

How Far Can We Go? (Further Than You Might Think!)

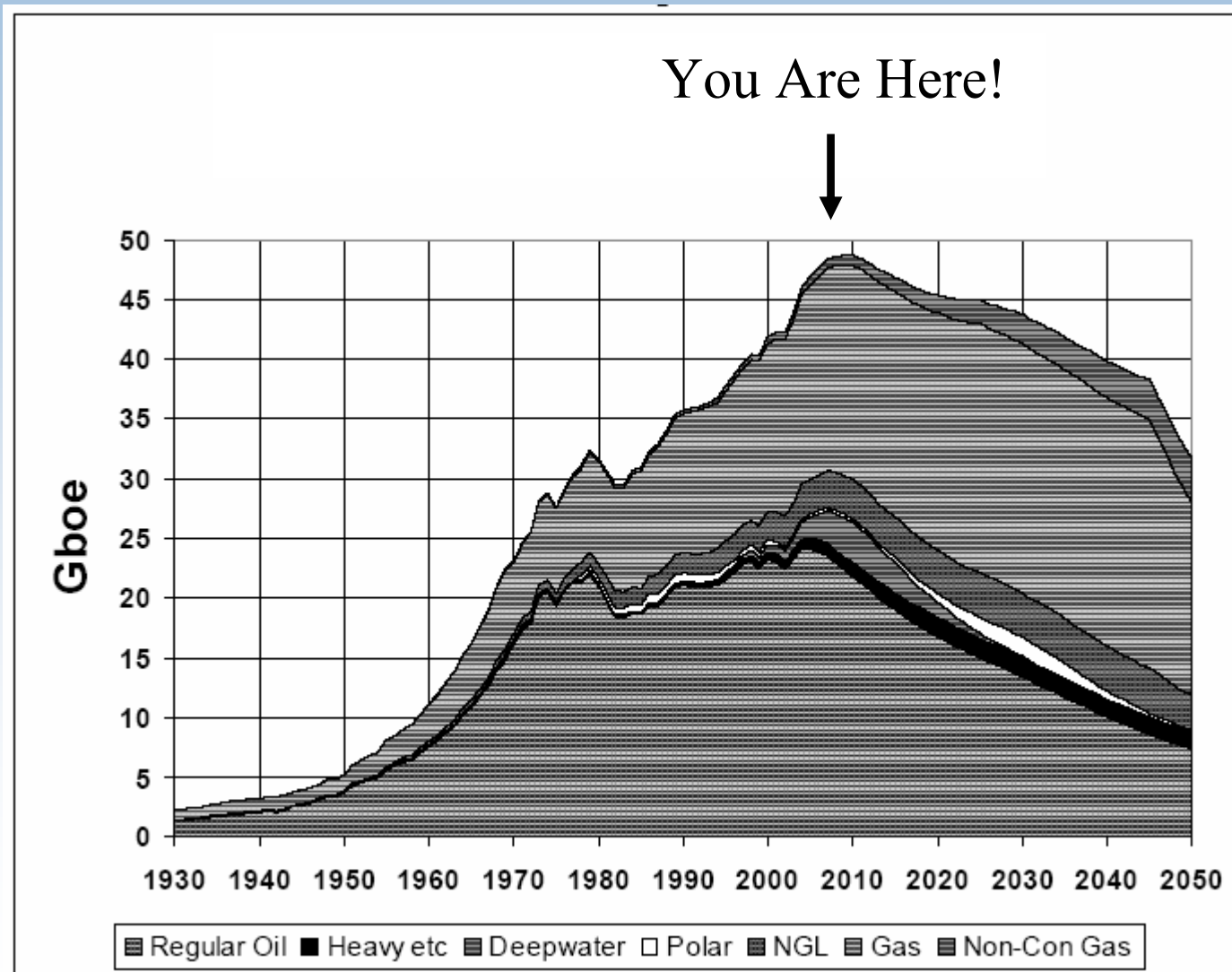
Ren Anderson
National Renewable Energy Laboratory
SWEEP Workshop
November 3, 2005



How Far Can We Go?

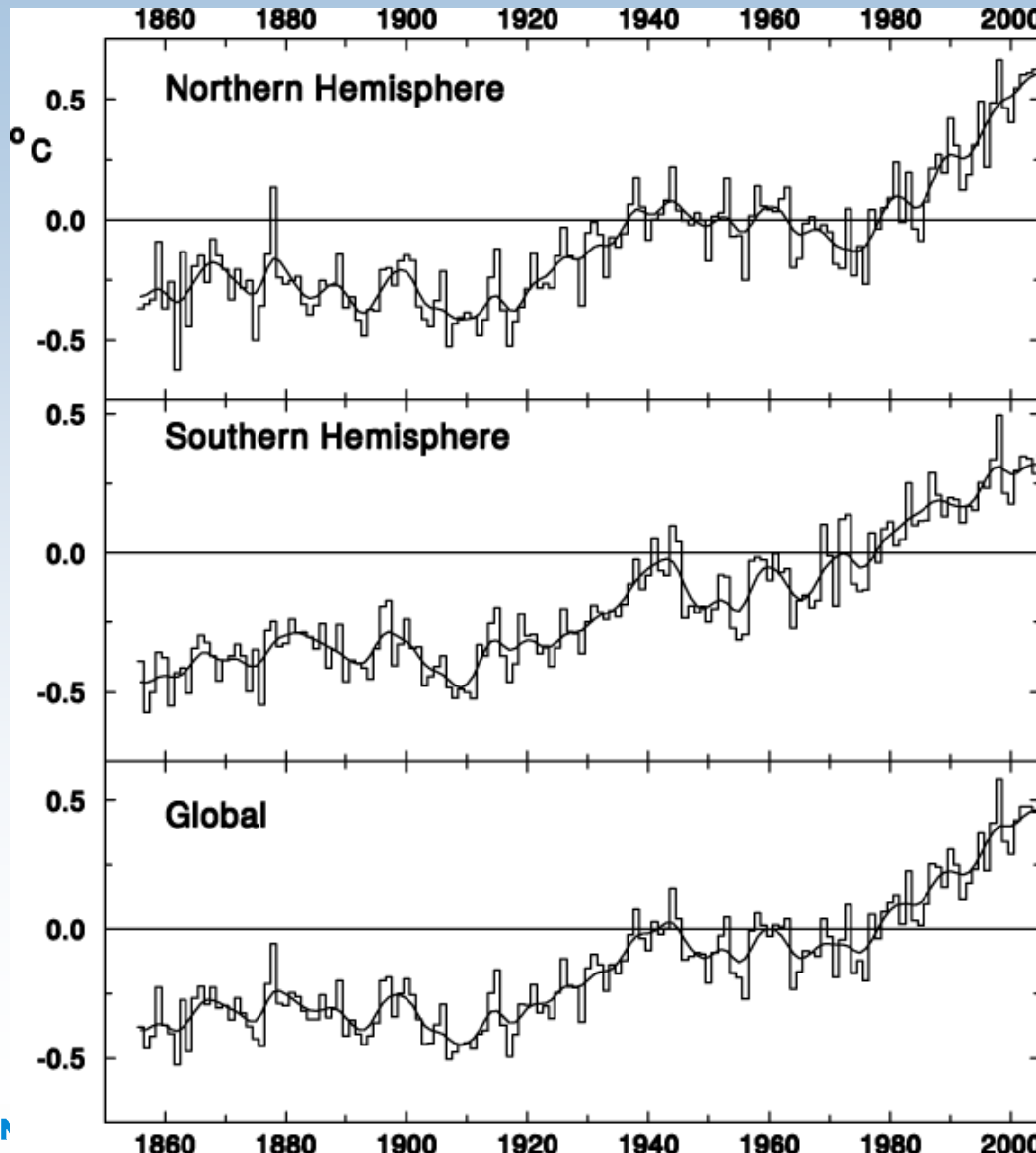


How Long Will Fossil Fuels Last?



The Association for the Study of Peak Oil and Gas, October 2005 Newsletter, www.peakoil.ie

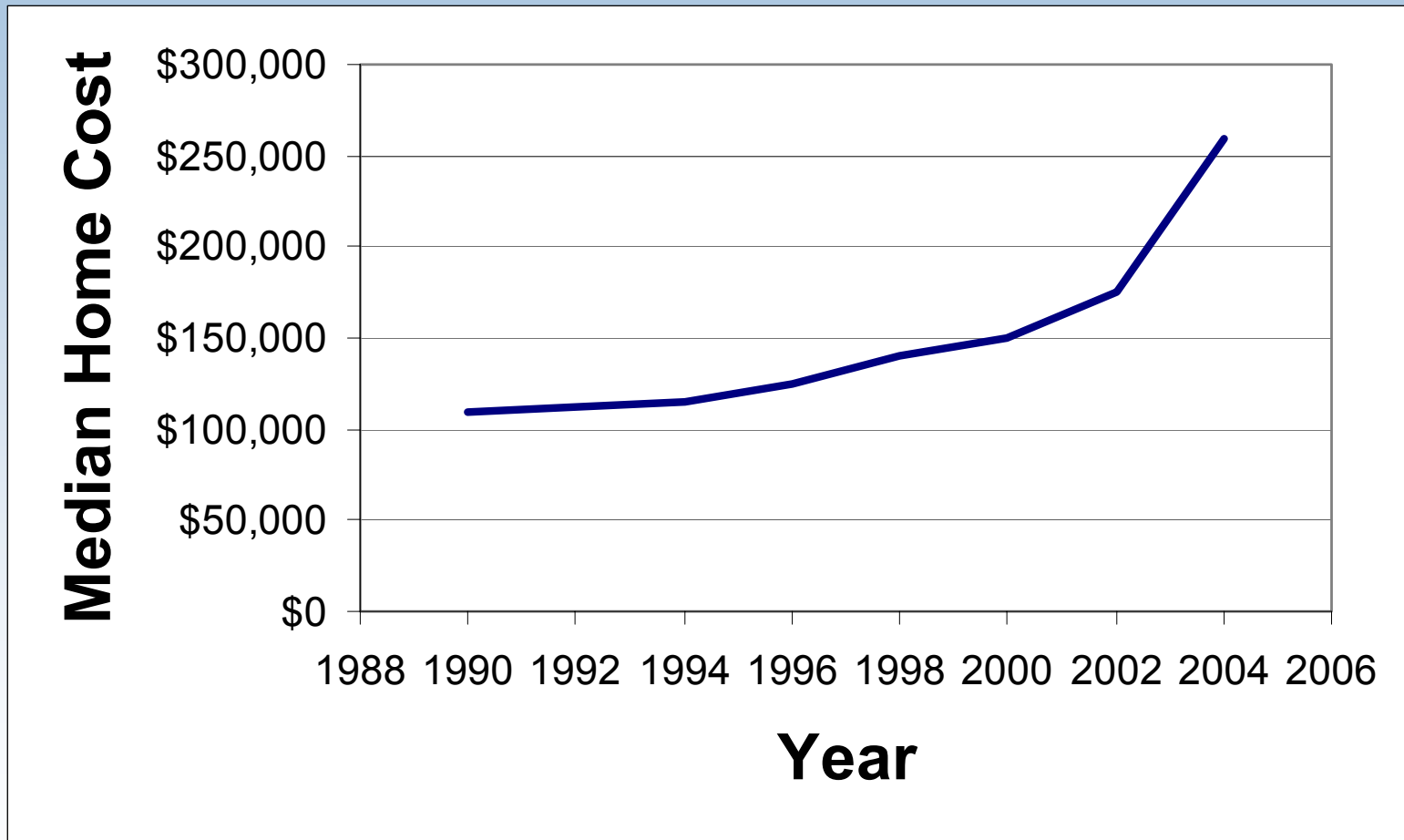
How Hot Will It Get?



“World temperatures keep rising. Climate data show 2005 on track to be hottest on record.”



How Much are Homebuyers Willing to Pay for High Performance Homes?



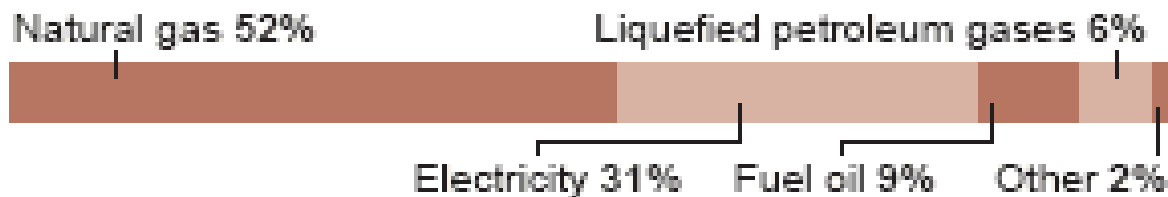
Median Home cost in Las Vegas. Source: Sales Traq, Professional Builder, November 2004.

How High Will Utility Bills Go?

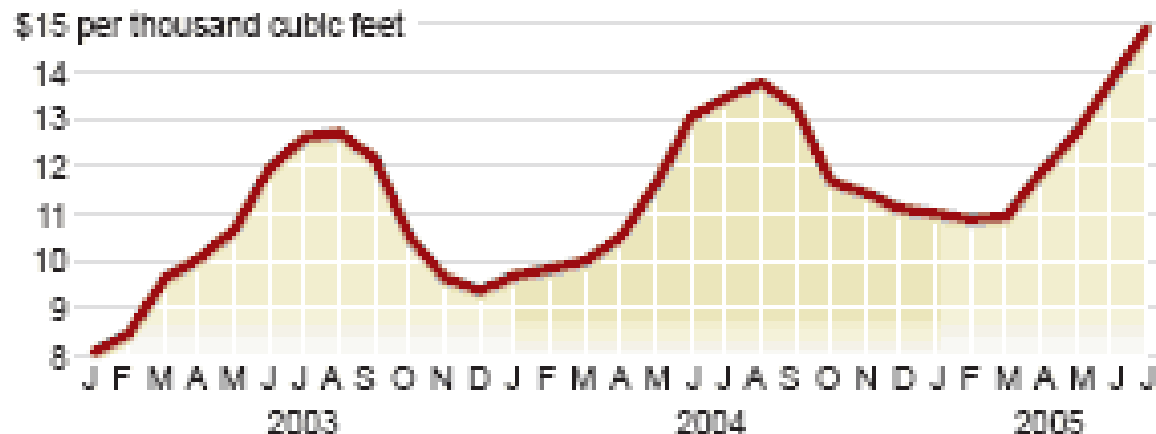
A costly winter for home heating expected

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



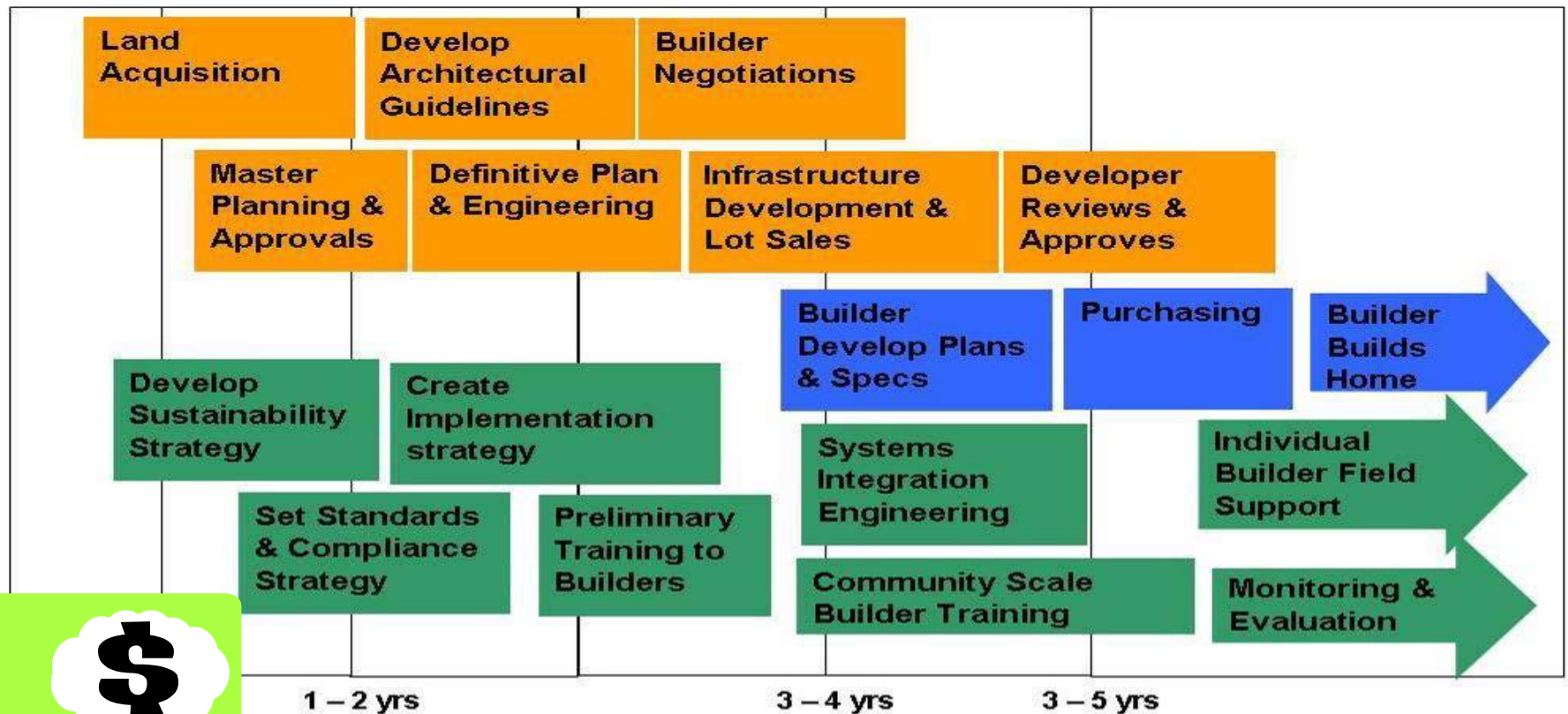
U.S. natural gas residential price



SOURCE: Energy Information Administration

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What “Opportunity Cost” are Builders Willing to Pay to Deliver High Performance Homes?



