

## CO-BENEFITS OF LOW INCOME WEATHERISATION PROGRAMMES:

### Framing the Role of Co-Benefits

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## BACKGROUND

- Co-benefits / non-energy benefits (NEBs)
  - From litany to estimation of NEBs
  - Worth evaluation? Evaluate to guide program decision-making (Granger)
  - Theory / “bundled features”, positive and negative effects other than energy savings
- Sources
  - Classification / 3 Beneficiaries or perspectives
  - Drivers

## NEBS “DRIVERS”

Utility/Ratepayer	Societal	Participant (all)
<input type="checkbox"/> Payments/financial <input type="checkbox"/> Debt collection <input type="checkbox"/> Emergencies / insurance <input type="checkbox"/> T&D, power quality, reliability <input type="checkbox"/> Subsidy (LI) <input type="checkbox"/> Other	<input type="checkbox"/> Economic dev’p <input type="checkbox"/> Tax impacts <input type="checkbox"/> Environmental (emissions & wildlife/other) <input type="checkbox"/> Health <input type="checkbox"/> Water & other resources / utilities <input type="checkbox"/> National security	<input type="checkbox"/> Payments & coll’n <input type="checkbox"/> Education <input type="checkbox"/> Building stock <input type="checkbox"/> Health <input type="checkbox"/> Equipment service (productivity, comfort, maintenance, etc.) <input type="checkbox"/> Other utilities (water, etc.) <input type="checkbox"/> Other (transactions, enviro, psychic, etc.)

More than 60 categories derive from these drivers  
Include subsets as appropriate to application

## BACKGROUND – WHAT NEBS CAN TELL US

- “Net” NEBs
  - Why analyzed? / worth evaluation?
  - Assumption of zero
  - Attribution and precision
- Esoteric? Many program-related applications

## NEBS – NOT ESOTERIC TO MANY AUDIENCES...

- Three primary audiences care...
  - **Program:** Utilities, agencies, regulators, program planners, cities, government / poverty agencies
    - ➔ Omitted / attributable effects; benefit-cost, program effects, design, barriers, progress, goals; program refinements, econ dev'p; individual situation & progress in hardship, fuel poverty
  - **Sales:** Utilities/agencies, builders, retailers, designers, vendors, mfg
    - ➔ Features that "sell"; marketing; barriers; reaching "buyers"; understanding / influencing decisions
  - **Users/participants:** Owners, occupants, decision-makers
    - ➔ Decision-making / internal payback; fuller effects

*Energy savings is not the key determinant or value, based on extensive interviews.*



## UTILITY BENEFITS – INDIVIDUAL CATEGORIES

Utility Benefits – changes in... ... valued at utility marginal costs, or similar	
<ul style="list-style-type: none"> <li>• Carrying cost on arrearages</li> <li>• Bad debt written off</li> <li>• Shutoffs</li> <li>• Reconnects</li> <li>• Notices</li> <li>• Customer calls / bill or emergency-related</li> <li>• Other bill collection costs</li> </ul>	<ul style="list-style-type: none"> <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>

Source: (Skumatz/SERA, ACEEE 2005 And others)



## SOCIETAL BENEFITS – INDIVIDUAL CATEGORIES

Societal Benefits – changes in... ... Valued at relevant societal values for the category.
<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>

Source: (Skumatz/SERA, ACEEE 2005 And others)



