



Energy Technologies Area

Lawrence Berkeley National Laboratory

# Evaluating and Quantifying the Non-Energy Impacts of Energy Efficiency

December 14, 2016

EM&V Webinars Facilitated By:  
Lawrence Berkeley National Laboratory  
<https://emp.lbl.gov/emv-webinar-series>

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Electricity Policy Technical Assistance Program

In Collaboration With:  
U.S. Environmental Protection Agency

National Association of Regulatory Utility Commissioners  
National Association of State Energy Officials

# Introduction

- ◆ LBNL is supported by the U.S. Department of Energy to conduct non-classified research, operated by the University of California
- ◆ Provides technical assistance to states—primarily state energy offices and utility regulatory commissions

*The presentation was funded by the U.S. Department of Energy's Office of Electricity Delivery and Energy Reliability-National Electricity Delivery Division under Lawrence Berkeley National Laboratory Contract No. DE-AC02-05CH11231.*

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# Technical Assistance

- ◆ LBNL's provides technical assistance to state utility regulatory commissions, state energy offices, tribes and regional entities in these areas:
  - ❑ Energy efficiency (e.g., EM&V, utility programs, behavior-based approaches, cost-effectiveness, program rules, planning, cost recovery, financing)
  - ❑ Renewable energy resources
  - ❑ Smart grid and grid modernization
  - ❑ Utility regulation and business models (e.g., financial impacts)
  - ❑ Transmission and reliability
  - ❑ Resource planning
  - ❑ Fossil fuel generation
- ◆ Assistance is independent and unbiased
- ◆ LBNL Tech Assistance website: <https://emp.lbl.gov/projects/technical-assistance-states>
- ◆ US DOE Tech Assistance gateway: <http://energy.gov/ta/state-local-and-tribal-technical-assistance-gateway>

# Webinar Series

- ◆ Webinars designed to support EM&V activities for documenting energy savings and other impacts of energy efficiency programs
- ◆ Funded by U.S. DOE in coordination with EPA, NARUC and NASEO
- ◆ Audience:
  - Utility commissions, state energy offices, state environment departments, and non-profits involved in operating EE portfolios
  - Particular value for state officials starting or expanding their EM&V
  - Evaluation consultants, utilities, consumer organizations and other stakeholders also are welcome to participate
- ◆ For more information (upcoming and recorded webinars, EM&V resources) see:
  - <https://emp.lbl.gov/emv-webinar-series>
  - General Contact: [EMVwebinars@lbl.gov](mailto:EMVwebinars@lbl.gov)

## Series Contact:

Steve Schiller  
Senior Advisor, LBNL  
[SRSchiller@lbl.gov](mailto:SRSchiller@lbl.gov)

# Next Webinar

- ◆ Opportunities and Approaches for EM&V and Reporting Consistency and Coordination – tentatively scheduled for late January
- ◆ More webinars coming for 2017 and beyond...



# Today's Webinar

Non-energy impacts are those associated with efficiency activities other than direct energy and demand savings. While these impacts can be positive or negative, most situations result in the impacts being overall positive (non-energy benefits, or NEBs).

Some examples:

- ❑ Reduced emissions
- ❑ Comfort and productivity improvements
- ❑ Local economic development
- ❑ Reduced risk of utility service disruptions or price spikes

There are a number of methods for evaluating NEBs. The next presentation will provide an introduction to the types of NEBs and approaches to NEB EM&V

## ***Today's agenda:***

- ◆ Quick introduction – **Steve Schiller, Berkeley Lab**
- ◆ The Basics – **Lisa Skumatz, Skumatz Economic Research Associates**
- ◆ Energy Savings Performance Contract NEBs - **JP Carvalho, Berkeley Lab**
- ◆ Minnesota experience - **Jessica Burdette, Minnesota Department of Commerce**
- ◆ Arkansas experience - **Matt Klucher, Arkansas Public Service Commission**
- ◆ Q&A with panelists

# Why Are Non-Energy Impacts Important

We often focus on energy and cost savings in our assessment of efficiency projects and programs

However.... policy makers, utilities and consumers often consider non-energy impacts in their decisions to pursue efficiency opportunities, for example:

- ❑ Policy makers – pollution avoidance, economic development (jobs)
- ❑ Utilities – deferring distribution system upgrades, price stability
- ❑ Participants – improved system performance, comfort

Thus.... understanding and quantifying NEIs, supports:

- ❑ Cost-effectiveness analysis to assess the value of efficiency
- ❑ Program design and marketing of efficiency to increase uptake of efficiency by addressing the non-energy interests of participants, utilities and others

# Now - Our Other Speakers

- ◆ Lisa A. Skumatz, Principal, Skumatz Economic Research Associates
- ◆ Juan Pablo Carvallo, Sr. Scientific Engineering Associate, Berkeley Lab
- ◆ Jessica Burdette, Energy Office Manager, Energy Efficiency and Operations, Minnesota Department of Commerce
- ◆ Matt Klucher, Director, Rates and Demand Resources, Arkansas Service Commission

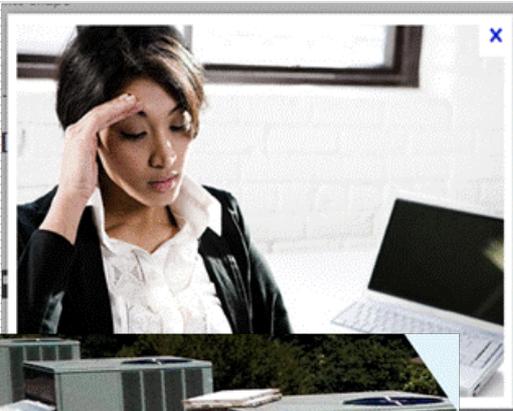
# ***NON-ENERGY BENEFITS / NEIs***

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***What have we learned  
in 20 years?  
Status / What's Next?***

*EPA Webinar  
December 14, 2016*

Lisa A. Skumatz, Ph.D.  
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# ***NON-ENERGY BENEFITS / NEIs***

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- Value from programs and measures beyond savings
  - *NEBs/NEIs are the bundle of effects received from energy efficiency equipment or programs other than efficiency and accompanying savings.*
- 20+ years of study and progress
- Motivation
  - “0” is the wrong number in analysis
  - “Bundled features” / rational / tunnel
- High value
- B/C incomplete – all costs, not all benefits biases decision-making (big numbers)

# 20+ YEARS OF NEBs/NEI PROGRESS...

Re-explore B/C  
Introduction in states, growth  
Expanding literature

Expanding estimates, sectors, studies, methods  
Wider use in marketing  
Initial applications in planning

Explore B/C (LIPPT),  
Expanding R&C Ests.  
Initial mktg applics

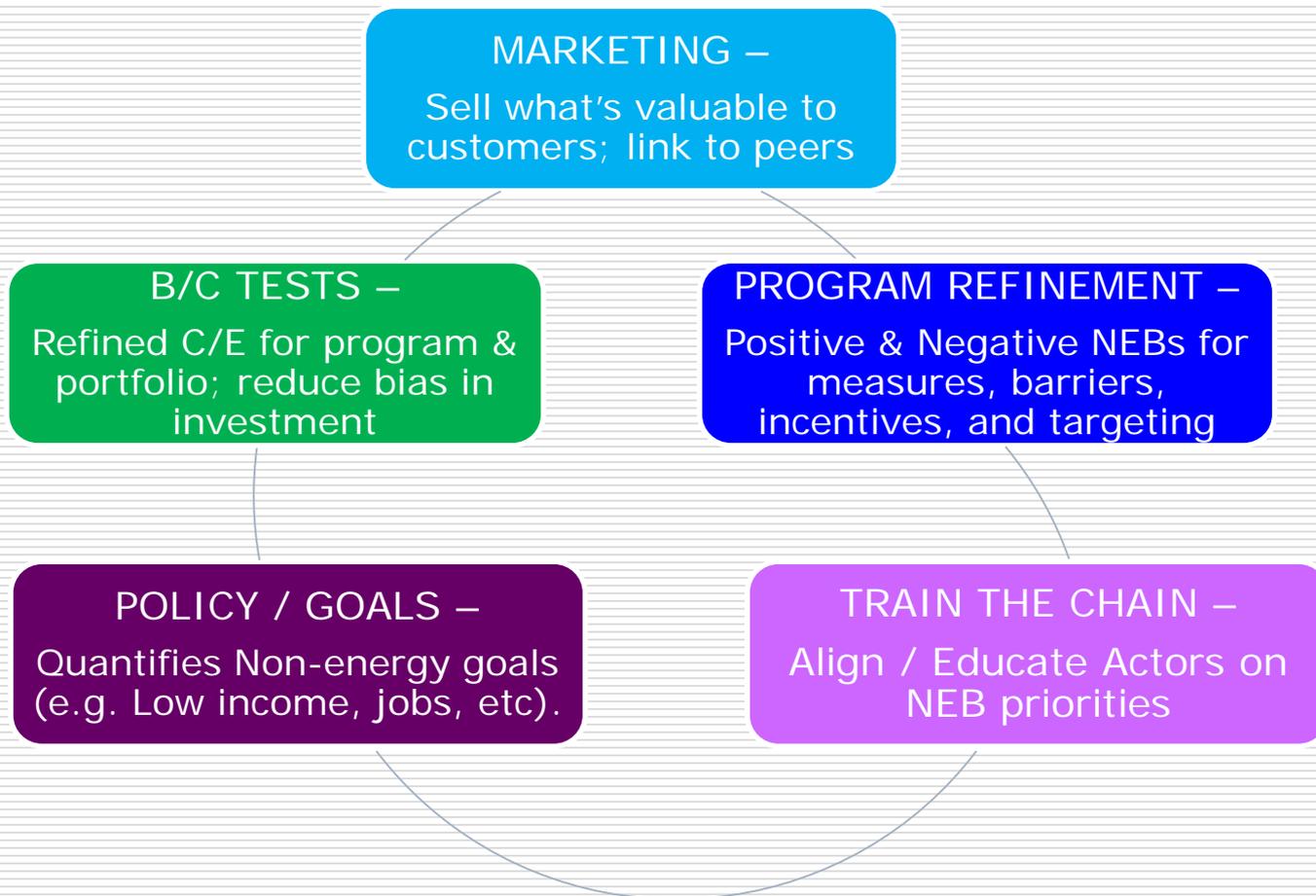
Perspectives, +/-  
Basic measurement  
LI, Res & Com'l

Lists

1994 1996 1998 2000 2002 2004 2006 2008 2010 2012 2014 2016

***But there still isn't agreement on name! - NEB, OPI, NNEB, MB, co-benefits...***

# KEY APPLICATIONS OF NEBS



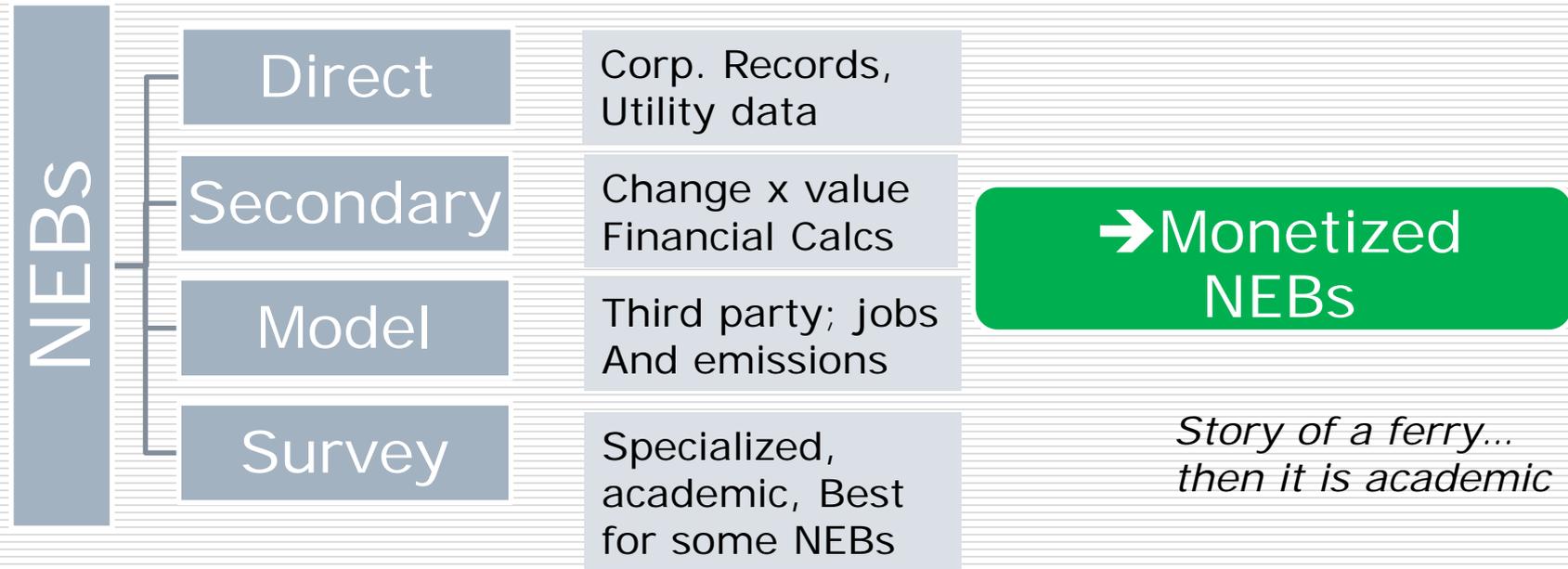
# NEB PERSPECTIVES, CATEGORIES, BEST PRACTICES