These Are All Very Good Questions!

However, during this presentation, I'm going to focus on the following questions:

- What combinations of energy savings features provide customers with the most bang for the buck?
- What is the least cost required to achieve different levels of energy savings?
- What are the estimated costs and benefits for the \$2000 residential tax credit for new homes?

Presentation Overview

These are still very difficult questions, so a specific approach will be used to answer these questions:

- Specific Residential Energy Saving Options
- Consistent Approach for Evaluation of Incremental Costs and Benefits for Energy Efficient Homes
- Simple definition of Energy Saving Strategies
- Simple Method to Determine Market Potential for Energy Efficient Homes

Then We can Discuss the Estimated Impacts of the Tax Credits on Markets for Energy Efficient Homes!

Residential Energy Saving Options



Residential Energy Saving Options

The interface displays a tree view of energy-saving options on the left, a central list of categories and sub-items, and an 'Orientation' panel on the right.

Tree View Selections:

- Building: 4 3 2 1 (4, 3, 2, 1)
- Envelope: 6 5 4 3 2 1 (6, 5, 4, 3, 2, 1)
- Foundation: 6 5 4 3 2 1 (6, 5, 4, 3, 2, 1)
- Windows & Shading: 7 6 5 4 3 2 1 (7, 6, 5, 4, 3, 2, 1)
- Appliances & Lighting: 2 1 (2, 1)
- Equipment: 8 7 6 5 4 3 2 1 (8, 7, 6, 5, 4, 3, 2, 1)

Central List:

- Building**
 - Orientation
 - Neighbors
- Envelope**
 - Walls
 - Ceiling
 - Thermal Mass
 - Infiltration
- Foundation**
 - Slab
 - Basement
 - Crawl Space
- Windows & Shading**
 - Glass Type
 - Total Window Area
 - Window Area per Wall
 - Eaves
- Appliances & Lighting**
 - Refrigerator
 - Cooking Range
 - Dishwasher
 - Clothes Dryer
 - Clothes Washer
 - Lighting
- Equipment**
 - Air Conditioner
 - Furnace
 - Heat Pump
 - Cooling Capacity

Orientation Panel:

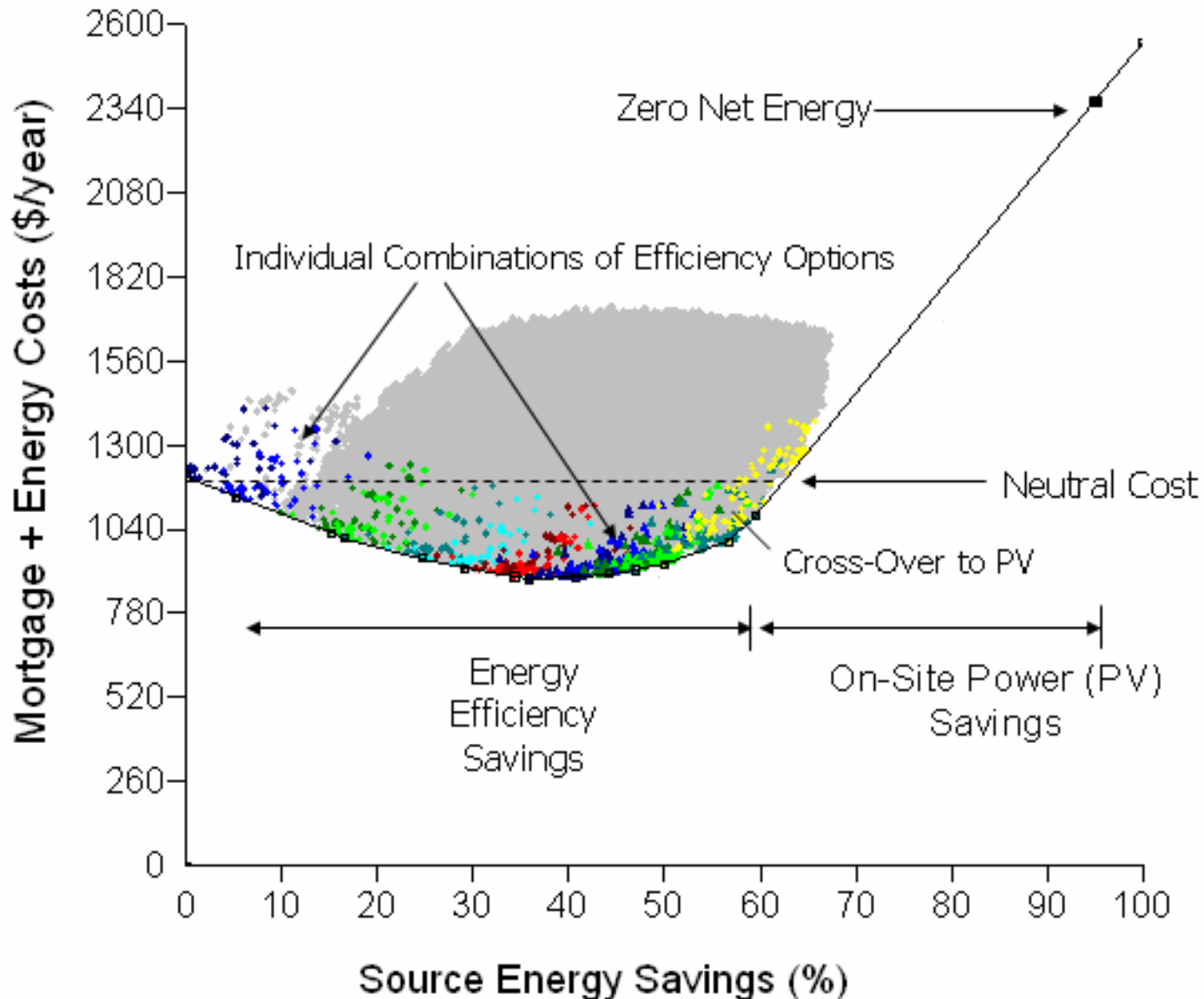
Options: (Select to include in optimization)

- 1) South-facing
- 2) West-facing
- 3) North-facing
- 4) East-facing

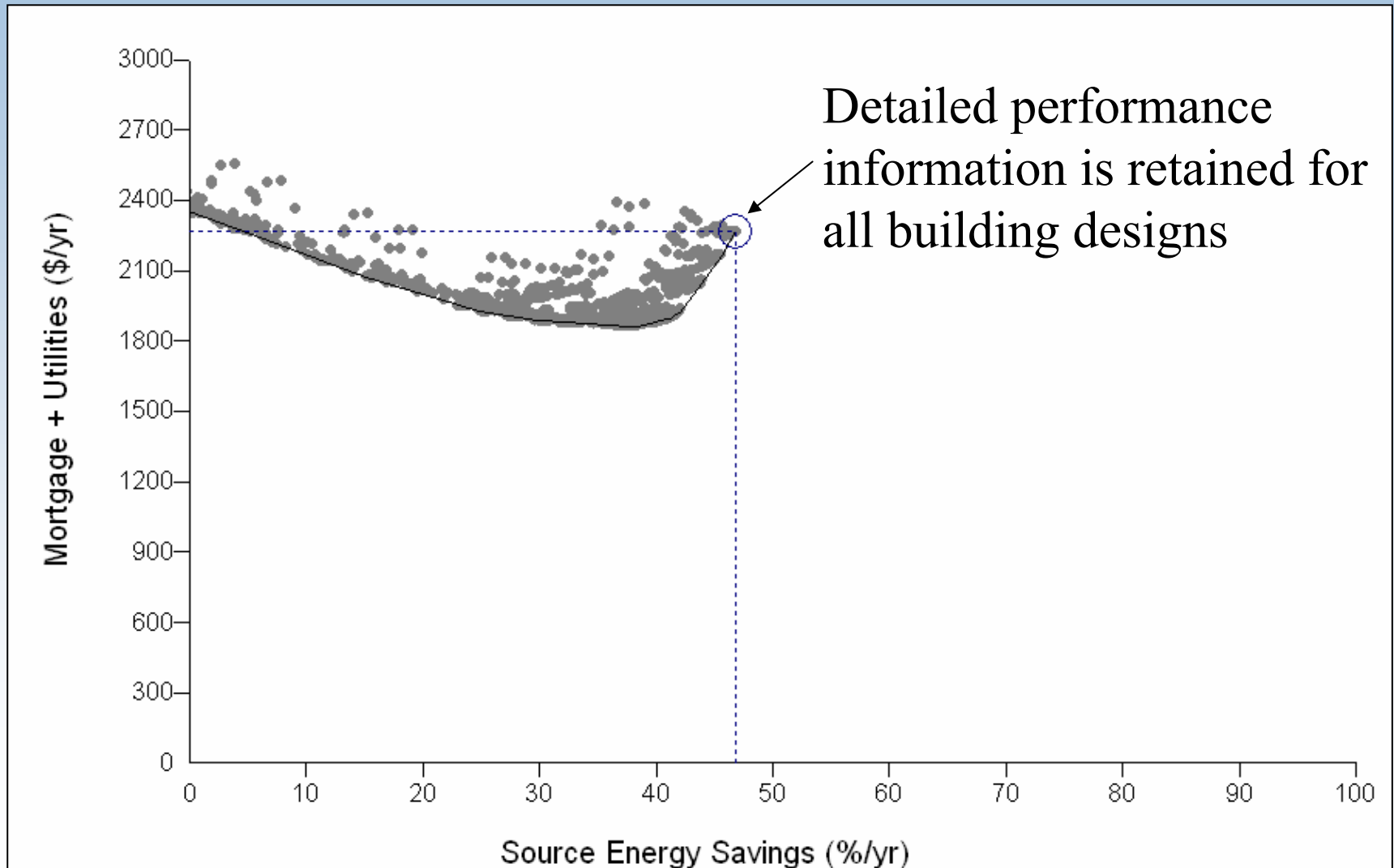
Residential Energy Saving Options

Building		Walls			
Orientation		Options: (Select to include in optimization)			
Neighbors		Framing Factor	Lifetime (years)	Unit Cost (\$/sq ft)	
Envelope		1) R11 batts, 2x4, 16"oc	0.25	30	\$3.15
Walls		2) R13 batts, 2x4, 16"oc	0.25	30	\$3.17
Ceiling		3) R11 batts, 2x4, 16"oc + 1" foam sheathing	0.25	30	\$3.92
Thermal Mass		4) R19 batts, 2x6, 24"oc	0.20	30	\$3.28
Infiltration		5) R19 batts, 2x6, 24"oc + 1" foam sheathing	0.20	30	\$4.05
Foundation		6) R19 batts, 2x6, 24"oc + 2" foam sheathing	0.20	30	\$4.24
Slab					
Basement					
Crawl Space					
Windows & Shading					
Glass Type					
Total Window Area					
Window Area per Wall					
Eaves					
Appliances & Lighting					
Refrigerator					
Cooking Range					
Dishwasher					
Clothes Dryer					
Clothes Washer					

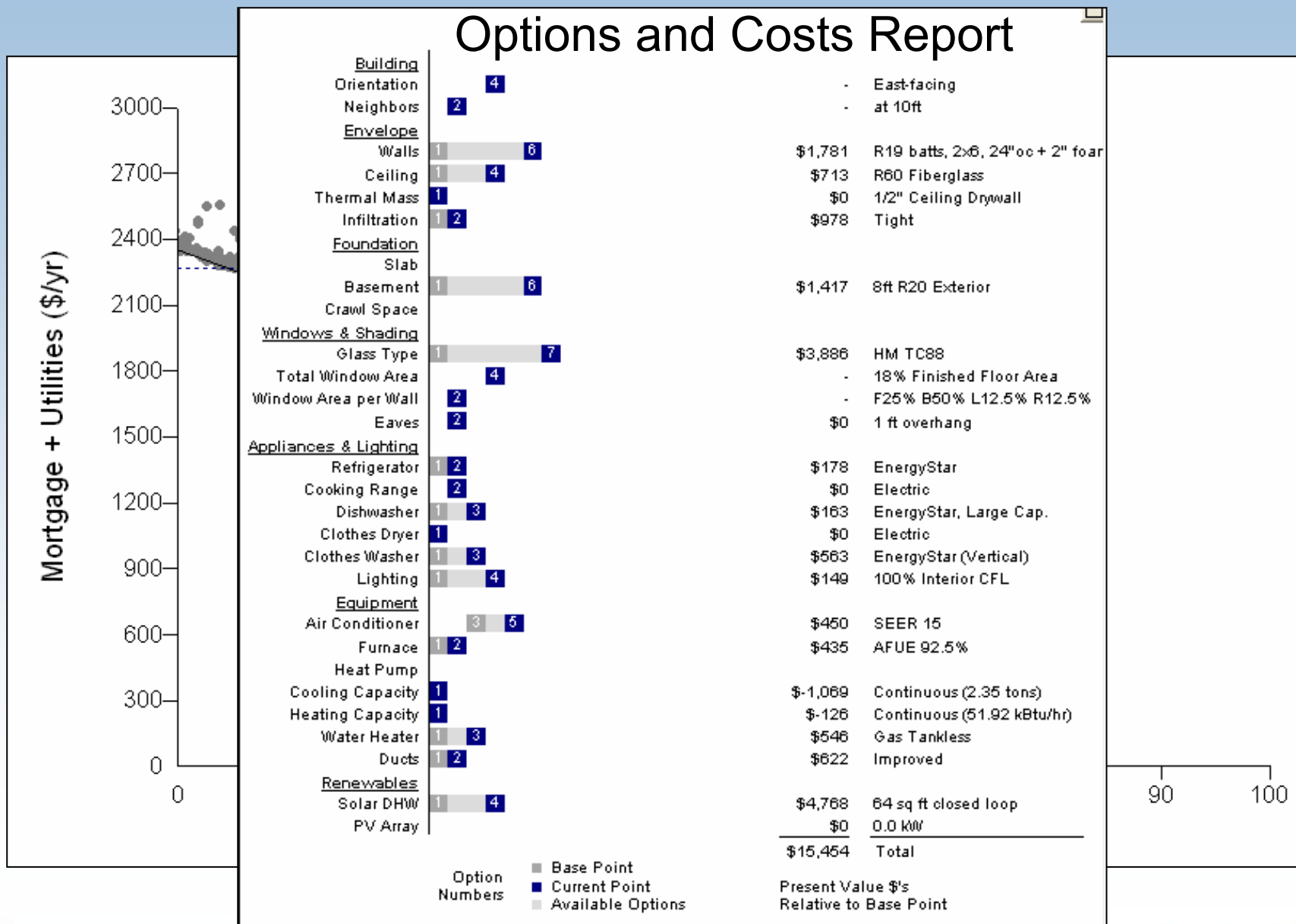
Determining Incremental Costs and Benefits for Energy Efficient Homes



