The Total Resource Cost of Saved Energy for Utility Customer-Funded Energy Efficiency Programs

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SWEEP Annual Workshop
November 21, 2014

The work described in this presentation was funded by the National Electricity Delivery Division of the U.S. Department of Energy’s Office of Electricity Delivery and Energy Reliability and the Office of Energy Policy and Systems Analysis under Lawrence Berkeley National Laboratory Contract No. DE-AC02-05CH11231.
Overview

• Why study the cost of saving energy through efficiency programs?
• Data Collection: LBNL DSM Program Database
• Defining Total Resource Cost of Saved Energy
• Metrics
• Results
  ➢ National
  ➢ Sectoral
  ➢ Program
  ➢ State
• Summary
The cost of saved energy (CSE) has not been comprehensively documented or analyzed at the program level

**Approach**
- Collected & analyzed reported annual EE program data in 34 states

**Objectives**
- Enable policymakers and program administrators to compare and weigh resource options
- Encourage more consistent reporting of EE program impacts and costs
- Enable assessment of program approaches and performance across different markets, delivery mechanisms and designs
Data Collection and Standardization

LBNL DSM Program Database

• Program Administrator (PA) CSE: 100+ administrators in 34 states
  ➢ 5,900 program years for 2009-2013
• Total Resource CSE: 50 administrators in 19 states
  ➢ 2,100 program years for 2009-2013
• Internal QA/QC process for data integrity

Types of Data Collected

• Net & gross savings
• Annual incremental & lifetime savings
• Budgets & expenditures
  ➢ Administrative costs
  ➢ Incentive costs
  ➢ Education, marketing & outreach
  ➢ Evaluation
• Participant costs
• Measure lifetimes for programs
• Number of program participants

Standardization Is Critical to Aggregating Data and Comparing Cost Performance

• Developed a common DSM lexicon
  • Standard terms and definitions for program data and metrics
  • A national typology of programs
• Encourage more consistent reporting by program administrators
LBNL Efficiency Program Typology

7 sectors

Program Administration Portfolio

Residential
- Whole Home Programs
- Whole Home Retrofit, Home Performance
- Audits—Standalone, Onsite
- Direct Install

Commercial
- Consumer Products Rebate
- Electronics
- Lighting
- Appliances

Industrial & Agriculture
- Custom
- Prescriptive
- HVAC
- RCx
- Performance Contracts, Bidding
- Small Commercial
- Lighting
- Refrigerated Warehouses

CrossCutting & Other
- Multi-Sector
- Codes & Standards
- Agriculture Prescriptive (Pumps)
- Market Transformation

Low Income
- Low Income
- EM&V
- Marketing & Education


30 simple categories

65 detailed categories

Program Type Categorization Level
- Portfolio
- Sector
- Simplified
- Detailed
Defining the Levelized Total Resource CSE

**Levelized Total Resource Cost of Saved Energy**

\[
\text{Levelized Total Resource Cost of Saved Energy} = \frac{\text{Capital Recovery Factor} \times (\text{Total Program Administrator Costs} + \text{Participant Costs (net of incentives)})}{\text{Annual Energy Savings (in kWh)}}
\]

Where the **Capital Recovery Factor** = \[\frac{A \times (1 + A)^B}{(1 + A)^B - 1}\]

A = Discount rate (LBNL uses 6% real as a proxy for an electric utility WACC)
B = Years of program savings, calculated as the savings-weighted life of the efficiency actions in aggregate

**Critical value: Net Participant Costs** (in constant 2012 dollars)

*The levelized total resource cost of saved energy is not the TRC cost-effectiveness screening test.*
Metrics used in the results

• Focus on **total resource costs**:
  - at national and state levels
  - by market sector (e.g., C&I, residential)
  - by program type (e.g., residential whole house programs, commercial retro-commissioning, and industrial custom programs)

• CSE values are calculated in two ways:
  - **Savings-weighted average CSE**: Calculated using all savings and expenditures at the level of analysis: national, sector, program category
  - **Program-specific medians and inter-quartile ranges**:
    - Based on calculations for each individual program type
    - Gives equal weighting to all programs irrespective of their relative size (either in terms of savings or costs)
- U.S. savings-weighted average levelized total resource CSE is $0.044/kWh
- **Residential programs** had the lowest savings-weighted total resource CSE ($0.03/kWh) followed by **C&I programs** ($0.056/kWh)

Values in this figure are based on the 2009-2013 data in the LBNL DSM Program Impacts Database. CSE values are for program administrator costs are based on gross savings. Savings are levelized at a 6% real discount rate. The savings-weighted average CSE is calculated using all savings and expenditures at the level of analysis. The inter-quartile range and median CSE values are calculated for each program type.

