Issue 5: Optimizing High Levels of Insulation

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Issue 5 - How Much Insulation is Too Much?

How do we define the cost-effective limit for improvements in enclosure efficiency?

<u>Key Factors to Consider</u>:

-Cost of savings vs. cost of grid-supplied energy

-Cost of efficiency savings vs. cost of savings from renewable generation.

-Savings from envelope improvements vs. other efficiency options

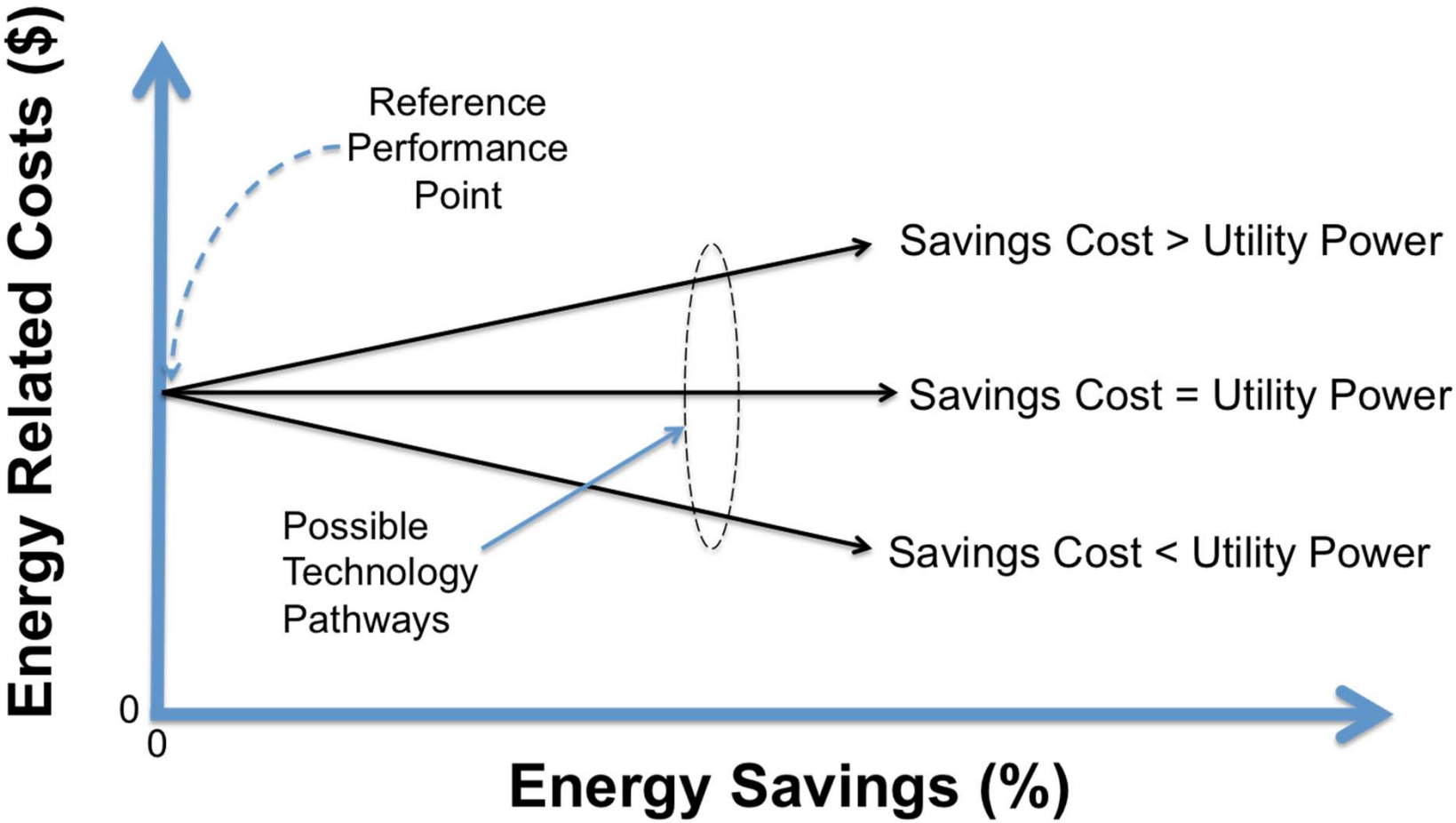
Context

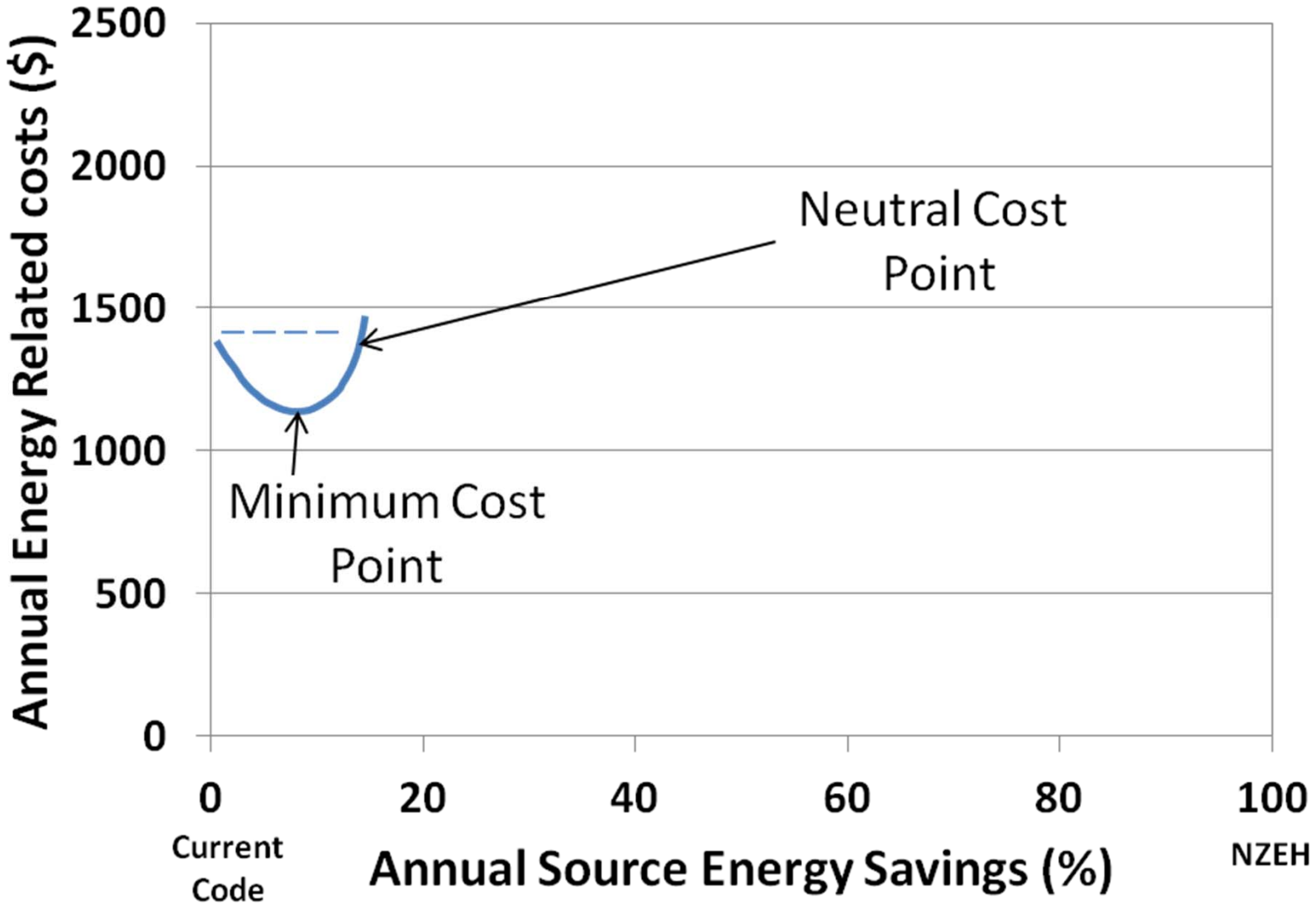
- **It is widely believed that code-specified insulation levels also represent cost-effective limits.**
- **However, the cost-effective insulation levels exceed IECC values in many climates.**
- **The homeowner-driven value of modest increases in enclosure performance can create economies of scale that will reduce the overall cost of high R wall assemblies**

