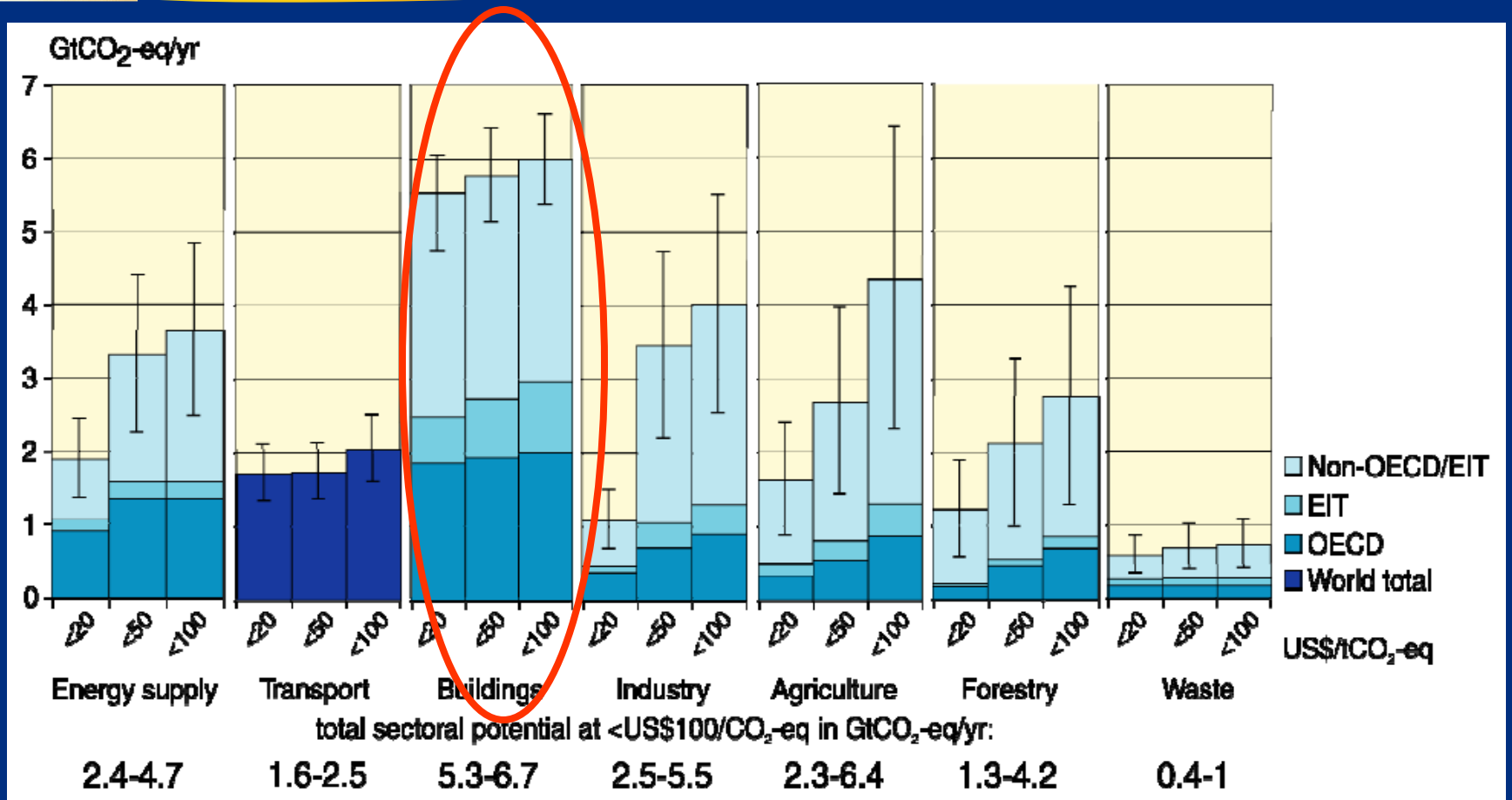
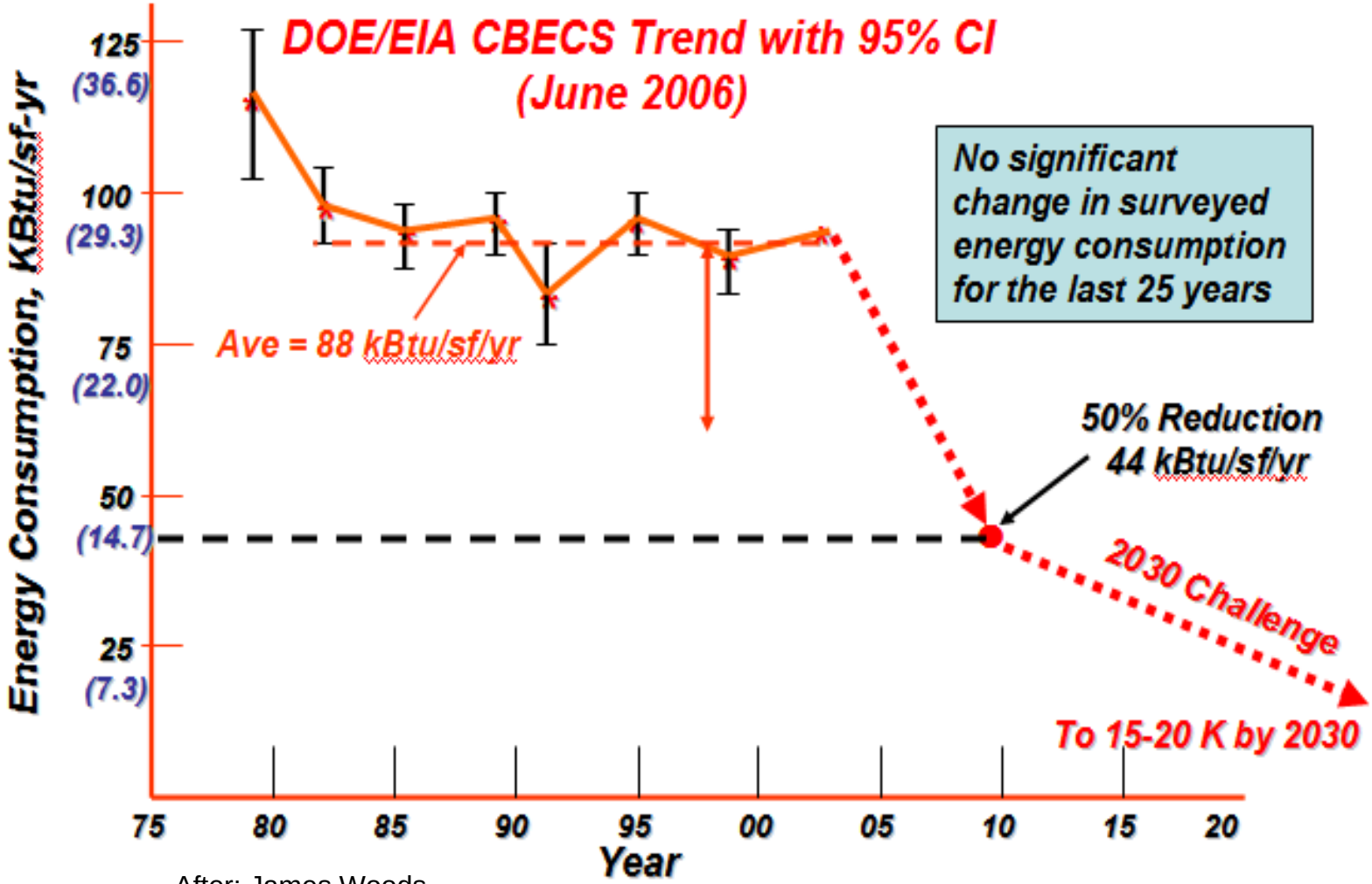
The Building Sector's CO_2 Mitigating Potential for 2030



