



Passive Building in the US

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Outline and Objectives:

- Passive building metrics and principles
- Cost optimized passive building standards for varying climates
- Multifamily and policy examples
- Summary

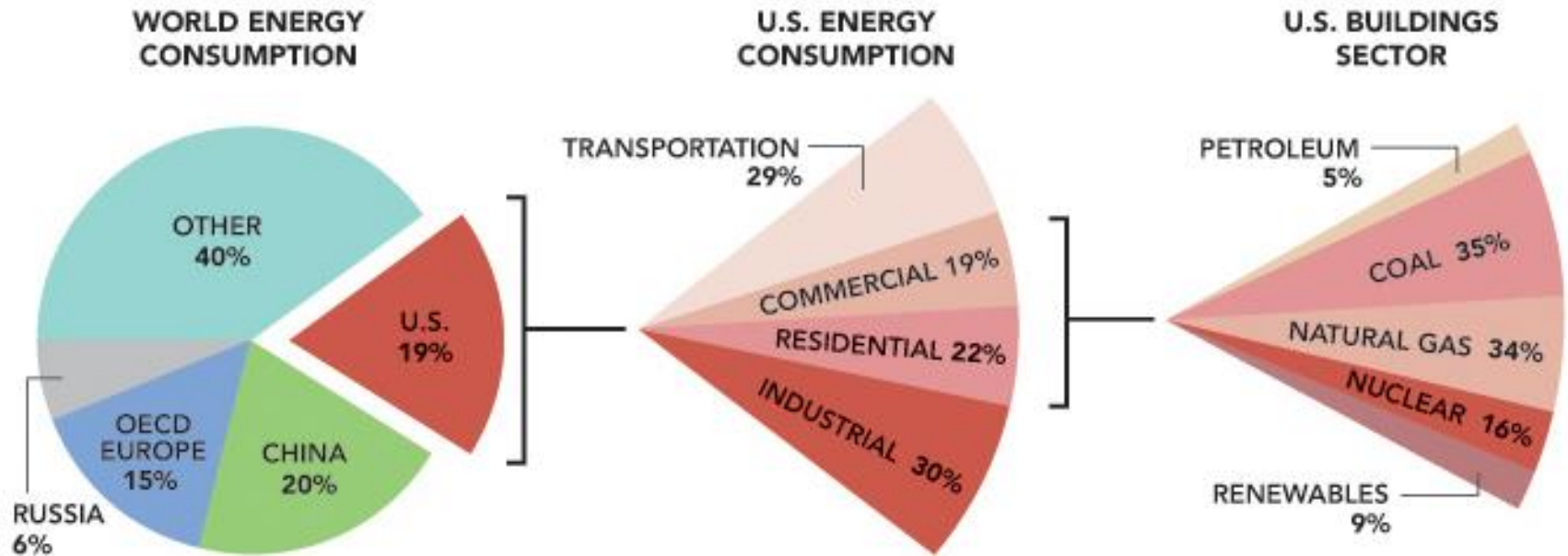


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PASSIVE BUILDING METRICS AND PRINCIPLES

