

ARCHITECTURAL ENERGY
C O R P O R A T I O N



Title 24 2013: Life-Cycle Cost Methodology

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■ Cost-Effectiveness Under Title 24

- Cost-effectiveness requirement comes from the Warren-Alquist Act § 25402(b)(3):

The Standards “. . . shall be cost-effective when taken in their entirety and when amortized over the economic life of the structure compared with historic practice.”
- Distinct from other standards such as ASHRAE 90.1, which are consensus based

Basic Equation for Life-Cycle Cost Analysis

$\Delta\text{LCC} = \text{Cost Premium} - \text{Present Value of Energy Savings}$

or

$$\Delta\text{LCC} = \Delta\text{C} - \Delta\text{TDV } \$$$

- Objective is to find measures with negative ΔLCC



■ “*Historical practice*” or “Basecase”

- Delta components of LCC equation require foundation point of analysis
 - ➔ Warren-Alquist Act prescribes “*historical practice*”
 - ➔ Commonly referred to as: “Basecase”
- Basecase is:
 - ➔ 2008 Standards for measures already in Standards
 - ➔ Conventional building practices for measures not yet in the Standards

Measure Cost

$$\Delta LCC = \Delta C - \Delta TDV \$$$

■ Measure cost inputs:

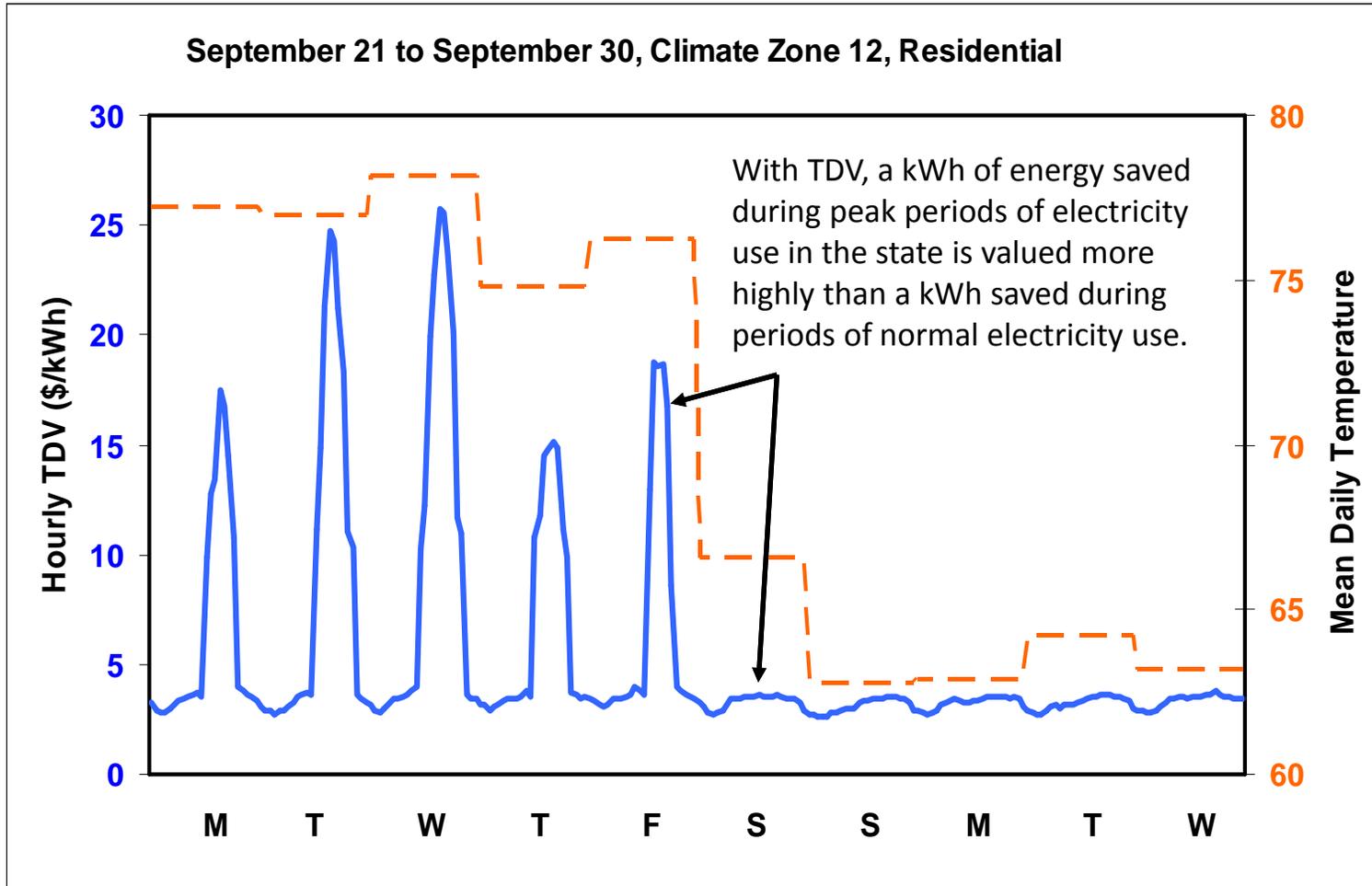
- Delta (Δ) requires cost data for both basecase and proposed measures
- ➔ Materials
- ➔ Labor
- ➔ Variations in maintenance and replacement costs
- Discount future costs at 3%
- ➔ Other notable cost differences, if any

