

2010-07-07 Passive House & Reach Code

Passive House Oregon

Recurring questions on cost-benefit

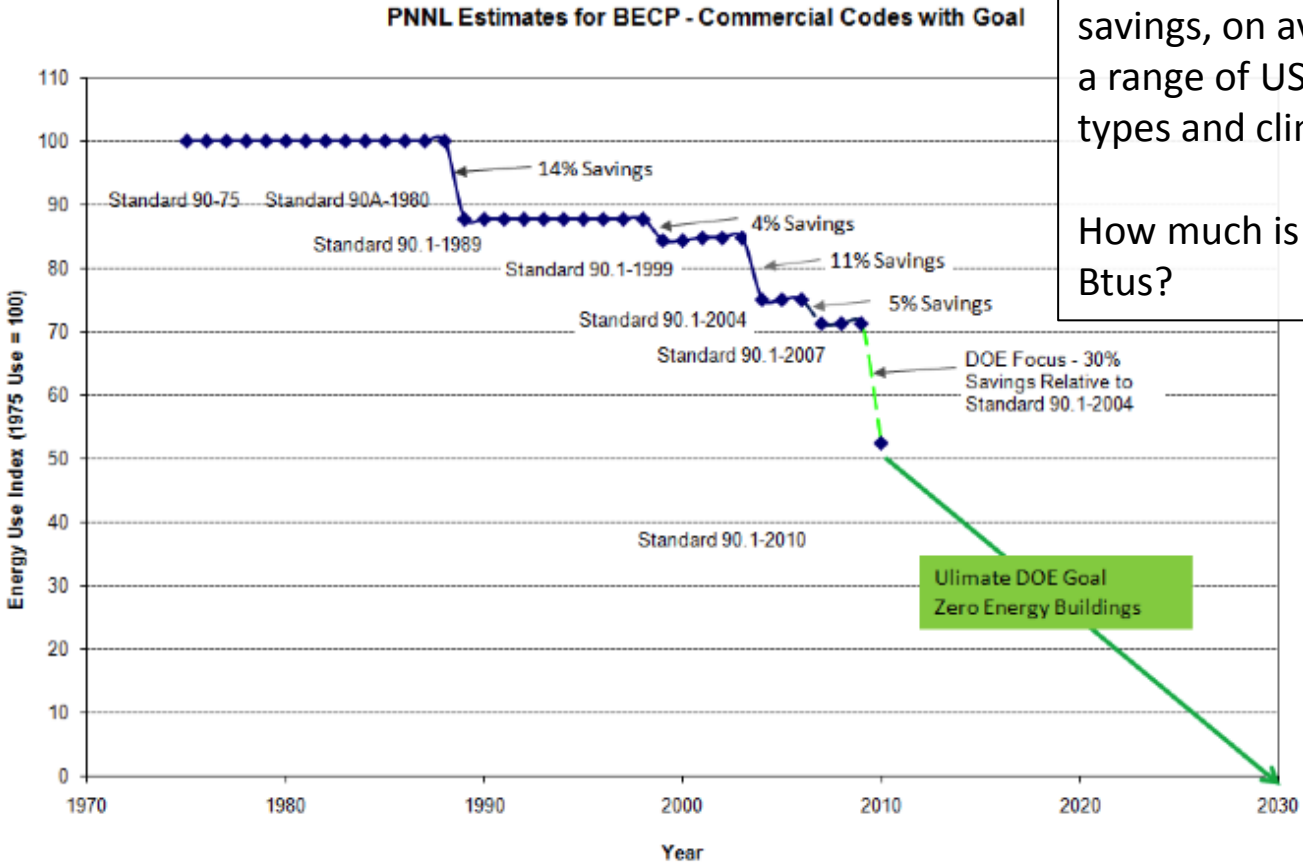
- What is good energy performance?
 - How does Passive House compare?
- What is the upfront cost premium?
- Is that a good investment?
 - Payback, ROI, NPV, etc.

