

*2007 ACI Home Performance Conference  
April 23-27, 2007  
Cleveland, Ohio*

## **Different Paths to Low Energy Homes: How Low Can You Go?**

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# MAM 17 - Different Paths to Low Energy Homes: How Low Can You Go?

Monday, April 23, 2007 · 8:00 AM - 12:00 PM

- *Low energy housing promises to provide fascination and relevance as the term “carbon neutrality” becomes a part of our everyday language.*
- *Explore approaches from different climates for achieving low energy homes in new construction.*
- *Case studies and / or measured results will examine the systems used to achieve and verify performance.*
- *Zero Energy Homes and the German Passivhaus (Passive House) experiences will be represented.*

# Session Objectives

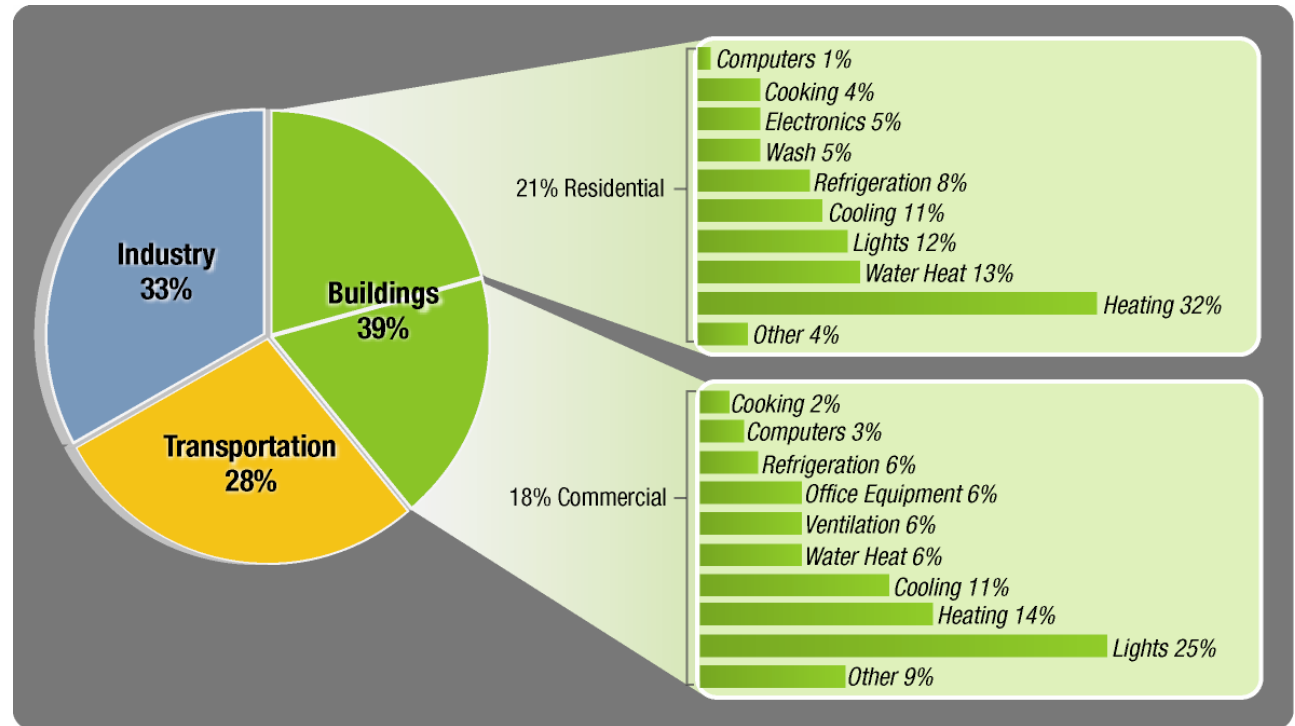
*By attending this session, participants will:*

- Recognize how design is impacted by specific loads and climate
- Have the opportunity to discuss technical and process aspects of low energy homes
- Glean insight from case studies and different approaches to achieving low energy homes

# Why Are We Interested in Low Energy Homes?

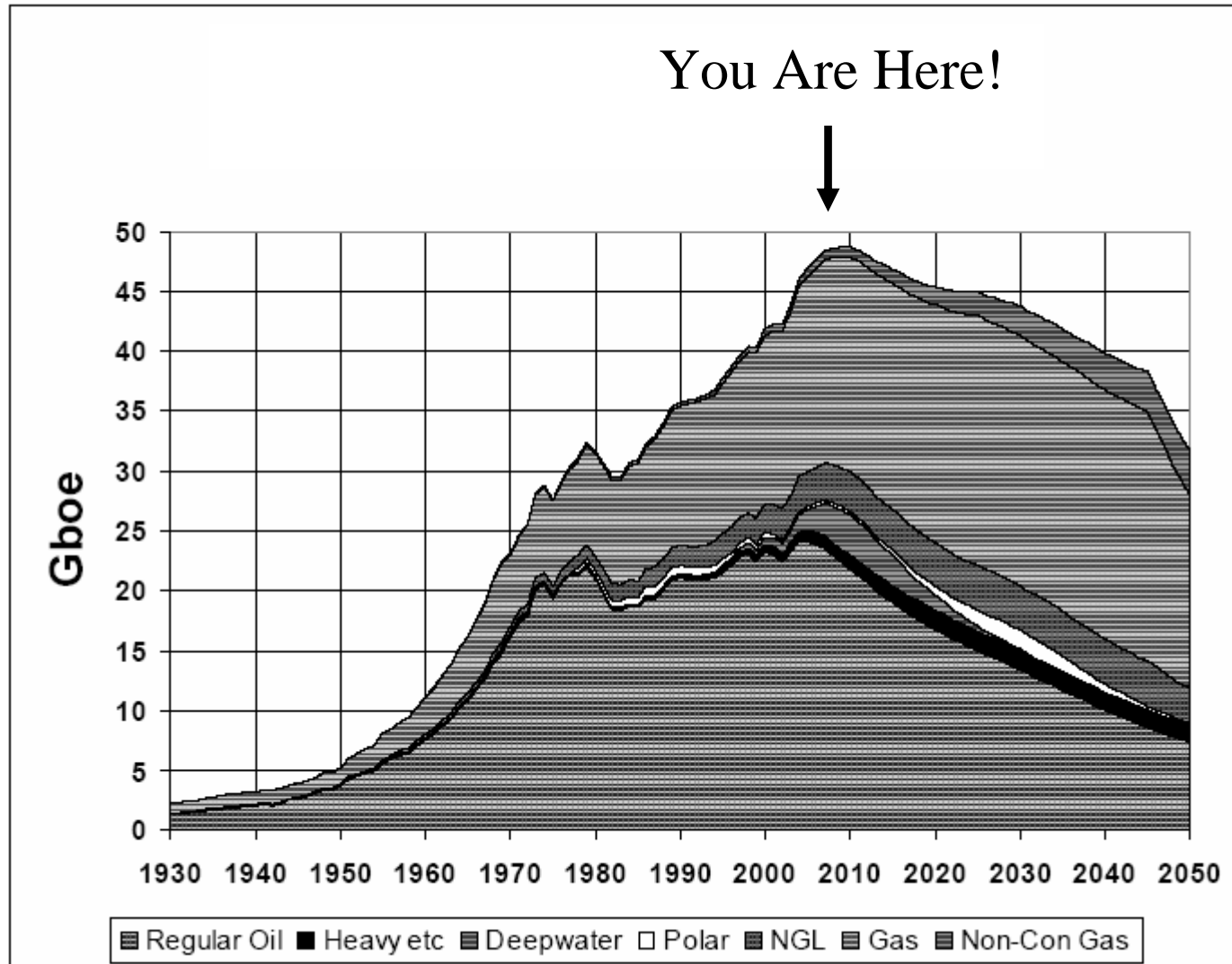
Buildings consume 39% of total U.S. energy