Time Dependent Valuation (TDV)

$$\Delta LCC = \Delta C - \Delta TDV \$$$

- What is Time Dependent Valuation?
 - ➔ Method for valuing energy use in a building that reflects hourly costs of energy at a state-wide level
- Developed for electricity, natural gas, and propane
 - ➔ Natural gas and propane use monthly values
- Development details to be explained by E3

Sample 2013 TDV Values (with daily temperatures)



Note: weekends will generally have low TDV values even on a “hot” day

■ TDV Has Two Standard Units:

- **TDV \$** → Used in LCC analysis
 - ➔ Expressed as $\$/kWh$ or $\$/therm$
 - ➔ Original output from E3 analysis
- **TDV Btu** → Used with energy modeling tools
 - ➔ Expressed as $kBtu/kWh$ or $kBtu/therm$
 - ➔ “TDV Btu” outputs analogous to source energy
- Both permutations have same shape
 - Conversion between units to be explained by E3

Analysis Timeframes

- **2013** Standards, but
- **2011** is the base year for “life-cycle” analysis
 - ➔ Cost-effectiveness conducted in 2011 dollars
 - ➔ 30-Year TDV based on projections 2011-2040
 - Used for all residential and nonresidential envelope
 - ➔ 15-Year TDV based on projections 2011-2025
 - Used for nonresidential equipment