total sectoral potential at <US$100/$CO_2$-eq in $GtCO_2$-eq/yr:

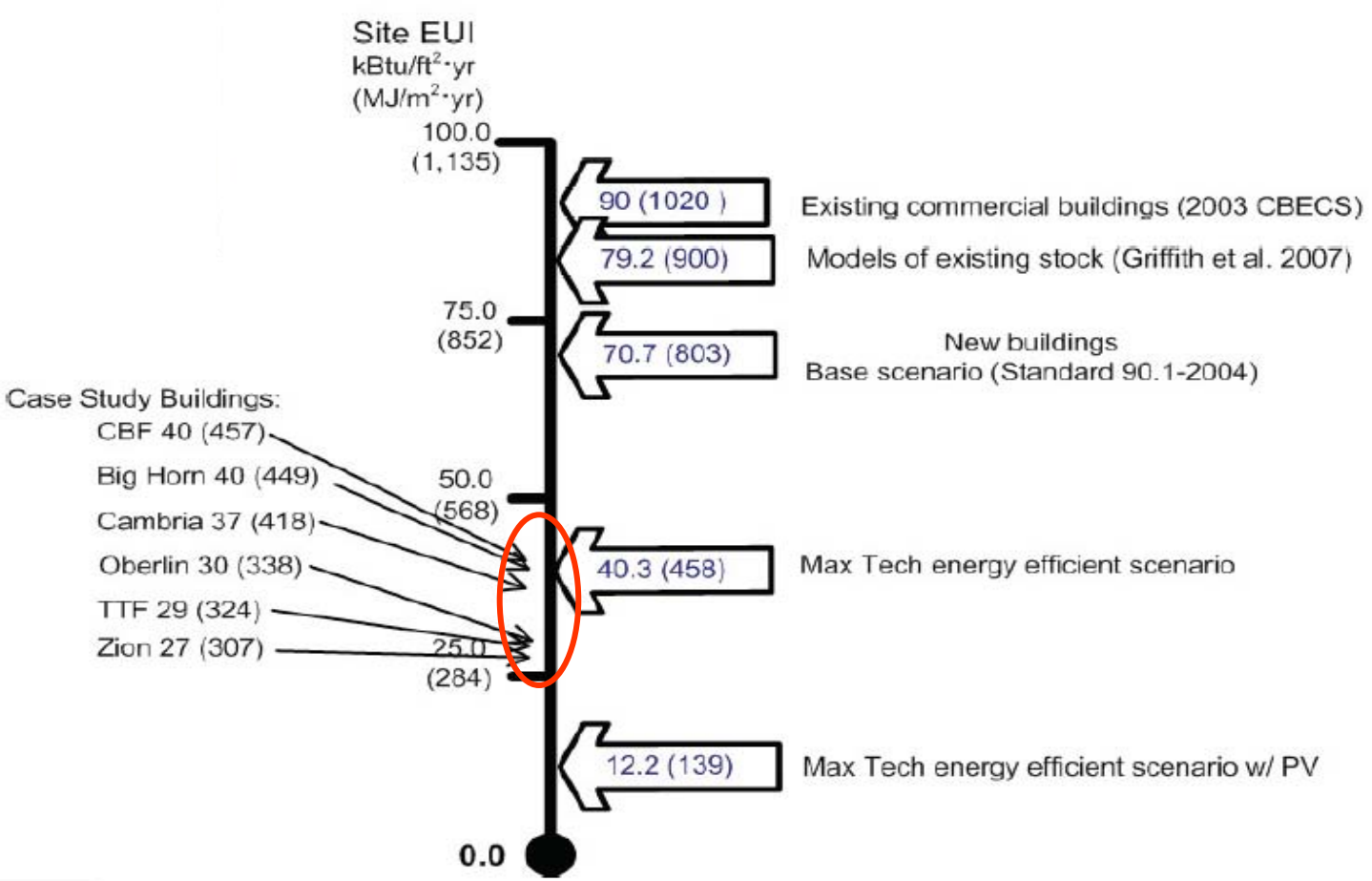
Energy supply	Transport	Buildings	Industry	Agriculture	Forestry	Waste
2.4-4.7	1.6-2.5	5.3-6.7	2.5-5.5	2.3-6.4	1.3-4.2	0.4-1

ASHRAE 90 Over the Last 30 Years



After: James Woods

How Low Can We Go



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Setting Targets and Benchmarks