Source: LBNL DSM Program Database
National TR vs PA Cost of Saved Energy

- Savings-weighted average TR CSE ($0.044/kWh) was nearly twice the PA CSE ($0.023/kWh), so every $1 spent by PAs drew $0.95 from participants
- Suggests that PA spending of $6B in 2012 drove an industry of $12.2B

Values in this figure are based on the 2009-2013 data in the LBNL DSM Program Impacts Database. CSE values are for program administrator costs are based on gross savings. Savings are levelized at a 6% real discount rate. The savings-weighted average CSE is calculated using all savings and expenditures at the level of analysis. The inter quartile range and median CSE values are calculated for each program type.
Residential TR CSE for Electricity Efficiency Programs

- Low residential TR CSE driven by **lighting programs** (60% of sector savings at $0.018/kWh)
- Normative **behavioral programs** were $0.025/kWh
- Other residential programs – especially **multi-measure** – were $0.06-$0.13/kWh
C&I TR CSE for Electricity Efficiency Programs

- Average values for **most C&I sector programs** are $0.045-$0.06/kWh, somewhat more costly than residential sector
- C&I programs garner **more participant investment** than residential programs

*Source: LBNL DSM Program Database*
Factors That May Influence Total Resource CSE

CSE may vary across program administrator portfolios for reasons other than programmatic efficiency.

- **Lower CSE**
  - Focus on low hanging fruit
  - Longer Assumed Program Lifetimes
  - Solely incremental measure costs

- **Higher CSE**
  - High labor costs
  - Comprehensive programs
  - All Cost-Effective EE
  - Lower Assumed Program Lifetimes
Large variability in the relationship of program costs to participant costs from state to state

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Source: LBNL DSM Program Database
Total Resource CSE and Relative Savings by State

- Greater savings moves states up the efficiency supply curve
- Coverage is percent of IOU retail sales in each state

Sources: LBNL DSM Program Database & Energy Information Agency Form 861; MA Energy Efficiency Advisory Council
Summary

• U.S. savings-weighted average total cost of saving energy: $0.044/kWh. Median: $0.07/kWh

• Residential programs had lowest TR CSE, influenced strongly by lighting rebate programs

• Commercial & industrial programs on average drew greater participant investment

• Many factors influence total resource CSE and relative administrator vs. participant cost contribution

• Improved estimation and reporting of total costs helps satisfy regulatory needs and instills market confidence in the efficiency resource
Why care about the cost of saved energy - and improved reporting

Regulators, Program Administrators and Stakeholders can use the cost of saved energy to:

• Weigh multiple energy demand and supply resource options
• Set or reassess EE Resource Standards
• Compare DSM program performance
• Assess integrated resource planning
• Assess options for compliance with environmental regulations

For others, better reporting is key for the same reasons, plus:

• Assessing confidence in efficiency as an investment (capital markets)
• Sizing up and better understanding the future of efficiency (researchers, industry actors)
• Developing business plans (contractors, ESCOs, retailers)
• Forecasting loads (resource planners)
Thank You

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- **Sponsor:** DOE Office of Electricity, National Electricity Delivery Division and Office of Energy Policy and Systems Analysis
Data and Definition Issues: Participant Costs

Two Primary Challenges

1) Program administrators define and calculate the participant portion of total resource costs differently
   - Some leave out all incentives
   - Some leave out end-user rebates
   - We fix these inconsistencies in data collection.

2) More fundamentally, participant costs are derived most commonly from a) measure costs or b) participant invoices. Both pose difficulties.
   - Raw price data often hard to interpret and translate into generalized measures
   - Ex ante values **rarely updated** and often borrowed, sometimes with **no adjustment for different markets, delivery channels or time**