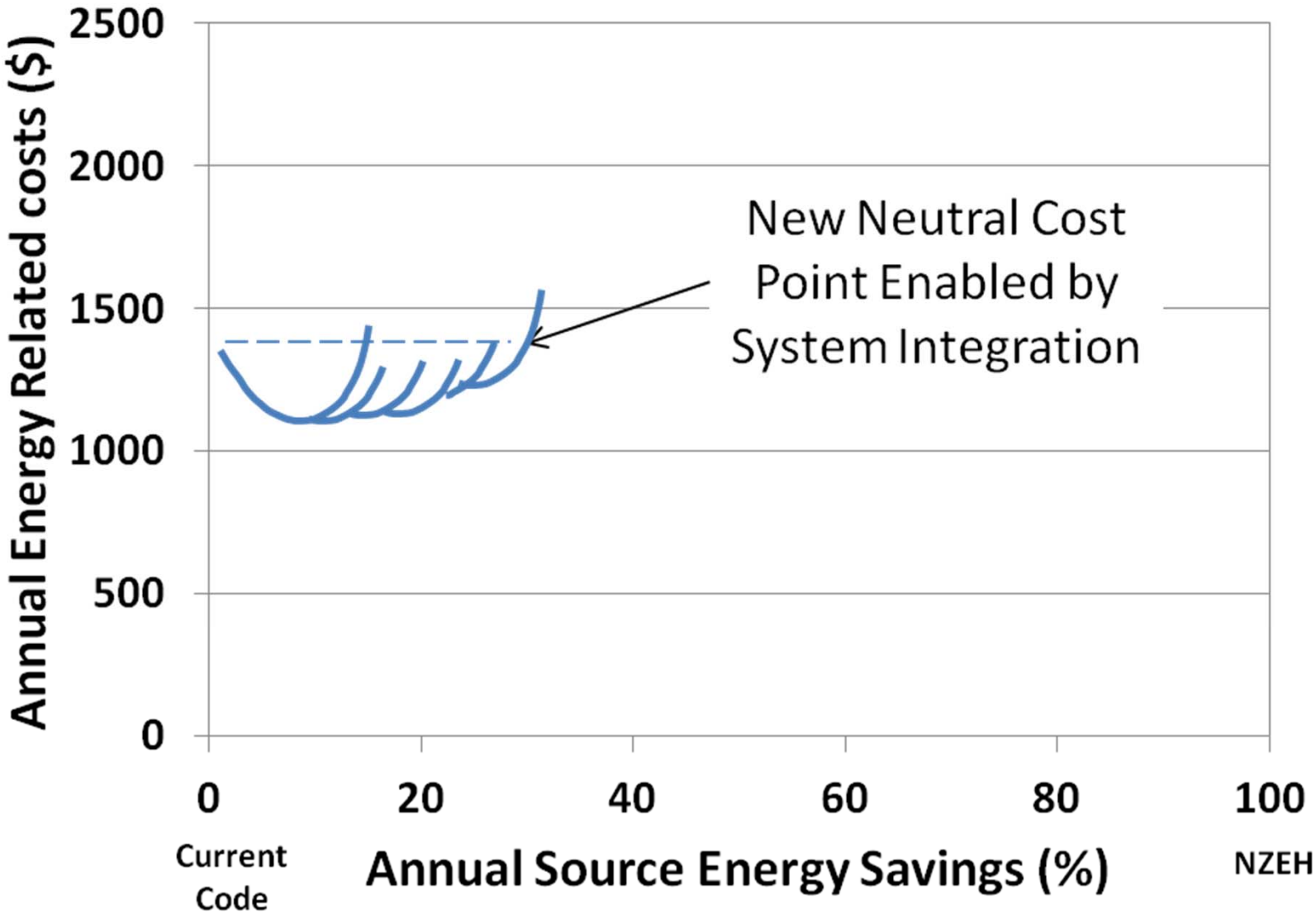
Technical Approach

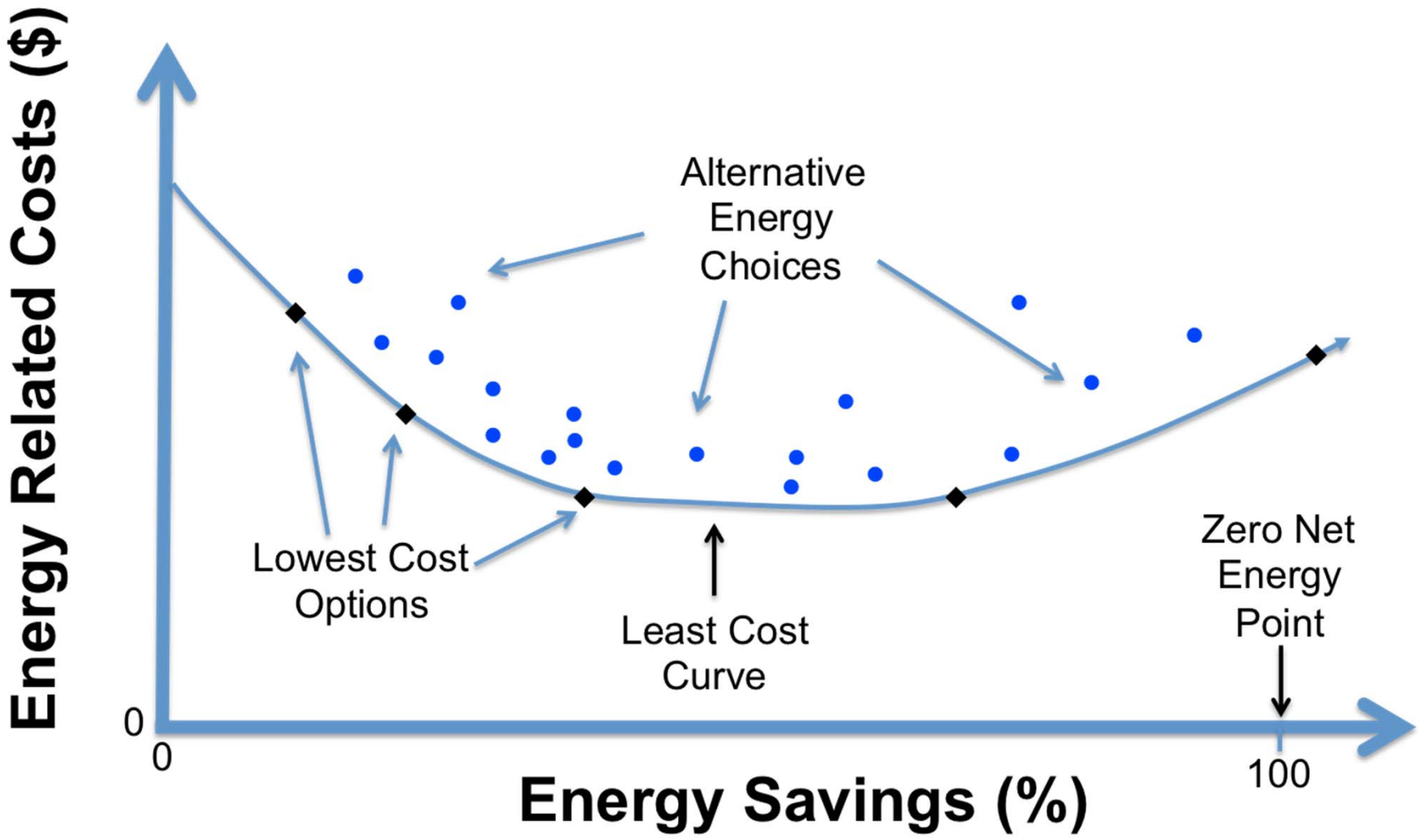
- **IECC 2012 starting point**
- **Cash flow analysis: 2500 ft^2 two story new home**
- **Include savings from reductions in equipment capacity**
- **Include alternative technology investments**
- **Include potential cost-reductions over next 3-5 years due to economies of scale**
- **Assume best practice design details to ensure durability: drainage plane, vapor retarder, flashing details, climate-based drying potential,…**