- EO 13423 & EISA – 30% better than ASHRAE 90.1-2004 (now)
- ASHRAE 189 – 30% better than ASHRAE 90.1 2007 (now to 2011)
- Architecture 2030 – 50% better than Average US Stock (now), 100% better or Zero Net Energy by 2030
- California AB32 – Zero Net Energy by 2030

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Architecture 2030

Year	Percentage Energy Reduction
Today	50
2010	60
2015	70
2020	80
2025	90
2030	100 (Carbon Neutral)

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California PUC's Application of AB32 to Buildings

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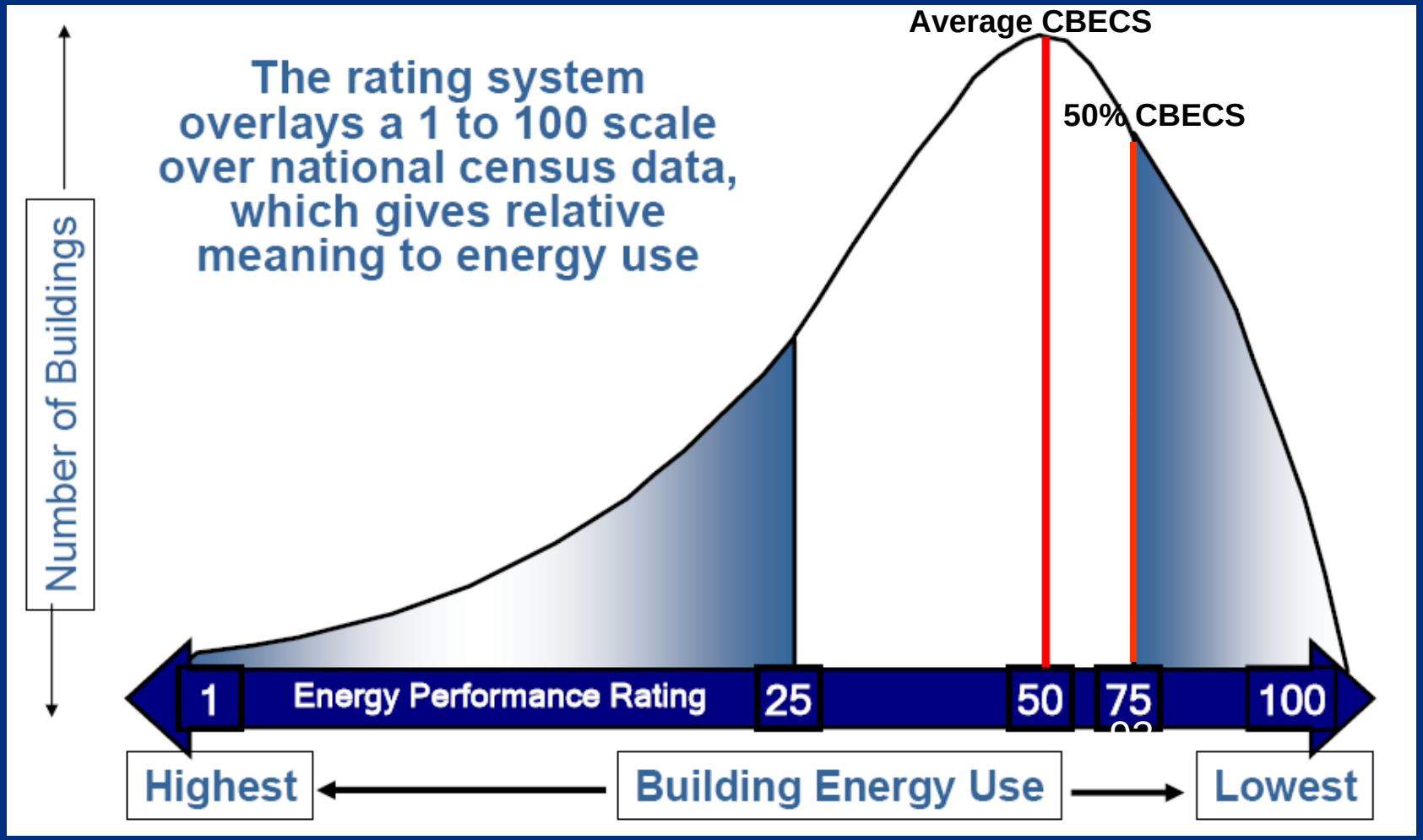
Grueneich, 2008