LCC Analysis - Implementation

■ Hypothetical example: **Residential Attic Insulation**

➔ Not presently under analysis

➔ Assume R-30 basecase

➔ Proposed measure is R-45

■ Objective: Reduce life-cycle cost

or: Negative $\Delta LCC = (\Delta C - \Delta TDV \$) < \$0.00$

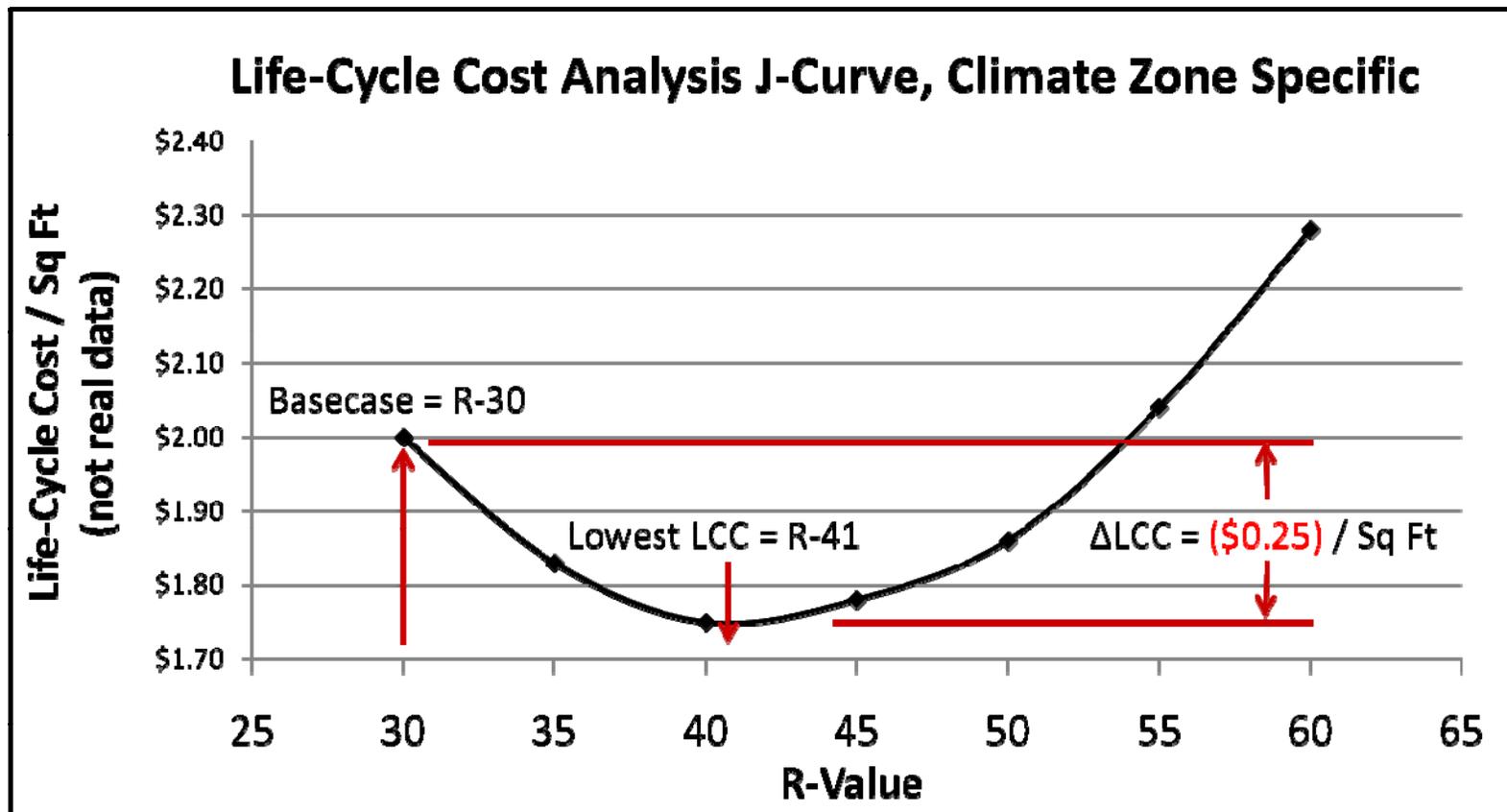
LCC Analysis - Implementation

Inputs for: $\Delta LCC = \Delta C - \Delta TDV \$$:

- $\Delta Cost = (\text{Cost proposed measure}) - (\text{Cost basecase})$
 - ➔ $= (\text{Cost of R-45}) - (\text{Cost of R-30})$
- $\Delta TDV \$ = (\text{Modeled R-30 TDV \$}) - (\text{Modeled R-45 TDV \$})$
 - ➔ $= \text{NPV of energy savings over 30 years, derived from TDV}$

LCC Analysis - Implementation

- With *continuous measures* such as insulation, objective is to minimize life-cycle costs
 - ➔ J-Curve can be used to compare options



LCC Analysis - Implementation

- J-Curve defines economics of continuous efficiency measures
- Few analyses will actually produce a J-Curve representation
- Spreadsheet outputs of modeling are used to solve for measure with lowest LCC



LCC Analysis - Implementation

- Geographic variation in analysis
 - ➔ Analyze 16 climate zones separately for weather dependent measures
 - HVAC and envelope measures
 - Use the 16 designated primary weather stations
 - ➔ Analyze lighting measures on statewide basis