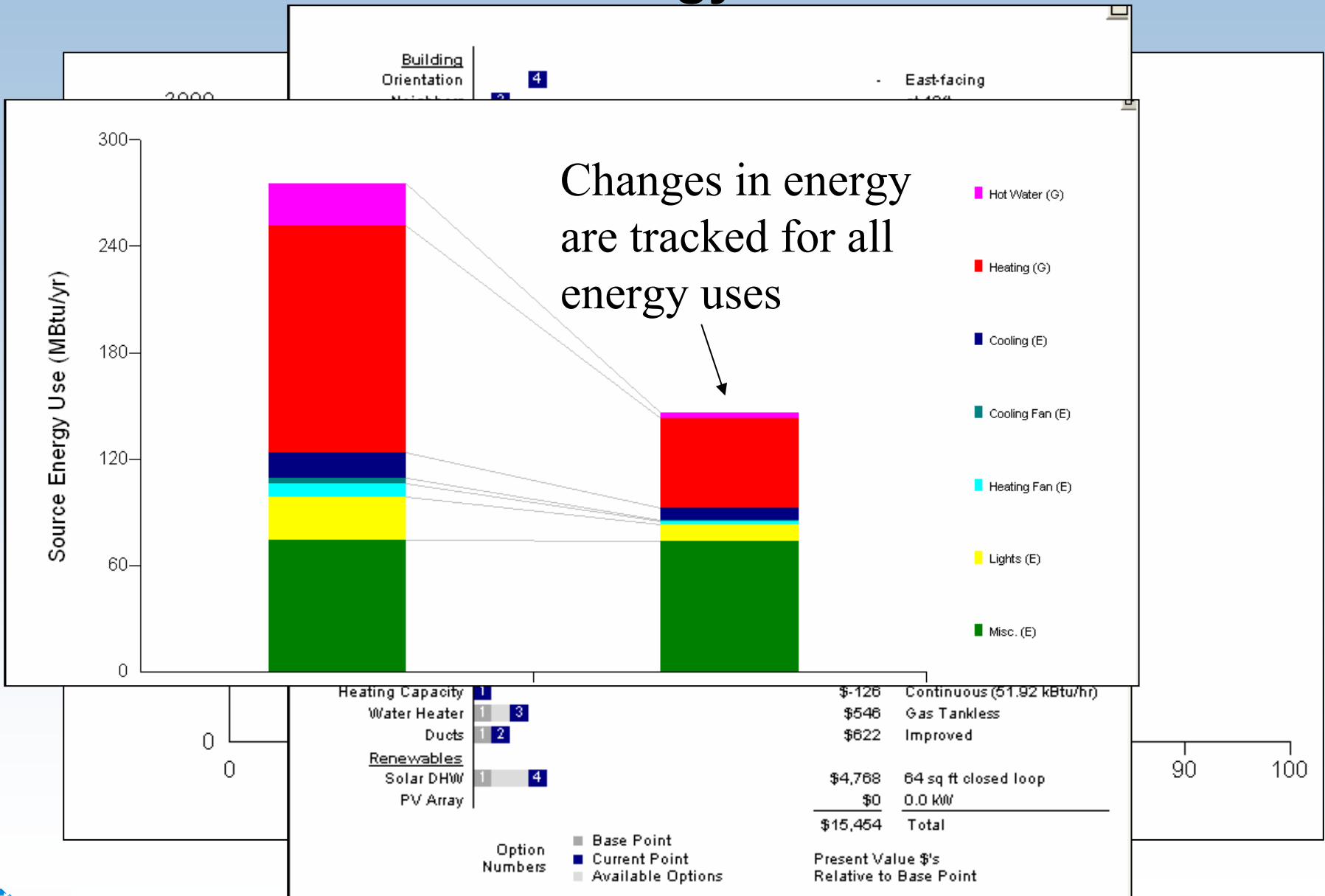
Determining Incremental Costs and Benefits for Energy Efficient Homes



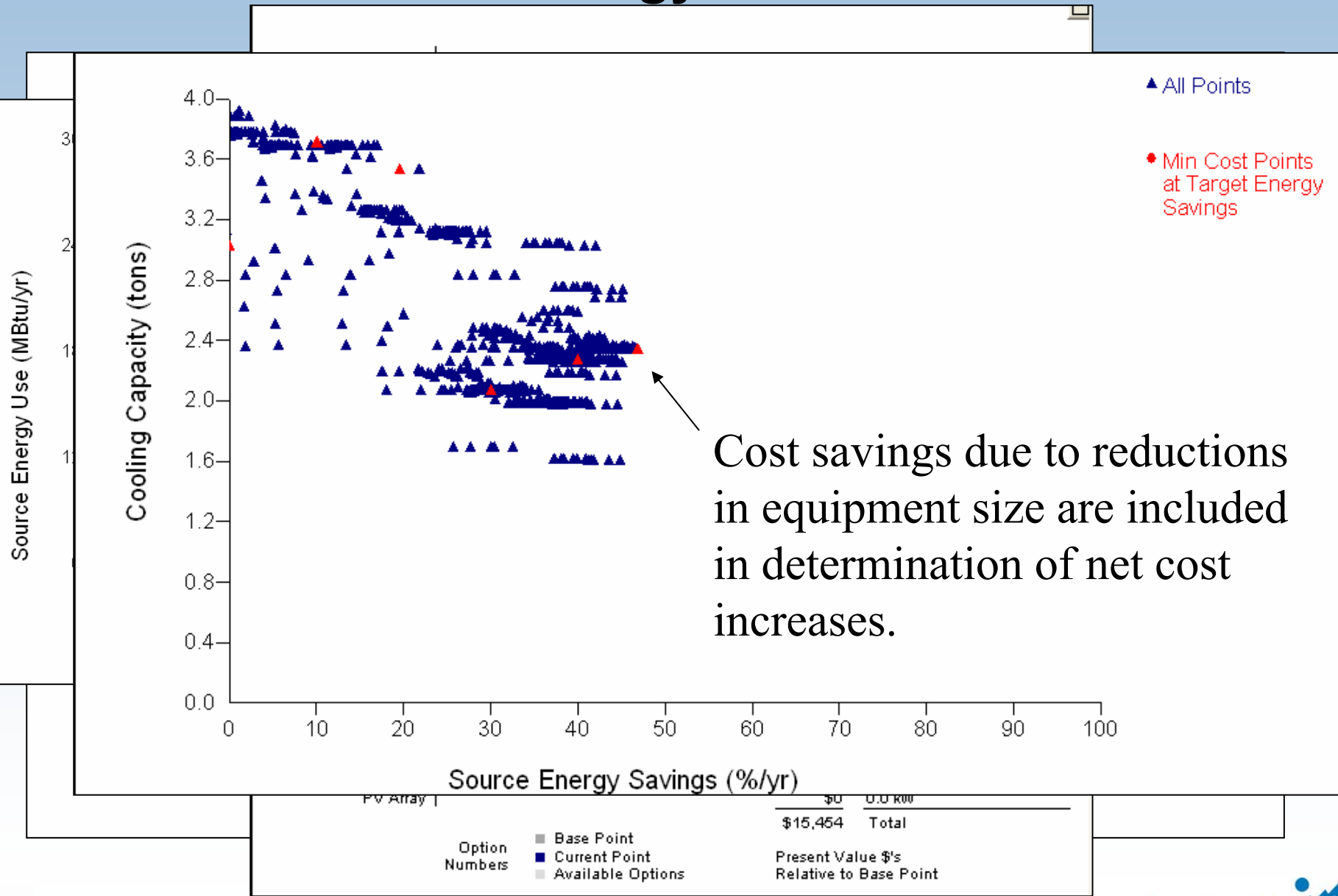
Determining Incremental Costs and Benefits for Energy Efficient Homes



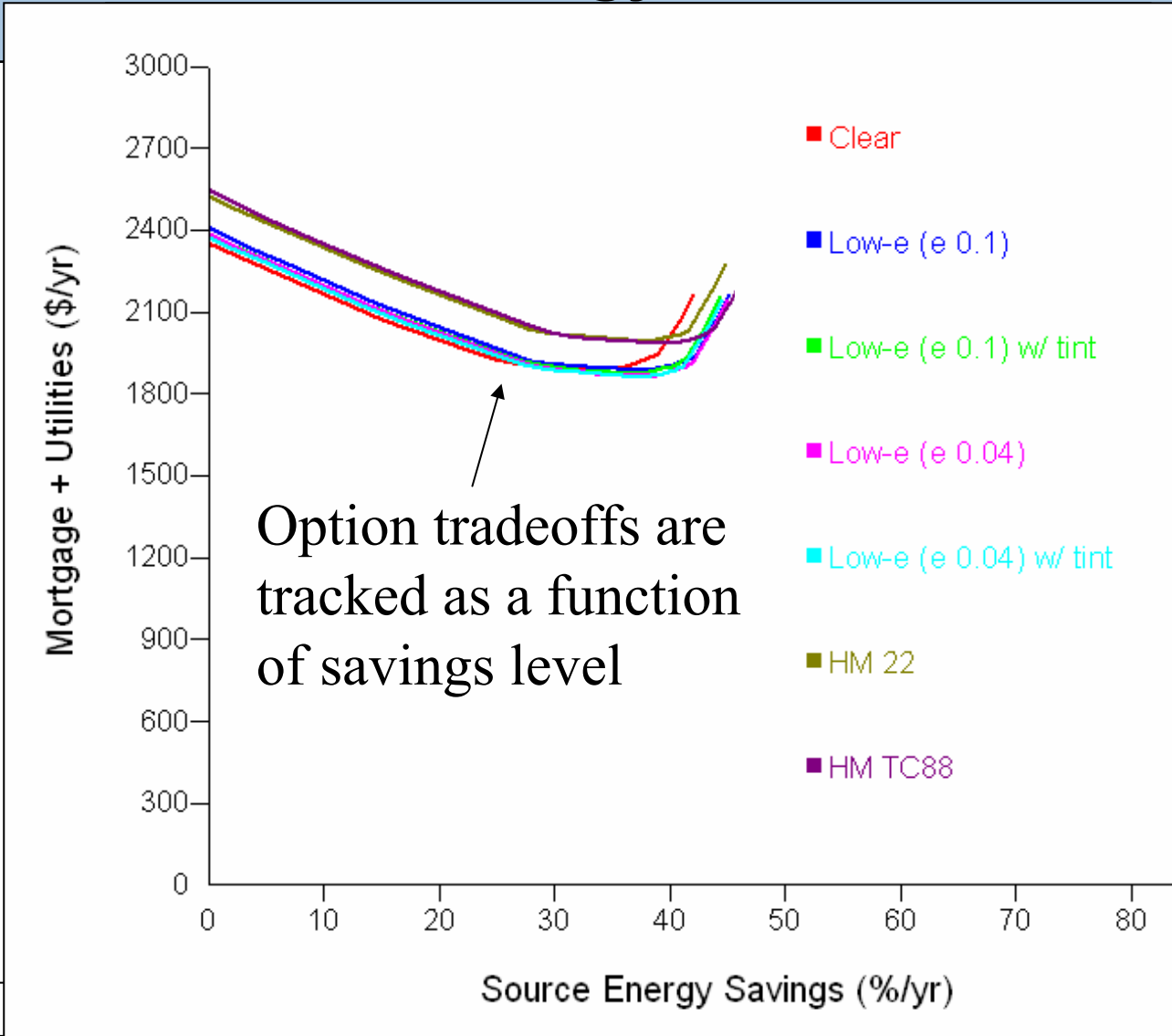
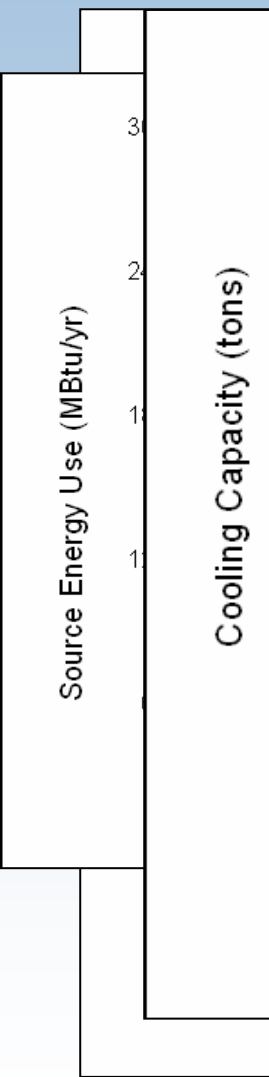
Determining Incremental Costs and Benefits for Energy Efficient Homes



Determining Incremental Costs and Benefits for Energy Efficient Homes



Determining Incremental Costs and Benefits for Energy Efficient Homes

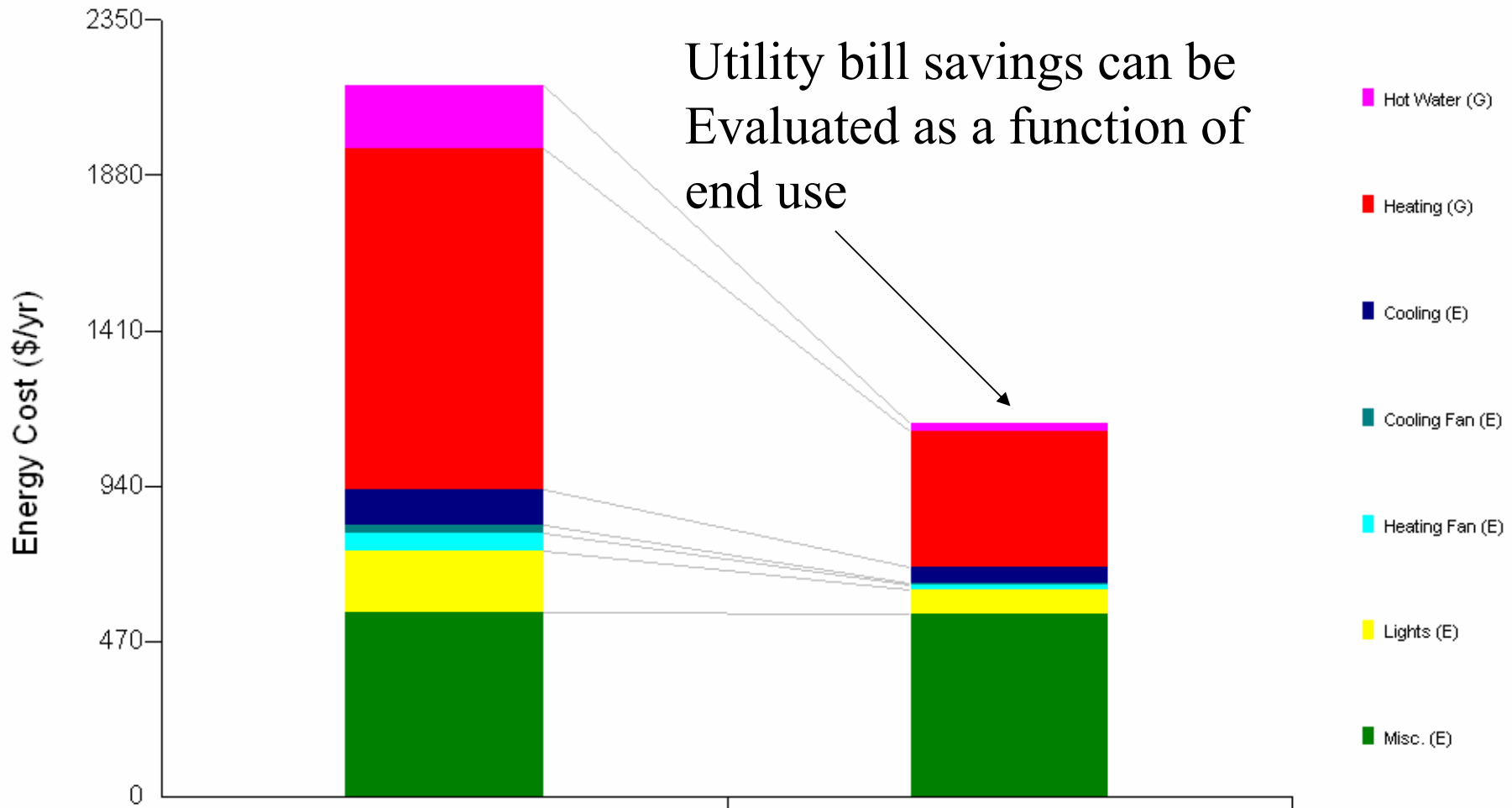


Option Numbers: ■ Base Point, ■ Current Point, ■ Available Options
 Present Value \$'s Relative to Base Point



