Comprehensive Home Energy Retrofits versus the Total Resource Cost Test

…a call for policy change

Bob Knight

Bevilacqua-Knight, Inc. (BKi) and California Building Performance Contractors Association

ACEEE Workshop on Non-Energy Benefits

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What This is About

An emerging class of energy efficiency programs that

…addresses a huge underserved residential market

…has highest possible home energy savings

…creates major non-energy benefits for participants

…keeps expanding its savings indefinitely after it ends

and is systematically undervalued in public-goods cost-benefit tests

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Home Performance Retrofits

The contractor equivalent of your favorite auto mechanic shop

- Building Science: Treat the house as a system
- Comprehensive solutions—shell, HVAC, baseload
- Energy savings plus much broader “non-energy” benefits
- Based on performance testing and verification

…All “home performance” benefits that the homeowner values enough to pay for happily

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Energy Efficiency Payoff

Highest possible per-home energy savings

- Home analysis includes envelope, HVAC, appliances, lighting, exterior energy uses
- Focus on reducing thermal and base loads first, then HVAC equipment efficiency
- Resulting performance verified, including energy savings
- BUT…Sold on the basis of ALL benefits, not just energy bills

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The Total Resource Cost Test

$$TRC = \frac{\text{BENEFITS: Utility Avoided Power Cost}}{\text{COSTS: Program + participant expense}}$$

This considers ALL the costs…but only the energy supply cost savings benefit

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High Participant Costs

California home performance jobs average $15,000 and are sometimes much higher

- California construction costs high, savings low
- Energy bill savings justify only a small portion
- The buyers weren't misled about energy savings
- So why were they willing to spend so much?

…It had to be the other benefits!

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What Homeowners Want

- ✓More comfort…in all rooms
- ✓More reliable, durable HVAC
- ✓Save energy resources and environment
- ✓Reduced energy bills
- ✓Improved indoor air quality
- ✓Home value increase or protection
- ✓Home safety
- ✓Moisture/mold protection
- ✓First on the block/pride
- ✓Family health (general)
- ✓Health specifics (asthma)
- ✓Take advantage of incentives
- ✓Improved home appearance
- ✓Additional space
- ✓Better/nicer windows
- ✓Reduced home repair
- ✓All credible improvements

Most want <u>many</u> of these…

Home retrofits can deliver ALL

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How Are Decisions Really Made?

- Project cost
- Comfort
- Quiet
- Green Image
- Upkeep savings
- Safety
- Other desires
- Bill savings
- Home value
- Asthma Help
- Family care

Not just bill savings: It's the BUNDLE that counts!

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Motivations and Expenditures

What is the buyer really thinking?

- Buyer perceives a bundle of benefits + costs
- Spending based on perceived overall value
- Total package may justify a high expenditure
- …but energy bill savings are only one benefit

…Public goods cost tests ignore this balancing of cost vs. all benefits

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Non-Energy Benefits Research

NEBs often conceded, but then ignored

- Energy programs focus on energy savings
- Evaluations often find big non-energy benefits
- Most focus only on societal gains (air quality, etc.)
- Not enough on buyer decisionmaking values

…We only count what's easy to measure

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The Lutzenhiser Survey Study

California Home Performance Program

- Independent evaluator of program for PG&E/CPUC
- Surveyed customer satisfaction and motivation
- Tantalizing first survey in 2003, refined in 2005
- Included detailed self-reports on motivations
- Suggestive only; small sample, not yet replicated

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Motivational Factor	Rated Very Importnt	Priority Among "Very Important" 1st	2nd	3rd	Total in Top 3	3-2-1 Weight
Improve home's comfort	**50**	**15**	**8**	**8**	**31**	**69**
Replace older equipment	**47**	**14**	**1**	**3**	**18**	**47**
Save energy & resources	**47**	**5**	**15**	**5**	**25**	**50**
REDUCE ENERGY BILLS	**45**	**8**	**14**	**12**	**34**	**64**
Improve indoor air quality	36	4	1	4	9	18
Increase / preserve home value	31	4	5	4	13	26
Contractor Affiliated with E-Star	26	0	0	1	1	1
Address Health issues	25	1	5	1	7	14
Rebate Available	24	0	1	2	3	4
Retrofits indicated by contractor	15	0	0	0	0	0
Improve home's appearance	13	1	0	2	3	5
Work recommended by HP test	11	0	0	1	1	1
Add additional space	2	0	0	0	0	0
Interest buy down program	1	1	1	0	2	5
Customer choice (at Home Depot)	1	0	0	1	1	1
Reliable windows	1	0	0	0	0	0
Contractor's knowledge and reputation	1	0	1	0	1	2

Source: Lutzenhiser, 2006 (forthcoming)

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Profound Implications for Policy

…home performance changes the game

Non-energy motivations must be considered

- As much as 75% of the expenditure justification?
- Could try to monetize NEBs (unlikely agreement)
- Alternative: Reduce participant cost in TRC
- Could radically shift energy efficiency portfolios
- Justifies more EE funding, incentives, new programs

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Simple TRC Example

$20,000 home retrofit

saving 3000kWh/300 therms

- Assume $1000 as share of program costs
- RESULT: TRC is less than 0.5 due to participant cost
- BUT if NEBs are 75% of motivation…
- TRC is about 1.7

The conventional TRC test is unfair

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A Little Humility Here…

Answers we don't have:

- What other kinds of programs have NEBs too?
- How do we assess motivations reliably?
- How robust are our initial findings?
- How variable are motivations among people?