Utility	Society	Participant (Res&ICI)	
<ul style="list-style-type: none"> <li>•Carrying cost on arrearages</li> <li>•Bad debt written off</li> <li>•Shutoffs / Reconnects</li> <li>•Notices; calls, collection costs</li> <li>•Emergency gas service calls (for gas flex connector and other programs)</li> <li>•Insurance savings</li> <li>•Transmission and distribution savings (usually distribution)</li> <li>•Fewer substations, etc.</li> <li>•Power quality / reliability</li> <li>•Reduced subsidy payments (low income)</li> <li>•Other</li> </ul>	<ul style="list-style-type: none"> <li>•Economic development benefits – direct and indirect multipliers</li> <li>•Tax effects</li> <li>•Emissions / environmental (trading values and/or health / hazard benefits)</li> <li>•Health and safety equipment</li> <li>•Water and waste water treatment or supply plants</li> <li>•Fish / wildlife mitigation</li> <li>•National security</li> <li>•Health care</li> <li>•Other</li> </ul>	<ul style="list-style-type: none"> <li>•Water / wastewater bill savings</li> <li>•Operating costs (non-energy)</li> <li>•Equipment maintenance</li> <li>•Equipment performance (push air better, etc.)</li> <li>•Equipment lifetime</li> <li>•Shutoffs / Reconnects</li> <li>•Property value benefits / selling</li> <li>•(Bill-related) calls to utility</li> <li>•Comfort</li> <li>•Aesthetics / appearance</li> <li>•Fires / insurance damage (gas)</li> <li>•Lighting / quality of light</li> <li>•Noise</li> <li>•Safety</li> </ul>	<ul style="list-style-type: none"> <li>•Control over bill</li> <li>•Understanding / knowledge</li> <li>•“Care” or “hardship” (low income)</li> <li>•Indoor air quality</li> <li>•Health / lost days at work or school</li> <li>•Fewer moves</li> <li>•Doing good for environment</li> <li>•Savings in other fuels or services (as relevant)</li> <li>•GHG and environmental effects</li> <li>•Negatives</li> </ul>

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# ***NEB MEASUREMENT***

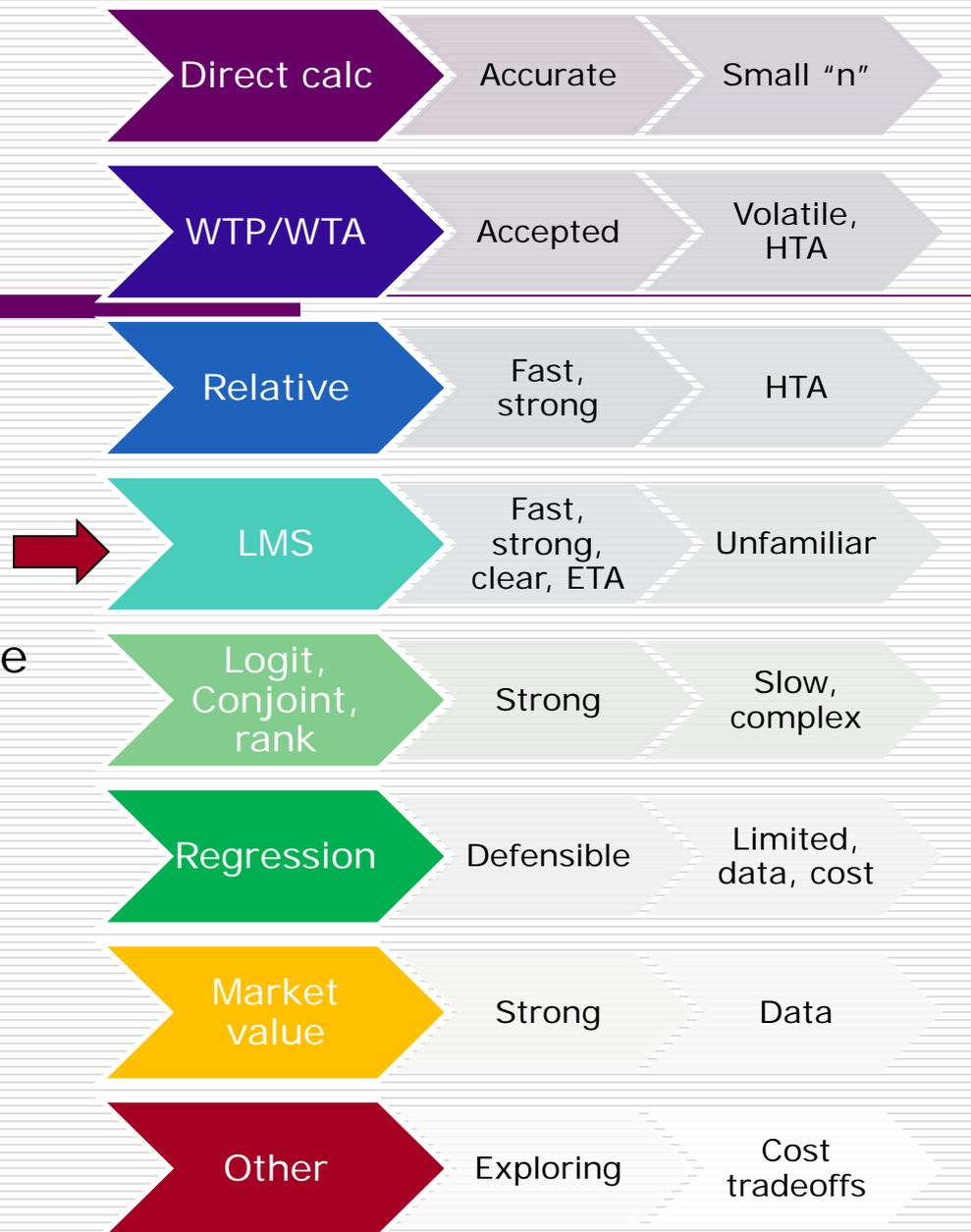
# NEBs MEASUREMENT – 4 MAIN MEASUREMENT APPROACHES



- Methods discussion / Tradeoffs
  - Multiple methods / triangulation
  - Surveys most appropriate for some
  - Balancing precision, practical – avoid bias / stats / large “N”
  - Multiple survey approaches – story of a ferry
  - Accuracy level needed... false comparisons...

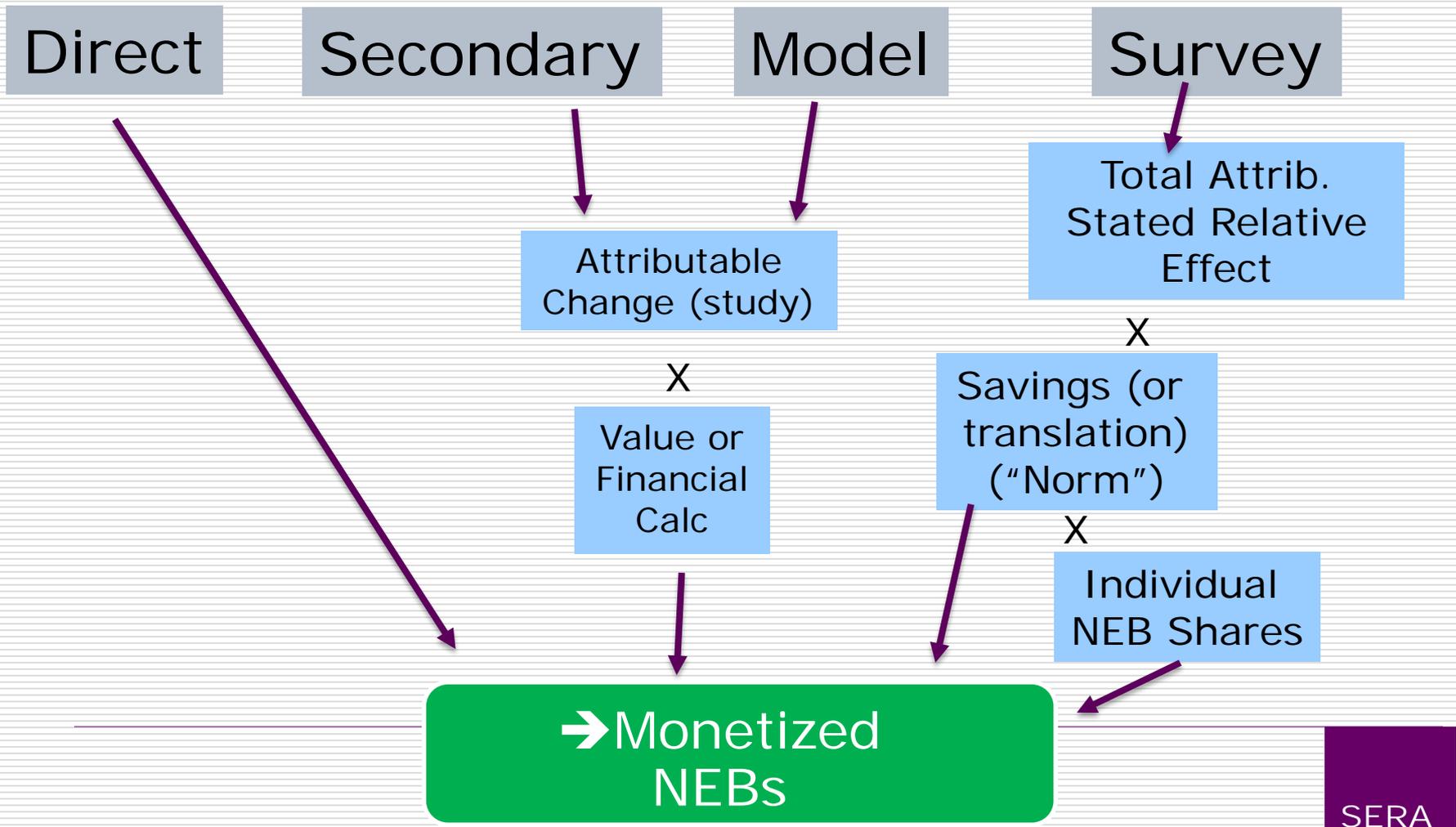
# MEASURING PARTICIPANT NEBs

- Best practices:
  - WTP not fruitful
  - 7+ better options
- Net Three:
  - Net positive & negative
  - Net beyond standard efficiency
  - Net to Gross
- Non-overlapping
- Consistent units
- **Recommend in ALL process (impact) surveys - barriers.**



HTM=Hard to measure; HTA=Hard to answer

# HOW THE NEBs ARE MONETIZED (CAN'T USE "FEEL GOOD" IN A B/C or ROI CALCULATION!)

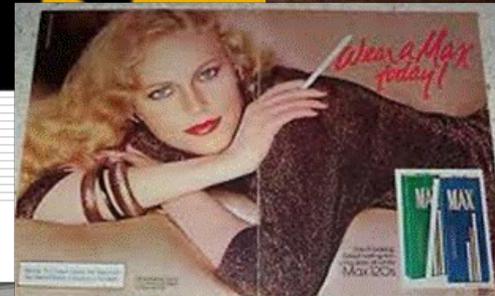


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# ***NEBS IN MARKETING APPLICATIONS***

# BUY ME? PARTICIPATE? COMPELLING?

Crowded marketplace –  
seconds to capture  
Not compelling, visual  
Not visual, catchy  
Mis-marketed now



U.S. Government Federal law prohibits removal of the label before consumer purchase.

## ENERGYGUIDE

Refrigerator-Freezer XYZ Corporation Model ABC-L Capacity: 23 Cubic Feet

- Automatic Defrost
- Side-Mounted Freezer
- Through-the-Door Ice

Estimated Yearly Operating Cost

# \$67

Cost Range of Similar Models \$57 - \$74

630 kWh Estimated Yearly Electricity Use

Your cost will depend on your utility rates and use.

- Cost range based only on models of similar capacity with automatic defrost, side-mounted freezer, and through-the-door ice.
- Estimated operating cost based on a 2007 national average electricity cost of 10.66 cents per kWh.
- For more information, visit [www.ftc.gov/appliances](http://www.ftc.gov/appliances).

HunterDouglas



EE Just Got Gorgeous

Which do you notice?

# HOW TIDE DOESN'T SELL

## BUY TIDE BECAUSE IT HELPS US MAKE LOTS AND LOTS OF MONEY!

## BUY TIDE BECAUSE IT HAS ONE OF OUR LARGEST PROFIT MARGINS



Like regular Tide, Tide with a touch of Downy contains surfactants. Surfactant molecules have two parts. One is "water loving" and the other is "water hating." The water-loving (hydrophilic) part breaks the surface tension of water. The water-hating (hydrophobic) part is attracted to oil and grease in soils, loosening and removing them from fabrics. Tide with a Touch of Downy is also formulated with special ingredients that provide softening benefits throughout the wash.

Source: SERA Research

Procter & Gamble's amazing new TIDE gives you a real **MIRACLE WASH!**

No soap - no other "suds" - no other washing product known - will get your family wash as **CLEAN** as Tide!

**THE WORLD'S CLEANEST, BRIGHTEST, WHITEST WASH**

... only Tide gives you all this! Tide gets your whole family wash cleaner than any soap or any other washing product. Tide not only leaves clothes free from dirt, but actually restores soap film, too. Yet with all the suds it creates power, Tide is safe ... steady safe for all your washable colors. In fact, Tide actually brightens soiled faded colors. What's more ... in hardest water, Tide gets white things whiter than any soap or any other washing product known! Yes, we're! For a real stretch wash - try Tide!

**TIDE**  
GETS CLOTHES CLEANER THAN ANY OTHER...  
WASHDAY PRODUCT YOU CAN BUY  
- get twice as far for value

**PROCTER & GAMBLE GUARANTEES EVERY PACKAGE OF TIDE!**

You will be completely satisfied or in full refund. If you are not completely satisfied, mail the unused portion of your package in three and the purchase price will be refunded.

**How miracle suds!**  
These suds do hard work! And kind our hands with that soft different, just different! Number 1 in the industry. First Tide for suds... now here they sparkle, even without light!

**Tide IN - DIRT'S OUT!**

© 2003 Procter & Gamble. All rights reserved.

It does sell miracles

WITH SOFTENERS RECOMMEND!

# MARKETING ONLY ON SAVINGS IS A FATAL FLAW...

- To buy this message requires:
  - Willingness / ability to **pay more up front**
  - **Trust savings** will really occur\* (& baseline)
  - Value **future** (possible) savings enough to motivate
- BUT – You probably **can't promise savings** (that they will see)...