Determining Incremental Costs and Benefits for Energy Efficient Homes

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Option Numbers
 ■ Base Point
 ■ Current Point
 ■ Available Options

Present Value \$'s
 Relative to Base Point

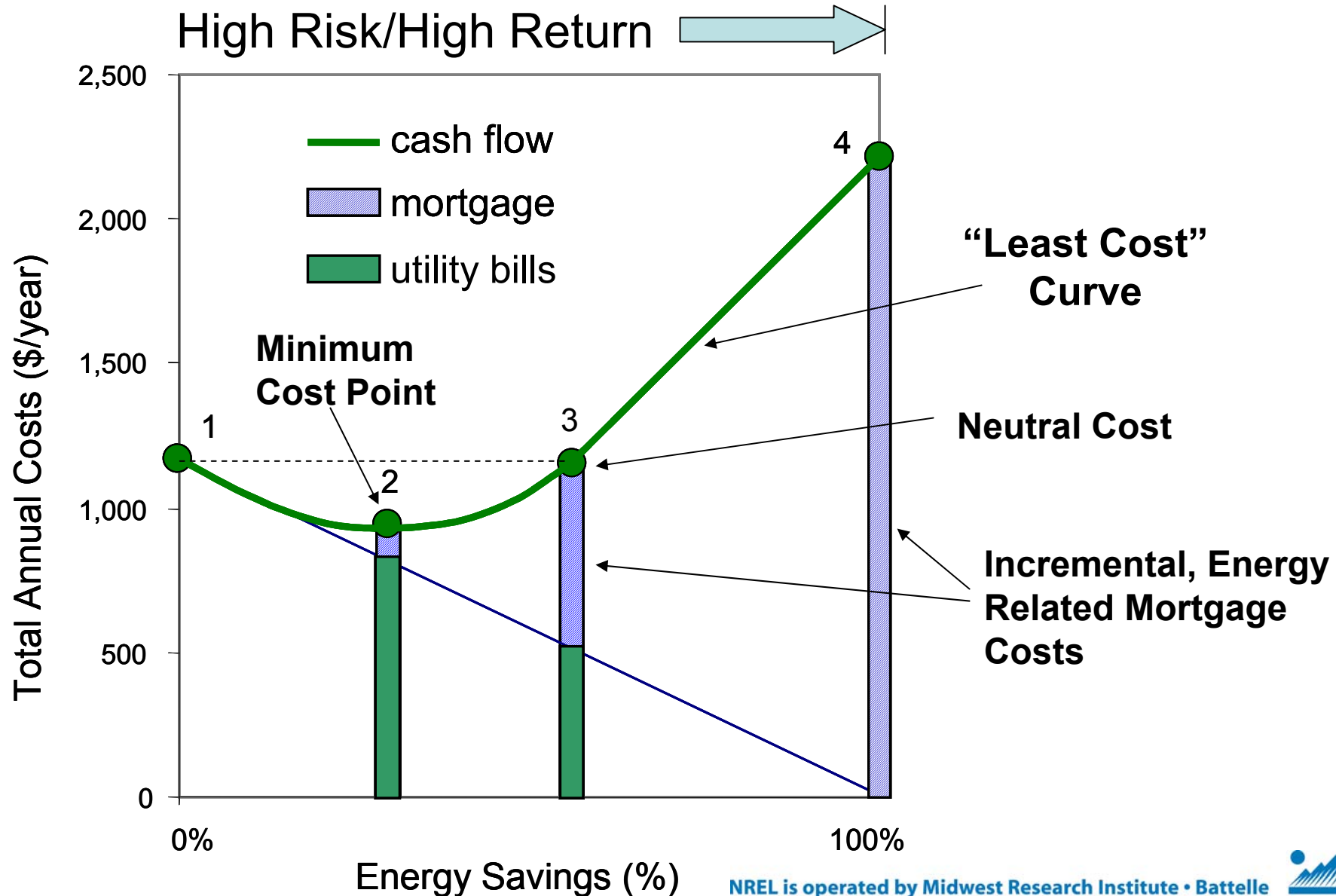
Comparison of Energy Saving Strategies

The current study focuses on the comparison of three energy saving strategies in a hot dry climate (Phoenix):

- Equipment, Insulation, and Windows Only (“sc”)
- All Space Conditioning Options (“SC”)
- All Options (“All”)

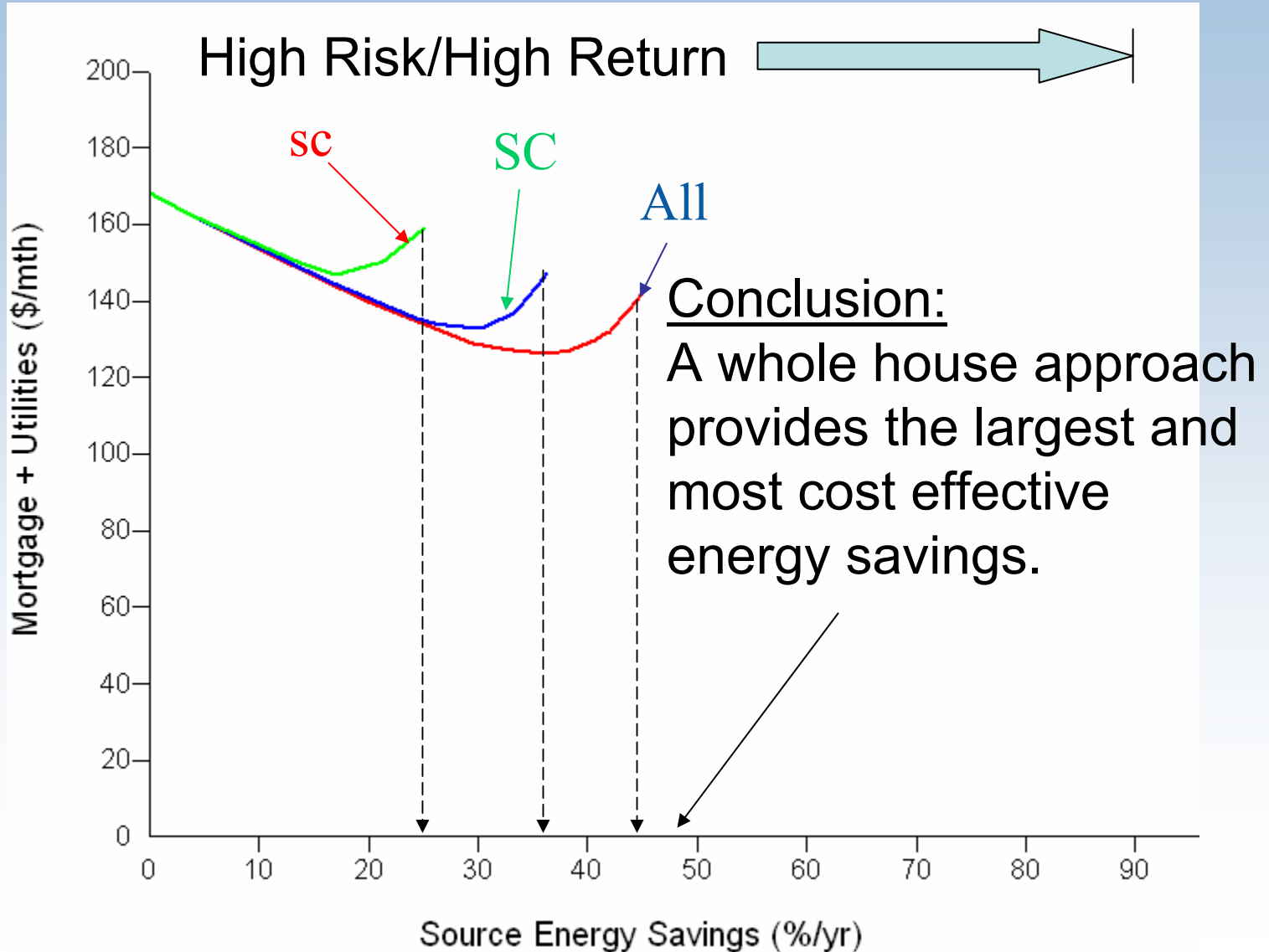
Builder redesign costs and costs to reduce risks are not included in cost estimates