- 71% of electricity
- 53% of natural gas (primary consumption)



Development of cost neutral Zero Energy Homes (ZEH) is a critical part of ongoing DOE efforts to increase the efficiency of US energy use.

# How Long Will Fossil Fuels Last?

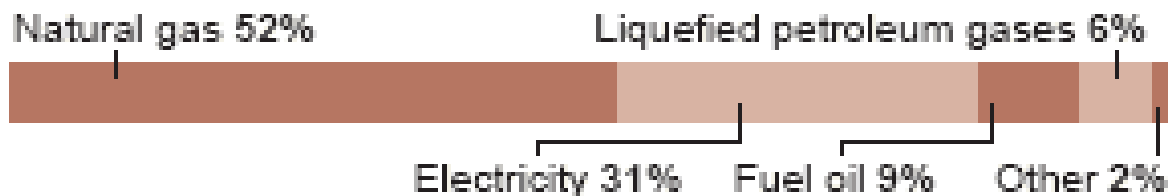


# How High Will Utility Bills Go?

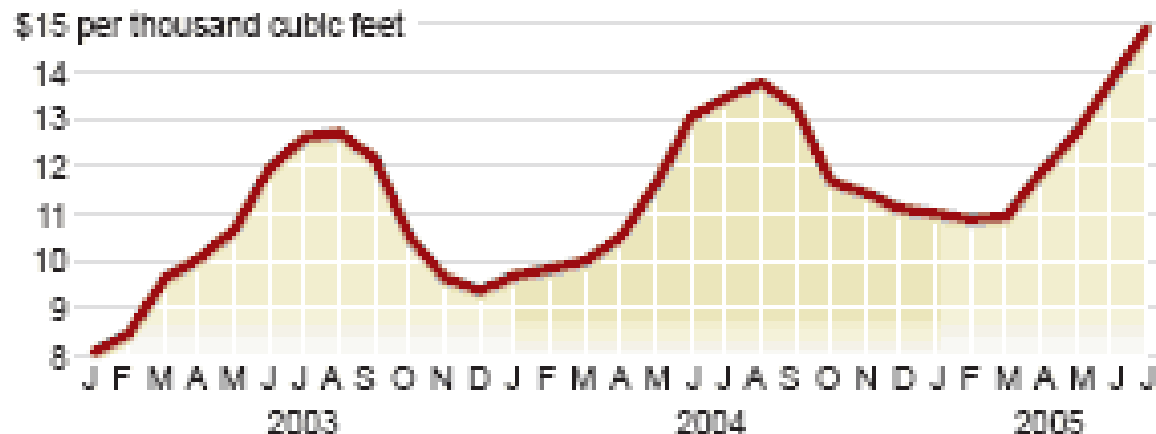
## A costly winter for home heating expected

Industry analysts expect higher than normal heating bills this winter. A majority of homes are heated using natural gas.

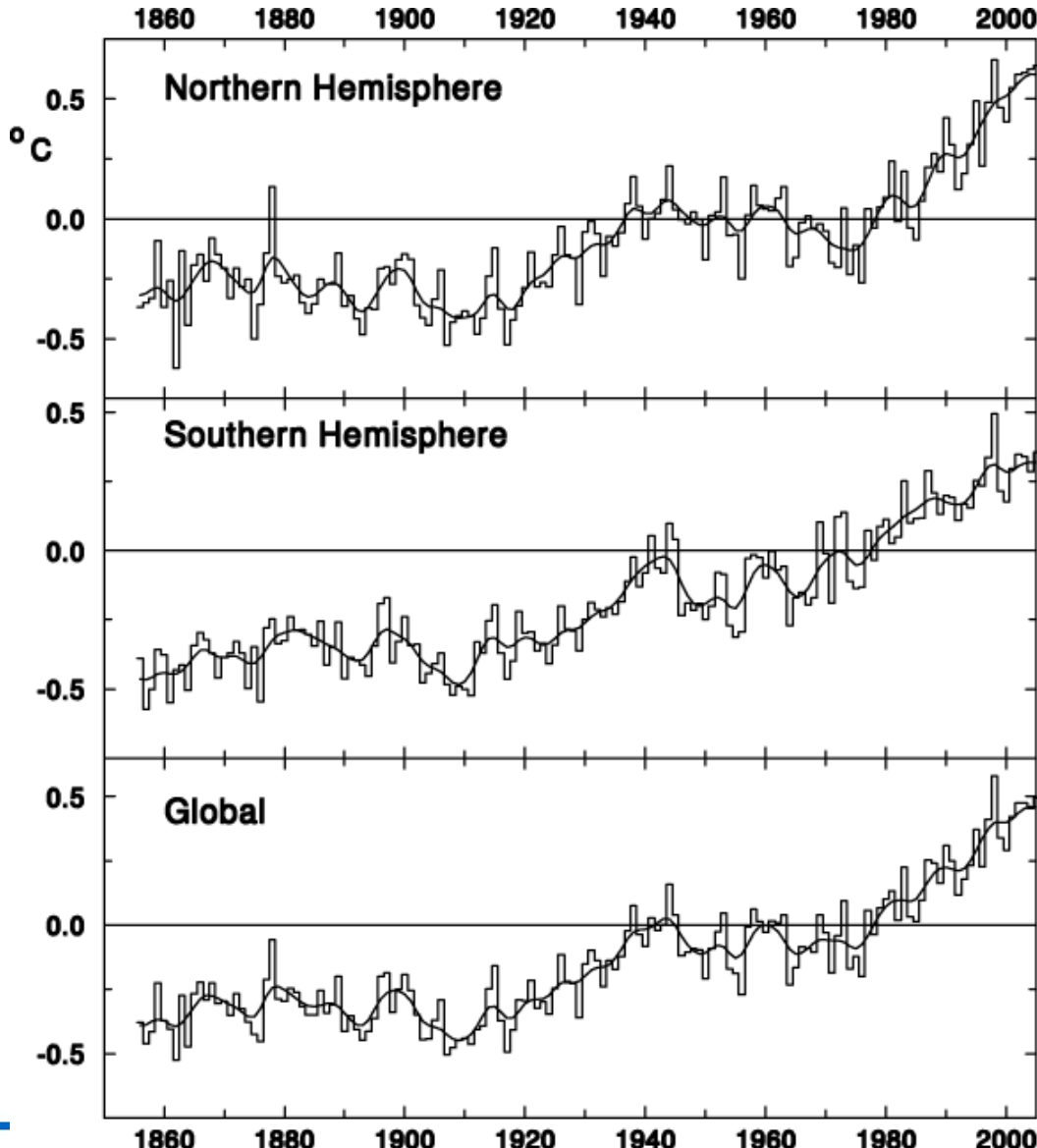
### Type of heating in occupied housing units, 2003