Weather changes

Takeback / rebound

Occupant & Business fluctuations

Utility Rate Increases & Charges

More eqpt & plug-ins

**Black Box Savings**

- ~~Steer clear of savings - "attractive" features connect better~~

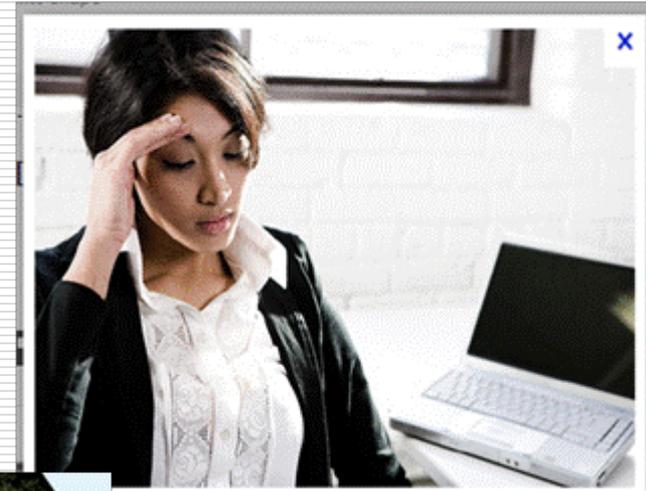
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## *Examples of NEBs in Ads*

# ***“SELLABLE” & VALUED FEATURES OF EFFICIENCY - HOUSEHOLDS***



# ***“SELLABLE” & VALUED FEATURES OF EFFICIENCY - BUSINESSES***



42-20045297 [RF] © www.visualphotos.com



**We're developing  
products and services  
that enhance customers'  
productivity and  
positively impact their  
energy efficiency**

# *APPEALING BEYOND EE*

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A photograph of a modern living room interior. The room features a light-colored sofa with patterned cushions, two striped armchairs, and a coffee table with various decorative items. Large windows with horizontal blinds are visible in the background. The text "EE Just Got Gorgeous" is overlaid in white on the image.

**EE Just Got Gorgeous**

# BEYOND EE-"SELLABLE" TO SEGMENTS

The advertisement features a central text block: "LG'S RANGE OF HEALTHY HOME APPLIANCES". Above this text is a green circular logo with the text "Healthy Living". Below the text are five appliances: a refrigerator, a front-loading washing machine, a top-loading washing machine, a microwave, and a stick vacuum cleaner. Each appliance has a green icon above it representing a specific technology: "Hygiene Fresh Technology" (a water drop), "Steam" (a steam cloud), "Lightwave Technology" (a square with a circle inside), and "Steam" (a steam cloud). Callout boxes with arrows point from the text to the corresponding icons on the appliances.

# BEYOND EE - "SELLABLE" TO SEGMENTS 27



Water  
mentioned  
first

ENERGY STAR® labeled clothes washers use about 50 percent less water and energy than conventional washers. And less energy means burning less fossil fuels that contribute to smog, acid rain, and global climate change. Finally there's a washer that does more than clean clothes — it helps protect the environment. Look for the ENERGY STAR label.

ES Lake.4.jpg



## DUCTLESS HEATING AND COOLING SYSTEMS

are the ideal solution for your electrically heated home, especially if you use baseboard, wall, or forced-air furnace heating. When you have a ductless system's efficient, quiet and even air distribution, you have:

- **TOTAL COMFORT**  
no matter the weather,  
no matter the season
- **25-50% SAVINGS**  
on electric heating costs
- **SUPER-EFFICIENT TECHNOLOGY**  
to cut energy waste



You may be eligible for **HUNDREDS IN UPFRONT SAVINGS** with utility incentives.

**MAKE YOUR GOOD HOME GREAT WITH DUCTLESS TECHNOLOGY.**  
Visit [goingductless.com](http://goingductless.com) to find an installer like me and learn more.

- 01 The **OUTDOOR UNIT** sits outside of your home at ground level.
- 02 The **INDOOR UNIT** is connected to the outdoor unit by a few small cables, including a refrigerant line.
- 03 A handy **REMOTE CONTROL** gives you constant temperature control.



COMFORT

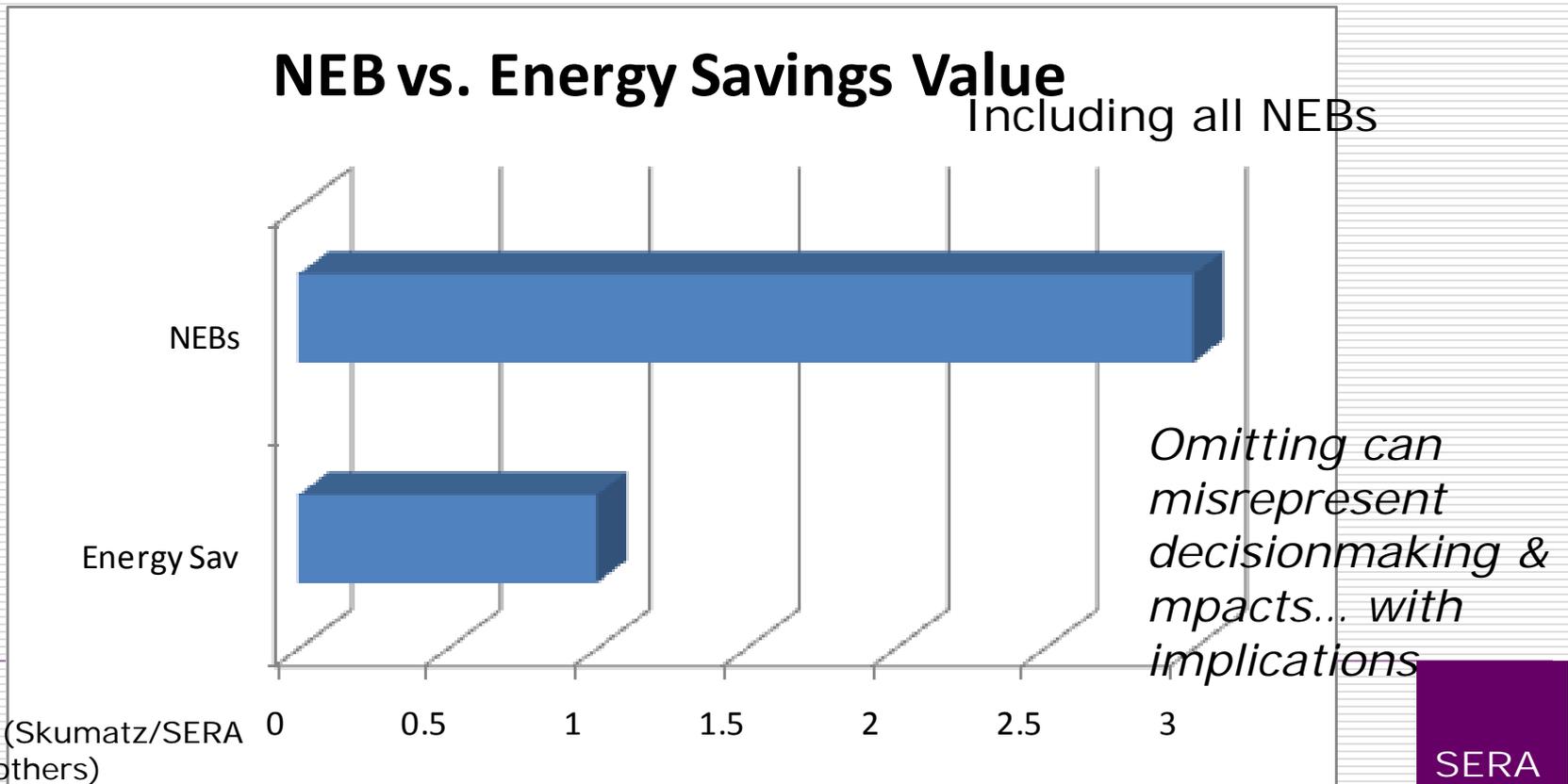
**LIVE THE DUCTLESS LIFE**  
More comfort. More savings.

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# ***LEADING NEB VALUES***

# ARE NEBS HIGH VALUE?

- *Energy savings are often the minority of benefits from program measures– Don't ignore that!*