Determining Incremental Costs and Benefits for Energy Efficient Homes



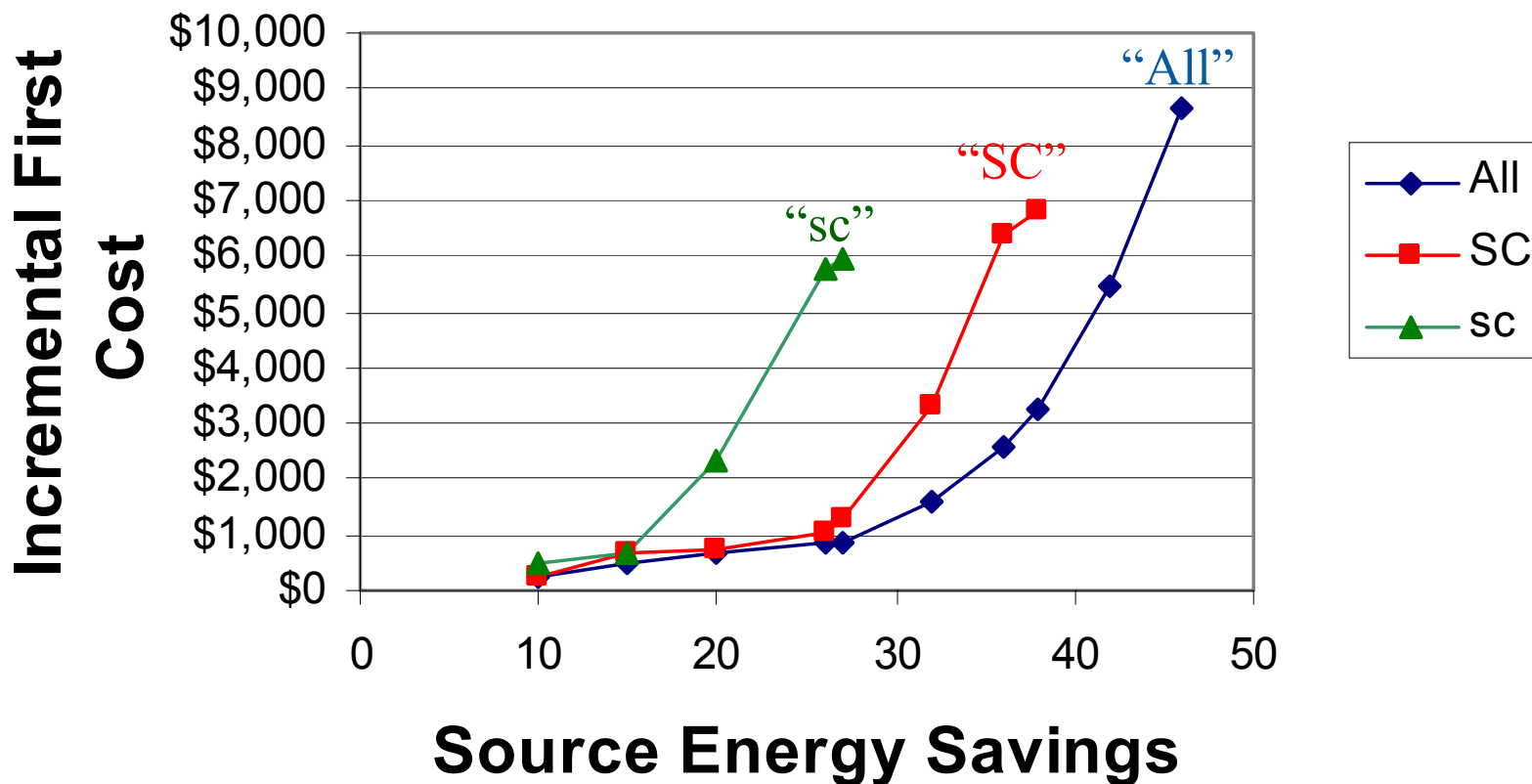
Comparison of Energy Saving Strategies

Phoenix Base Energy Cost: \$0.08/kWh, \$0.80/Therm



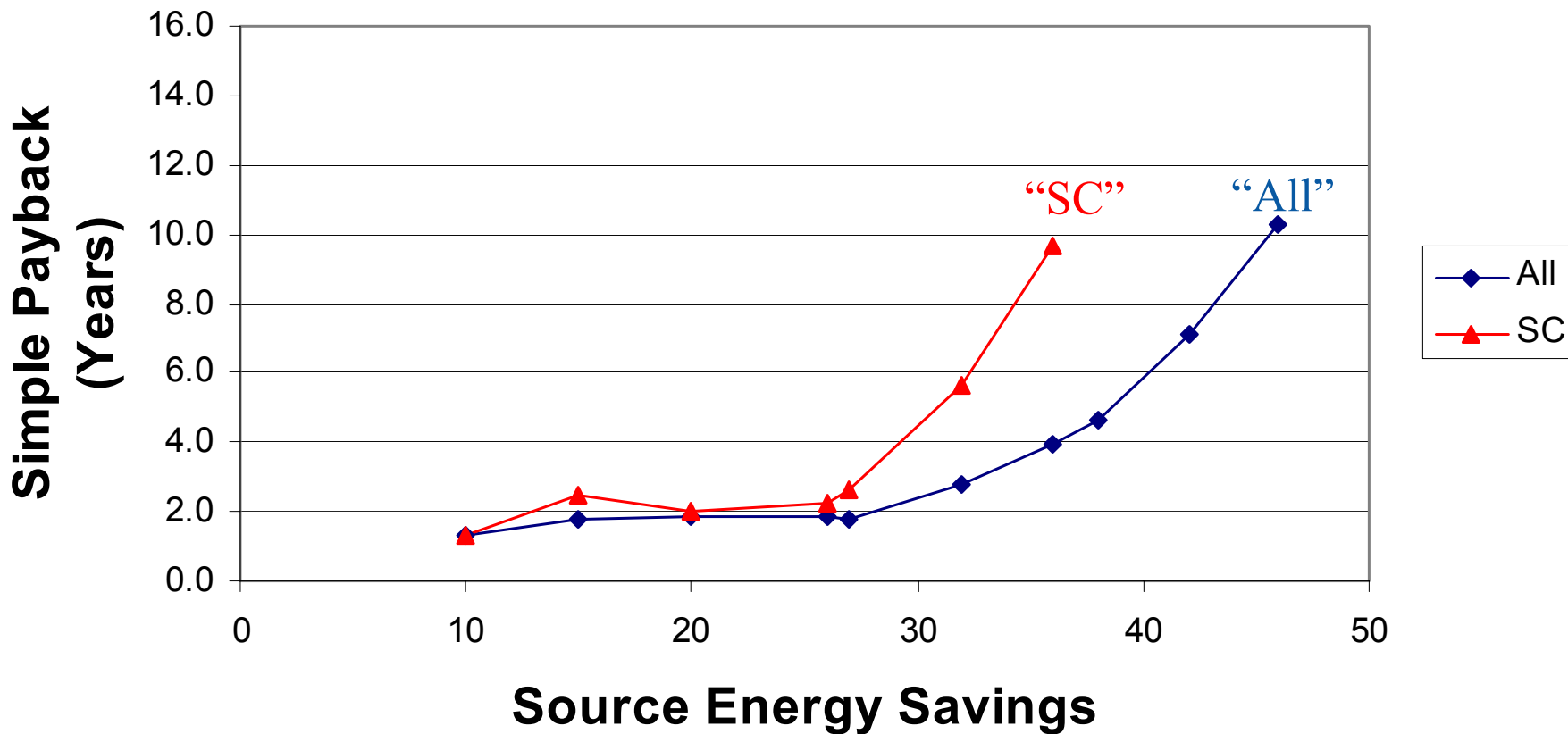
Comparison of Energy Saving Strategies

Phoenix First Cost Comparison



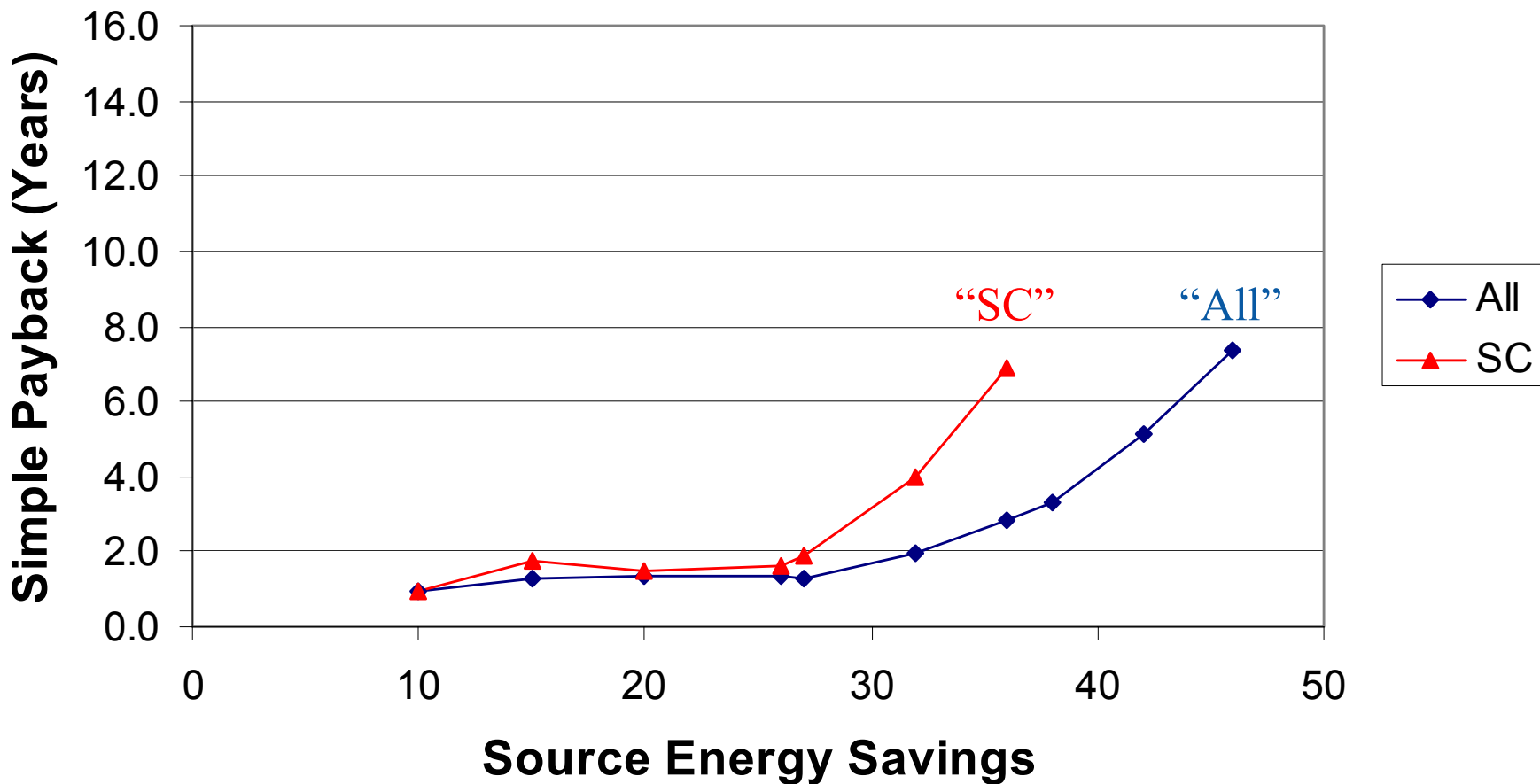
Comparison of Energy Saving Strategies

Phoenix Simple Payback (\$0.80/Therm, \$0.08/kWh)



Comparison of Energy Saving Strategies

Phoenix Simple Payback
(40% Increase: \$1.12/Therm, \$0.112/kWh)



Estimated Impacts of Current Tax Credit On Market for Energy Efficient Homes

Cautions:

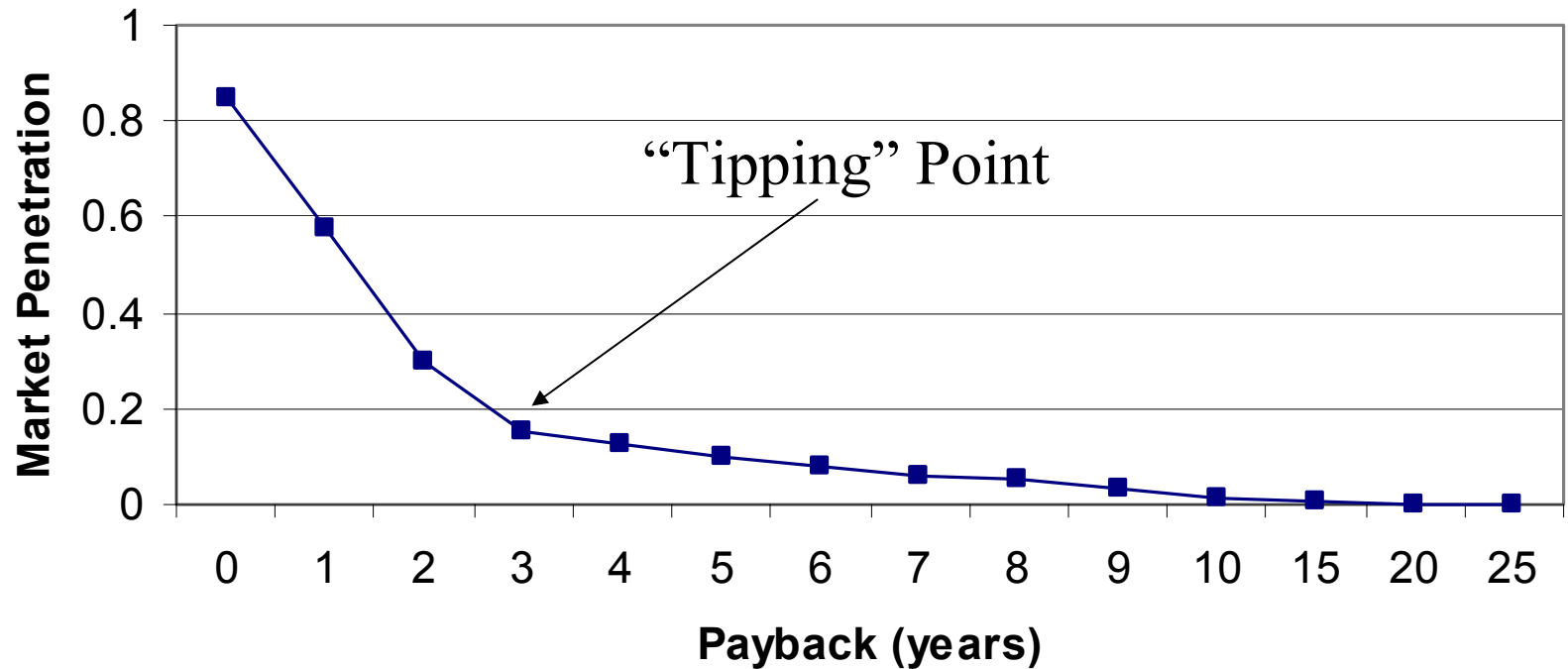
Tax credit guidelines have not been released by the IRS so several assumptions have been made:

- SEER 13 is base AC requirement
- Achieving tax credit is estimated to cost \$1000 (Net tax credit benefit is \$1000)
- IECC is reference for energy savings

Energy Scale Conversion Note: For the current case, 50% space conditioning savings is equivalent to 26% in whole house energy savings.

Estimated Impacts of Current Tax Credit: Market Model

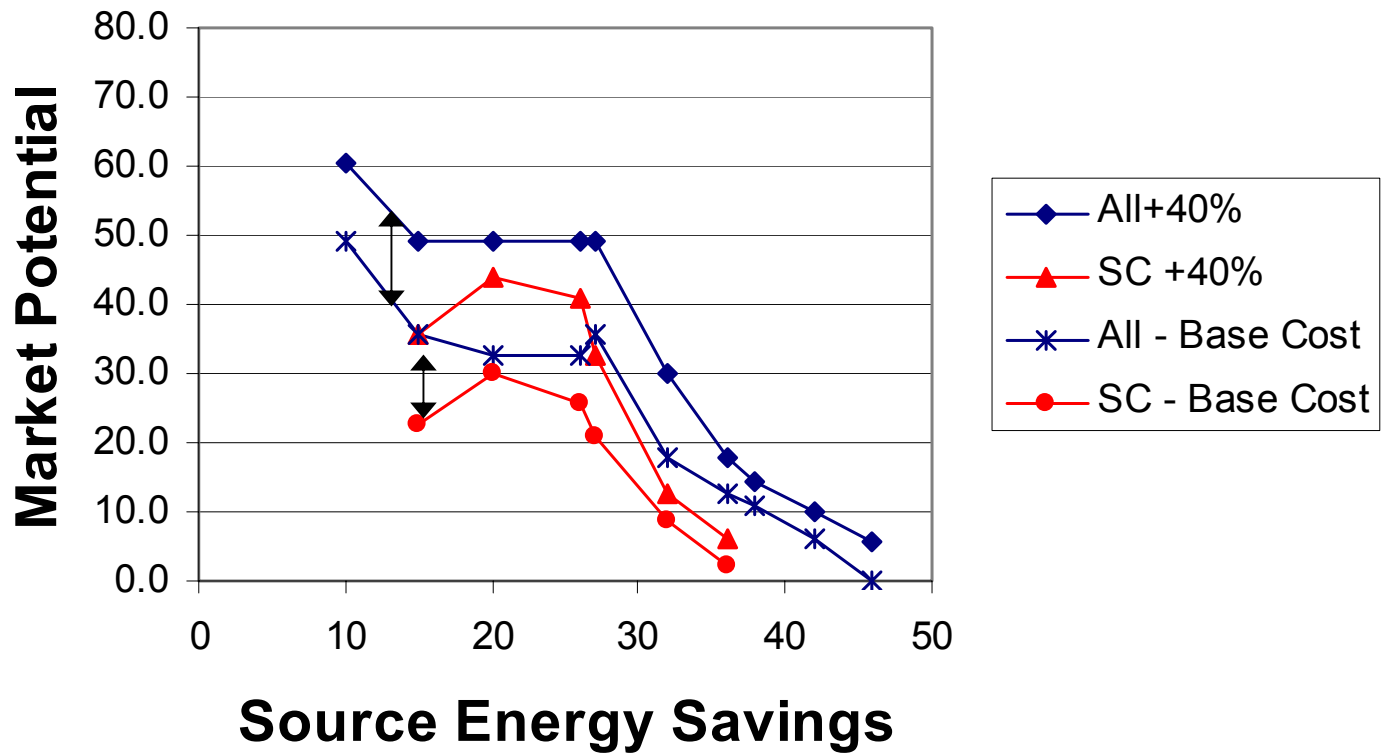
Long Term Market Potential for Energy Efficient Homes



“Fuel Cells for Building Cogeneration Applications – Cost/Performance Requirements and Markets”; prepared for the Building Equipment Division, Office of Building Technologies, U.S. Department of Energy; prepared by Arthur D. Little, Cambridge, MA; Arthur D. Little, Reference Number 42526; Figure 6.1.2, January 1995.