EPA Has Modified the CBECS Database



Example Building for this Case Study

- 21,000 square foot office building
- Located in Washington D.C. (ASHRAE Climate Zone 4A)
- 50 person occupancy
- 50 hours per week operation
- Envelope performance, internal loads and HVAC efficiency are dependent on the version of the code used

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EPA Target Finder

http://www.energystar.gov/index.cfm?c=new_bldg_design.bus_target_finder

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Buildings & Plants

- Guidelines for Energy Management
- Tools & Resources Library
- Expert Help
- New Building Design
  - Benefits & Recognition
  - ENERGY STAR Challenge for Architects
  - Active A&E Firms
  - **Target Finder - EPA Rating**
  - Building Design Guidance
  - News & Resources
  - Classes & Conferences
- Green Buildings

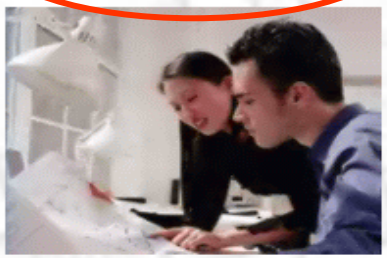
Home > Buildings & Plants > Tools & Resources Library > New Building Design > Target Finder

Target Finder

Target Finder can help you set "realistic" energy performance goals and receive a rating for the intended energy use in design projects. By setting and achieving superior energy performance goals, architects can help their clients prevent greenhouse gas emissions associated with burning fossil fuels. Target Finder can help to establish energy targets that support:

- The 2030 Challenge and American Institute of Architects (AIA) fossil fuel reduction goal
- Architects Participating in the ENERGY STAR Challenge

Enter Target Finder



ARCHITECTS:

Quick Finder

- Portfolio Manager Login
- Target Finder
- ENERGY STAR Challenge
- ENERGY STAR Leaders
- Earn the ENERGY STAR
- Purchasing & Procurement

It's Easy to Establish Energy Goals

EPA tools and resources help you choose a target for achieving:

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EPA Target Finder

Target Finder

* REQUIRED

Select a target rating and/or compare your Design Energy to the target.

1. Facility Information

*Zip Code: 20515

Facility Name: Small Office Building

City: Washington, DC

State:

2. Facility Characteristics

*Select Space Type(s) for this project.

[Space Types]

Office — Delete

*Gross Floor Area	*Operating Hours/Week	*Workers on Main Shift	*Number of PCs	*Office Air-Conditioned	*Office Heated
21000 Sq. Ft.	50 Hours	50	50	50% or more	50% or more

3. The Target[1]

Target Rating: Select

Or

Energy Reduction Target: 50%

*Choose the design target and select "**View Results**" to display associated energy use for the target.

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EPA Target Finder

Target Energy Performance Results

The design **must** achieve a rating of 75 or higher to be eligible for "Designed to Earn the ENERGY STAR". **View Statement of Energy Design Intent** for project summary.

View

NOTE: Assumptions are 79% electricity and 21% Natural Gas. The Target & Top 10% energy use for this facility are calculated based on the typical fuel mix in the zip code specified.

Target Energy Performance Results (estimated)			
Energy	**Design**	**Target**	**Top 10%**
Energy Performance Rating (1-100)	N/A	93	90
Energy Reduction (%)	N/A	50	45
Source Energy Use Intensity (kBtu/Sq. Ft./yr)	N/A	97.9	107.5
Site Energy Use Intensity (kBtu/Sq. Ft./yr)	N/A	33.3	36.6
Total Annual Source Energy (kBtu)	N/A	2,055,078.9	2,256,625.5
Total Annual Site Energy (kBtu)	N/A	700,402.7	769,092.9
Total Annual Energy Cost ($)	N/A	$ 13,830	$ 15,186