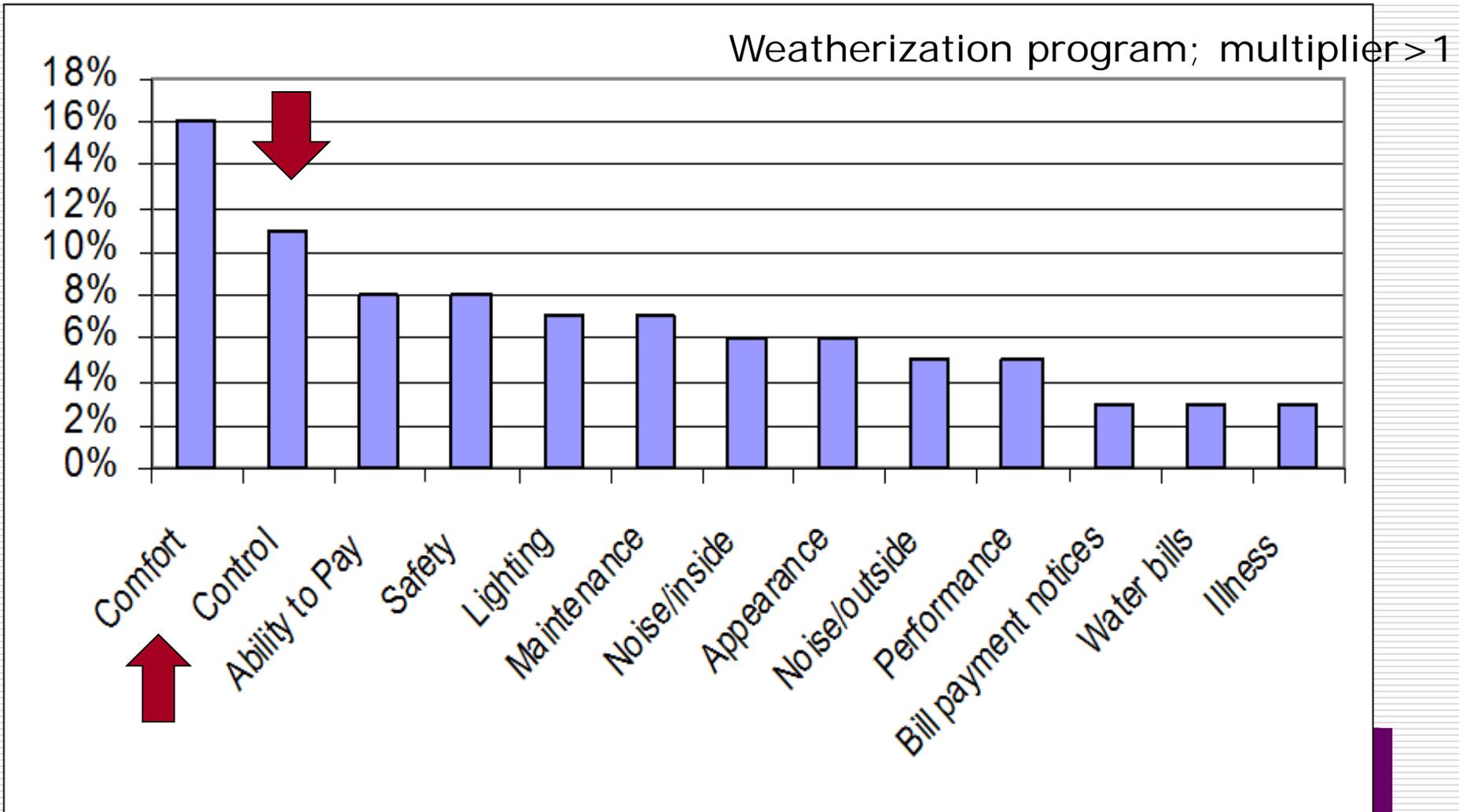


# *RESIDENTIAL PROGRAMS*

## *"NEBBED"*

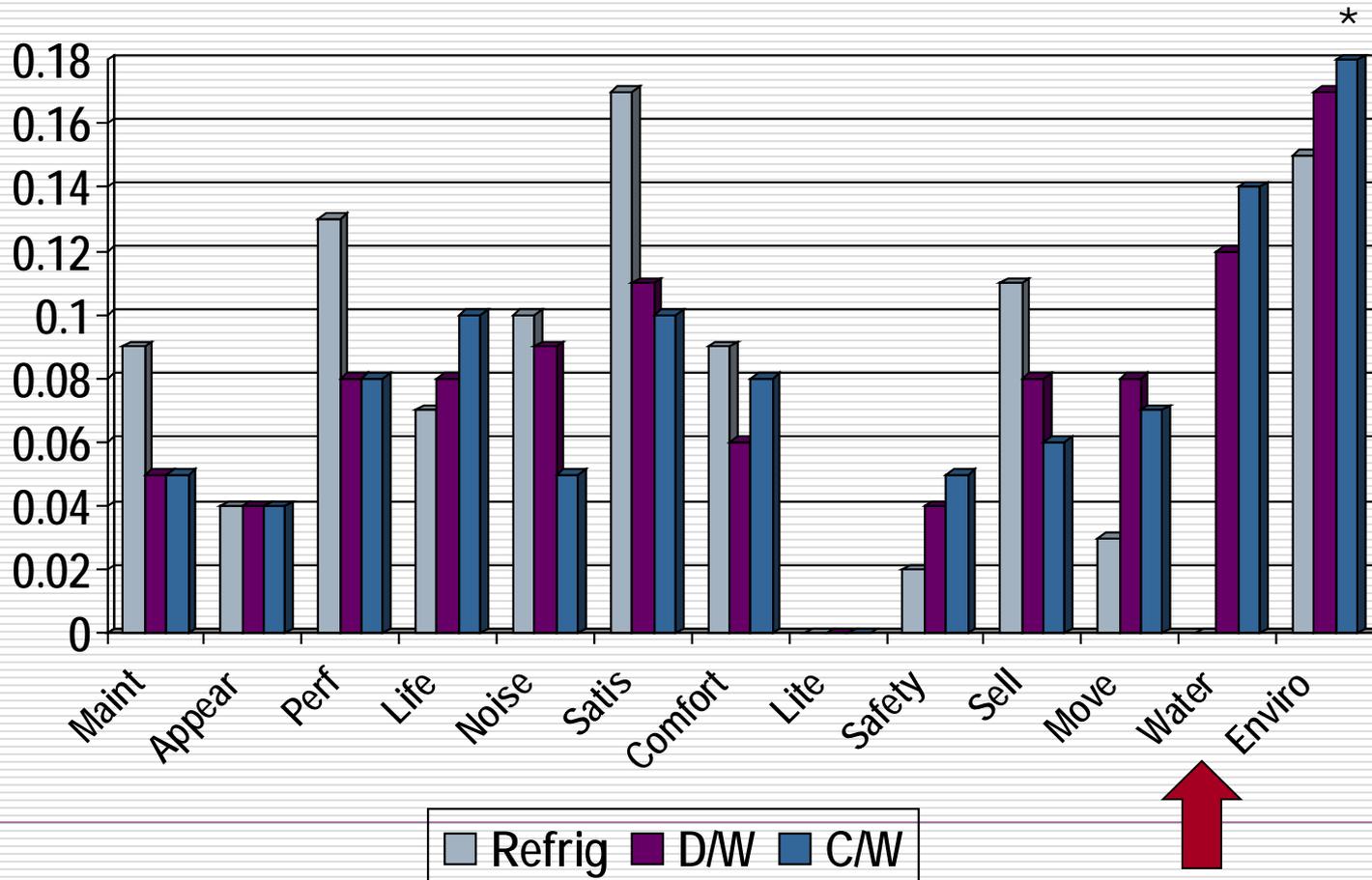
- New construction (incl ES)
- Lighting
- Weatherization
- Audit
- Home Performance (&ES)
- Appliances
- Water heating
- Insulation
- Window coverings
- Eqpt. rebate
- Training / outreach
- Real time pricing
- Solar / renewables
- MF
- Many others
- Thousands of surveys, results
  - By measures
  - By program types
  - By sectors
  - By stakeholders
  - By geography
- Variety of end uses