Changes in LCC Methodology 2008 to 2013

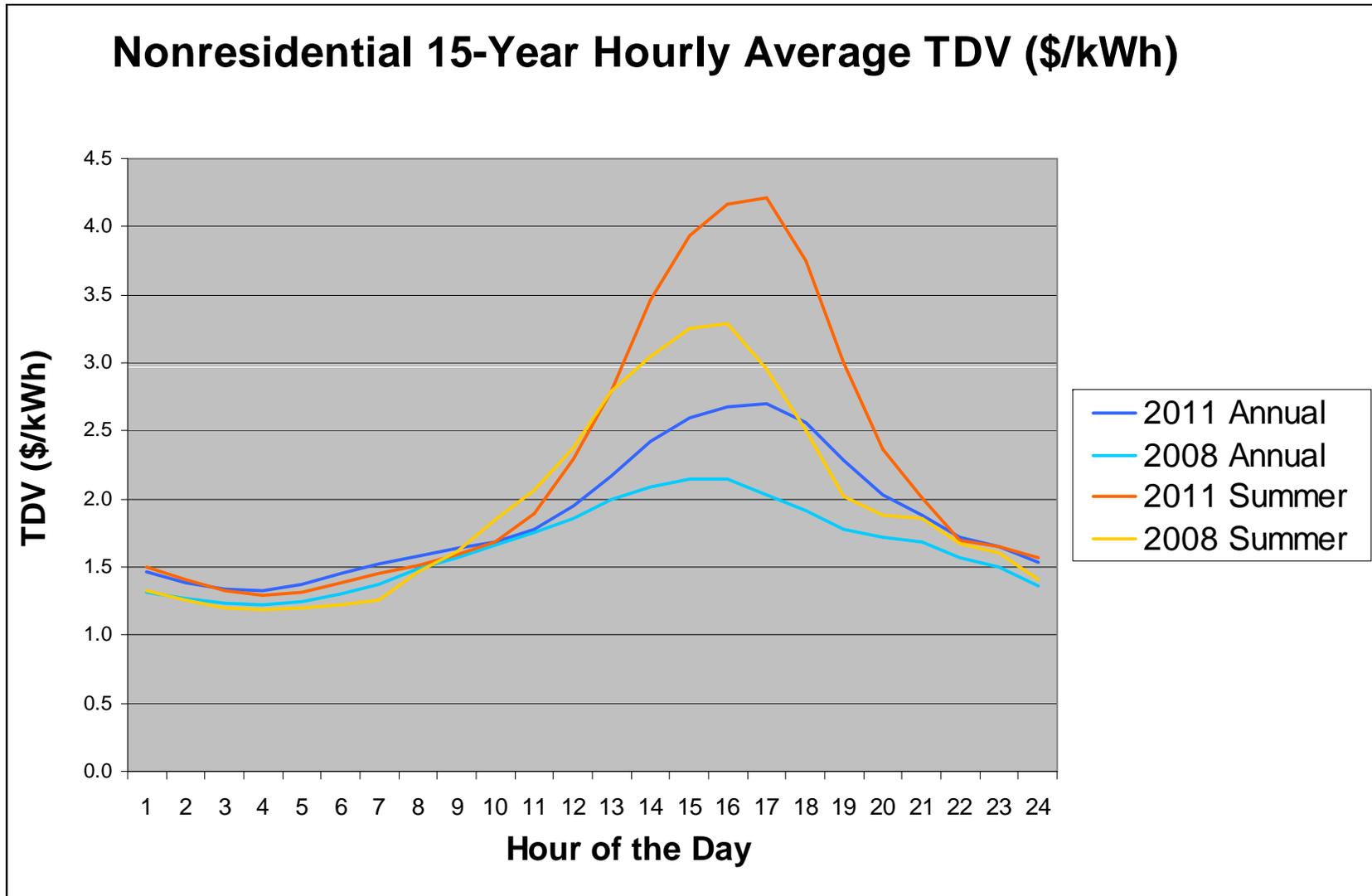
■ New weather files

- ➔ New data
- ➔ Better correlation between climate zones
- ➔ To be explained by Joe Huang