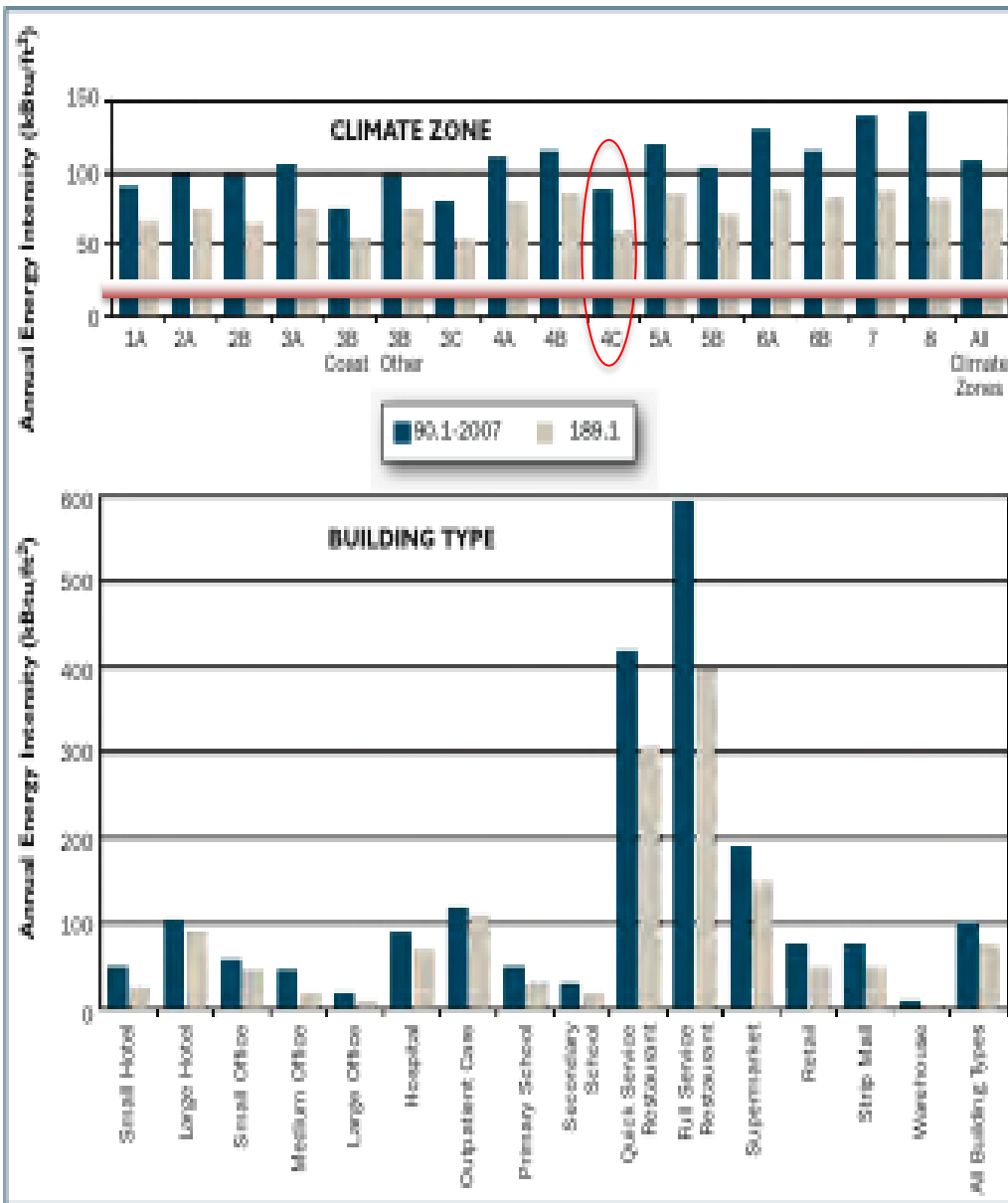
Compare P/H to ASHRAE 189.1

History of ASHRAE Standard 90.1

ASHRAE 189.1 (aka 90.1-2010) intended to produce 30% energy savings, on average over a range of US building types and climates.

How much is that in Btus?