### U.S. natural gas residential price



# How Hot Will It Get?



**“World temperatures keep rising. Climate data show 2006 on track to be hottest on record.”**



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## **RECORD HEAT WAVE IN EUROPE TAKES 35,000 LIVES**

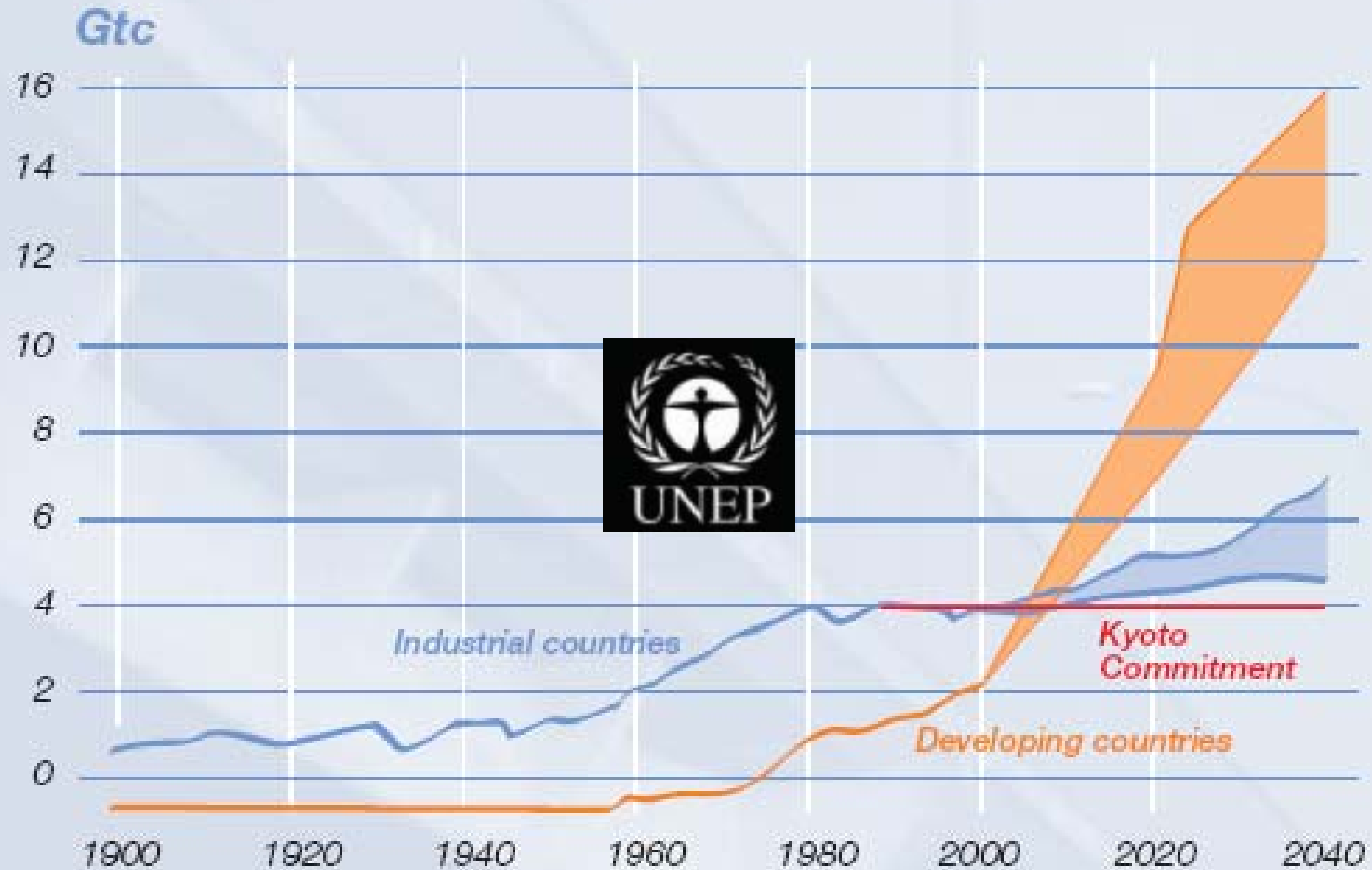
Far Greater Losses May Lie Ahead

Janet Larsen



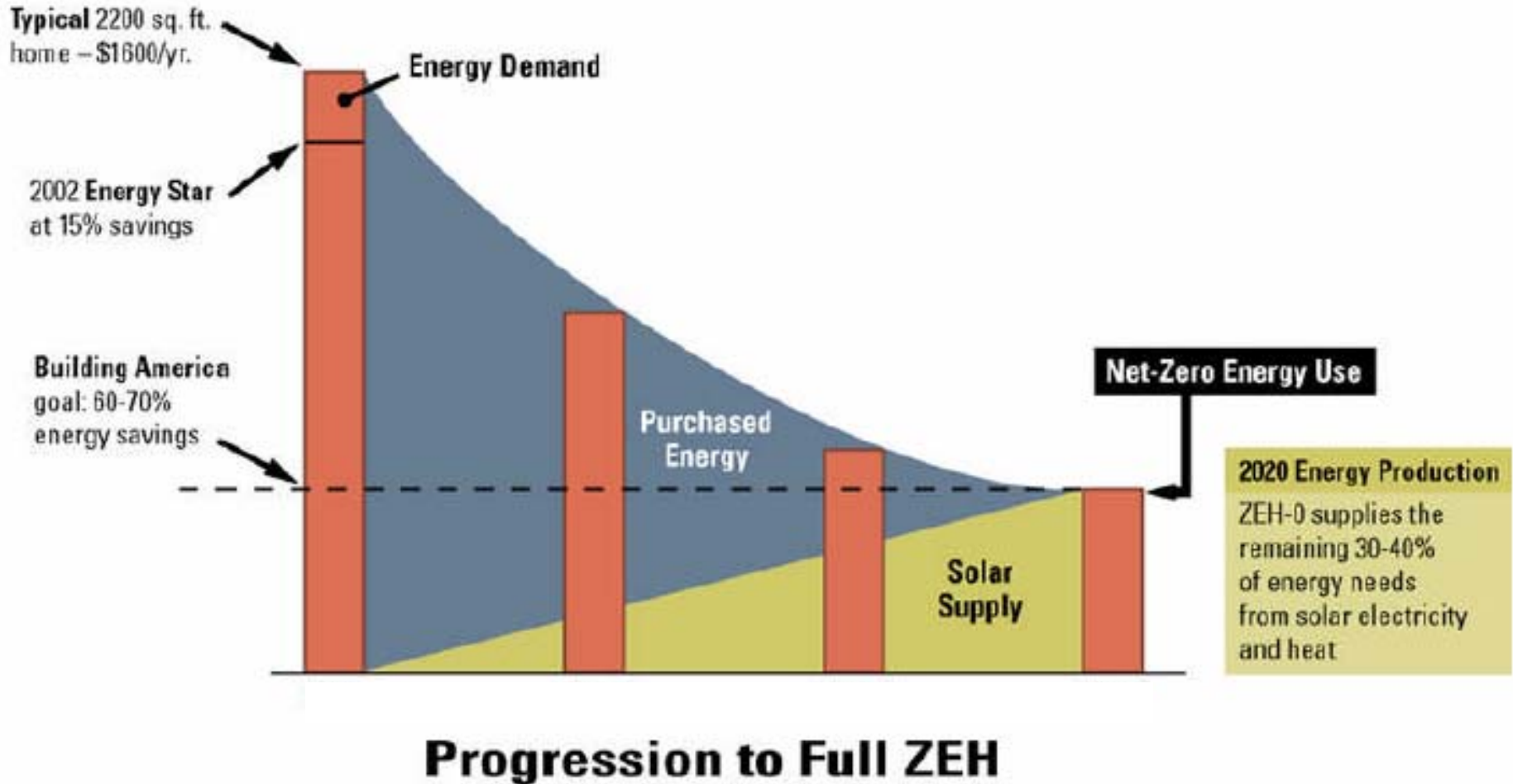
A record heat wave scorched Europe in August 2003, claiming an estimated 35,000 lives. In France alone, 14,802 people died from the searing temperatures—more than 19 times the death toll from the SARS epidemic worldwide. In the worst heat spell in decades, temperatures in France soared to 104 degrees Fahrenheit (40 degrees Celsius) and remained unusually high for two weeks.