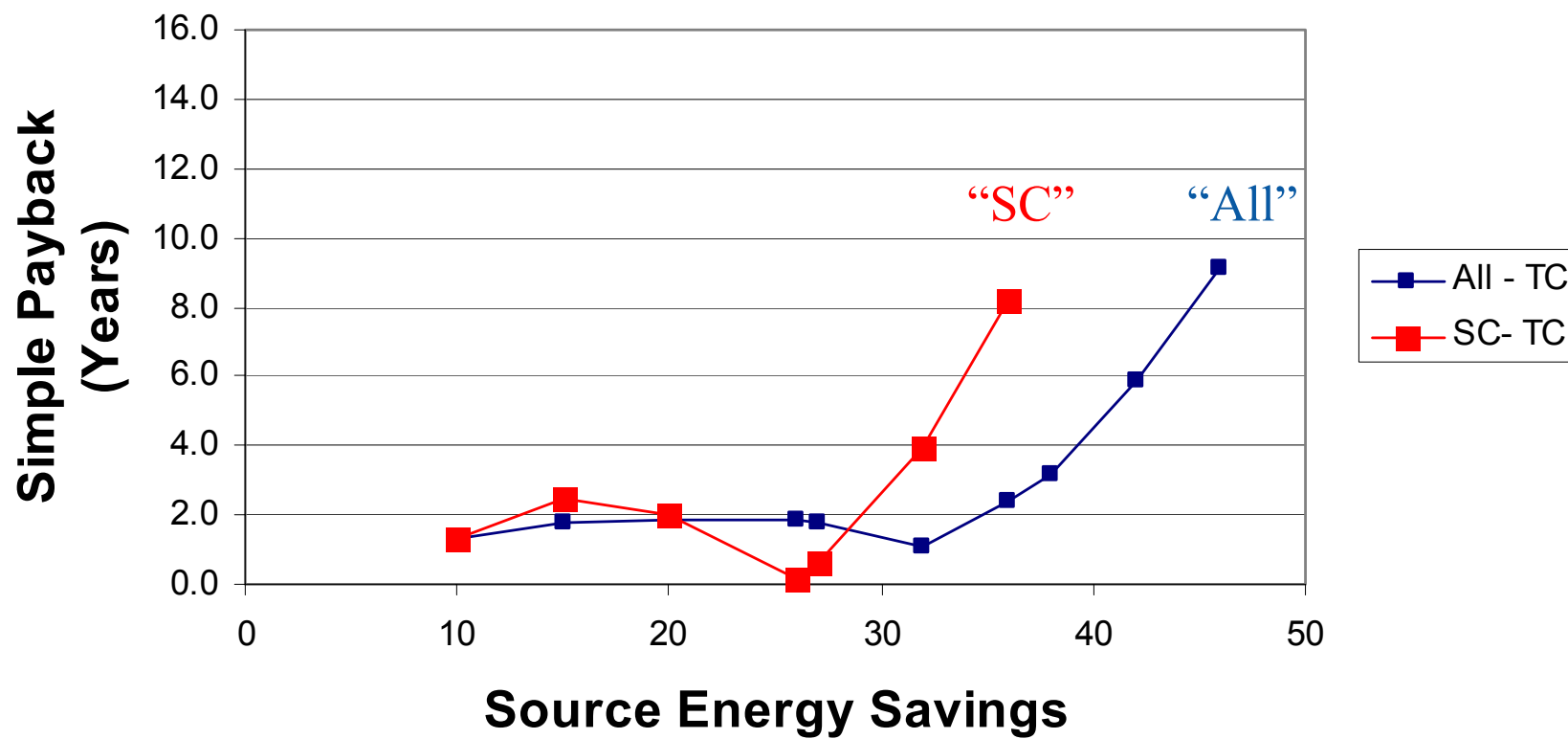
Estimated Impacts of Energy Costs On Market for Energy Efficient Homes

Long Term Market Potential 40% Energy Cost Increase



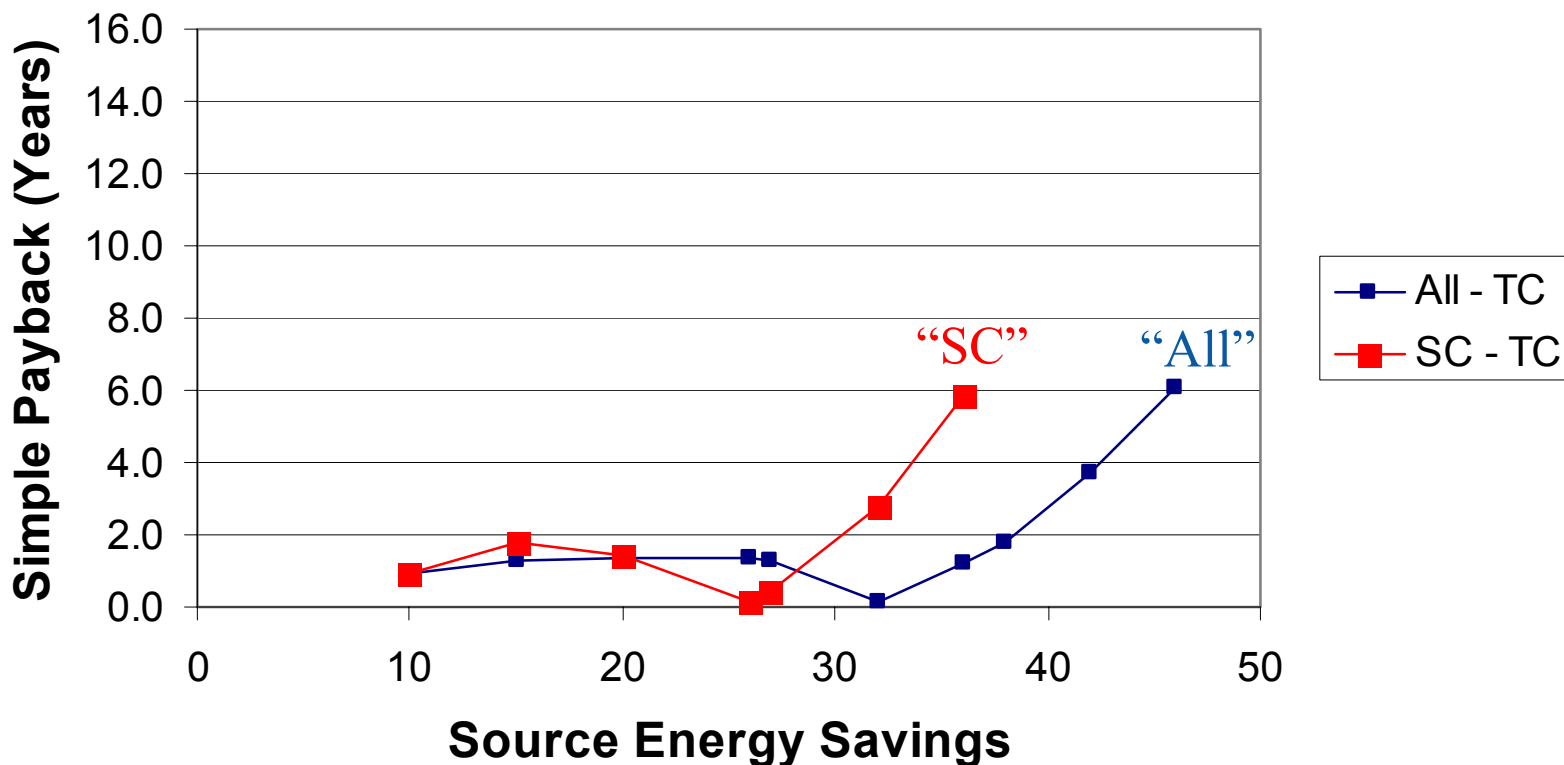
Estimated Impacts of Current Tax Credit On: Simple Payback

Phoenix Simple Payback (\$0.80/Therm, \$0.08/kWh)

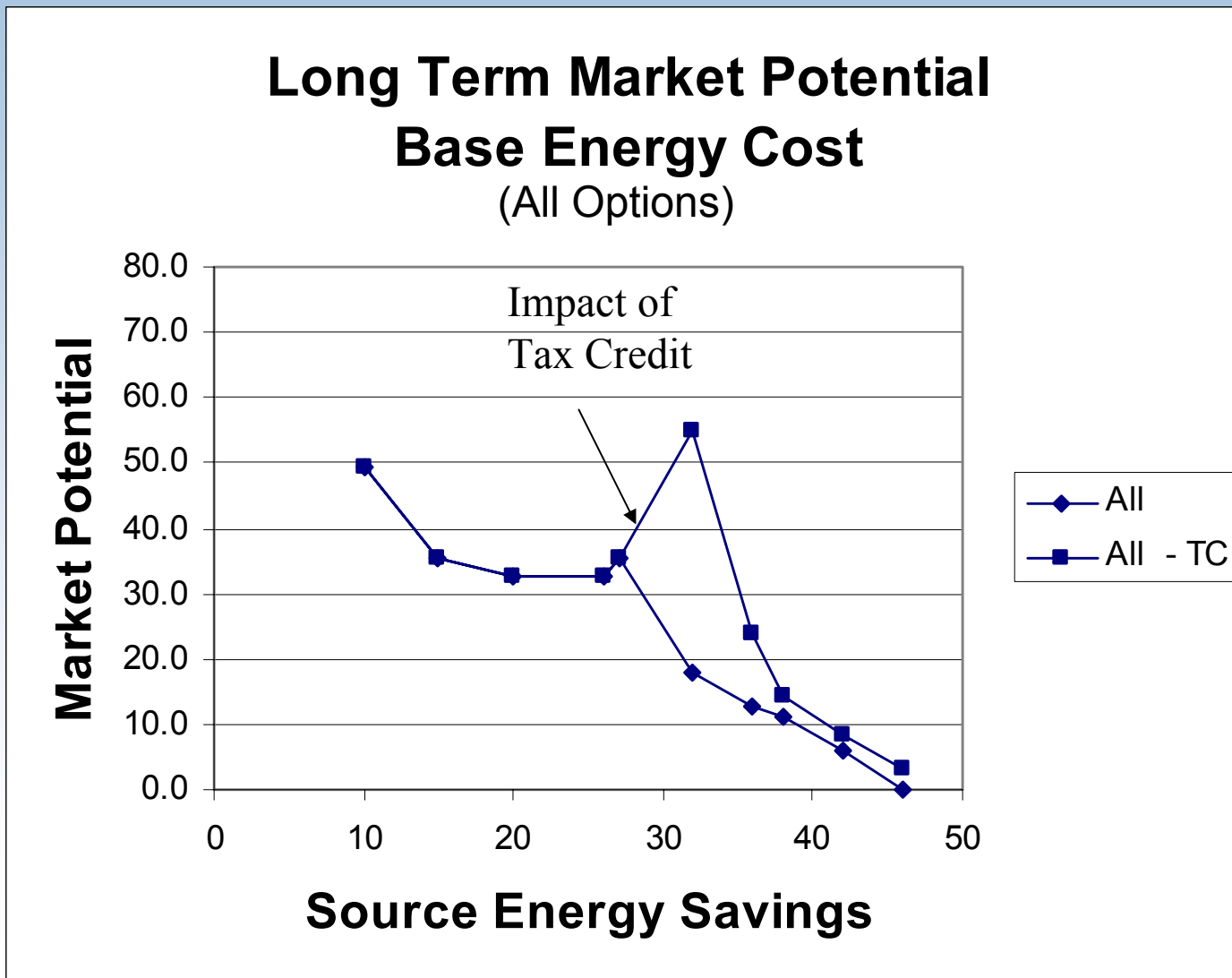


Estimated Impacts of Current Tax Credit On: Simple Payback with Increased Energy Cost

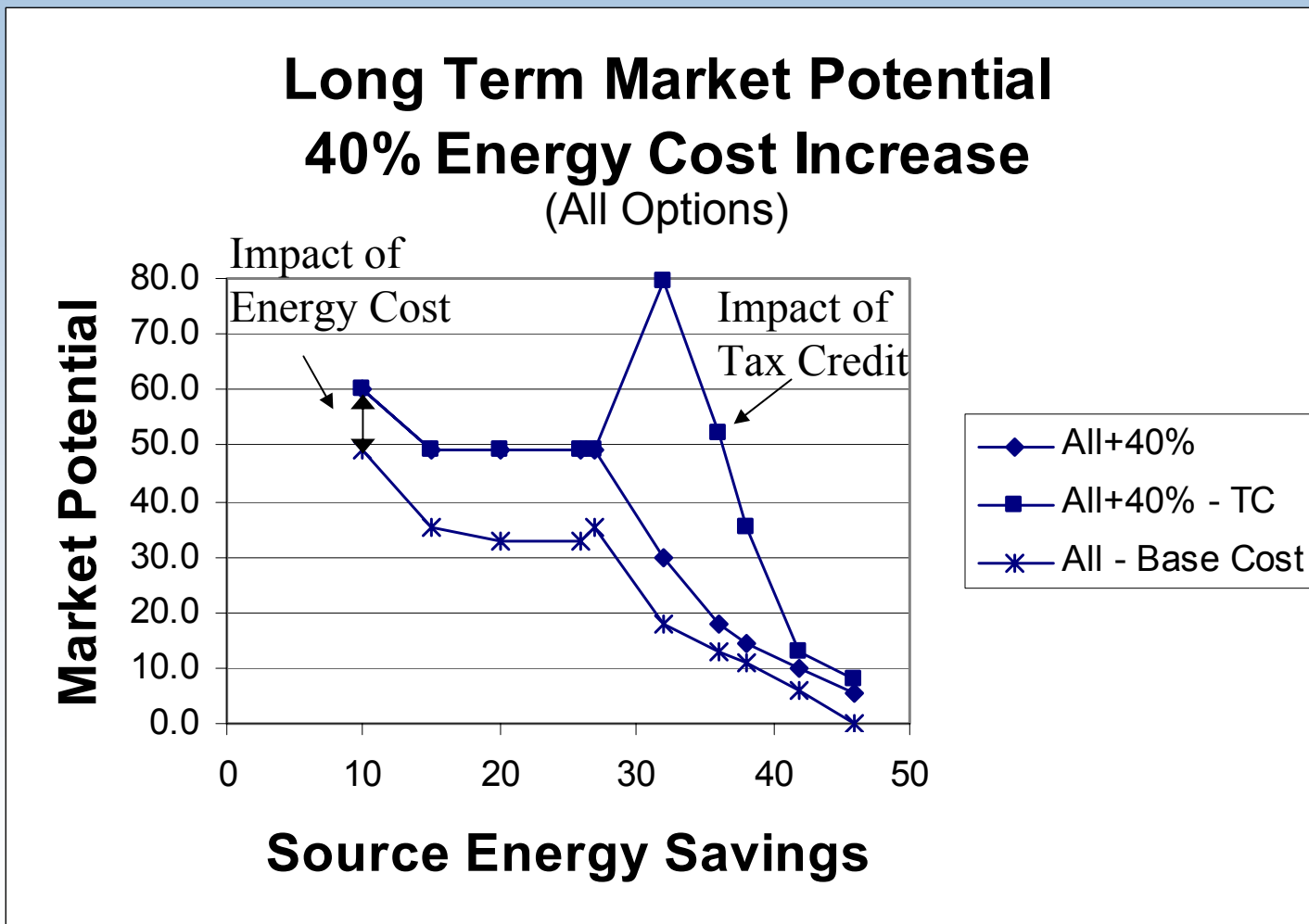
Phoenix Simple Payback
(40% Increase: \$1.12/Therm, \$0.112/kWh)



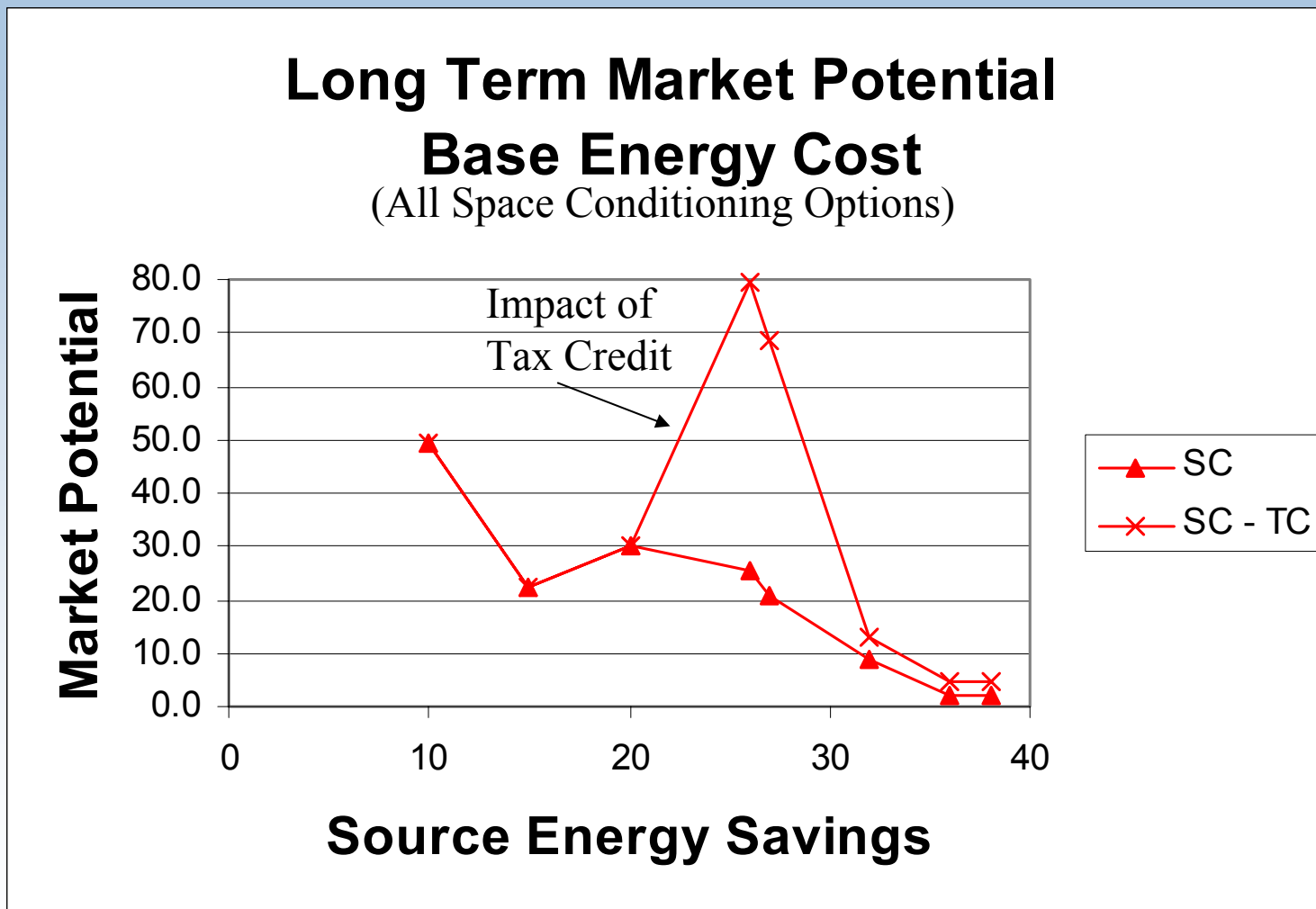
Estimated Impacts of Current Tax Credit On Market for Energy Efficient Homes