# TOP NEBS FOR WEATHERIZATION PROGRAM

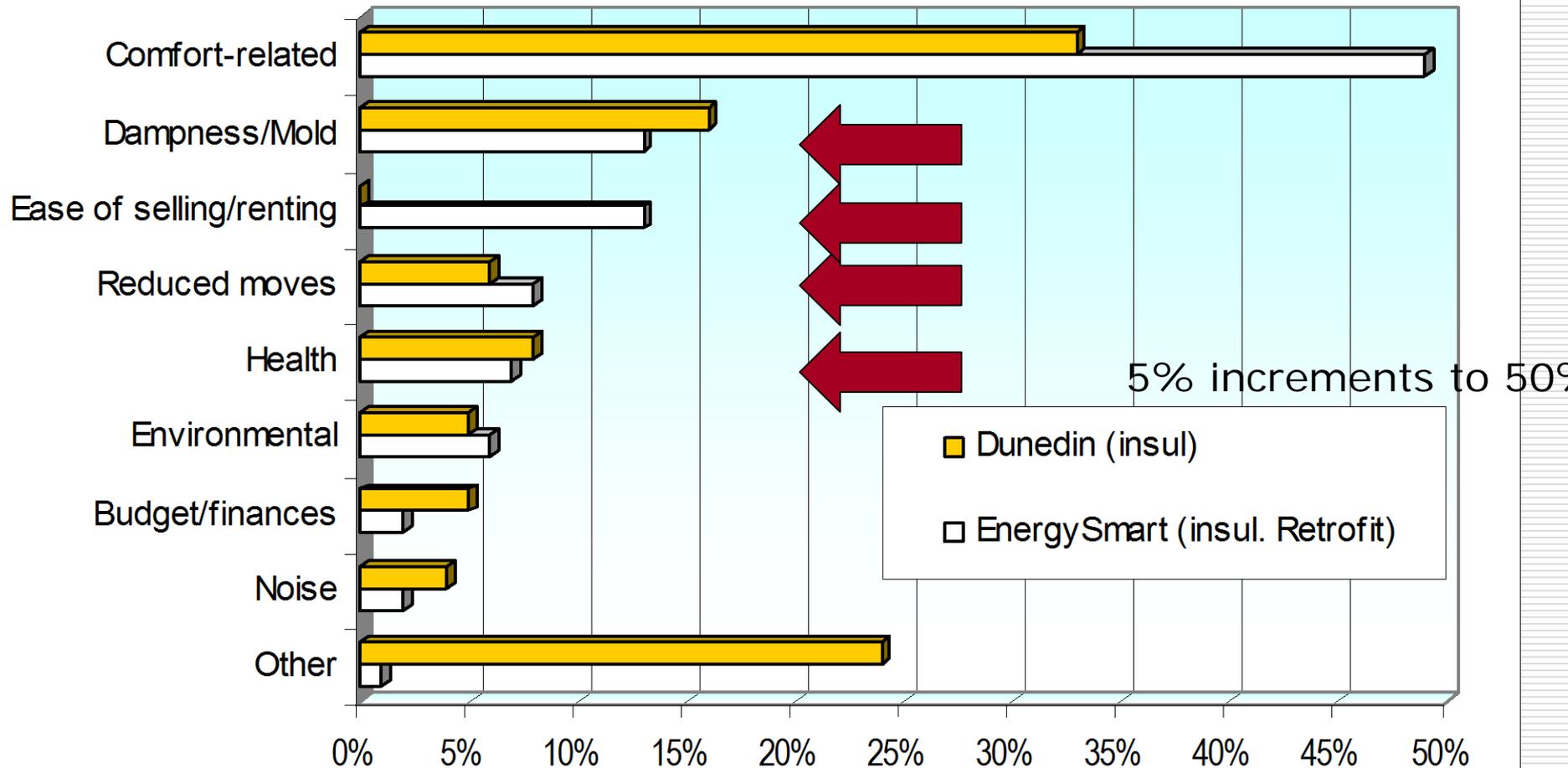


Source: SERA Research

# RESULTS FOR ENERGY STAR® APPLIANCES

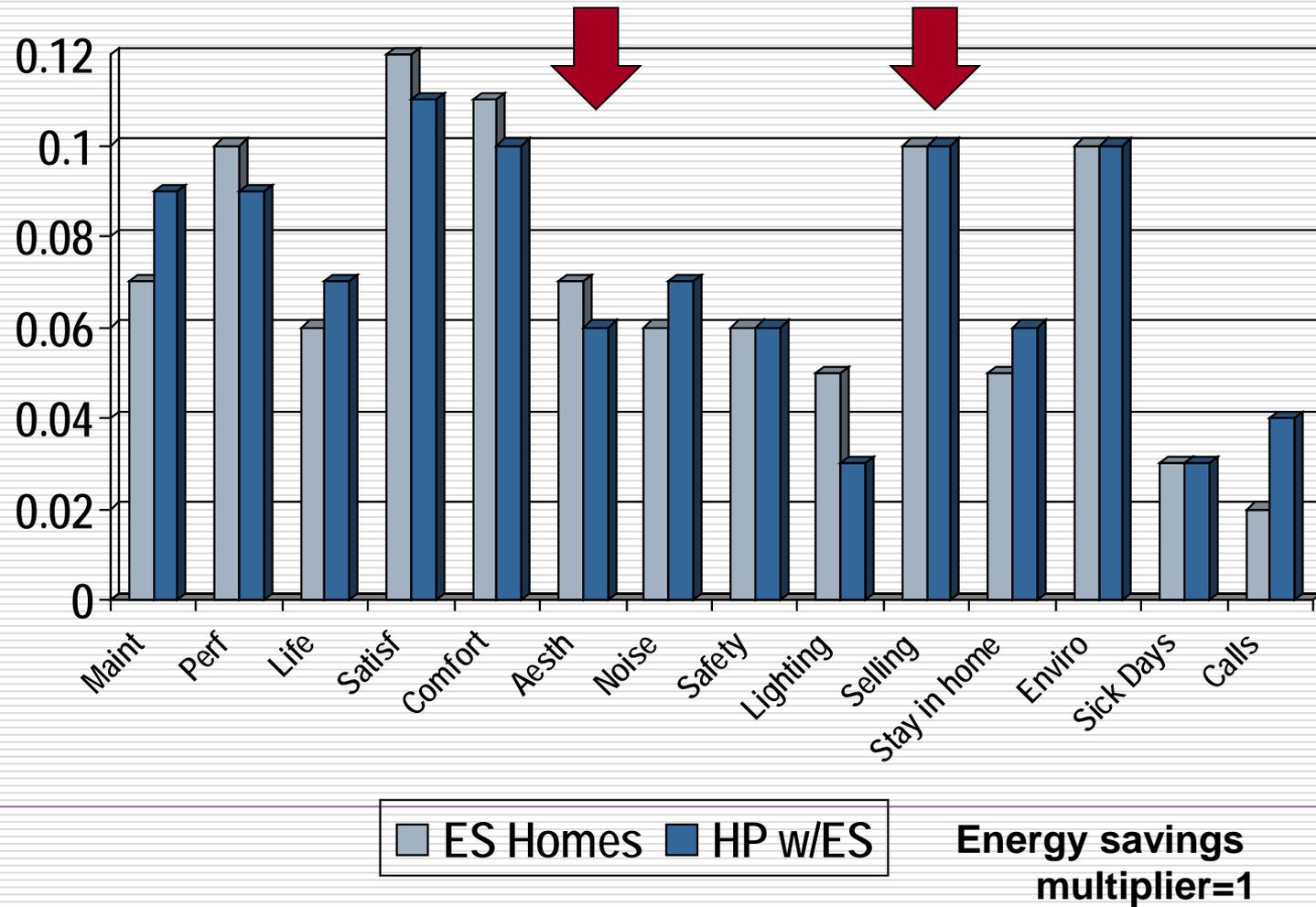


# INSULATION RESULTS (DUNEDIN & ENERGY SMART)



Source: SERA research

# ENERGY STAR HOMES & HP PROGRAMS - RESIDENTS

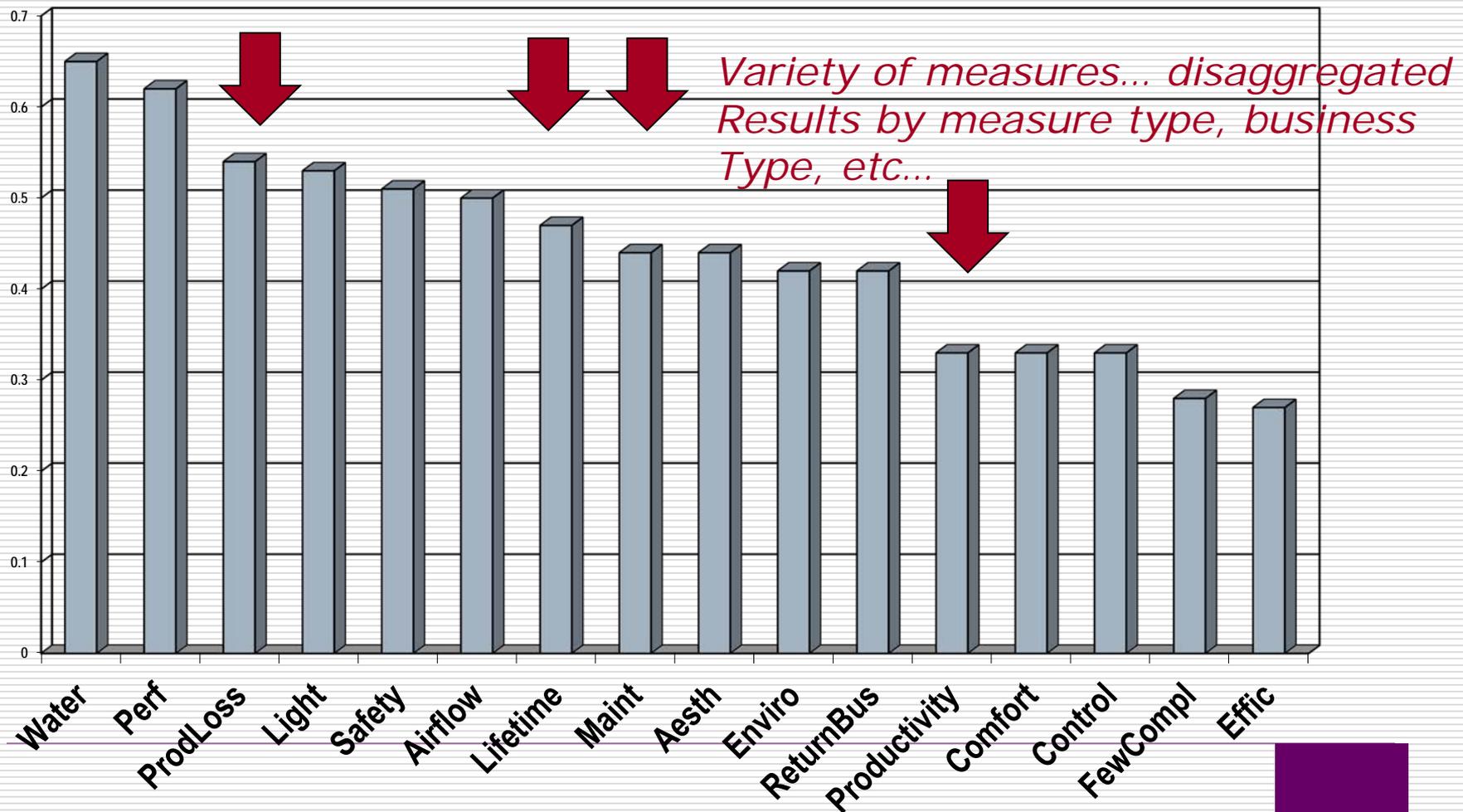


# *C&I PROGRAMS “NEBBED”*

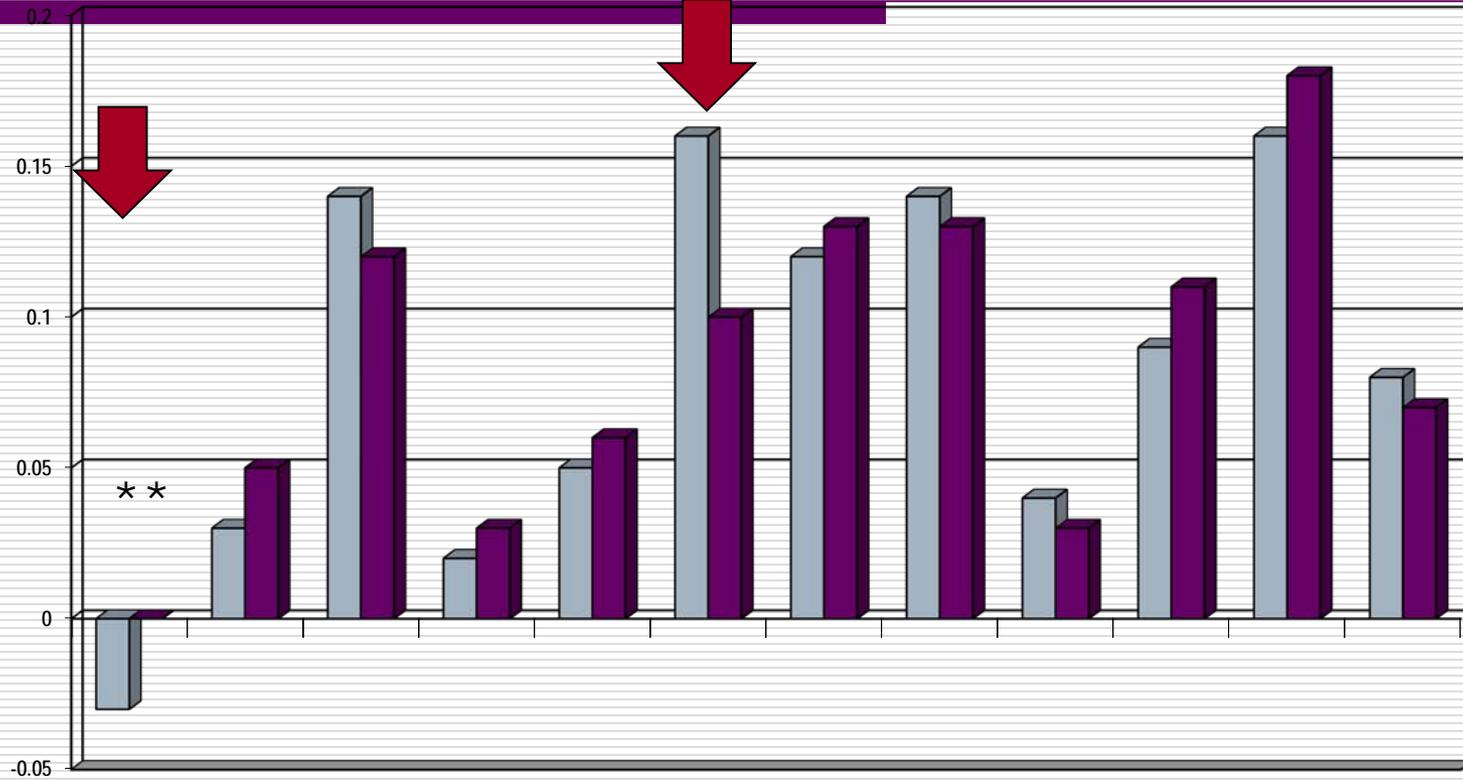
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- New construction
- Lighting
- Motors
- Audit
- Eqpt. rebate
- Commissioning
- Technical assistance
- Training / outreach
- PV
- Retail renewable
- SPC
- DG / CHP
- HVAC
- Equipment rebate
- Other
- Building codes, incentives by cities
- Thousands of surveys, results
  - By measures
  - By program types
  - By many sectors
  - By stakeholders
  - By geography
- Variety of end uses

# AUDIT / FINANCIAL PROGRAM



# C&I NEW CONSTRUCTION



Maint Productiv Perf Life Op Cost Tenant Sat Comfort Lite Safe Sell Enviro Other

■ A&E ■ Owner

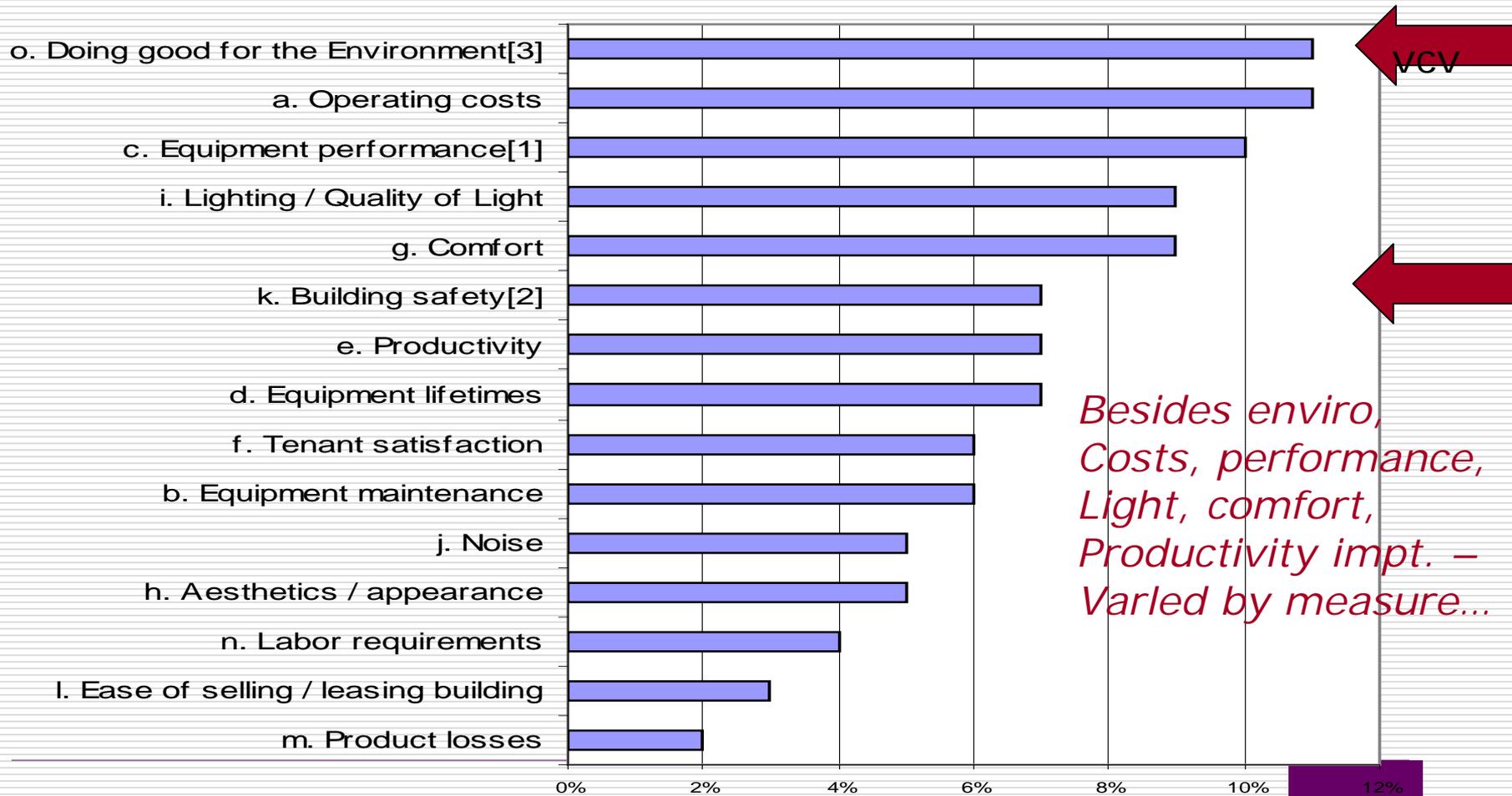
(Pct of Total Partic NEBs)

Source: SERA Research



# C&I TECHNICAL ASSISTANCE

C&I Technical Assistance NEBs



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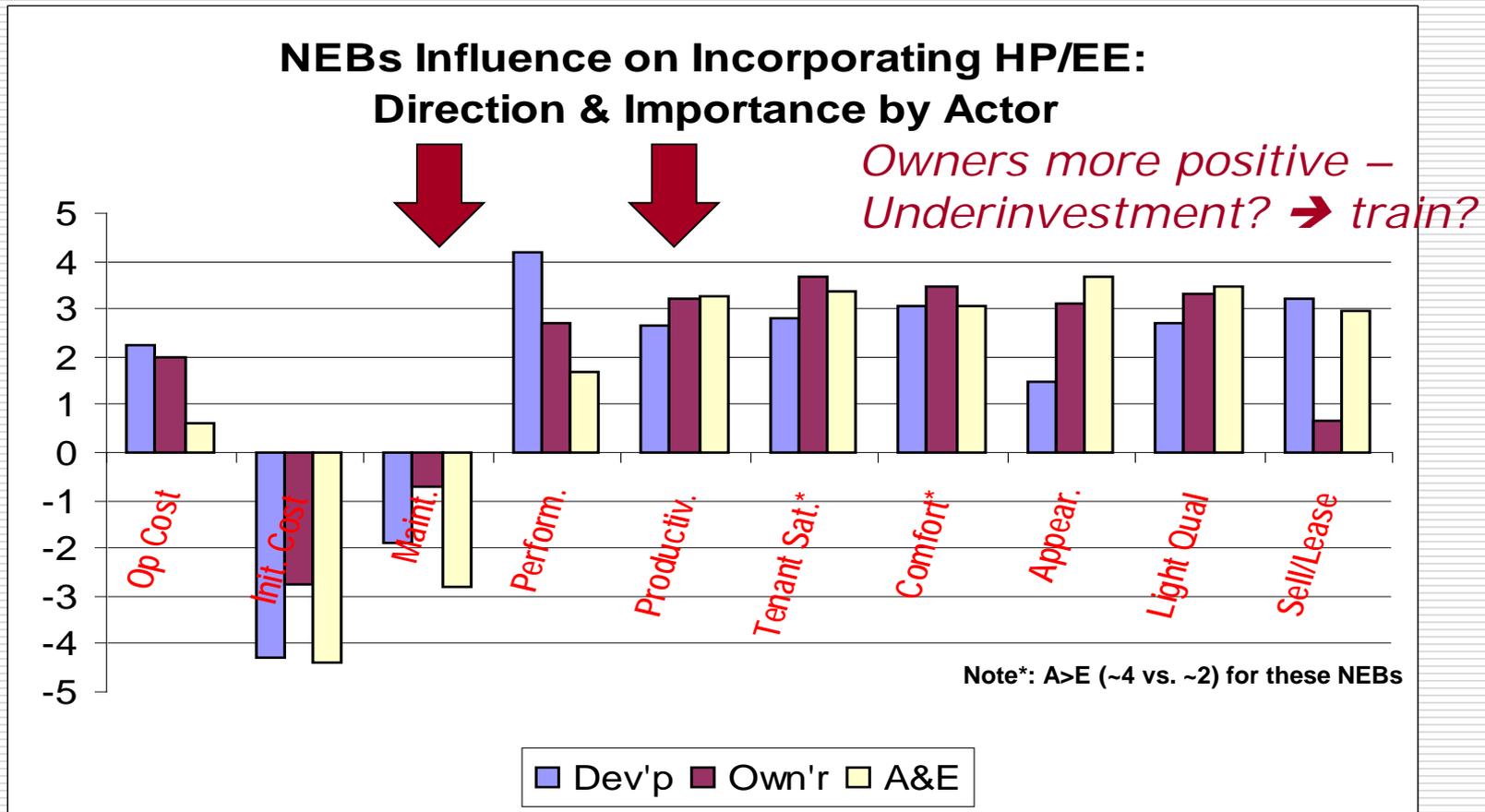
***NEGATIVE NEBS  
(BARRIERS);  
DISCONNECTS***

# NEGATIVE NEBS VALUE / PERCEIVED COST OF BARRIERS

Negative NEB values / cost of barrier	Solar Water Heat NZ\$ / Euros	Solar Design NZ\$ / Euros
Appearance (NZ\$ / Euros)	-14 / -7	- 3 / -2
Maintenance (NZ\$ / Euros)	-9 / -5	- 5 / -3
Other (NZ\$ / Euros)	-	- 3 / -2
Total value of Negative NEBs for Measure (and share of energy savings)	-23 / -12 (0.79)	-11 / -6 (.06)

Implications: **Negatives / barriers**  
 Can be very real & important.  
 Can address with redesign, or, presumably, rebates. Perhaps warranties...