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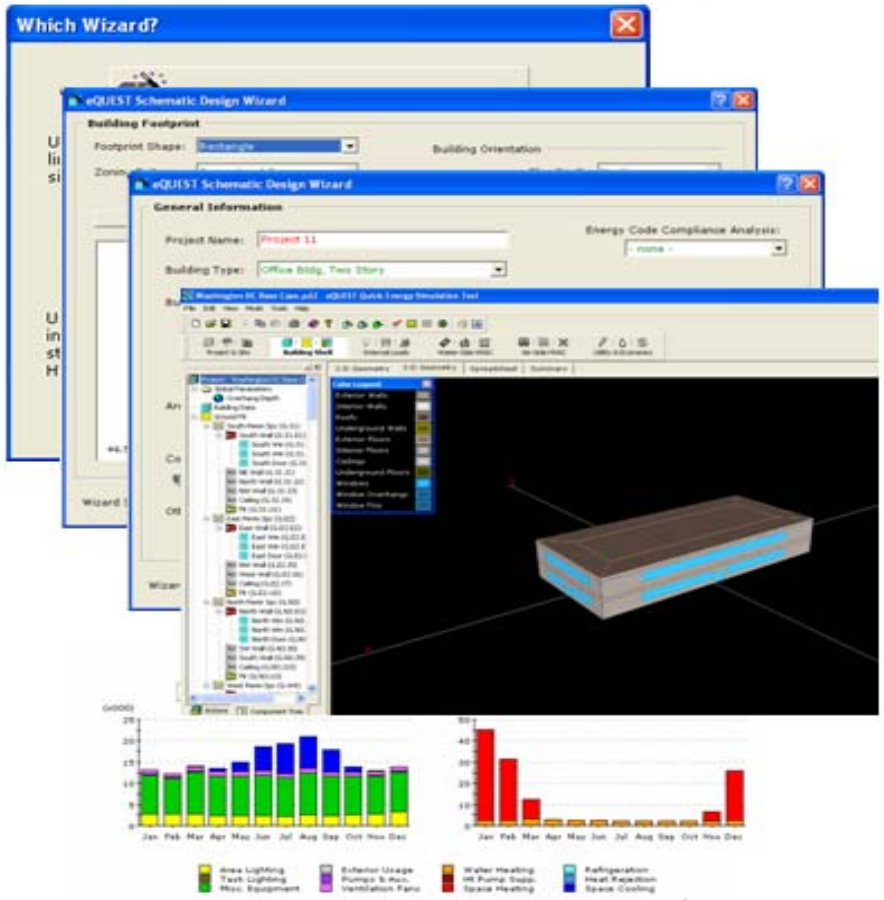
Energy Modeling



eQUEST

Building Creation Wizard

Energy Efficiency Measure Wizard

Graphical Results Display

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EUI for Small Office Building – Zone 4A

Scenario	Gas	Electric	Renewables	Total
Ave. CBECS	13.98	52.62	0	66.60
50% CBECS	6.99	26.31	0	33.30
90.1-2007	4.46	36.62	0	41.08
189	6.40	27.76	-0.33	33.83

Units: EUI (kBtu/ft^2-yr)

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CUI for Small Office Building – Zone 4A

Scenario	Gas	Electric	Renewables	Total
Ave. CBECS	1.63	24.20	0	25.83
50% CBECS	0.82	12.10	0	12.92
90.1-2007	0.52	16.84	0	17.36
189	0.75	12.77	-0.15	13.37

Units: CUI (lbs-CO^2/ft^2-yr)

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Proposed Sustainable Building Technologies