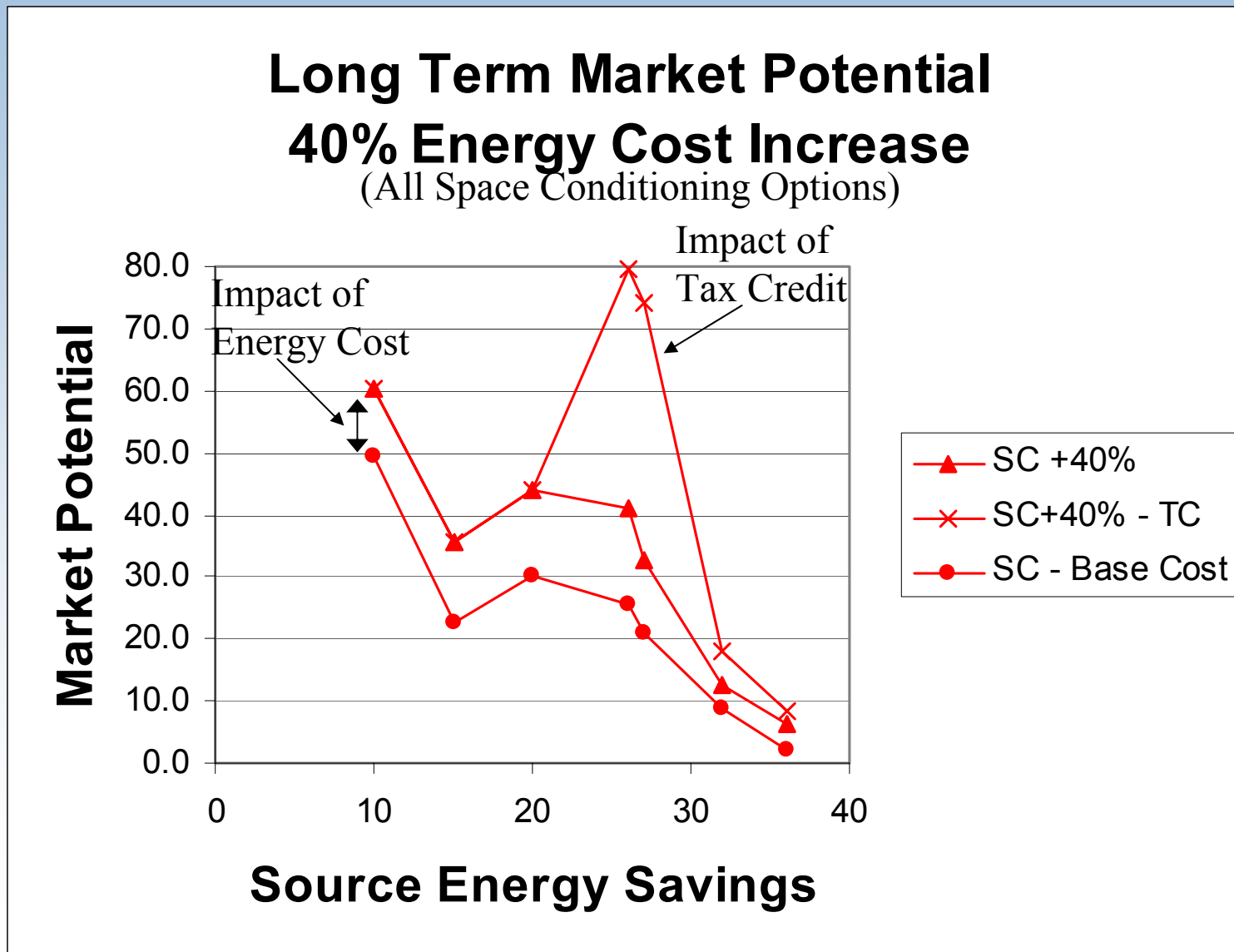
Estimated Impacts of Current Tax Credit On Market for Energy Efficient Homes



Estimated Impacts of Current Tax Credit On Market for Energy Efficient Homes

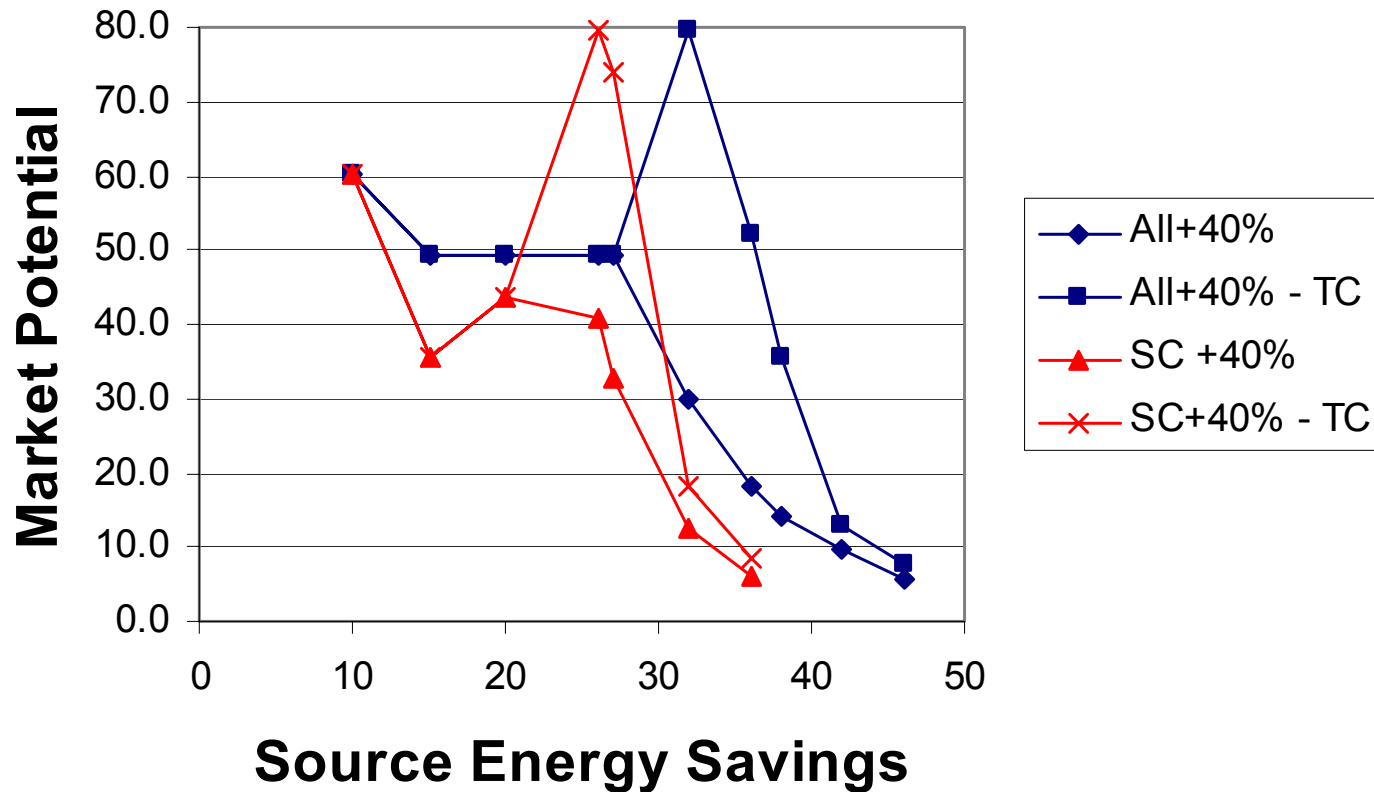


Estimated Impacts of Current Tax Credit On Market for Energy Efficient Homes



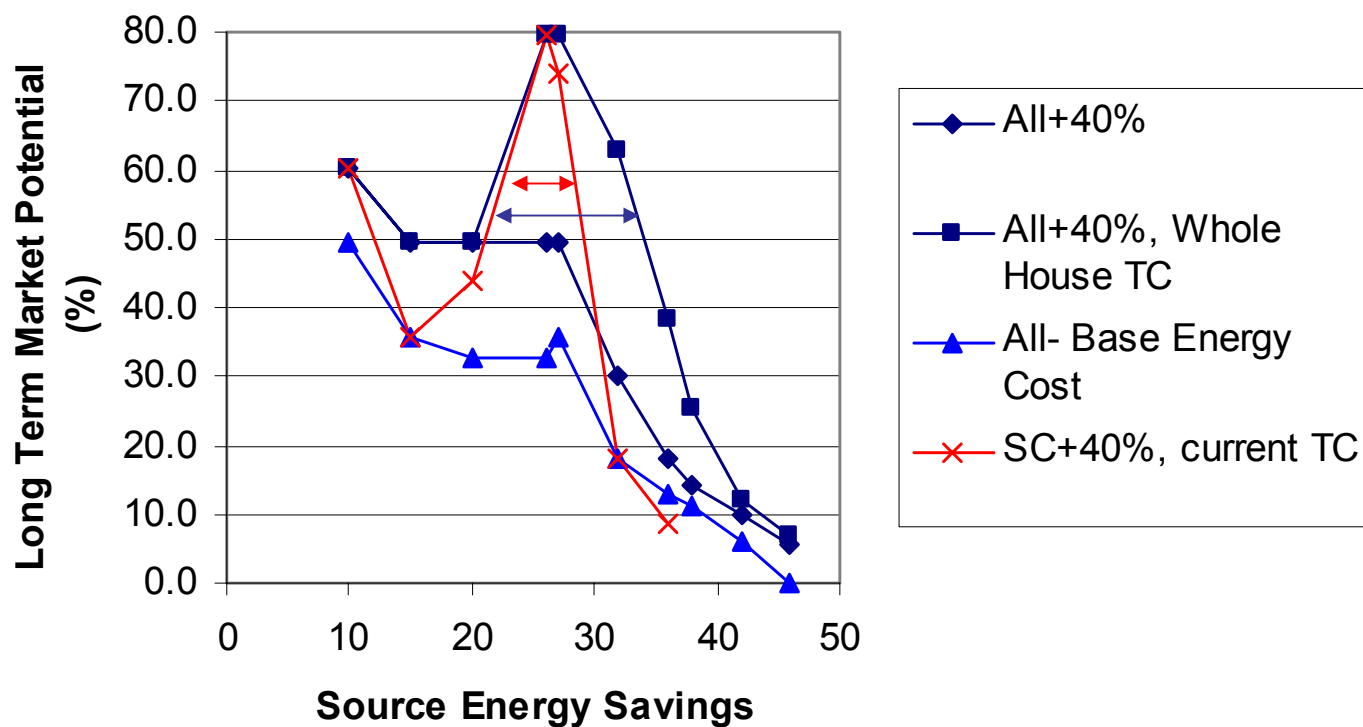
Estimated Impacts of Current Tax Credit and Increased Energy Costs On Market for Energy Efficient Homes

Estimated Market Impact of Tax Credit Plus Energy Cost Increase

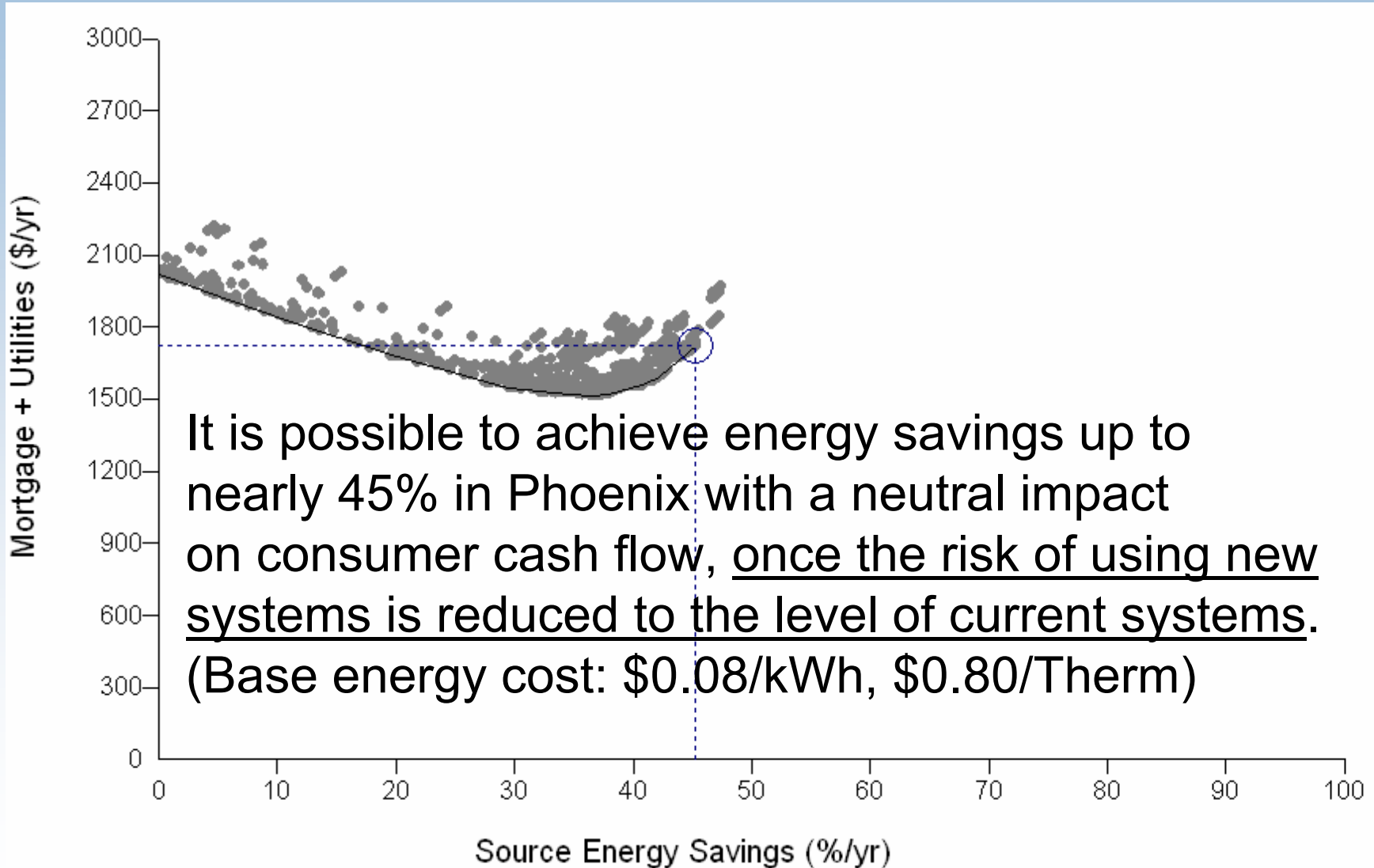


Estimated Impacts of Hypothetical “Whole House” Tax Credit On Market for Energy Efficient Homes