Investment Model

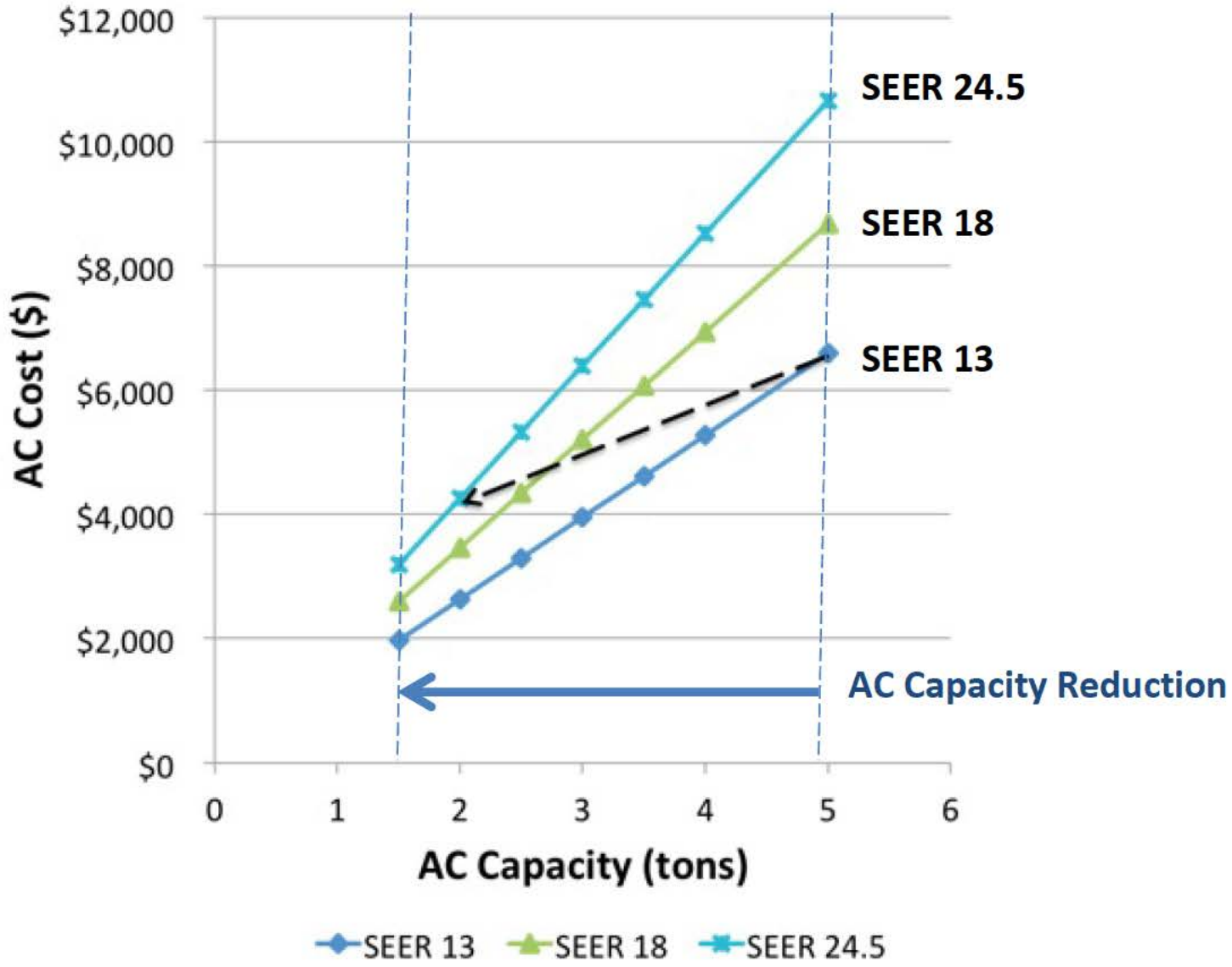



Annual Energy Related costs ($)
2500
2000
1500
1000
500
0
Neutral Cost Point
Minimum Cost Point
0
20
40
60
80
100
Current Code
Annual Source Energy Savings (%)
NZEH