Energy savings attributable to Standard 189.1 vary substantially by climate zone and building type.

ASHRAE 189.1 is looking to reduce Annual Energy Use Intensity from about 85 kBTu-Site/ft²-FFA down to 60, in Seattle climate zone.



Passive House criterion:
Converted from Source to Site and Treated Floor Area to Finished Floor Area.

38.1 kBTu-Source/ft²-TFA
1 kBTu-Site

X -----
(1.3 to 2.7) kBTu-Source

(0.75 to 0.85) ft²-TFA
X -----
1 ft²-FFA

= 10 to 25 kBTu-Site/ft²-FFA
-> **58 to 83% saving vs 189.1**
-> **70 to 88% saving vs 90.1**

P/H Cost premium?

CPHC	PHIUS	Green Hammer	Bilyeu Homes
Type	Residence	Office bldg	Residence
Climate	Illinois	Portland	Salem
Size TFA / FFA	3071 / ?	2424 / 2852	1567 / 1885
Total Cost / per sf	\$371,600 / \$121	\$444,000 / \$156	\$300,000 / \$159
P/H premium* / %	\$66,900 / 18%	\$84,600 / 24%	\$18,000 / 6%

*Before any incentives

Economic feasibility?

- Green hammer
 - Payback 32-42 years depending on presumed performance of “standard construction”, and assuming 4.7% per year energy price increase (extrapolation of 1994-2010 regional nat gas trend).
- PHIUS
 - Passive House envelope made net-zero energy a net-positive \$ investment over 30 years, Building America and Energy Star envelopes did not, due to much larger PV arrays.

Strategy for net-zero by 2030

- Build passive house now.
- Buy PV system in 20 years.

What else are you going to invest in?

- Stocks? Consider the 40 yrs From May 1970 to May 2010
 - Inflation 4.43%, annualized
 - Dividend-reinvested S&P500 total return 5.64% annualized.
 - Real return 1.21% annualized.
- Bonds? Current 30-year bond yield 3.94%, 1-yr 0.32%



As can be seen, the stock market was very profitable, in real terms, in the 1950 to 1965 and 1983 to 2000 periods. On the other hand, it didn't perform well from 1955 to 1983, and neither it did for the last decade. Still, during these periods, it partially worked as a shelter from inflation.