Standard Context

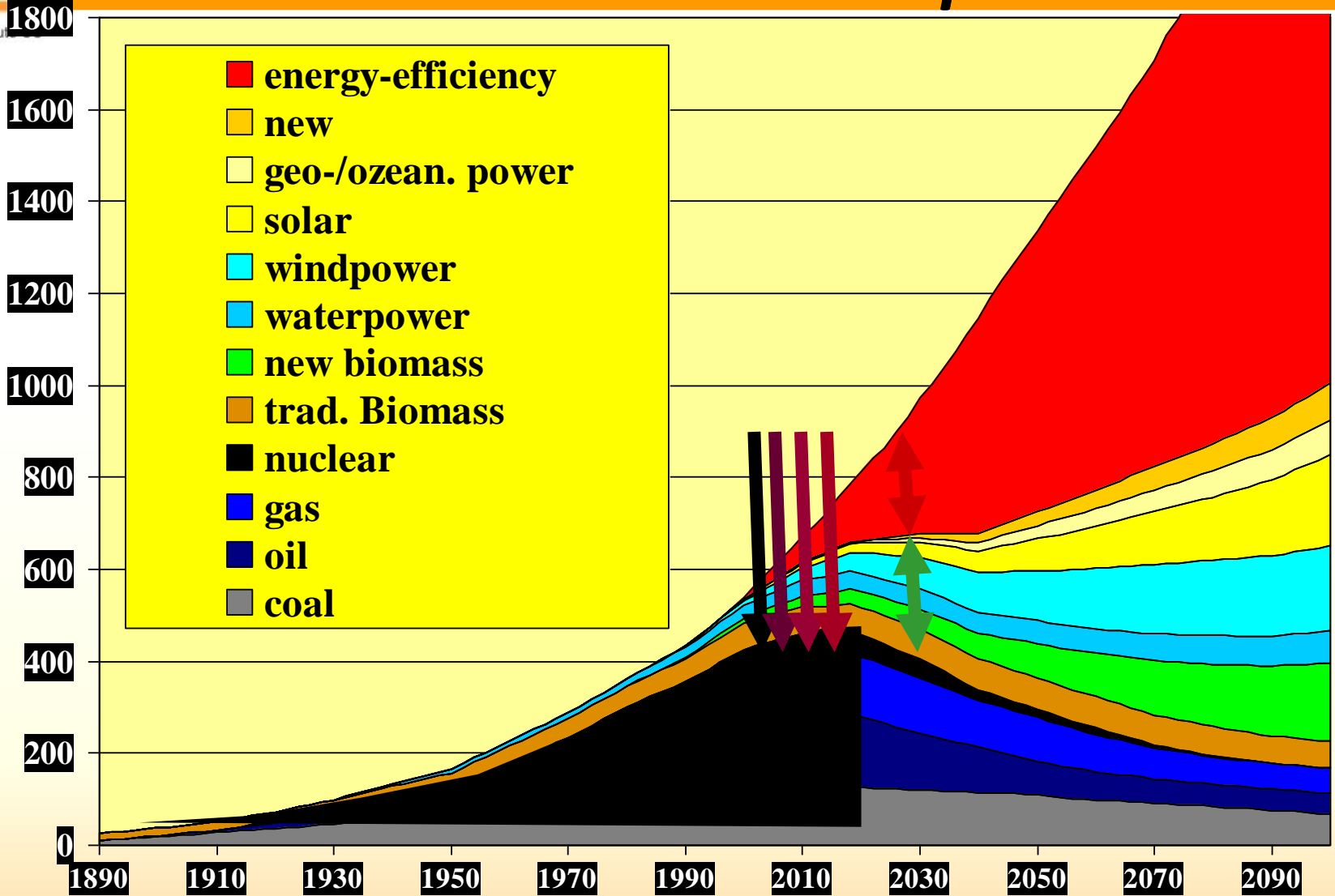
U.S. Buildings Contribution



U.S. building energy use accounts for 41% of total U.S. energy use.