# Carbon Savings are a Major Driver for ZEH



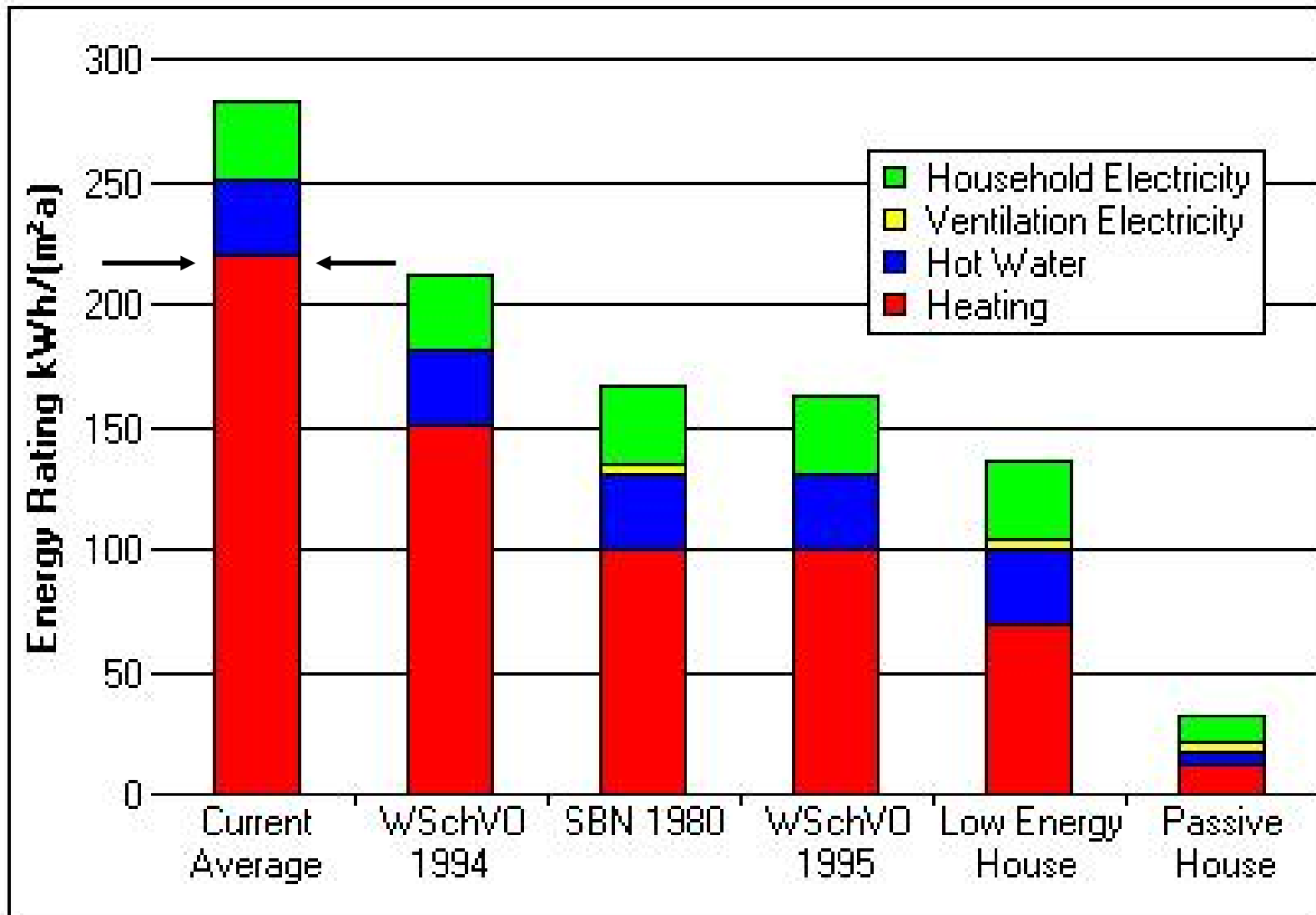
Source : Energy visions 2030

# How Far Can We Go?



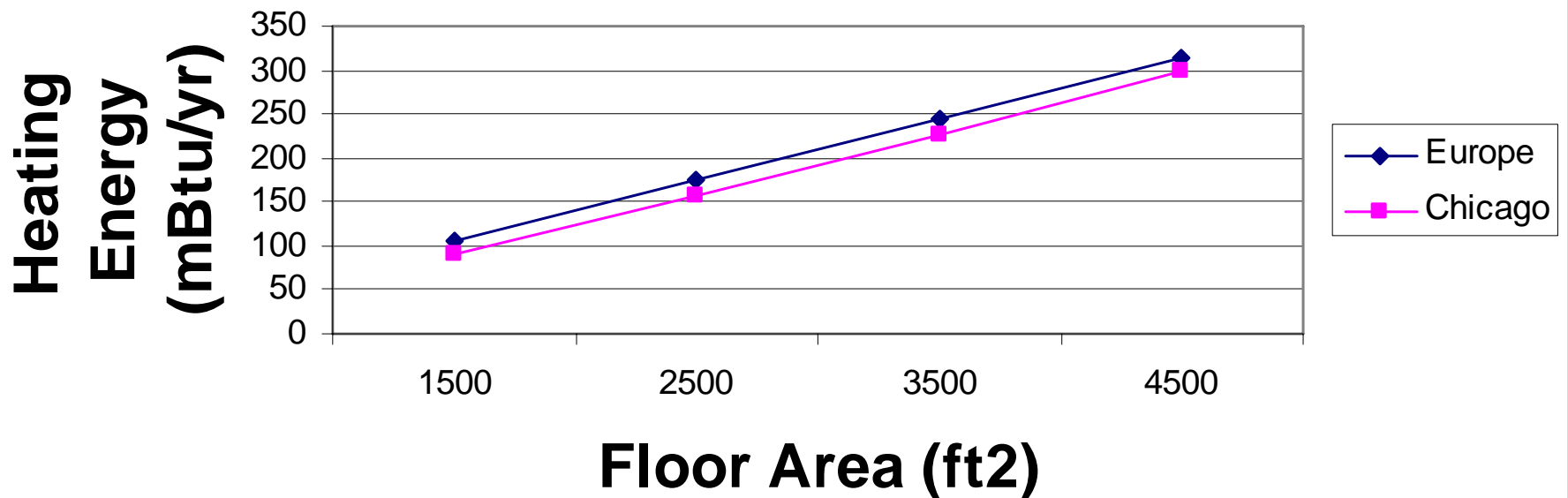
**Long Term Goal: Homes that Produce as Much Energy as they Use on an Annual Basis.**