Estimated Impact of Hypothetical Whole House Tax Credit at the 30% Savings Level with 40% Energy Cost Increase

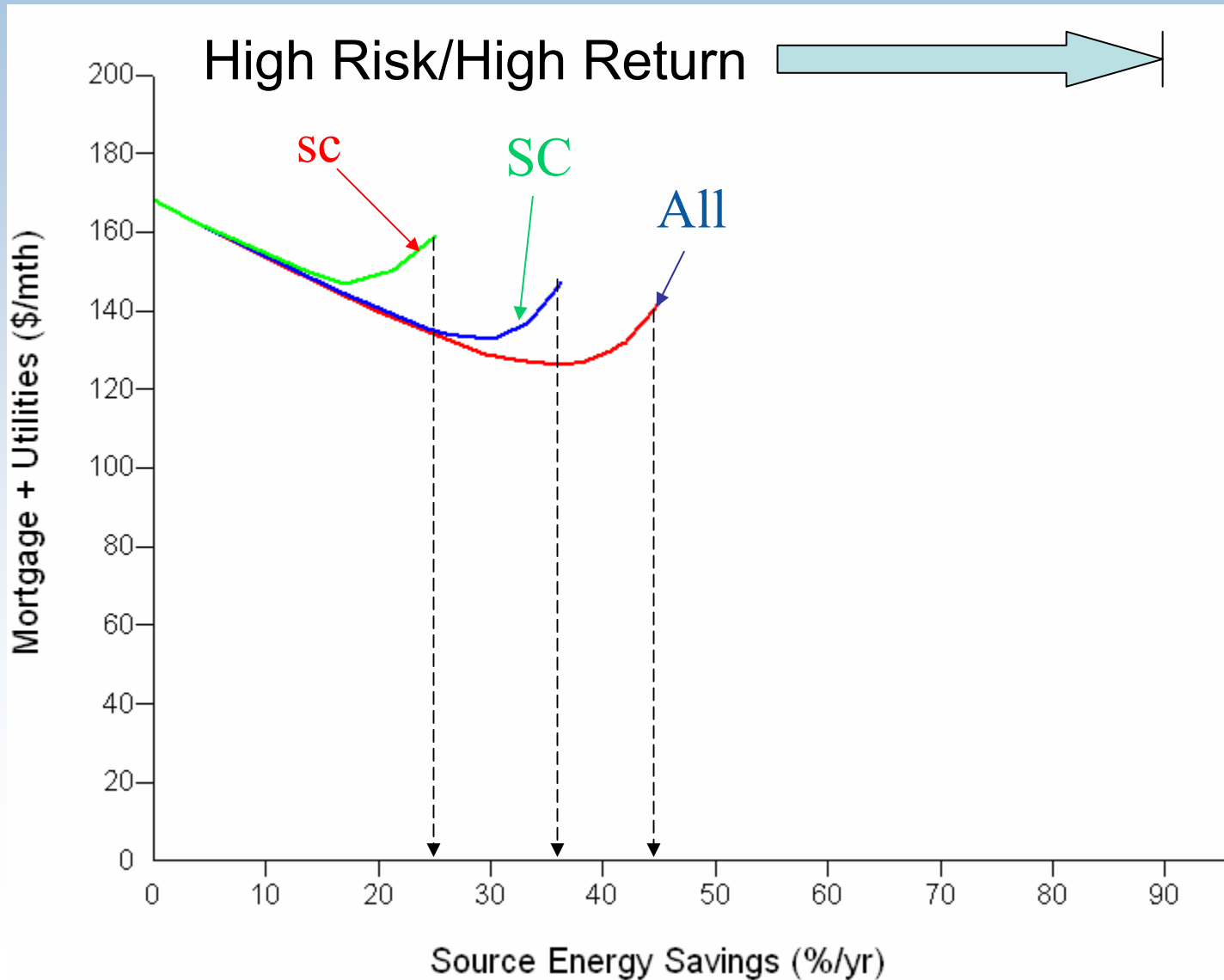


Conclusions



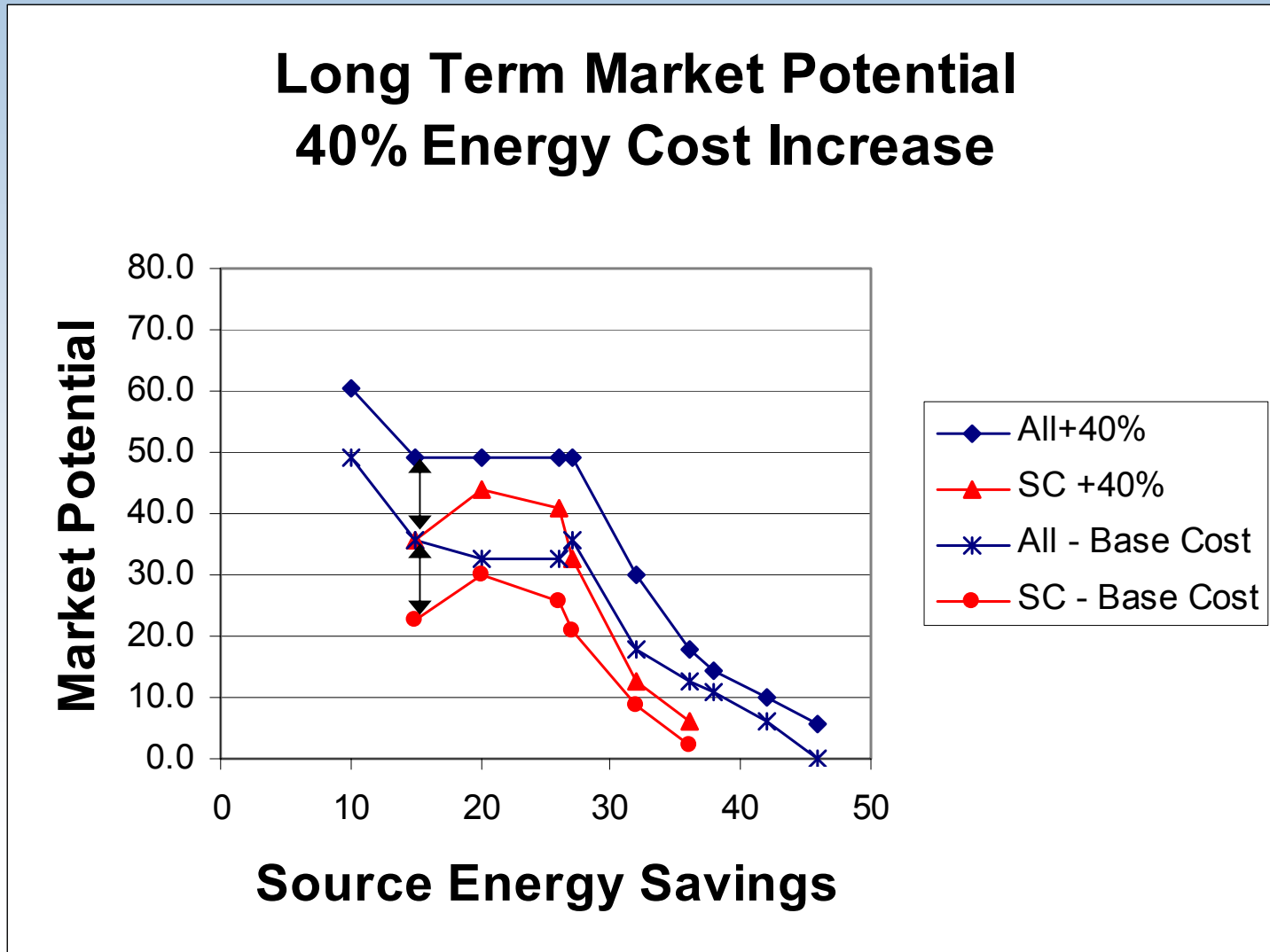
Conclusions

A “whole house” approach provides the largest and most cost effective energy savings.



Conclusions

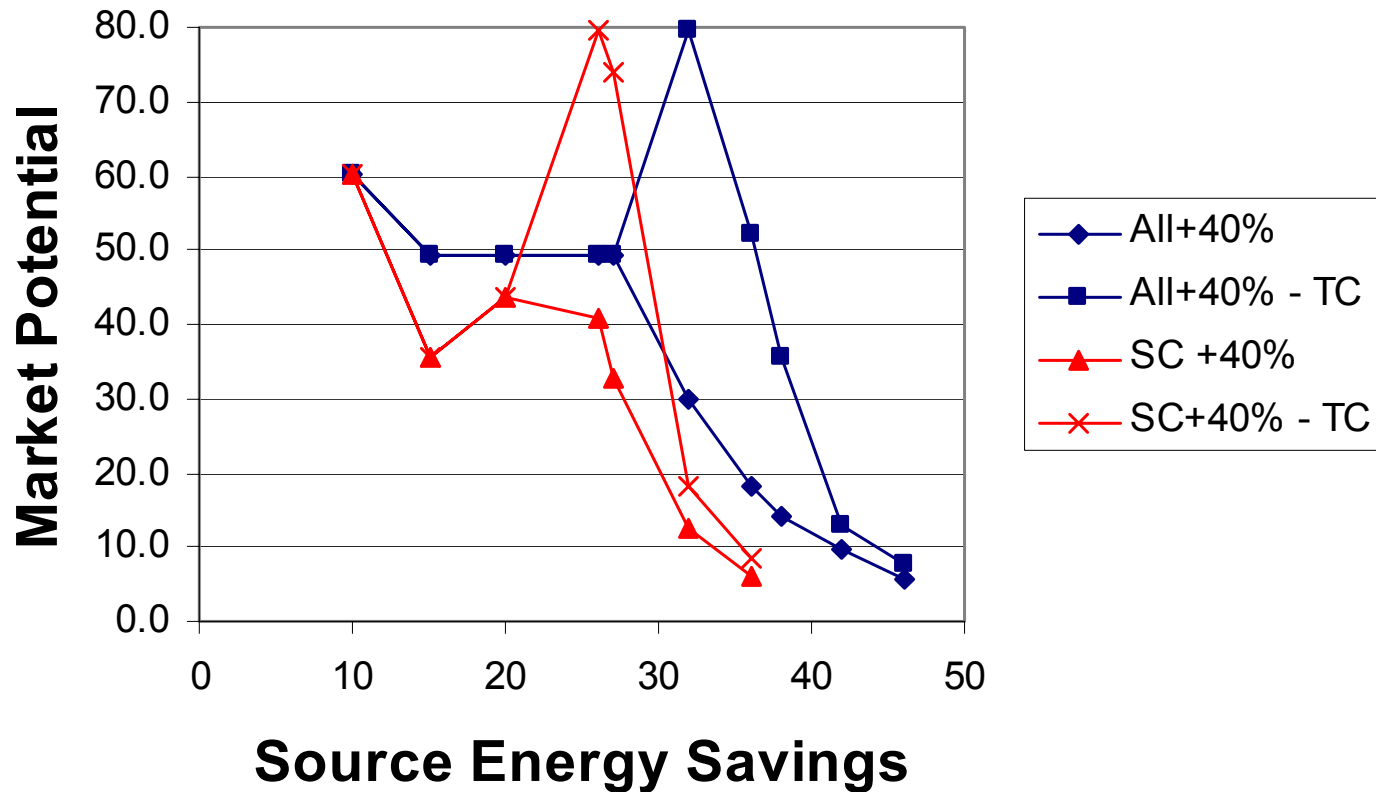
Near term increases in energy costs are expected to contribute to an increase in the demand for houses in the 10-25% savings range.



Conclusions

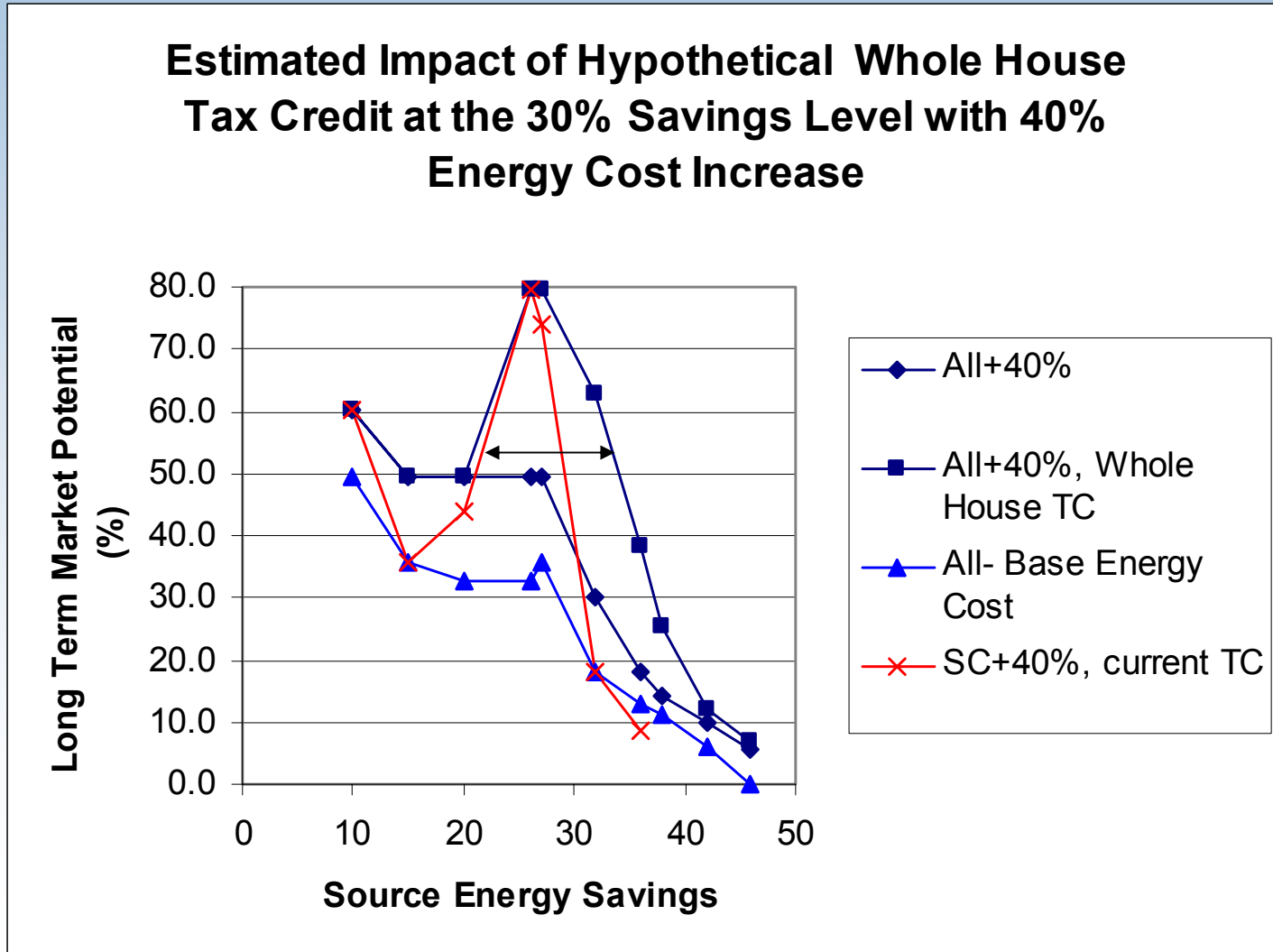
The current tax credit is expected to contribute to an increase in the demand for houses in the 25-40% savings range.

Estimated Market Impact of Tax Credit Plus Energy Cost Increase



Conclusions

A “whole house” tax credit could provide more savings than the current tax credit.



Questions?

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