Worldwide Energy Demand *Resources and Consumption*

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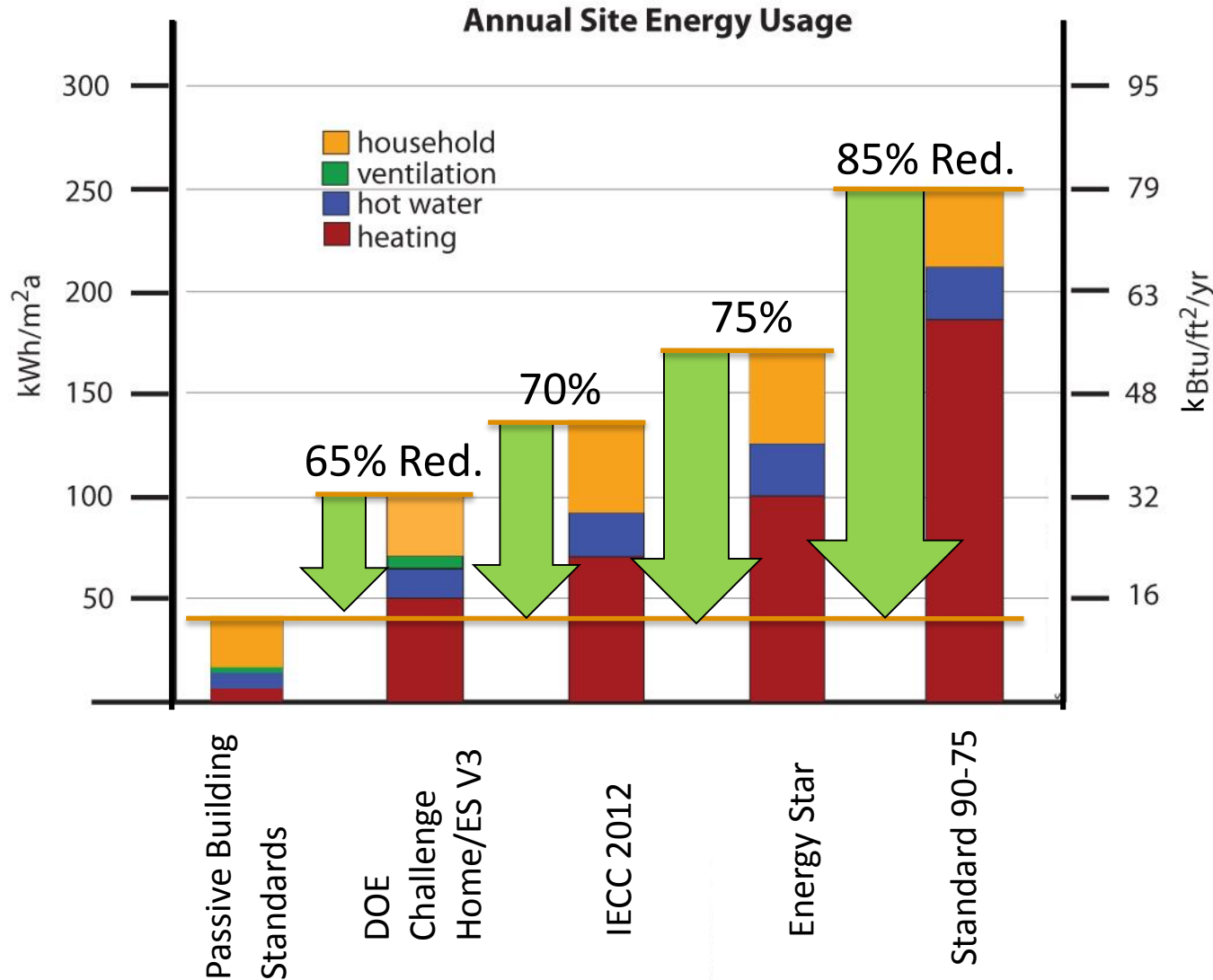
Reference: Shell-Study (till 2005), Scenario with high efficiency and regenerative usage of energy

Factor 10 Reduction Passive Energy Standards:

“Energy/sf” Measurement for Buildings



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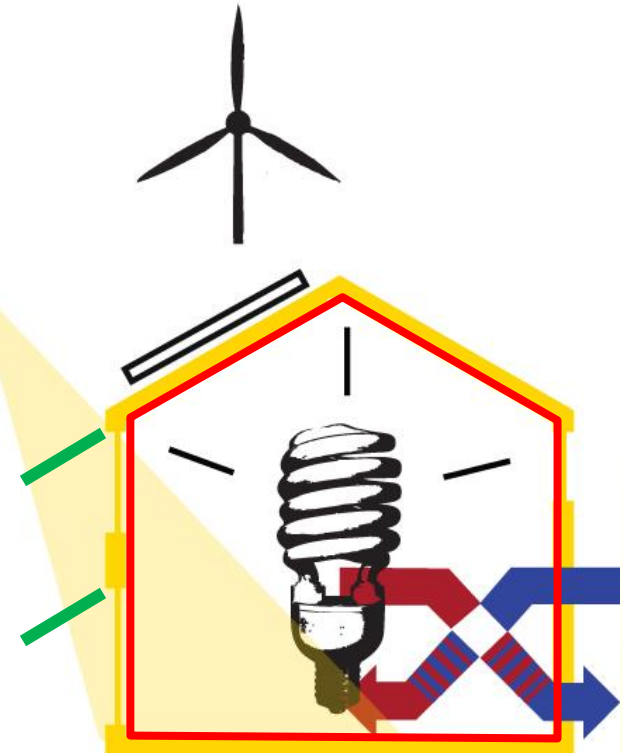
Passive Principles and Metrics: Sweet Spot



Between Conservation and Generation

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- **Continuous Insulated Envelope**, *airtight compact building shape, thermal-bridge-free*
- **High Performance windows & doors**, *optimal solar orientation, shading and modest window areas*
- **Constant Fresh Air Supply** *balanced mechanical ventilation system w/ heat/ moisture recovery*
- **Managing Internal Loads** *efficient appliances, lighting and plumbing*
- **Efficient Heating and Cooling devices** *minimize fossil fuel and electric energy consumption*
- **Efficient Hot Water Generation** *optimizes primary energy and carbon emissions*
 - **Solar and Wind Energy** *offset remaining energy consumption and carbon emissions*



Passive Energy Balancing
as Basis for Zero/Positive
Energy

PASSIVEHOUSE REQUIREMENTS

Certificate Criteria: **European**

Heating Demand

specific: **4.3** kBtu/ft²yr

total: 7892.5 kBtu/yr

peak (month): 1.5 kBtu/ft²



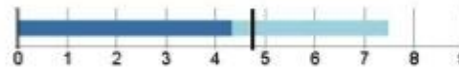
Cooling Demand

specific: **7.5** kBtu/ft²yr

total: 13824.8 kBtu/yr

peak (month) - sensible: 1.2 kBtu/ft²

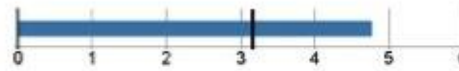
latent: 3.1 kBtu/ft²yr



Heating Load

specific: **4.8** Btu/hr ft²

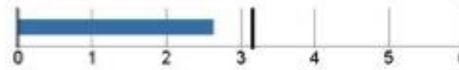
total: 8804.6 Btu/hr



Cooling Load

specific: **2.6** Btu/hr ft²

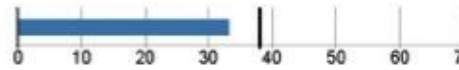
total: 4869.4 Btu/hr



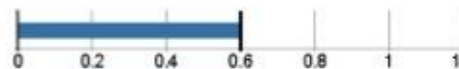
Primary Energy

specific: **33.2** kBtu/ft²yr

total: 61468.6 kBtu/yr



Air Tightness ACH50 **0.6** 1/hr





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COST OPTIMIZED PASSIVE BUILDING STANDARDS FOR VARYING CLIMATES

PHIUS+ Passive Building /DOE Zero Energy Ready Home Certifications



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(Formerly known as Challenge Home)



PHIUS+ Certifications (third party onsite QAQC is required):