# C&I EDUCATION / TRAINING – NEBS BY ACTOR – “DISCONNECT”



Source: Skumatz Economic Research Associates, Inc., 2002

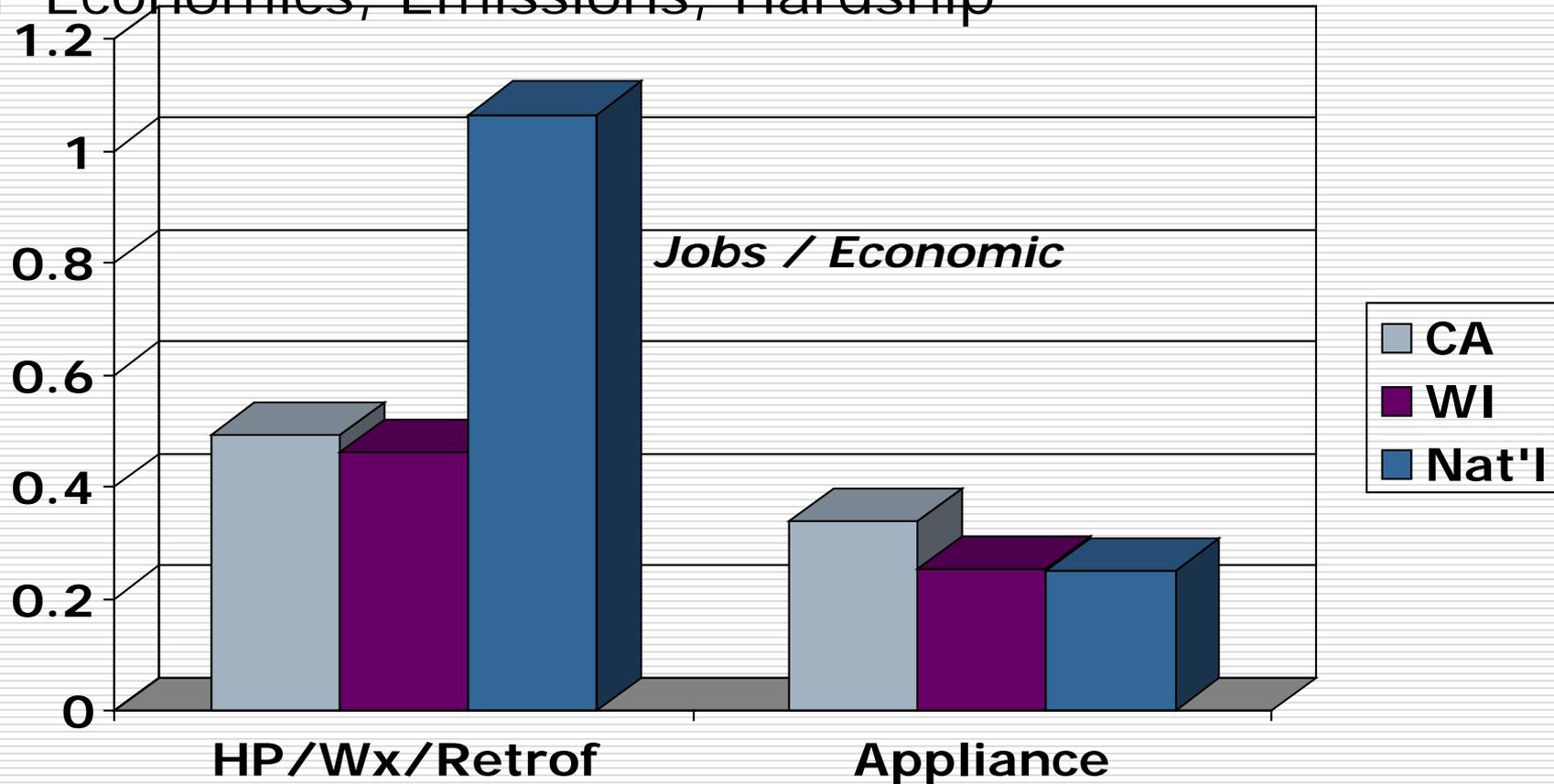
*Uses: ID “winners”, influencing factors for intervention, “disconnects”, program, interventions, research, assess / design training, target needed actors...*

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# ***SOCIETAL NEB EXAMPLES***

# ***JOBS / ECONOMICS – ALL PROGRAMS AREN'T ALIKE***

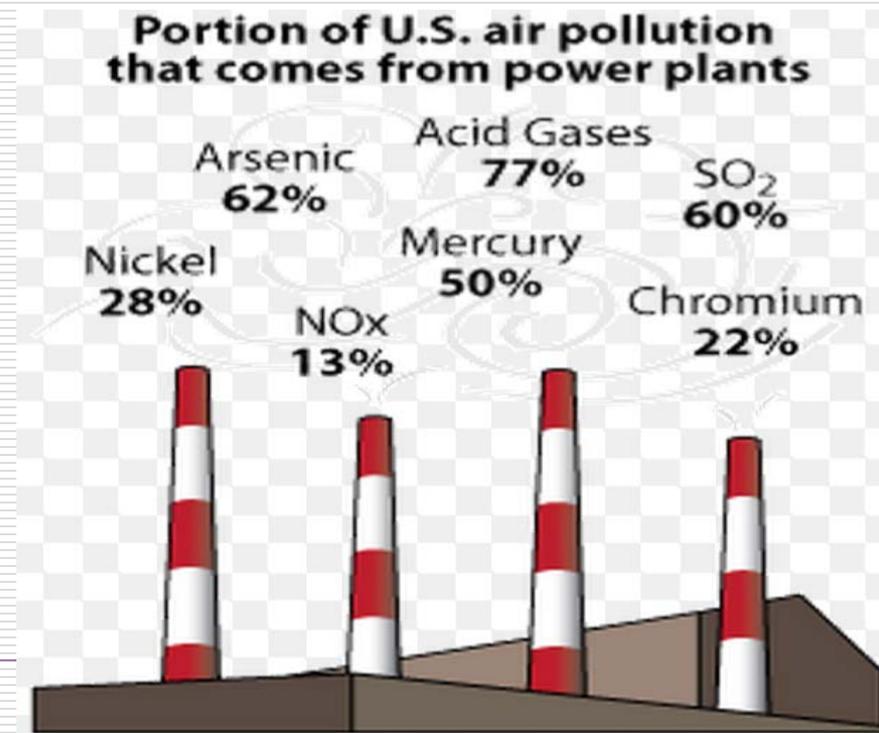
□ Economics, Emissions, Hardship



(Source: Skumatz /SERA  
ECEEE 2007, ACEEE 2006)

# *EMISSIONS (SOCIETAL NEBS)*

- Simple to complex models (slippery slope)
- Baseload vs. peak
- Some elements well / already accepted
- Incorporation as adder



# ***NEBS WIDELY RESEARCHED***

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- 20+ years; hundreds of studies on varied programs, nationally & internationally
  - All program types, sectors, (renewables, RTP)

## **Progress and Gaps**

- Extensive work on SF, Commercial programs and measures
  - MF less common; working more on all measures
- Wide variety of measures & NEBs
  - Some gaps in C&I measures, health, and other topics; international work on health...
- Methods strong; refinements, mixed approaches
- Literature assembled into models\*
- Very suited to adding into process /impact surveys

# ADJUSTED PAYBACKS

- These NEBs are **DOLLAR VALUES**, so can be used to adjust payback and ROI
    - Gross payback: 5.6 yrs → 2.5\*
    - B/C incl all partic NEBs: 0.9 → 1.9
    - Total participant NEB multiplier ranges ~25%-300%+, depending on measure(s), target(s), climate, etc.
- Value of 100% HALVES Payback, doubles ROI



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# *NEBs IN BENEFIT-COST*

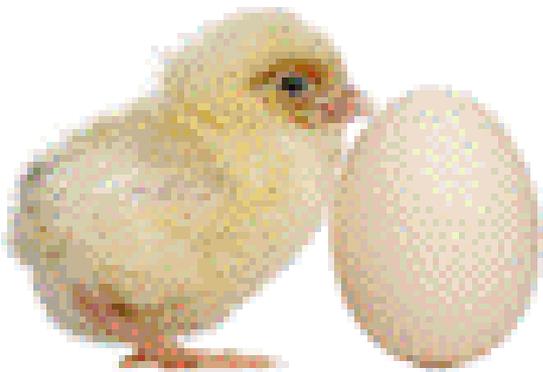
# NEBS IN B/C

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- TRC / Societal, Participant, UCT, RIM... NEBs
  - For true representation of B & C, elements of NEBs address missing factor bias
  - Better guide measure, program, & portfolio investment
  - **Address by:**
    - 1) incl monetized NEBs or
    - 2) exclude all costs associated with achieving NEBs or
    - 3) use UCT
  - B/C applications were considered early on, then pulled back, awaiting more quantitative evidence

# STATUS IN B/C

- **Chicken & Egg** – important uses ↔ \$; money if “serious” application
  - Much investment, data, expertise, increments in 20 years... State dominoes...
  - Exhaustive research on State by State treatment of NEBs in B/C
  - Extensive research on Corrections to Traditional B/C Tests



- Accuracy Concerns?

$$B/C = f\left(\frac{PV(Sav * NEB * Life * NTG)}{PV(Cost)}\right)$$

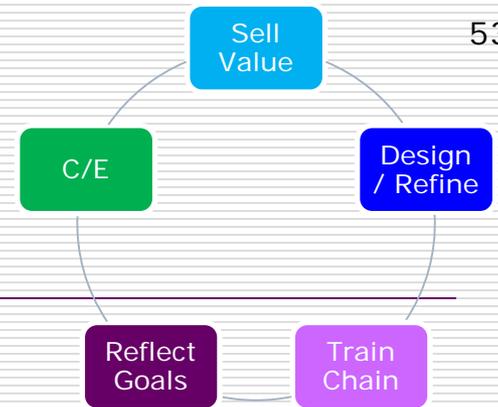
# ***METHODS TO INCLUDE NEBs IN REGULATORY TESTS***

	Maximize DSM opportunities & feedback; Accuracy / tailoring	Minimize Regulatory & Implementer Risk	Minimize Evaluation Cost
<b>Adder</b>			
<b>Readily Measurable</b>			
<b>Hybrid</b>			
<b>All NEBs</b>			

# USING NEBS – USEFUL EVALUATION RESULTS

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- **Rankings** tell strengths & marketable features – outreach
  - For successive groups of potential participants & deeper measures
- **Dollars** inform ROI & payback & B/C tests from customer and utility/ regulator perspectives
- **Barriers** suggest concerns, intervention needs
- Peer information relevant
- **Values** affect measures, program design, targets
- **Gaps** suggest training needs
- Variations by measure, target, program, climate; some invariant
- Affordable, useful evaluation / market research



# TAKEAWAYS

- NEBs / NEIs:
  - Well researched & **quantified**; **vetted** methods, 20+ years
  - Valuable – and **more valuable** to customers than EE
  - Stronger / easier marketing than EE; long use in marketing
  - Much data / results; some transferable, some gaps
- Easily measured – can / should be part of process evaluation surveys
  - Better than traditional for barriers (and strengths) –
  - More implementable than Likert
  - Practical, Useful, and SPECIFIC
- Improves / reduce bias in benefit-cost testing
  - Spreading nationally

# *THANK YOU / Questions?*

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*(Can you tell we do  
day-long workshops on this!?)*

# Discussion/Questions

For more EM&V information see:

- Webinars: <https://emp.lbl.gov/emv-webinar-series>
- For technical assistance to state regulatory commissions, state energy offices, tribes and regional entities, and other public entities see: <https://emp.lbl.gov/projects/technical-assistance-states>
- Energy efficiency publications and presentations – financing, performance contracting, documenting performance, etc. see: <https://emp.lbl.gov/research-areas/energy-efficiency>
- New Technical Brief - *Coordinating Demand-Side Efficiency Evaluation, Measurement and Verification Among Western States: Options for Documenting Energy and Non- Energy Impacts for the Power Sector*  
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From Albert Einstein:

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*“Everything that can be counted does not necessarily count; everything that counts cannot necessarily be counted”*



**BERKELEY LAB**  
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# **Non-energy benefits in projects installed by the U.S. Energy Service Company (ESCO) industry**

**NEBs EM&V Webinar**

**December 14<sup>th</sup>, 2016**

**Juan Pablo Carvallo**

**Sr. Scientific Engineering Associate**

**Lawrence Berkeley National Laboratory (LBNL)**

# Content

- Data driven analysis for specific, end-use (client) non-energy benefits (NEBs), not costs.
- Trends for NEBs use in Energy Savings Performance Contracting (ESPC) projects.
- Review of standardized methods to measure, monetize, and report NEBs.
- The economics of NEBs in projects installed by ESCOs

# LBLN ESCO resources available

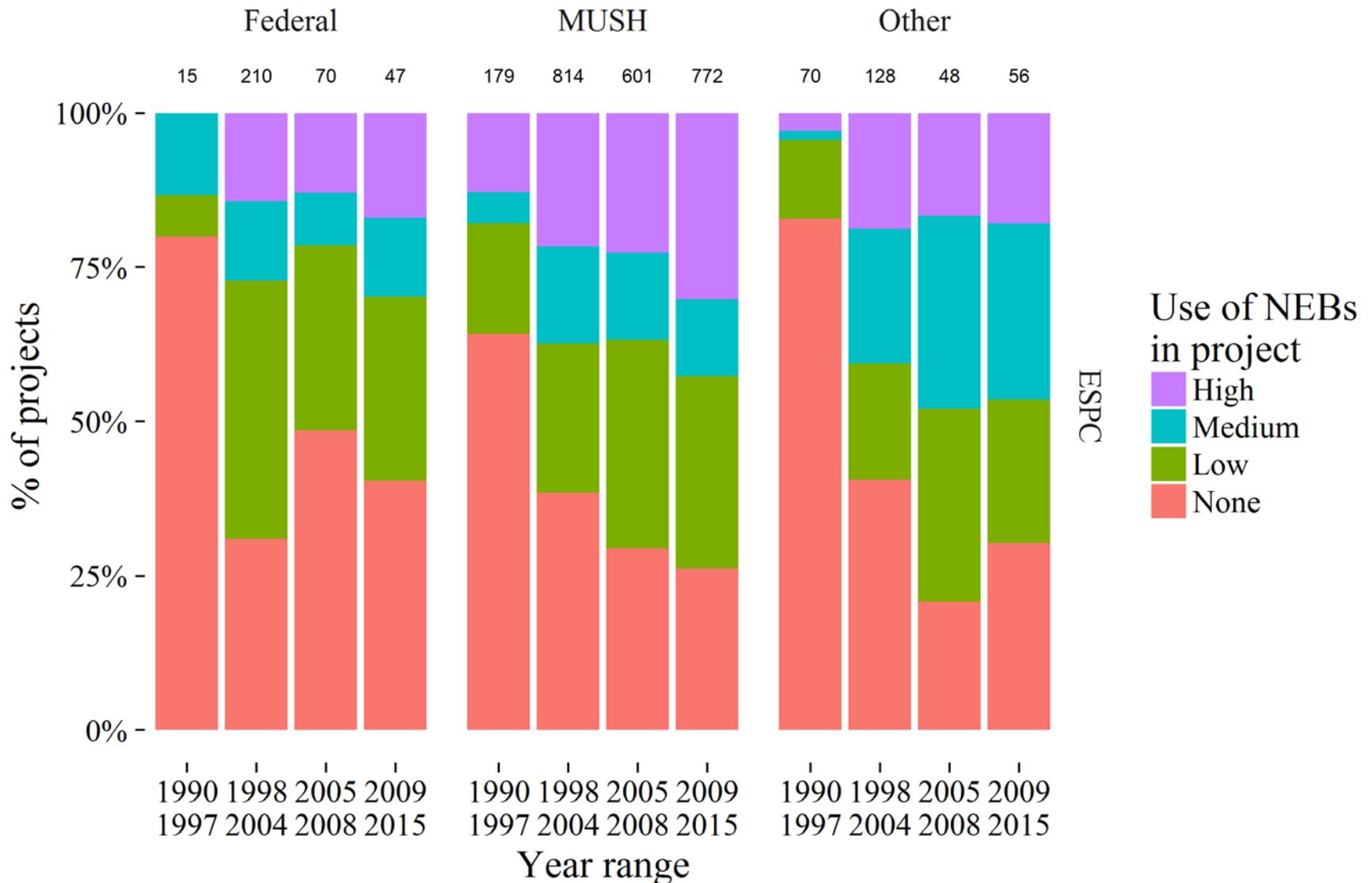
## (1) LBNL/NAESCO database of projects

- 6,000+ ESCO projects.
- Currently stores project data from NAESCO accreditation process.
- Largest database of ESCO energy efficiency projects in the world.