## PARTICIPANT BENEFITS – RESIDENTIAL

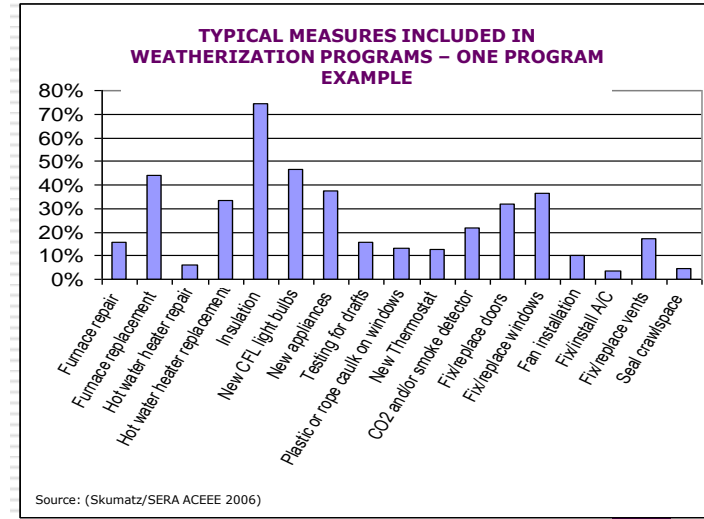
Residential Participants – changes in... ...Valued at household marginals.	
<ul style="list-style-type: none"> <li>•Water / wastewater bill savings</li> <li>•Operating costs (non-energy)</li> <li>•Equipment maintenance</li> <li>•Equipment performance (push air better, etc.)</li> <li>•Equipment lifetime</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> </ul> <p>•NEGATIVES include: Installation hassles / mess, negative values from items above.</p>

Source: (Skumatz/SERA) ACEEE1997&others)



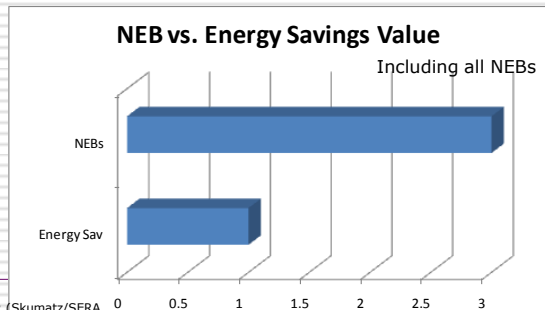
## ARE NEBS HIGH VALUE?

- Measurement approaches vary
  - Computation and measurement
  - Modeling
  - Survey-based underlying many participant NEBs (8 methods)
  - Measurement and bounding; confidence
- 20 years of research; hundreds of studies; US and international
  - Reviewed several hundred studies / pulled out low income results for this presentation
- Variations in literature by measures included, targets, program specifics, climate, but...



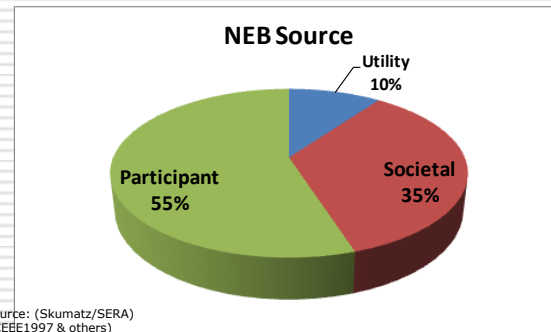
## ARE NEBS HIGH VALUE?

- Energy savings are less than 1/4 of benefits from low income weatherization programs



## WHICH SOURCES OF NEBS ARE HIGH VALUE?

- NEBs are often 3x value of energy savings. Which sources dominate?



## WHICH NEBS ARE HIGHEST VALUE?

- Utility
  - Few, low value (arrearages, subsidies)
- Societal
  - Emissions
  - Economic development
  - Potentially health (not well measured yet)
- Participant
  - Avoid moving / homelessness
  - Illness / health
  - Comfort
  - Ability to pay bills / other bill savings
- Gaps
  - Health & safety, peak, infrastructure, security, hardship

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## RESEARCH GAPS?

- Gaps – Health
  - Some work on links between chronic illness and IAQ (indoor air quality); work by Fisk and others (Billions in impacts for commercial programs / linked to measures)
  - Effects on household illness reports by 25%, decreases in absence from work, values
  - Difficult data / measurement issue

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## RESEARCH GAPS?

- Gaps – Hardship
  - Hardship measured through employment scores, family stability, reduced dependency on state benefits
  - Indicators – arrears decreases (25% common); some with 50% reductions in disconnections;
  - Moving home – Energy bills one of top 5 reasons for moving; 7.9% of persons in shelters noted utility termination as reason for homelessness
  - Moving frequently increases school dropout rates decreasing childrens' lifetime earnings... High value when included (SERA estimates)

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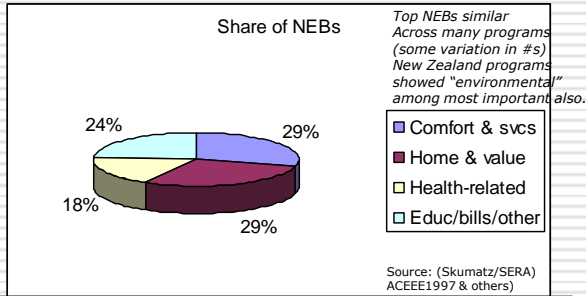
## RESEARCH GAPS?