# Passive House Energy Performance Targets

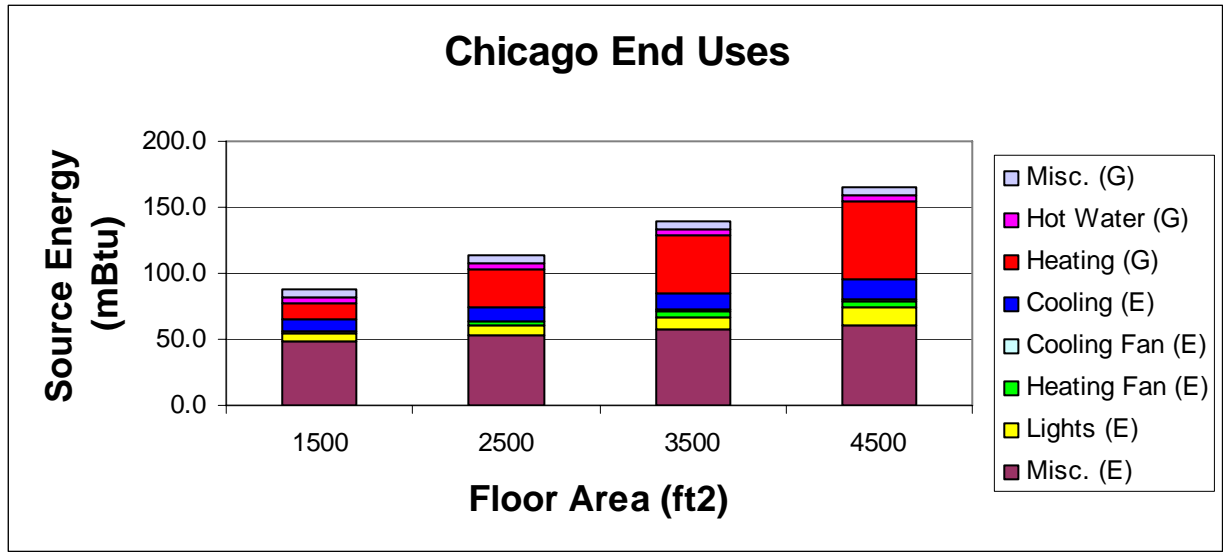


# Comparison of Current Average Heating Energy Use

## Reference Space Heating (mBtu/yr)

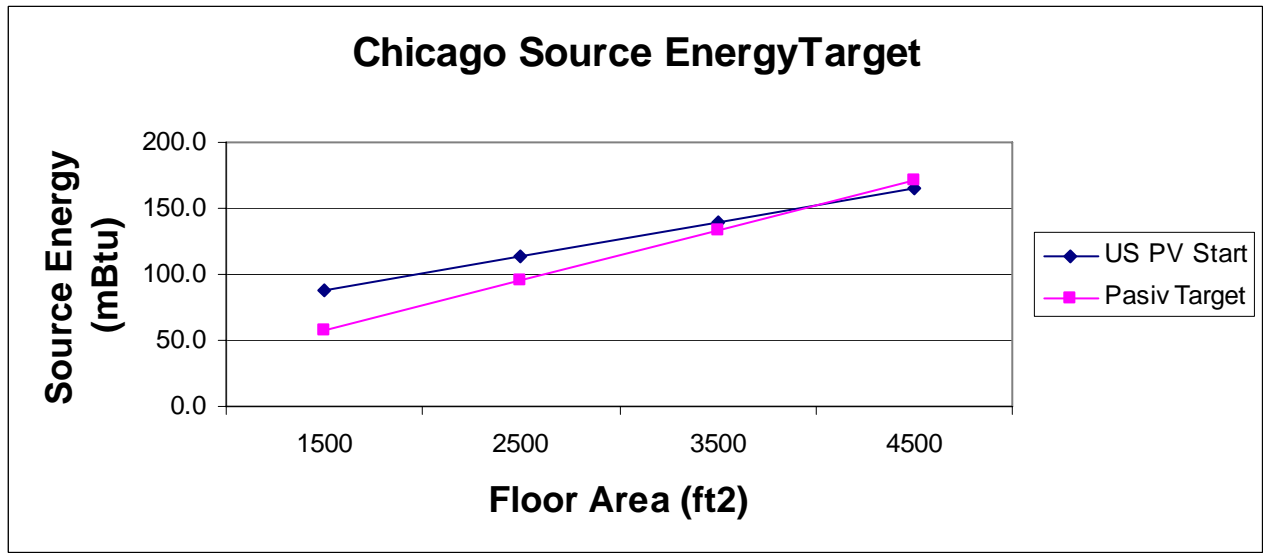