# For this analysis, we classify projects by share of savings coming from NEBs

Level of NEB	Share of NEBs to total savings
None	0%
Low	1%-20%
Medium	20%-50%
High	Over 50%

# NEBs increasing over time in performance contracting



# NEB economics: Current policies related to NEBs

## ***Federal:***

- FEMP's methodology recognizes three NEBs:

(1) Decreased water/wastewater usage.

(2) Reduced O&M\* expenditures.

(3) Reduced Repair and Replacement expenditures.

\* Compares baseline O&M costs against actual O&M costs after implementation.

## ***State:***

- Broader allowance of NEBs; wide variation across states

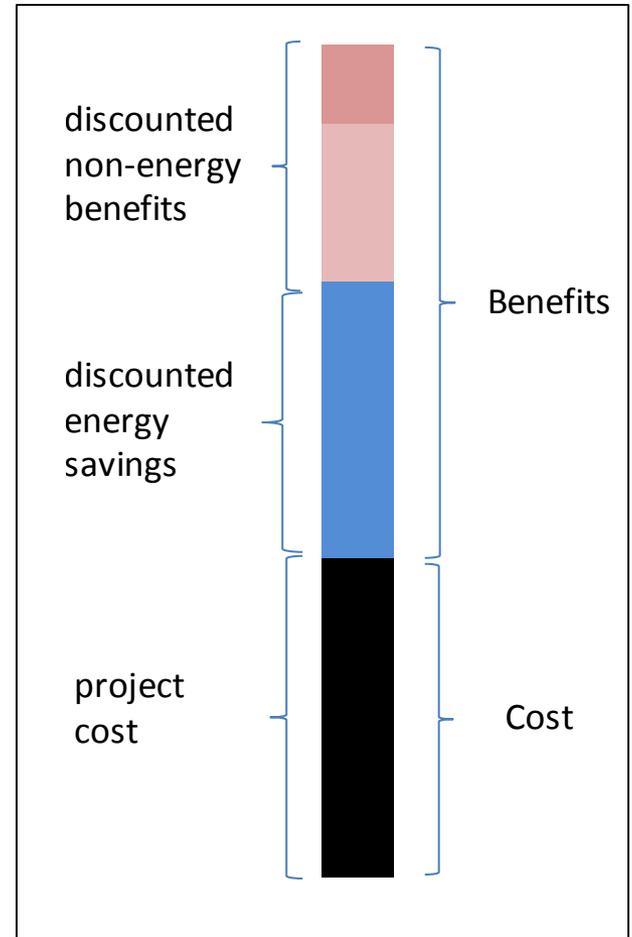
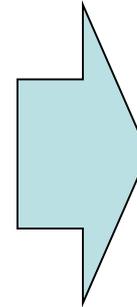
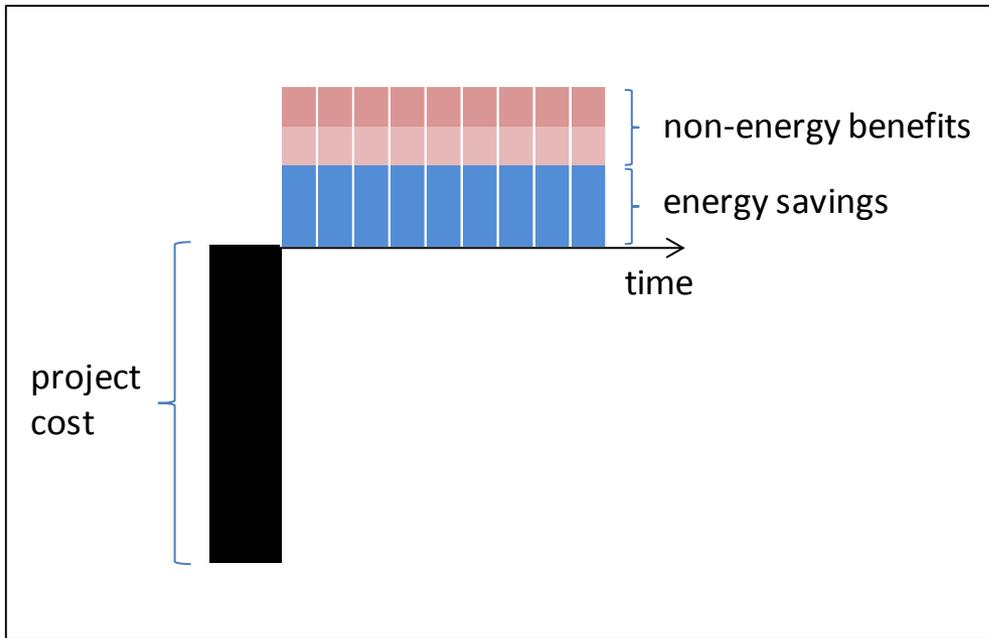
- Little or no guidance on how to monetize NEBs\*\*

\*\* ESCOs have developed customized methods to monetize NEBs

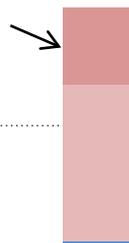
# EM&V requirements for calculating O&M savings

- Understanding O&M cost structure: costs of inventory, maintenance contracts, down time, overtime, and emergency repairs, among others.
- Recording and tracking systems for baseline and ongoing monitoring produces detailed data on:
  - Scope and costs in current and new maintenance contracts.
  - Labor and material costs for each equipment.
  - User complaints.

# NEBs project economics from customer perspective



NEBs that are currently monetized



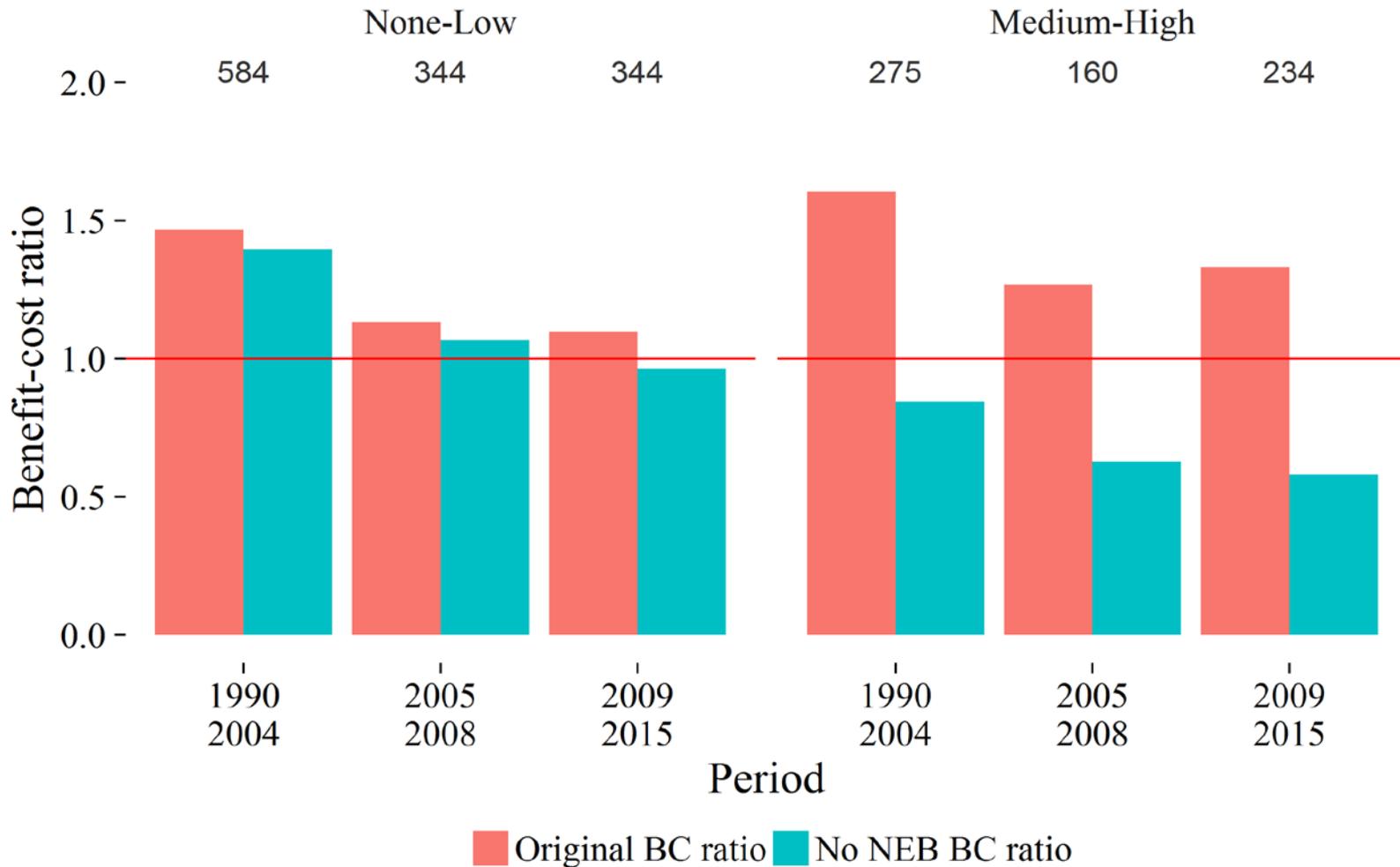
NEBs that are not yet monetized

# NEBs play important role in ESPC project economics

*How do the benefit/cost ratios of projects depend on the level of NEBs used?*

We recalculate project economics by removing the non-energy benefits and comparing this benefit-cost ratio against the benefit-cost ratio with *all* savings....

# Public/institutional ESPCs with NEBs *not included* often have negative net benefits



# Conclusions

- Use of NEBs is widespread throughout industry
- ESPC projects with higher use of NEBs increasing over time.
- Projects with no NEBs appear to be generally less attractive to public/institutional customers
- Some public/institutional projects may not be cost-effective without NEBs
- Need to standardize quantification, monetization, and reporting of wide range of NEBs—especially in ESPC projects.



## Contact information:

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We acknowledge our longtime collaboration with NAESCO and the support of the U.S. Department of Energy's Federal Energy Management Program and Weatherization and Intergovernmental Programs.



# Minnesota: Evaluating Non-Energy Impacts of Energy Efficiency Programs

Jessica Burdette

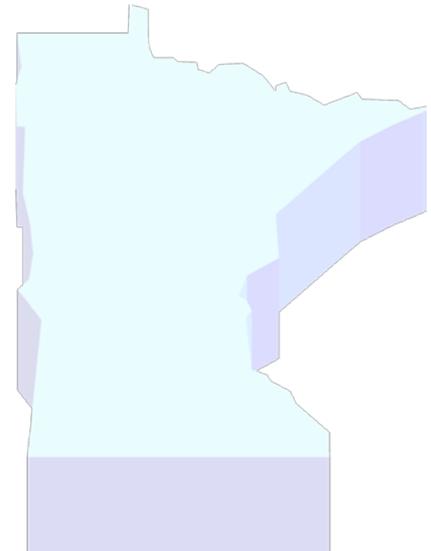
State Energy Office Manager, Efficiency & Operations  
Division of Energy Resources

December 14, 2016

# Overview

## Diverse portfolio of energy efficiency programs, including:

- Conservation Improvement Program\*
- B3: Sustainable Buildings 2030\*
- Wastewater Treatment Efficiency
- Guaranteed Energy Savings Program
- Local Unit of Government Efficiency
- Weatherization Assistance
- And more....