- Gaps – Hardship, continued
  - Energy Burden= $((\text{energy consumption} \times \text{price}) / (\text{earned income} + \text{subsidies}))$ .
    - Consumption affected by measures; prices by rate subsidies; income by job training; cash subsidies
    - Two programs decreased energy burden by about 25-30%
  - Home energy insecurity scale (Colton)
    - Thriving, Capable, Stable, Vulnerable, In-crisis
    - A weatherization program moved averages households from average "1" (in crisis) to 2.1 (vulnerable).
  - These metrics are not in "monetized form" generally yet... but progressing

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## WHICH NEBS ARE HIGH VALUE?

- Example Participant NEBs breakdown



Persistence issues...



## RELATIVE NEB VALUES FOR LOW INCOME PROGRAMS (LITERATURE REVIEW)

Red = high values.  
Blue = high indications

UTILITY	SOCIETAL	PARTICIPANT	PARTICIPANT
Arrearage	Econ Devp / Jobs	Water/WW	Light
Bad debt	Tax effects (unempl)	Op Costs (non-energy)	Noise (inside / outside)
Shutoffs /connects	Tax effects – tax credits	Maintenance	Safety
Notices	Emissions	Performance	Control/ knowledge
Calls	H&S / Health Care	Lifetime	Hardship / dependence
Emerg. Gas	Water/WW	Shutoffs	Fewer moves
Insurance	Reduced dependency	Prop val / aesthetics	IAQ / Health / sick days
T&D	Other	Calls	Good for enviro
Rate subsidy		Comfort	Other and negatives
		Fires / insur	

Source: Skumatz / SERA



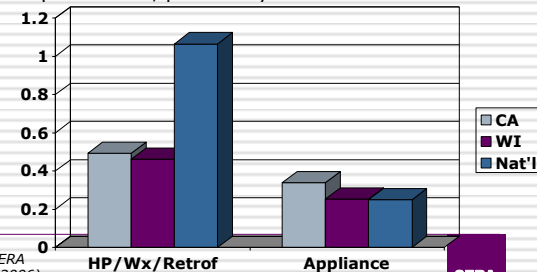
## NEBS MOST RELEVANT TO FUEL POVERTY DECISION-MAKING

- ...For mitigating resident hardship?
  - Avoided moves / family retention and associated lifetime education / earnings improvement (reflected in savings)
  - Illness (also reflected in comfort)
- ... For understanding / reaching potential participants (motivating uptake)? Add...
  - Comfort / service
  - Ability to affect environment
  - Property improvements



## NEBS MOST RELEVANT TO FUEL POVERTY DECISION-MAKING

- ...For obtaining funding?
  - Strong economic development performance
  - Emissions
  - Hardship reduction; potentially health care...



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



## **LINKING NEBS AND POLICY / PROGRAM DECISION-MAKING**

- Feedback to design
  - Measures with most impact, given budget
  - Audience targeting & marketing
  - Lost messages
- Funding / regulators
  - US
    - NEBs as "adders"
    - Scenarios
    - "Easily measured", subsets
    - Largely omitted
  - Speculative / risky perception (vs. engineering / supply)
  - Regulatory testing framework limits use
- Being reassessed

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## **SUMMARY**

- NEBs varied, quantifiable
- Valuable – more than 3 times energy savings
  - Concentrated in societal and participant
- Specific "leaders"
  - Continuing research (needed) in gaps (health, hardship, national security, insurance / safety)
- Regulatory testing framework limits use
  - Expand / incorporate subsets of NEBs in regulatory tests
  - Accuracy / riskiness issue
  - Payback on the order of 4 times better than energy alone
- Avoiding making wrong program investment decisions by incorporating NEBs

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## **QUESTIONS? CONTACT INFORMATION**

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