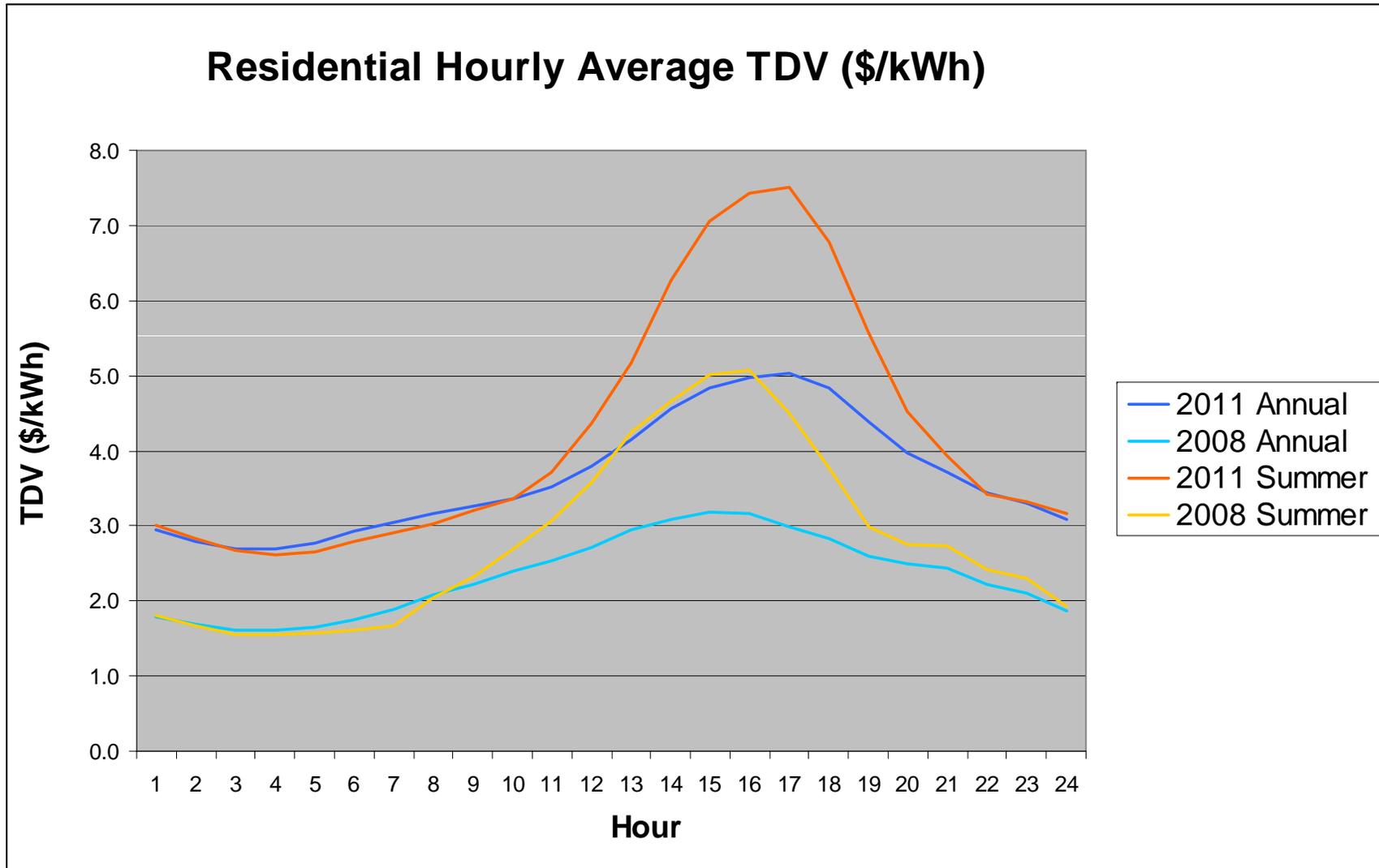
■ New TDV

- ➔ \approx 20% to 50% higher \$/kWh
- ➔ Better correlation between weather and TDV
- ➔ To be explained by E3

Changes in LCC Methodology 2008 to 2013



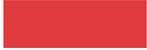
Changes in LCC Methodology 2008 to 2013



LCC Methodology

Questions?