- New Construction Residential
- New Construction Commercial
- Retrofit



Passive House/Building Evolution in North America over past 11 years

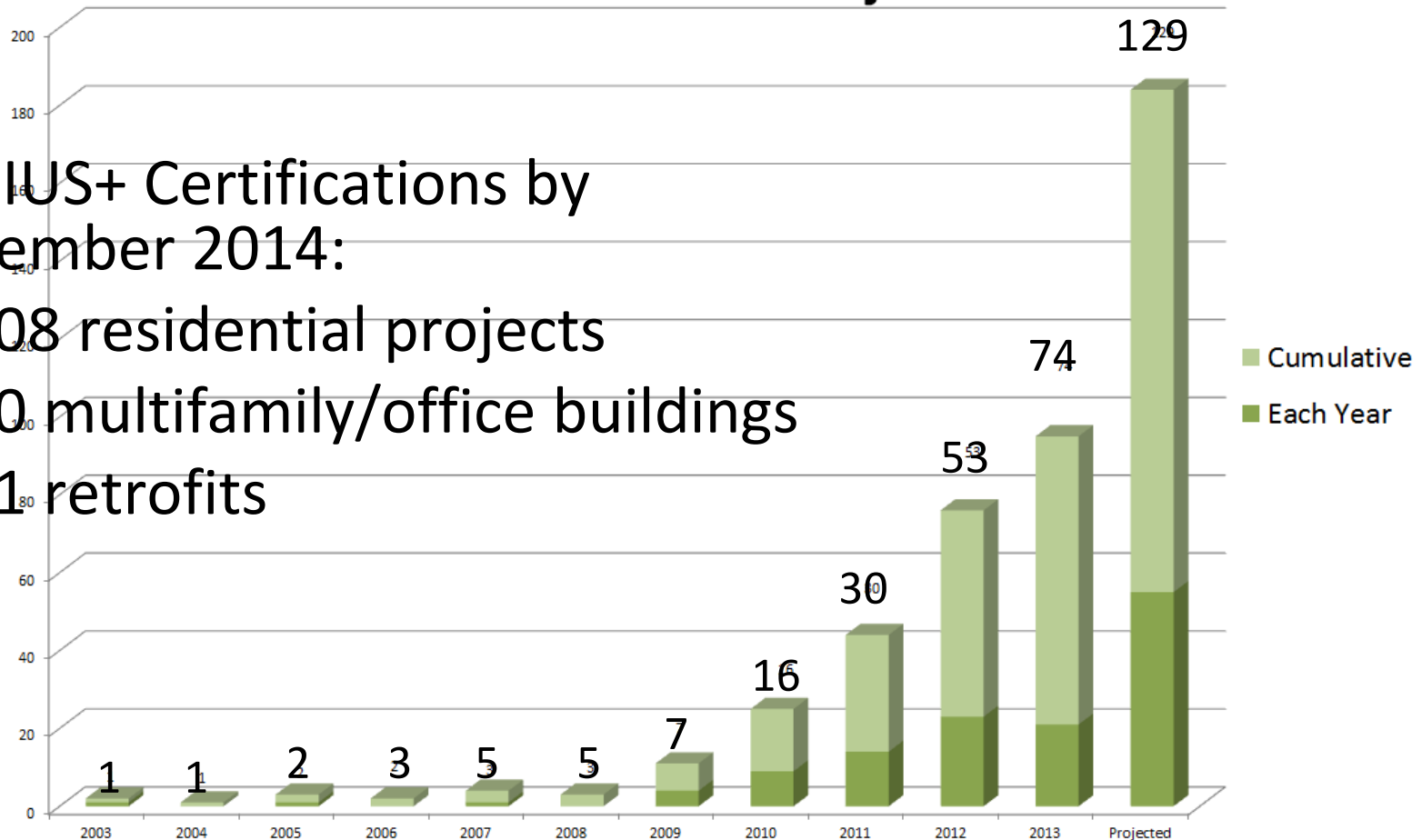


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PHIUS+ Certified Projects

129 PHIUS+ Certifications by September 2014:

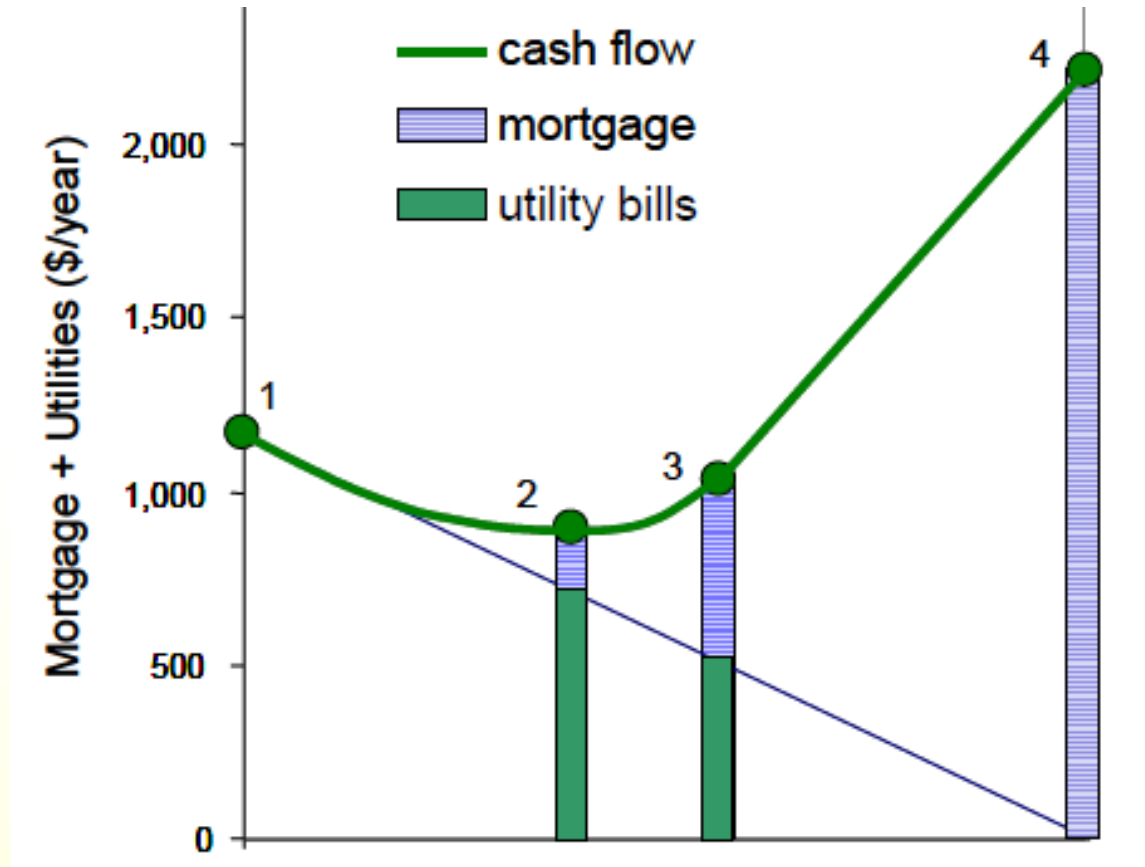
- 108 residential projects
- 10 multifamily/office buildings
- 11 retrofits



NREL Cost-Effectiveness of Energy Improvements Concept



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Conceptual plot of the “path to Zero Net Energy”

[NREL/CP-550-37733]

Financial parameters strictly conventional, e.g. 30-year analysis period.