# Comparison of Total Source Energy Targets: Chicago



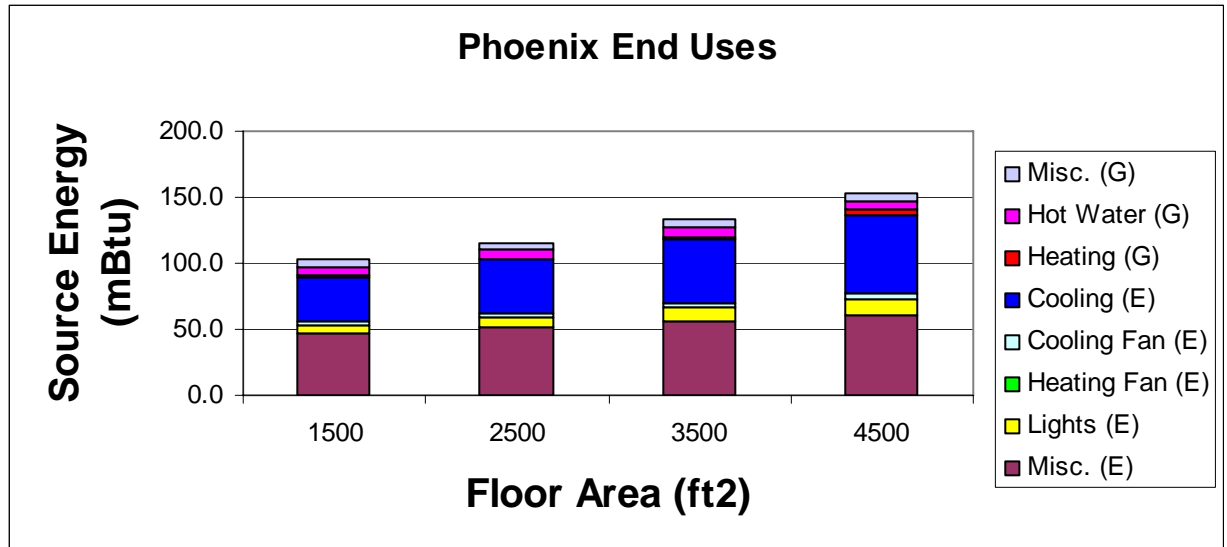
Heating:  
-4 F

Cooling:  
89 F



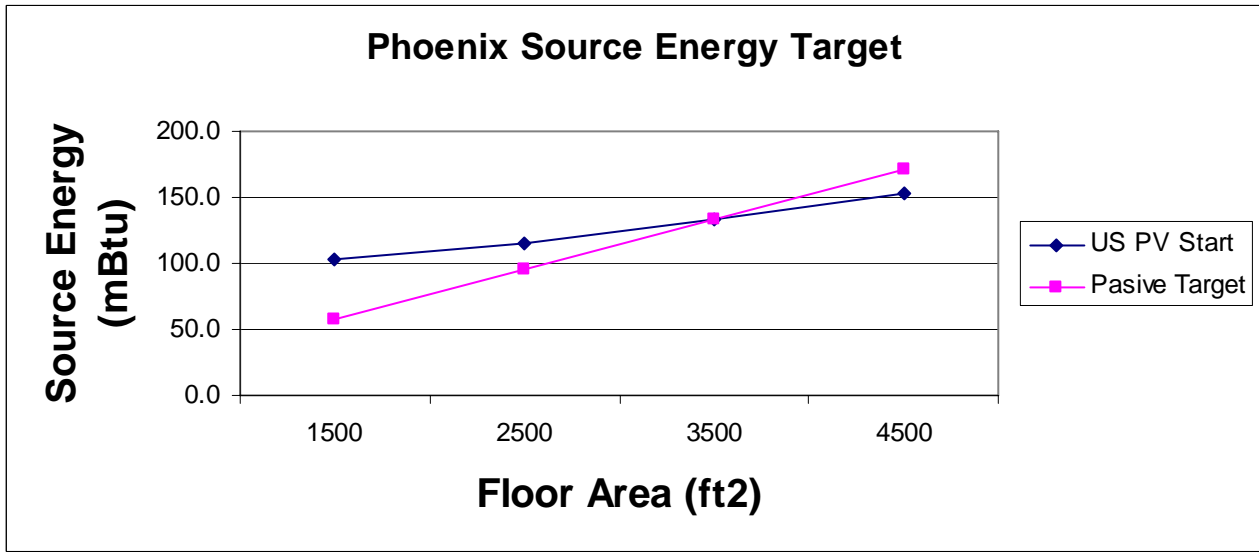
Passive Haus Total Source Target = 38 kBtu/ft<sup>2</sup>/yr