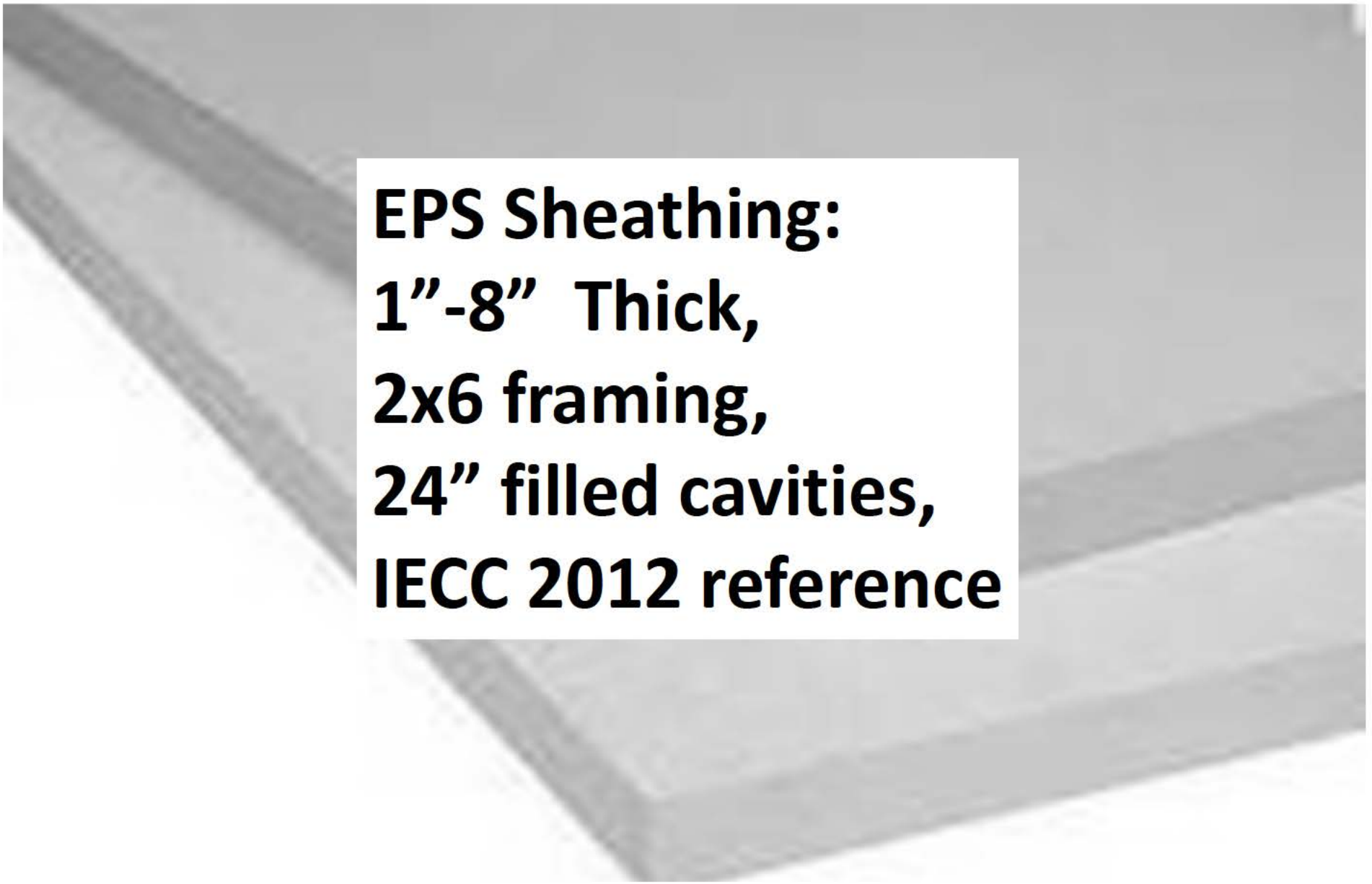

Annual Energy Related costs ($)
2500
2000
1500
1000
500
0
New Neutral Cost Point Enabled by System Integration
0
20
40
60
80
100
Current Code
Annual Source Energy Savings (%)
NZEH


Energy Related Costs ($)
Alternative Energy Choices
Lowest Cost Options
Least Cost Curve
Zero Net Energy Point
0
0
100
Energy Savings (%)