Title 24 2013 Reach Code: Proposed Life-Cycle Cost Methodology



Reach Code LCC Methodology

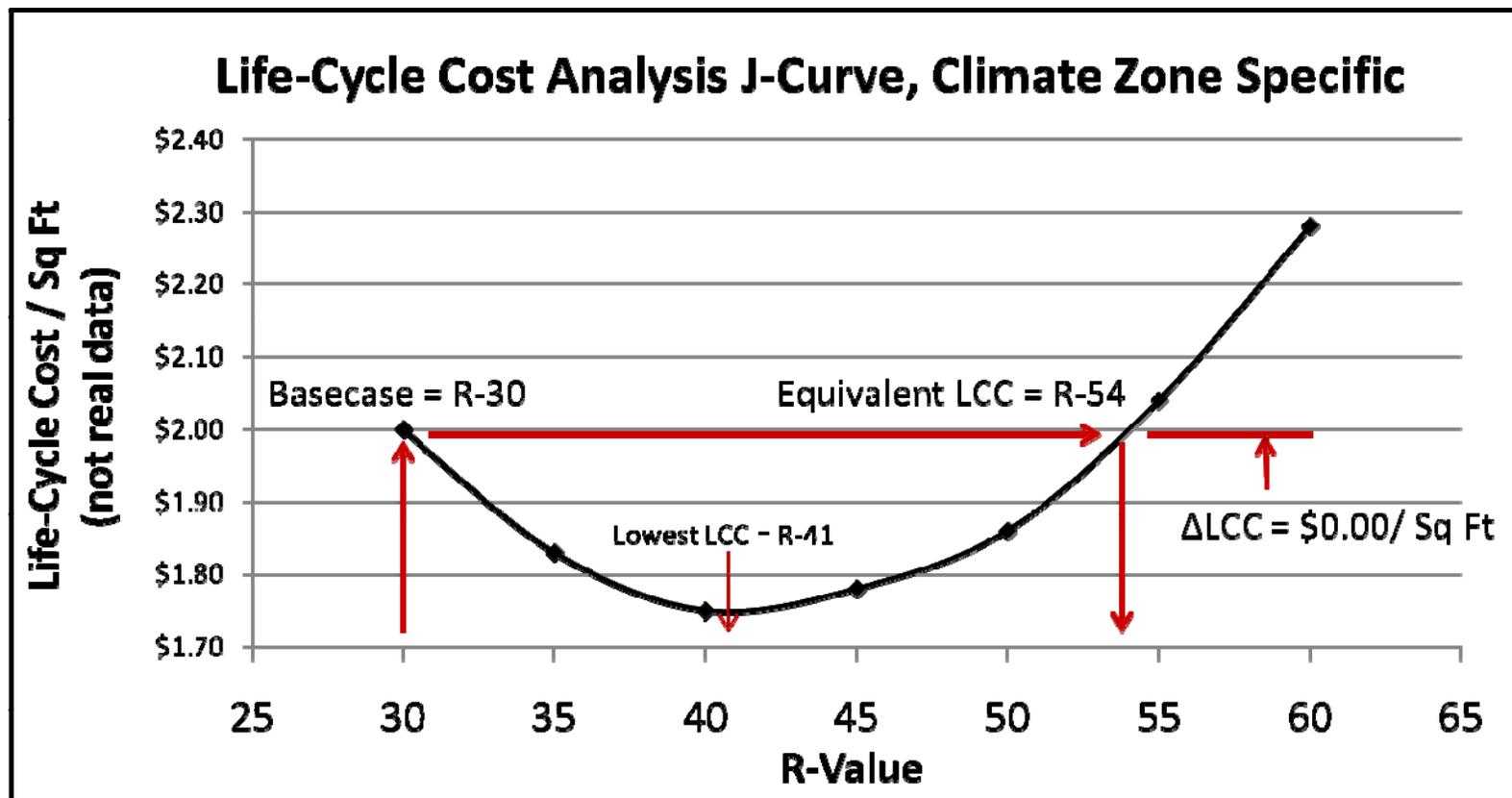
- Details of Reach Code LCC Methodology still under development
- Tier I and Tier II Reach Codes to be optional standards for adoption by local jurisdictions
- Energy Commission seeks to establish cost-effectiveness of Reach Code measures to assist with adoption by local jurisdictions
 - ➔ Modified LCC analysis methodology

Reach Code LCC Methodology

- Primary tools for Reach Code LCC analysis
 - ➔ Higher TDV numbers for valuing energy savings
 - Based on higher assumptions regarding societal obligations to reduce GHG emissions
 - To be further explained by E3
 - ➔ New objective for some measures: Adopt most efficient measures with LCC equivalent to current LCC
 - Optimizes J-Curve interpretation for efficiency priority
 - Still uses “*historical practices*” as basecase

Reach Code LCC Methodology

- Seek measure with highest efficiency that is still cost-effective compared to basecase
 - ➔ Moves hypothetical measure from R-41 to R-54



Reach Code LCC Methodology

Questions?