- 25% of the electricity usage from Solar PV

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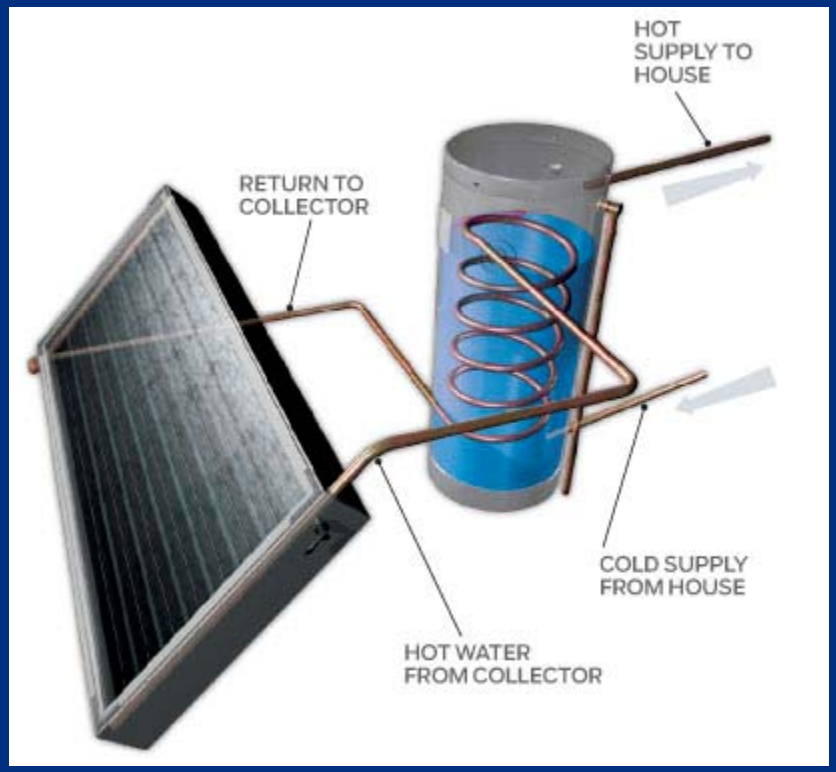
Proposed Sustainable Building Technologies

- Solar Thermal for space and DHW needs



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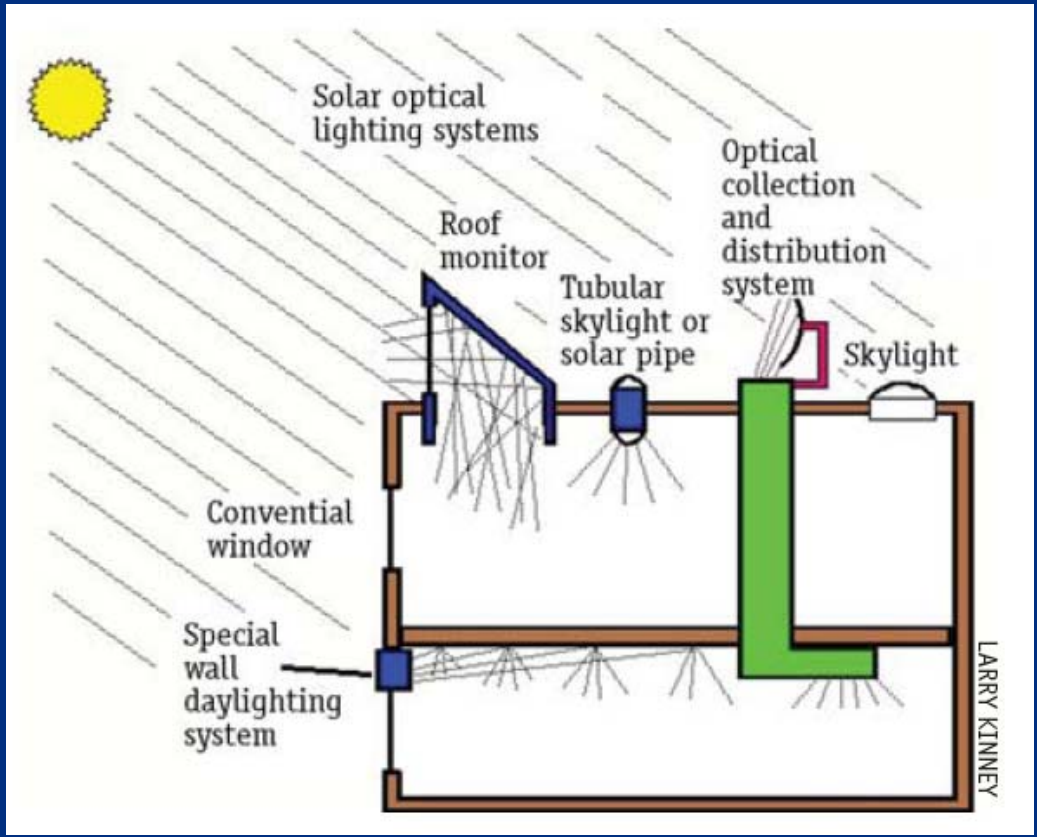
Proposed Sustainable Building Technologies