Analysis Includes Internal Cost Recovery

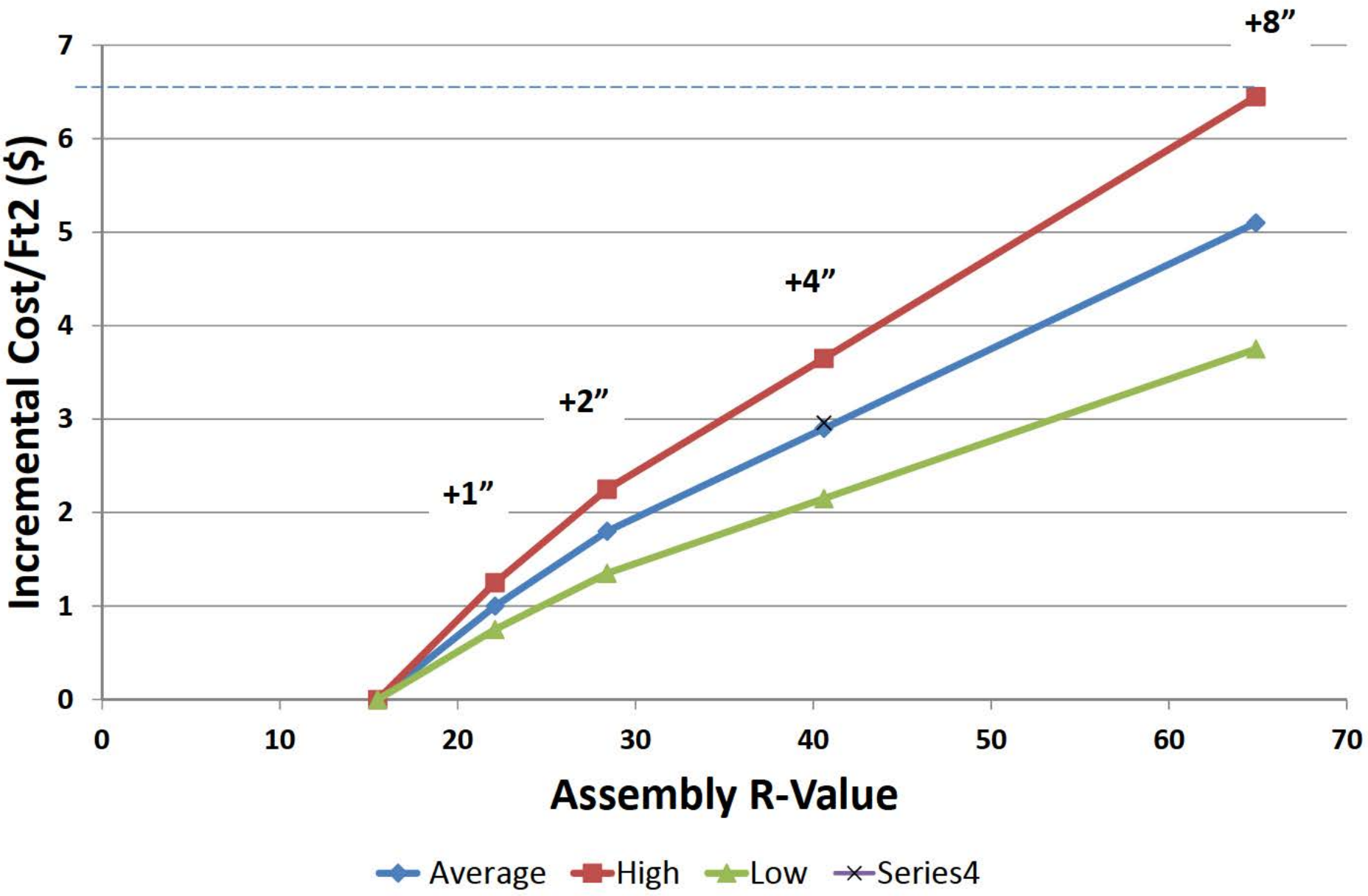


Wall Detail

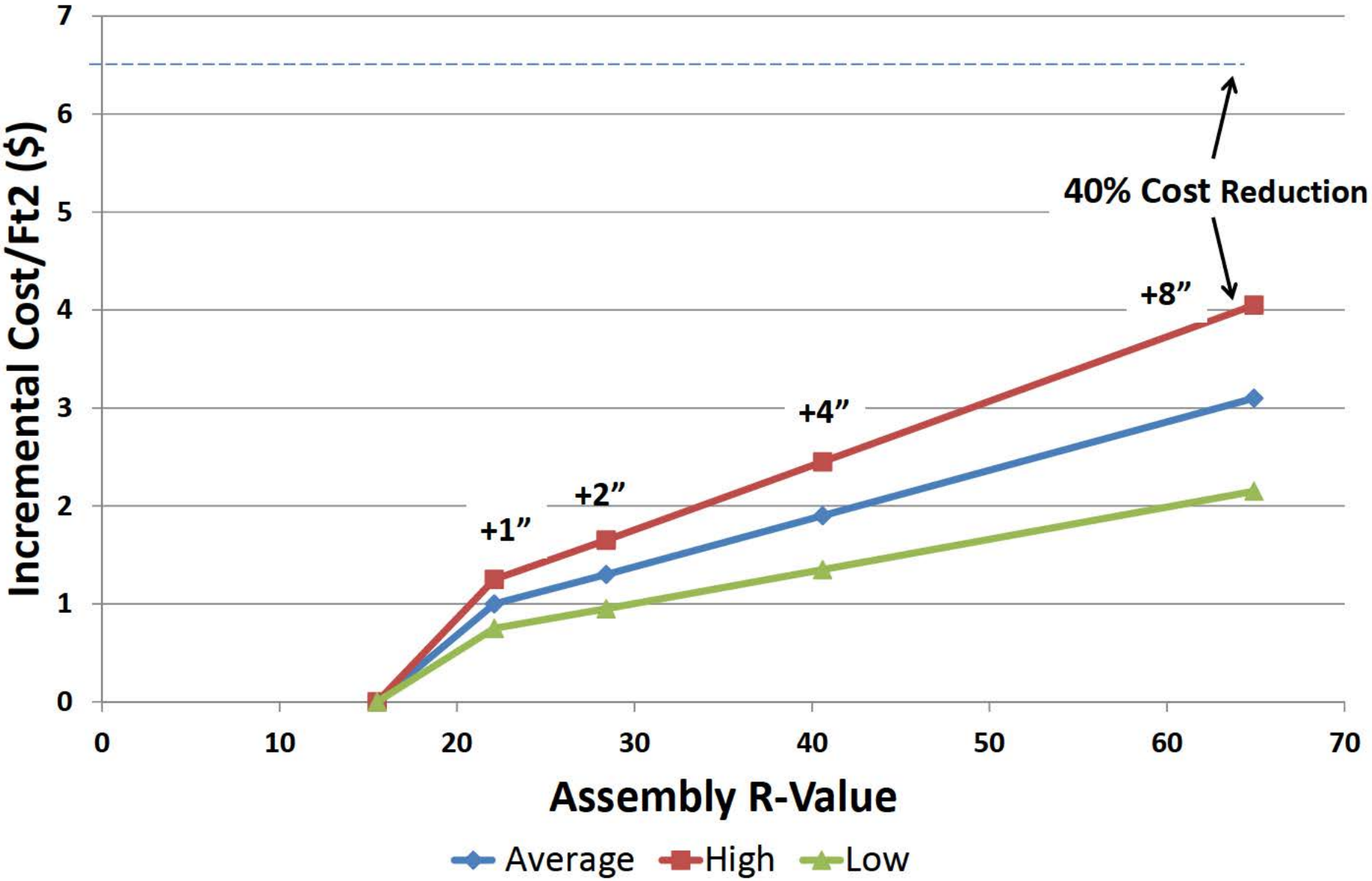


EPS Sheathing:
1”-8” Thick,
2x6 framing,
24” filled cavities,
IECC 2012 reference