# Conservation Improvement Program

## Utility Energy Savings Goals:

- 1.5% annual savings goal for all utilities
- Adjustable to 1% by Commissioner of Commerce

## Utilities Subject to CIP:

- 9 IOUs (natural gas and electric)
- 130 Municipal Utilities (natural gas and electric)
- 44 Distribution Coops

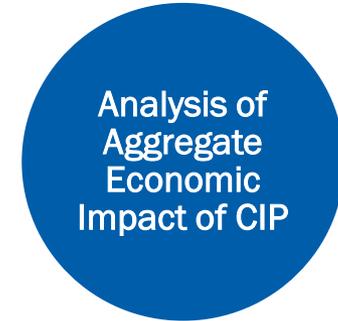
## Non-Energy Benefit: Economic Impact



- Benefits vs. Costs
- Multiple perspectives
- Impact on utility rates



- IMPLAN
- Impacts on:
  - Employment
  - Earnings
  - Income & Savings
  - Revenue & Production
  - Investment & Innovation
  - State Domestic Product



# Conservation Improvement Program

Economic Variable	2008-2032 Aggregate Impacts
<b>1. Employment</b>	<ul style="list-style-type: none"> <li>8,404 direct and 54,777 net job-years</li> </ul>
<b>2. Employee Earnings</b>	<ul style="list-style-type: none"> <li>Between \$1.9B and \$2.2B in net employee earnings</li> </ul>
<b>3. Household Income and Savings</b>	<ul style="list-style-type: none"> <li>Between \$2.2B and \$2.6B in net household income</li> </ul>
<b>4. Business Revenue</b>	<ul style="list-style-type: none"> <li>Between \$4.9B and \$5.9B in net revenue and production</li> </ul>
<b>5. Industry Production</b>	
<b>6. Capital Investment and Innovation</b>	<ul style="list-style-type: none"> <li>Between \$3.0B and \$3.6B in net profit (i.e., state domestic product)</li> </ul>
<b>7. State Domestic Product</b>	
<b>8. Utility Electricity and Natural Gas Rates</b>	<ul style="list-style-type: none"> <li>Upward pressure on future rates of about \$0.000705/kWh and \$0.00749/therm due to decreased sales (no estimate of impacts from supply-side investments)</li> <li>Cost-effective total benefits to utilities, program participants, and society</li> <li>“Enhanced” Societal Cost Test indicates that CIP provides \$4.00 to \$4.30 in benefits for every \$1.00 invested</li> </ul>

# Conservation Improvement Program

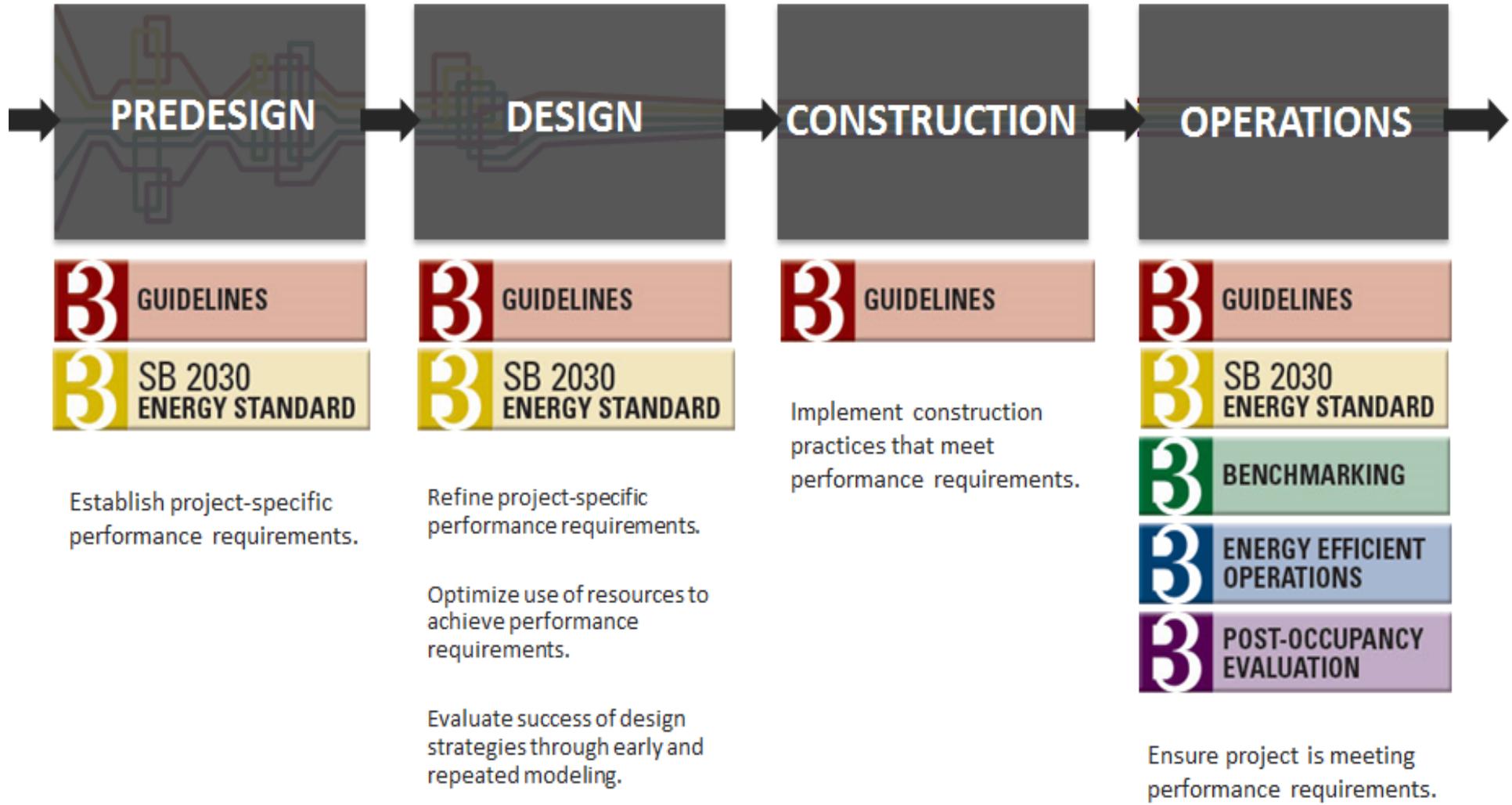
## Purpose

- Support public policy decisions
- Support objectives of economic development

## Considerations

- Inclusion in Cost-Effectiveness Tests?

# B3: Sustainable Buildings 2030

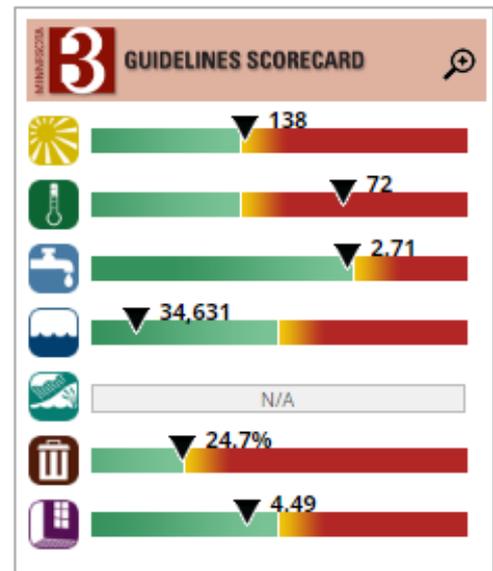
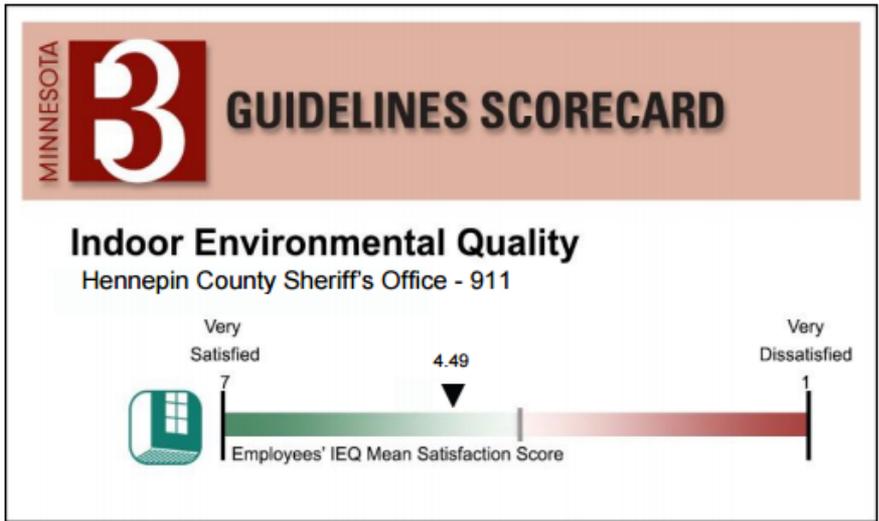


# B3: Sustainable Buildings 2030

## Non-Energy Benefit: Post Occupancy Evaluation

Online survey that asks occupants about their satisfaction with the indoor environmental quality (IEQ) of their physical environment.

- Acoustic Quality
- Appearance
- Cleaning and Maintenance
- Daylighting Conditions
- Electric Lighting Conditions
- Furnishings
- Indoor Air Quality
- Privacy
- Technology
- Thermal Conditions
- Vibration and Movement
- View Conditions



# B3: Sustainable Buildings 2030

## Purpose

- Benchmark along with other metrics
- Make operational improvements to facility
- Provide program evaluation and feedback

## Considerations

- Application to other energy efficiency programs?

# Conclusion

- Non-Energy Benefits or Non-Energy Impacts?
- Useful for determining full value of EE
- Useful for public policy development
- Use should be carefully considered

# Thank You

Jessica Burdette

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# Evaluating and Quantifying the Non-Energy Impacts of Energy Efficiency

**DECEMBER 14, 2016**

**Webinar Facilitated by:**

**Lawrence Berkeley National Laboratory**

**The Arkansas Experience**

**Presented by Matt Klucher**

# Non-Energy Benefits - Summary

- A working group worked collaboratively to identify appropriate Non-Energy Benefits (NEBs) for use in the EM&V of Energy Efficiency (EE) programs in Arkansas.
- In December 2015 the Commission approved 3 categories of NEBs.
- These NEBs will be used to evaluate the programs for the next 3-Year Cycle that begins in 2017.

# Arkansas Collaborative Model

- **Parties Working Collaboratively (PWC)**
  - **Consist of a diverse group of stakeholders with common interest in the successful development of EE initiatives for investor-owned public utility companies in Arkansas. Active PWC participants include:**
    - Public Utilities (7)
    - General Staff
    - Attorney General's Office
    - Other various stakeholder groups that include Audubon, Sierra Club, Arkansas's Advanced Energy Association, Arkansas's Energy Office, the Independent EM&V Monitor (IEM) and numerous other parties.
  - **The PWC develops and report findings and recommendations to the Arkansas Public Service Commission (Commission) in accordance with Commission directives.**

# Non-Energy Benefits Background

- Order No. 1 in Docket 13-002-U [January 2013]
  - **The Commission directed the parties to file comments regarding a number of significant proposed modifications to the development, structure, implementation, and evaluation of EE programs in Arkansas.**
  - **The Commission specifically expressed the need to include NEBs in the Total Resource Cost Test (TRC Test).**
    - The Commission directed the PWC to collaboratively develop and propose for Commission approval NEBs that could be reasonably quantifiable.

# Non-Energy Benefits Background

- The PWC responded to Order No. 1 [May 2013]
  - The PWC agreed that the TRC Test could be improved by including appropriate, reasonably-quantifiable NEB values.
  - The PWC requested that the Commission provide additional time for the parties to continue to develop NEB values to recommend for Commission approval.

# Non-Energy Benefits Background

- Order No. 7 [September 2013]
- **Directed the PWC to seek consensus on any recommended, reasonably quantifiable, and significant NEBs for inclusion in future program screening and evaluation.**
- **The Commission required that the TRC Test shall include well-defined NEBs which:**
  - Measurably reduce the use of scarce resources, add significant value or reduce costs;
  - Have quantifiable economic value; and
  - Are clearly applicable to the specific program or measure at issue.

# Non-Energy Benefits Background

- During 2014 the PWC worked together to address the issue of NEBs.
  - The NEBs working group was led by NEB experts on the IEM team.
- PWC filed its NEBs recommendation [April 2015]
- The PWC identified what they believed were the most important and reasonably quantifiable NEBs, including:
  - Avoided other fuels
  - Avoided water/sewerage consumption
  - Avoided and deferred equipment replacement cost
- PWC proposed four different recommendations for the Commission's consideration ranging from zero NEBs to the three listed above.

# Non-Energy Benefits Approved

- The Commission Issued Order No. 30 Approving the use of certain NEBs. [December 2015]
- The Commission order the following three categories of NEBs:
  - Benefits of electricity, natural gas; and liquid propane energy savings;
  - Benefits of public water and wastewater savings; and
  - Benefits of avoided and deferred equipment replacement costs.

# Non-Energy Benefits Order No. 30

- The Commission directed the IEM be requested to recommend an approach for quantification of deferred equipment replacement NEBs in individual instances when they are material and quantifiable.
- That the quantification of NEBs be included in the Arkansas Technical Reference Manual (TRM).
- The 3 categories of NEBs be consistently and transparently accounted for in all applications of the TRC Test.
- The approved NEBs will be effective for the evaluation of EE programs in Arkansas beginning with the 2017 program year.

# TRM Protocol L: Non-Energy Benefits

- Protocol L of the Arkansas TRM provides direction and guidance regarding the inclusion of NEBs in the EM&V process.
  - Electricity, natural gas, and liquid propane energy savings (i.e., other fuels)
    - The TRM provides consistent calculations for determining other fuel savings, including how to determine the avoided cost for other fuels.
  - Public water and wastewater savings
    - The TRM provides standard avoided water cost, based on marginal cost of water in Arkansas.
  - Avoided and deferred equipment replacement cost
    - The TRM provides guidance for the calculation of deferred replacement cost.

# Contact Information/ APSC Links

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Arkansas Public Service Commission Website – Energy Efficiency

<http://www.apscservices.info/ee.aspx>

Commission’s Rules for Conservation and Energy Efficiency

[http://www.apscservices.info/Rules/energy\\_conservation\\_rules\\_06-004-R.pdf](http://www.apscservices.info/Rules/energy_conservation_rules_06-004-R.pdf)

Arkansas Technical Reference Manual

<http://www.apscservices.info/EEInfo/TRM6.pdf>

# Discussion/Questions

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