- Northwest Commercial building stock assessment, December 2009

Figure 34. Annual Electric EUI by Building Size

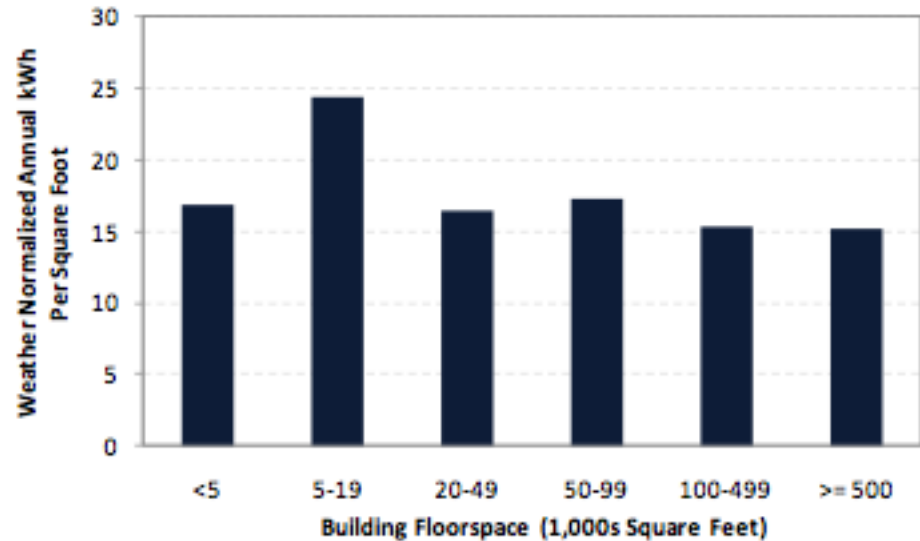


Figure 39. Natural Gas EUI by Building Size

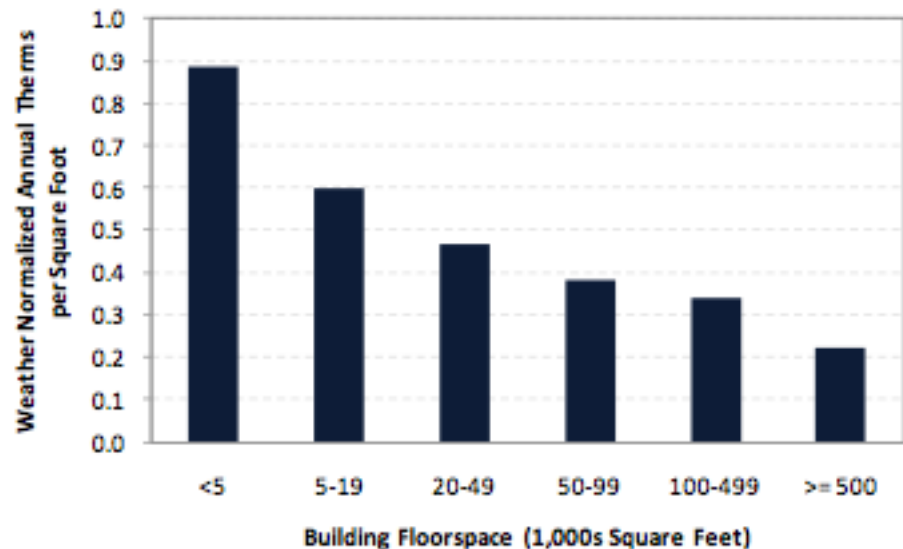


Figure 32. Annual Electric EUI by Building Type

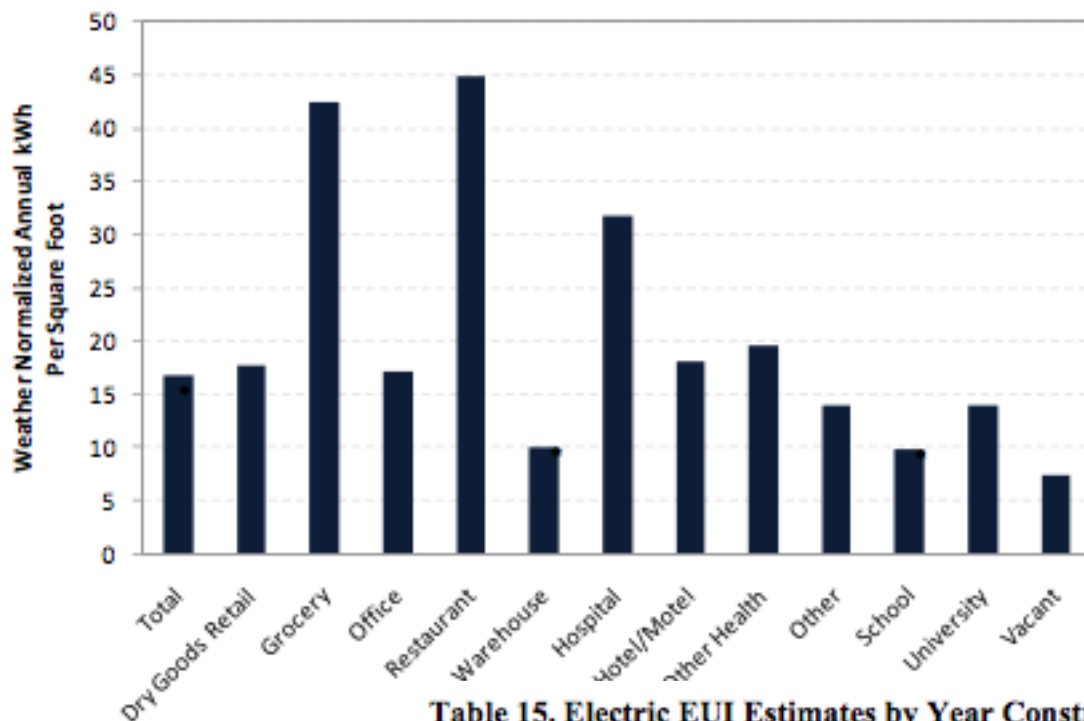


Table 15. Electric EUI Estimates by Year Constructed Compared to CBECS

	2007 CBSA	2003 CBECS
<i>CBSA Year Constructed</i>	<i>EUI (kWh/sq.ft.)</i>	<i>Western EUI (kWh/sq.ft.)</i>