# Comparison of Total Source Energy Targets: Phoenix



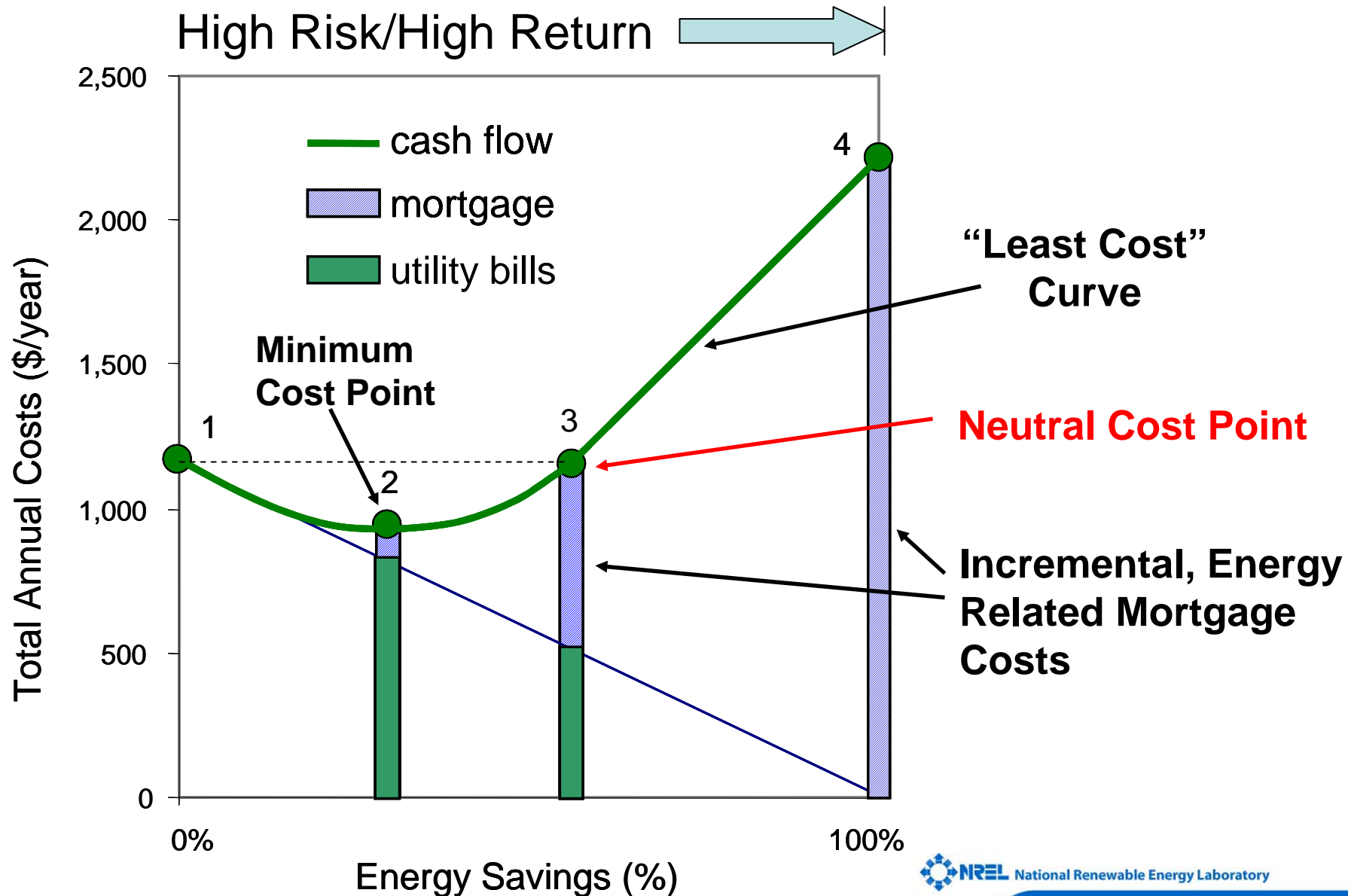
Heating:  
34 F

Cooling:  
107 F

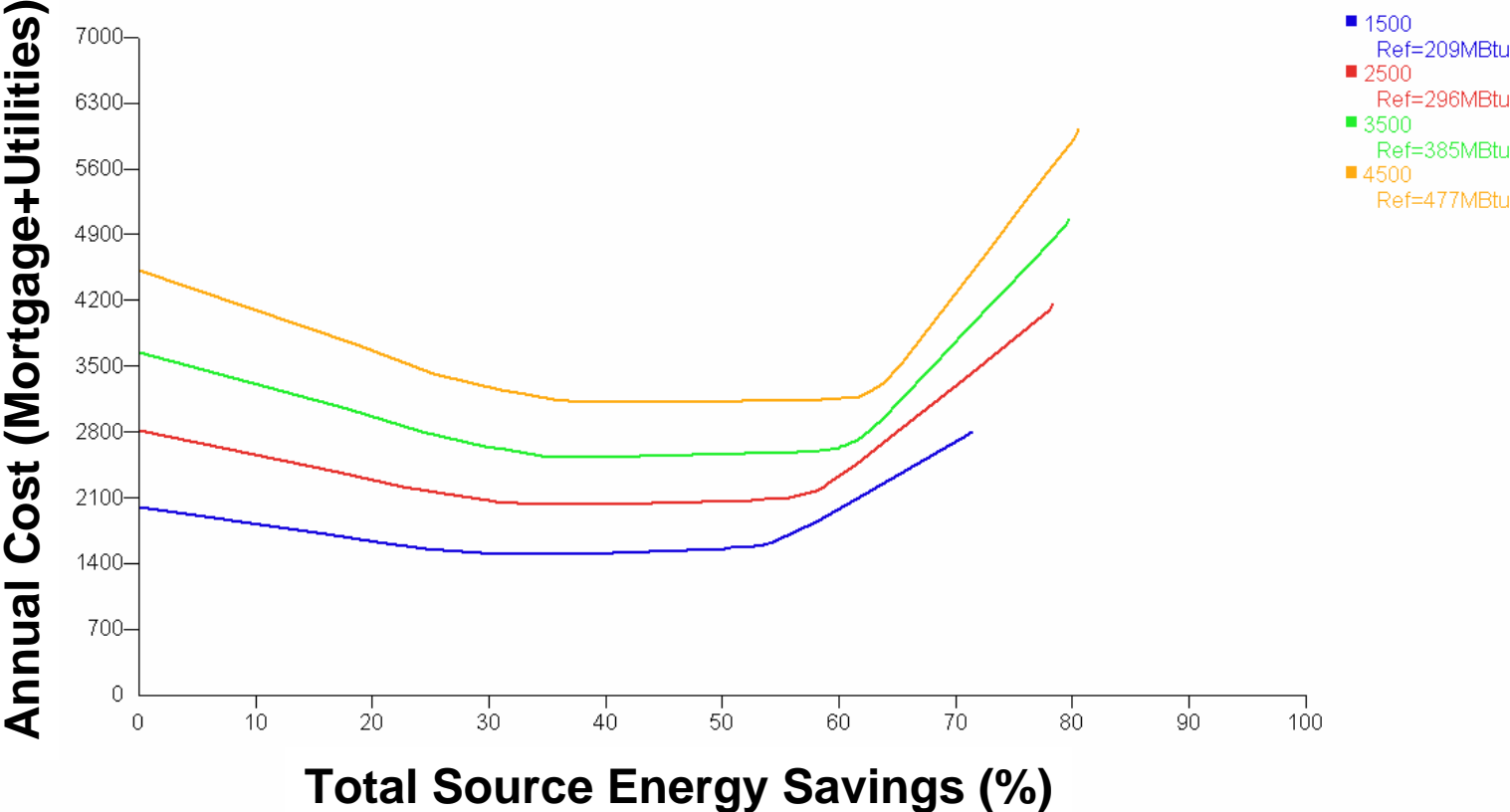


Passive Haus Total Source Target = 38 kBtu/ft²/yr

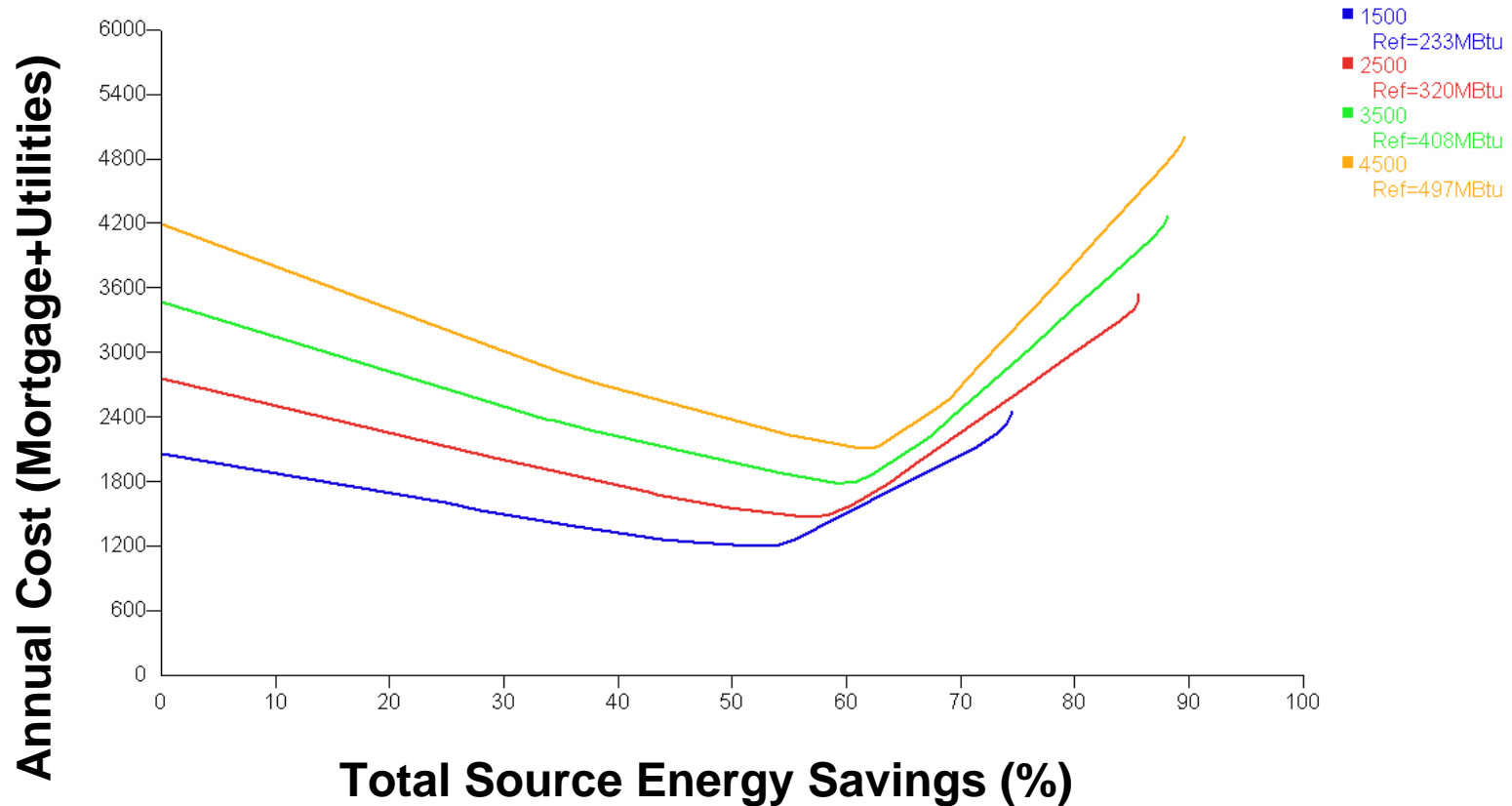
# Overview of Cost/Performance Results



# Chicago Cost/Performance Results



# Phoenix Cost/Performance Results



# Unit Conversions:

• **1 kWh = 3412 Btu**

• **1 kWh/m<sup>2</sup> = 317 Btu/ft<sup>2</sup>**

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# Economic Assumptions

- 30 year analysis period
- 3% inflation rate
- 5% discount rate (nominal)
- 7% interest rate (nominal)
- \$7.50/watt PV (installed cost)
- \$1/Therm natural gas
- \$0.126/kWh electric costs
- National average efficiency costs