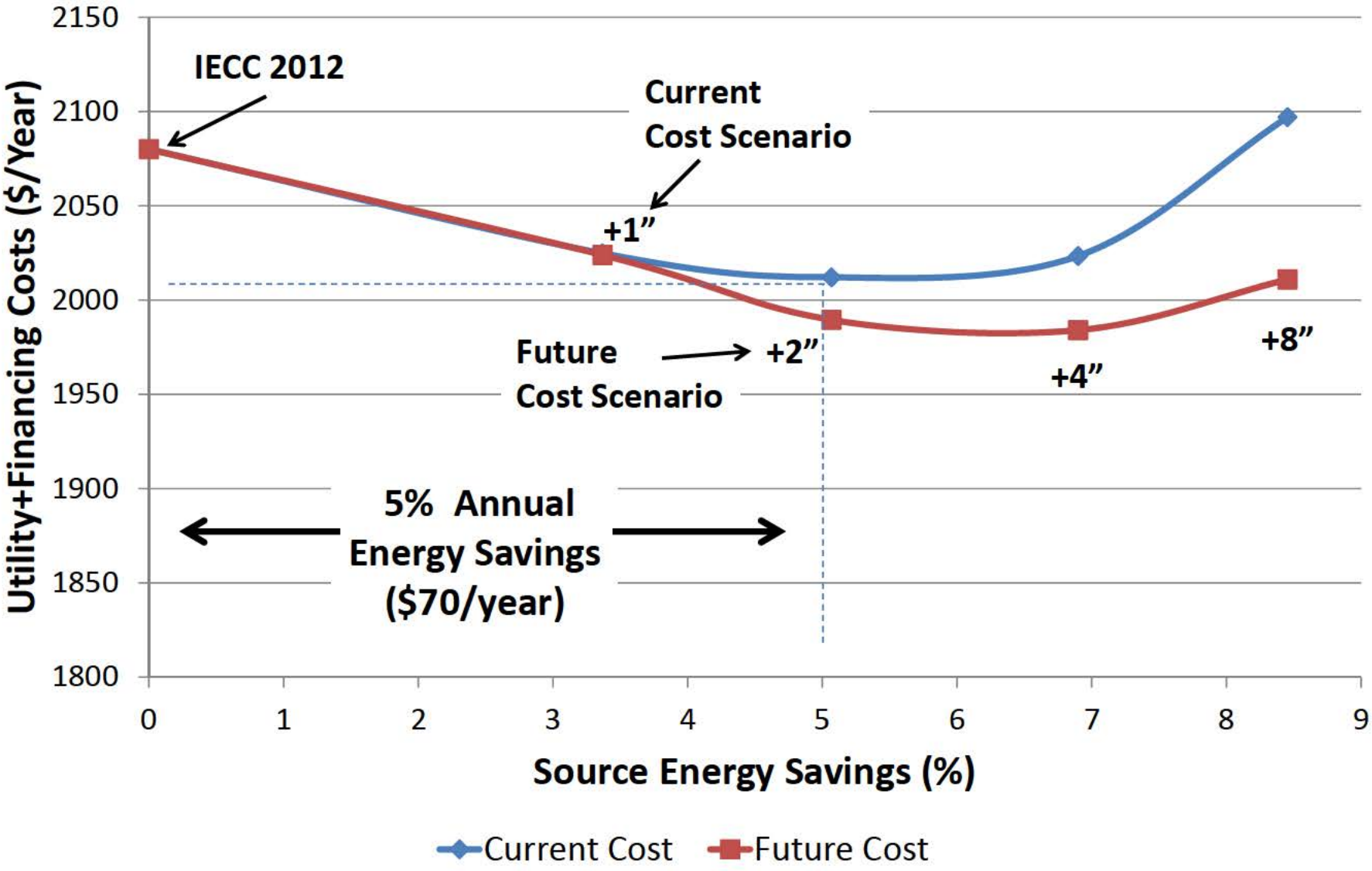
Current Cost Scenario



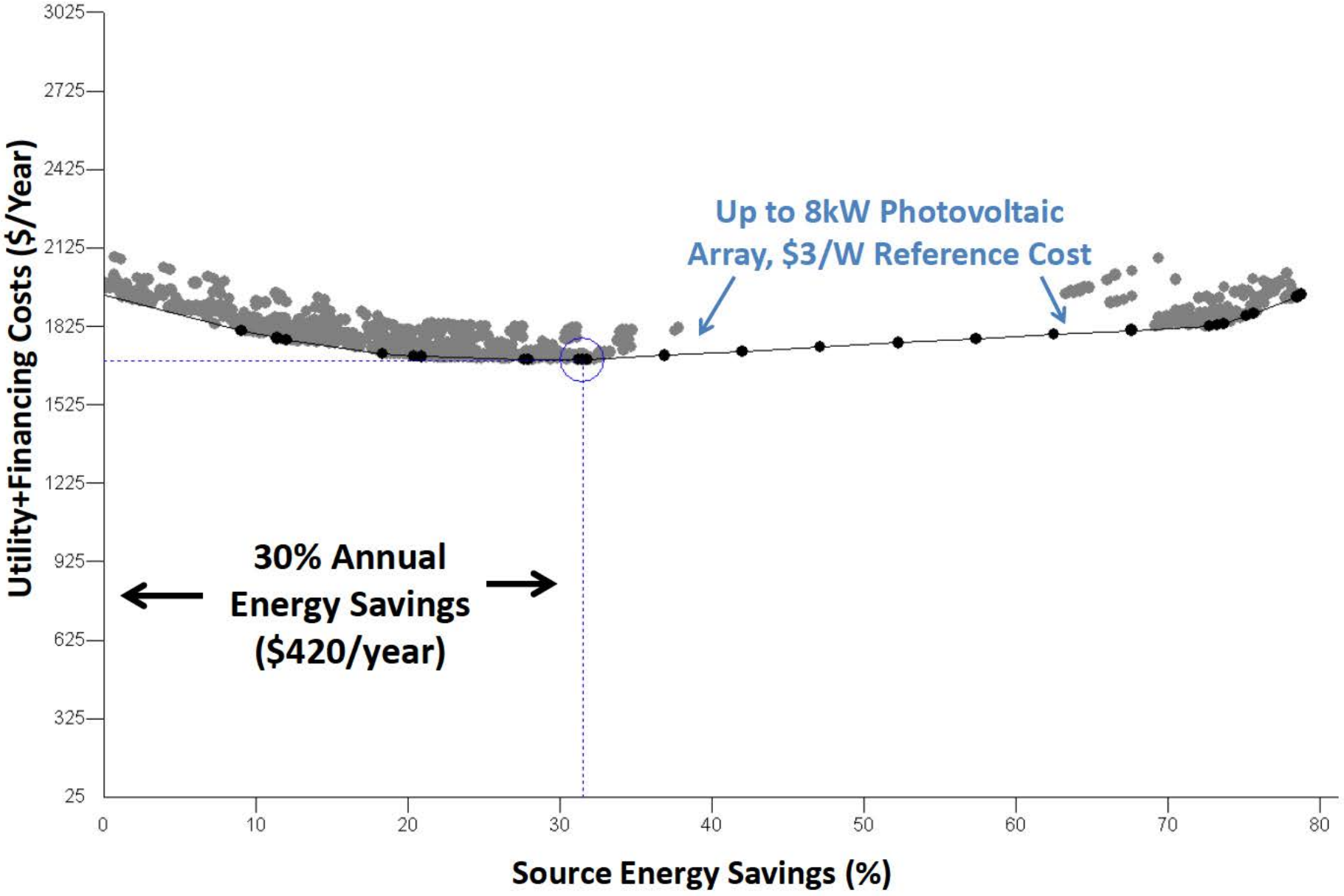
Future Cost Scenario



Example Cash Flow Result: Chicago



Multi-Measure Evaluation: Chicago



Recommended Best Practice Guidance

Zone	City	Current Cost	Future Cost	IECC 2012	Untapped Markets
1	Miami	20	20 ⟷	13	✓
2	Phoenix	20	20 ⟷	13	✓
3	Atlanta	20	20	20	
4	Seattle	20+1"	20+2" ⟷	20	✓
5	Chicago	20+1"	20+2" ⟷	20	✓
6	Minneapolis	20+1”	20+2”	20+1”	

Value

- **Maximizes homeowner cost/benefit**
- **Creates new markets and potential economies of scale**
- **Increases cost-effective energy savings**

Market Readiness

Expands and builds on existing market!

Pros and Cons

- **Pros**

  Includes cost-savings from reductions in equipment capacity.

  Focuses on best practice opportunities over next 3-5 years

- **Cons**

  Cost reductions require market-driven economies of scale

  Does not directly consider related costs: training/redesign/floor area-thicker wall tradeoffs

References

- **Residential Energy Efficiency Measures**:
  http://www.nrel.gov/ap/retrofits/

- **Residential Cost Optimization Software, BEopt**:
  http://www1.eere.energy.gov/buildings/building_america/building_energy_optimization.html