1987 and earlier	16 ± 4%	14
1988-1994	20 ± 5%	18
1995 – 2001	18 ± 6%	19
2002-2007	19 ± 6%	18 (to 2003)

Figure 37. Annual Natural Gas EUI Building Type

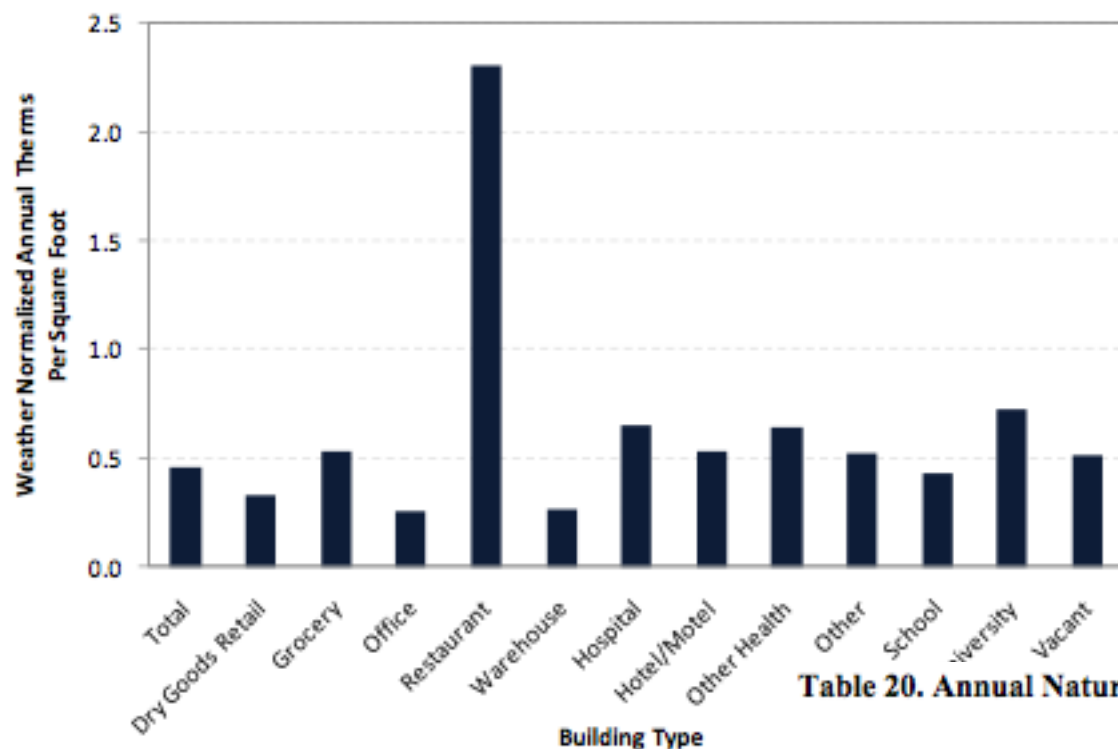


Table 20. Annual Natural Gas EUI Estimates Compared with CBECS Year Constructed

	2007 CBSA	2003 CBECS
<i>CBSA Year Constructed</i>	<i>EUI (therms/sq.ft.)</i>	<i>Western EUI (therms/sq.ft.)</i>
1987 or earlier	0.37 ± 6%	0.58
1988-1994	0.48 ± 9%	0.48
1995-2001	0.48 ± 9%	0.77
2002-2007	0.48 ± 10%	0.62 (to 2003)