These questions deserve more study

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Another TRC Problem:

Failure to count future savings growth

A trained contractor is a lasting resource

- Contractors take time to make the change
- Initial jobs and energy savings start low but grow
- Each job continues to save energy for many years
- Contractors gain skill, efficiency, sales volume

Result: Expanding energy savings each year

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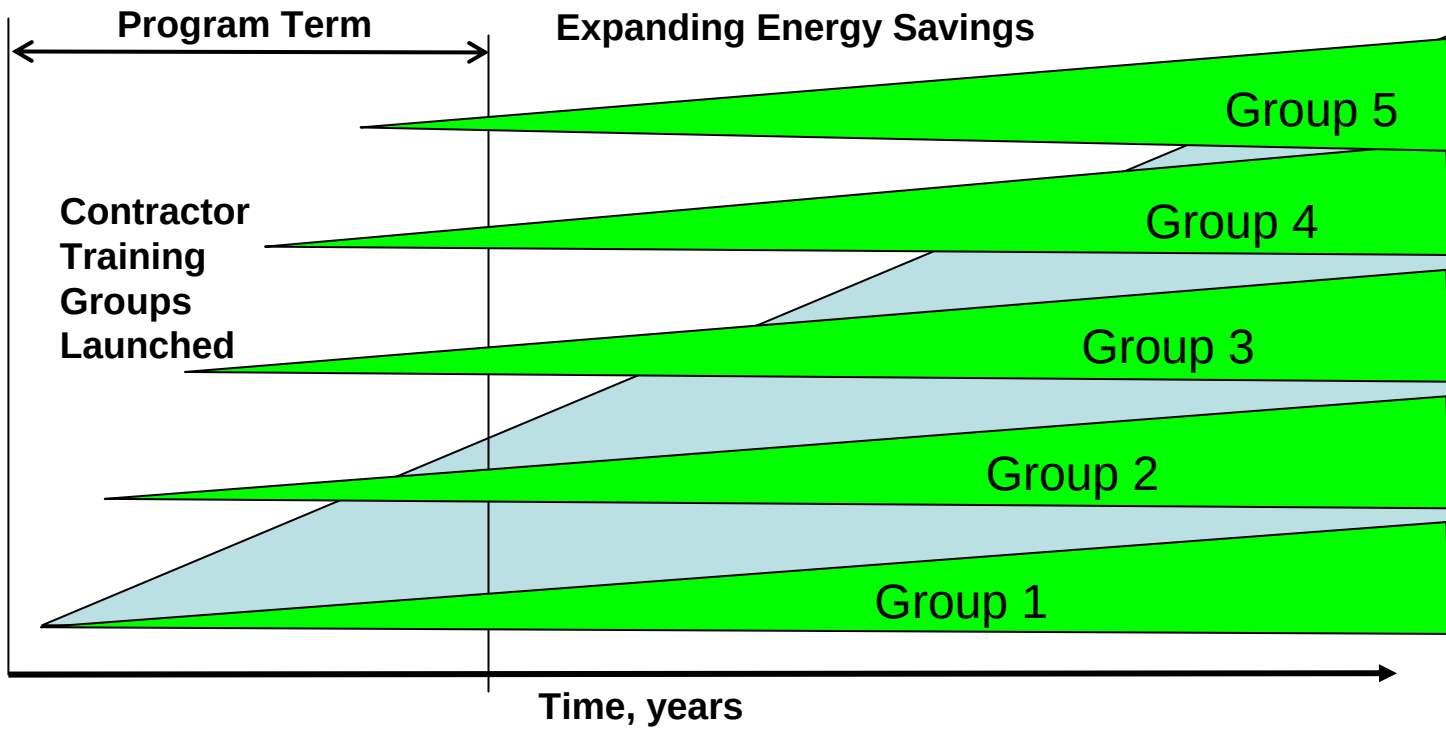
Market Transformation Happens

…creating an <u>expanding</u> savings pool



But cost tests assume <u>fixed</u> annual savings

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Yet Another Problem:
Use of Average Homes in Cost Tests

Energy use varies greatly among homes

- Home performance attracts big problem homes
- Typically systemic problems, wasteful energy use
- Mandated energy use statistics widely disputed
- Home Performance: High energy & demand savings

…Program energy savings underestimated

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The Paradigm has Shifted
…some proposals for policy debate

- Use energy savings based on actual program data
  …*e.g., New York, Wisconsin, or California*
- Use only the relevant fraction of the participant's cost
  …*to account for non-energy motivations*
- Allow maximum possible persistence and NTG ratio
  …*Home improvements are long-lived, hard-wired*
- Account for contractors continuing to add more jobs
  …*rather than just jobs completed in program*

Home Performance programs ARE cost-effective
…but public-goods cost tests don't know it

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A Call for Action Now

- Policy implications warrant further serious study
- Stronger theoretical foundation and support
- More sophisticated motivation assessment methods
- Larger scale surveys and methodological triangulation
- Reasonable case for cost-test changes now

…This is too important to ignore.

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Thanks…Questions?

For more information:

Bob Knight

rknight@bki.com

510.444.8707 x223

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