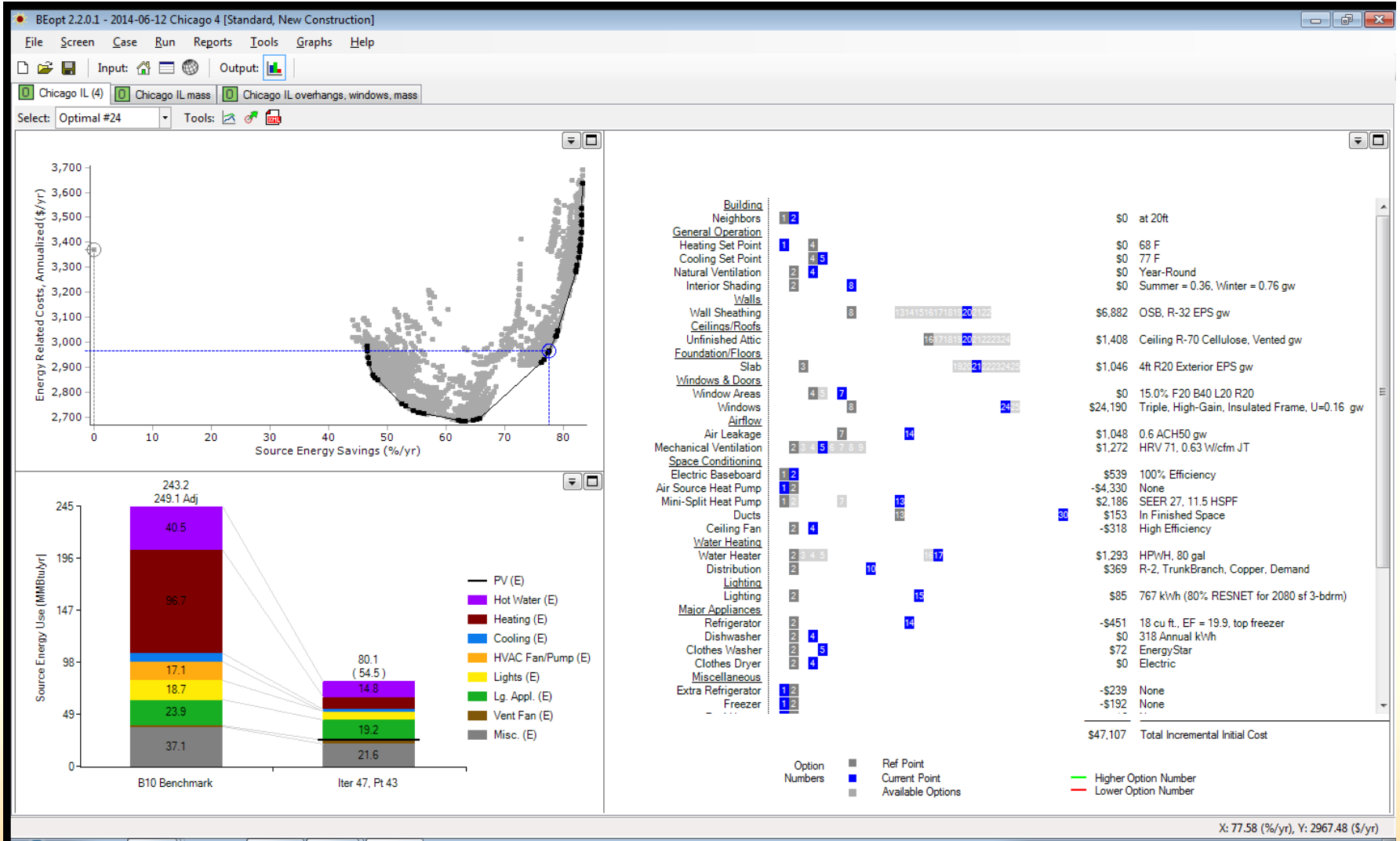
Energy prices vary state-by-state.

New Climate Specific Passive Standards



PHIUS / BSC / Building America

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MULTIFAMILY & POLICY EXAMPLES

Uptown Lofts Action Housing Pittsburgh PA (Architects: FortyEighty Architecture)



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Photos: Jesse Thompson

Kiln Apartments in Portland OR – 2013 (CPHC David Posada)



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Knickerbocker Project in Brooklyn NY– 2013 (Architect Chris Benedict)



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Photos: Chris Benedict

Passive Building Standard will be Code in Belgium starting 2015: A2M Projects



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Summary

- Of the various measures that can drive building performance towards net zero, passive measures are the most preferable
- Passive principles apply everywhere and to all building types – residential, multifamily and commercial
- They result in durable construction, increased comfort, health, and resiliency (climate, owning & maintaining)
- Climate specific standards for varying North American climates (calibrated according to construction costs and energy prices) make passive standards economically feasible everywhere and the most cost effective way to reach net zero



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Thank You

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