- Advanced Daylighting Devices



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Proposed Sustainable Building Technologies

- LED Lighting and Controls

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Proposed Sustainable Building Technologies

- Advanced HVAC Equipment

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Proposed Sustainable Building Technologies

- Radiant Heating & Cooling

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Proposed Sustainable Building Technologies

- On-site Generation of Electricity

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Proposed Sustainable Building Technologies

- 25% of the electricity usage from Solar PV
- Solar Thermal for space and DHW needs
- Advanced Daylighting Devices
- LED Lighting and Controls
- Advanced HVAC Equipment
- Radiant Heating & Cooling
- On-site Generation of Electricity
- Combination Scenarios (the red technologies)

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CUI for Small Office Building – Zone 4A

Scenario	Gas	Electric	Renewables	Total
Ave. CBECS	1.63	24.20	0	25.83
50% CBECS	0.82	12.10	0	12.92
90.1-2007	0.52	16.84	0	17.36
189	0.75	12.77	-0.15	13.37
25% Solar Electric[1]	**0.75**	**12.77**	**-3.33**	**10.19**
Solar Thermal Heating[2]	0.75	12.77	-0.56	12.96
Daylighting[3]	0.79	12.08	-2.94	9.93
LED Lighting & Controls	0.79	10.93	-0.15	11.57
Advanced HVAC	0.71	12.48	-0.15	13.04
Radiant Heating & Cooling[4]	0.38	11.04	-0.15	11.27
On-Site Generation	6.60	0	0	6.60
Combination Scenarios[1,2,3,4]	0.79	10.35	-6.68	4.46

Units: CUI (lbs-CO2/ft2-yr)

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Carbon Performance Standard (CPS) 2008

ASHRAE Climate Zones	Clinic	Community Center	Gymnasium	Hospital	Hotel/Motel	Multifamily High Rise	Multifamily Low Rise	Nursing Home	Large Office	Small Office	Elementary School	Secondary School	Shopping Center	Retail	Theater/ Auditorium	Warehouse
1A	20.99	16.12	21.30	49.53	26.62	20.70	16.26	25.88	18.19	17.30	18.04	20.41	29.28	22.92	23.21	13.75
2A	19.47	16.11	19.91	51.69	25.62	18.74	16.40	23.87	17.42	15.96	15.37	18.74	28.11	21.96	21.82	10.54
2B	19.83	16.71	20.14	55.12	26.39	18.74	17.02	25.61	17.96	16.24	14.99	18.89	28.89	22.49	22.17	9.84
3A	18.63	17.40	19.73	49.76	24.88	16.30	18.02	24.63	17.16	15.32	12.62	17.28	26.84	21.94	21.90	5.02
3B	17.02	15.07	17.67	46.51	22.73	15.46	15.46	22.21	15.59	13.90	12.21	16.11	24.68	19.75	19.49	6.50
3C	20.73	18.73	21.28	66.19	28.73	18.91	19.40	27.82	19.46	16.73	13.64	19.46	31.28	24.37	23.28	7.27
4A	16.66	13.72	16.80	49.42	22.54	16.24	13.86	21.55	15.12	13.58	12.74	16.10	24.64	18.90	18.34	9.24
4B	18.52	15.26	18.66	50.07	24.44	17.92	15.11	23.55	16.44	15.11	14.67	17.92	26.81	20.74	20.59	10.67

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Conclusion

- 4.46 lbs-CO2/ft2-yr is a 65% reduction from 50% CBECS. To move to ZNE or carbon neutrality we could increase the contribution of on-site solar electric (to 50%) or purchase off-site renewables.

- 2030 is 22 years away, undoubtedly there will be numerous technological advancements that will help this building move to ZNE or carbon neutrality in a cost effective way.

- Moving toward ZNE or carbon neutral buildings can be achieved. Architecture 2030 or California's AB32 are achievable.

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Thank You

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