NON-ENERGY BENEFITS (NEBS):

20 years – Monetizing NEBs/Multiple Benefits in Buildings

IEA - April 2015

Lisa A. Skumatz, Ph.D.,
Skumatz Economic Research Associates, Inc. (SERA)
303/494-1178; skumatz@serainc.com
© Skumatz Economic Research Associates, 2015, all rights reserved/may be used with permission of author

NON-ENERGY BENEFITS

- Program value beyond savings
- 20 years of progress/ where we are
- Motivation
  - 0 is the wrong number
  - “Bundled features” / rational / tunnel
- B/C incomplete – Benefit-cost - Biased investments / decisions because all costs, not all benefits
- High value from quantitative studies

20 YEARS OF NEBS PROGRESS...

Phase 1: Perspectives, Basic Measurement
1994-1998

Phase 2. Estimation & Benefit-Cost (B/C) & Revised Tests
1996-2001+

Phase 3: Measurement, Use, & Expansion
2001-present

Phase 4: Refocus B/C Applications
2008-present

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

Source: SERA, all rights reserved

KEY APPLICATIONS OF NEBS

Sell Value

B/C

Design / Refine

Reflect Goals

Train Chain

Source: SERA, all rights reserved
NEBs, DRIVERS, 3 BENEFICIARIES

<table>
<thead>
<tr>
<th>Utility/Ratepayer</th>
<th>Societal</th>
<th>Participant</th>
</tr>
</thead>
<tbody>
<tr>
<td>o Payments/financial</td>
<td>o Economic development</td>
<td>o Payments &amp; collection</td>
</tr>
<tr>
<td>o Debt collection efforts/calls</td>
<td>o Tax impacts</td>
<td>o Education</td>
</tr>
<tr>
<td>o Emergencies/insurance</td>
<td>o Environmental</td>
<td>o Building stock</td>
</tr>
<tr>
<td>o T&amp;D, power quality, reliability</td>
<td>o Emissions</td>
<td>o Health</td>
</tr>
<tr>
<td>o Subsidy (Low Income)</td>
<td>o Health</td>
<td>o Equipment service including productivity, comfort, maintenance, etc.</td>
</tr>
<tr>
<td>o Other</td>
<td>o Water &amp; other resources/utilities</td>
<td>o Other utilities (water, etc.)</td>
</tr>
<tr>
<td>o National security</td>
<td>o Wildlife/Other</td>
<td>o Other (transactions, environmental, psychic, etc.)</td>
</tr>
</tbody>
</table>

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

Source: (Skumatz/SERA, 2004) May be used with permission of author

NEB RESULTS: MEASUREMENT & EXAMPLES FROM 20 YEARS

NEBs MEASUREMENT & DATA – 4 MAIN MEASUREMENT APPROACHES

- Direct
- Secondary
- Model
- Survey

Story of a ferry… then it’s academic

Source: Skumatz/SERA research; may be used with permission of author

MEASUREMENT ISSUES & BEST PRACTICES

- Best measurement practices
  - “NET” in multiple facets
  - Large sample, non-overlapping, applicable subset
  - Valuation, discount rates, host of other best practices/research

- Measurement accuracy issue
  - Relative to other B/C elements

- Transferability (independent vs. climate, measures, recipients, etc.)?

Source: Skumatz/SERA research
**ARE NEBS HIGH VALUE? RESULTS OF NEBs RESEARCH**

NEB Value Ranges = Multiplier times Energy Savings

**TRANSFERABILITY**

Results range depend on programs, Measures, climate, client acceptance: (from NEB-IT™ Model) Some are program-independent

Similar information for each NEB category – residential & commercial

Source: Skumatz / SERA research
May be used with permission of author

---

**SOCIETAL AND PARTICIPANT NEBS – VARY BY PROGRAM**

**TRANSFERABILITY**

Results & range depend on programs, Measures, climate, client acceptance: (from NEB-IT™ Model) Some are program-independent

Source: SERA Study

---

**PARTICIPANT NEBS – ATTRIBUTING**

ATTRIBUTION: Regressions to decompose/attribute drivers:

Measures: Insulation, furnace, draft repair
Demographics: Children, elderly

Source: Skumatz /SERA research
May be used with permission of author

---

**NEGATIVE NEBS VALUE / PERCEIVED COST OF BARRIERS**

Commercial Example
Audience, disconnect, underinvestment

Residential Example
Negative NEBs  Solar W/H
Appearance  -$14 NZ
Maintenance  -$9 NZ

Source: Skumatz Economic Research Associates research
May be used with permission of author
NEBS VALUE / VARIATIONS & CONTEXT

Residential Examples

| Residential Program | Relative NEB | Positive NEBs | Negative
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Wx</td>
<td>&lt;100%</td>
<td>Comfort, Sale, Green, Years, Other</td>
<td>Few</td>
</tr>
<tr>
<td>Wx</td>
<td>&gt;100%</td>
<td>Comfort, Sale, Green, Years, Other</td>
<td>Few</td>
</tr>
<tr>
<td>Wx</td>
<td>&gt;100%</td>
<td>Comfort, Sale, Green, Years, Other</td>
<td>Few</td>
</tr>
<tr>
<td>Wx</td>
<td>&gt;100%</td>
<td>Comfort, Sale, Green, Years, Other</td>
<td>Few</td>
</tr>
<tr>
<td>Light</td>
<td>&lt;100%</td>
<td>Green, Light, Satisf, Life Quality</td>
<td>Varies</td>
</tr>
<tr>
<td>Appliances</td>
<td>&lt;100%</td>
<td>Green, Light, Satisf, Life Quality</td>
<td>Varies</td>
</tr>
<tr>
<td>Windows</td>
<td>&lt;100%</td>
<td>Noise, comfort, control</td>
<td>Green, Light, Satisf, Life Quality</td>
</tr>
<tr>
<td>Solar Wt.</td>
<td>&lt;100%</td>
<td>Green, comfort, control</td>
<td>Green, Light, Satisf, Life Quality</td>
</tr>
<tr>
<td>Real time, Zero &amp; low energy, education, renew, many others</td>
<td>&lt;100%</td>
<td>Green, Light, Satisf, Life Quality</td>
<td></td>
</tr>
</tbody>
</table>

Commercial Examples

| Commercial Program Type | Relative NEB | Positive NEBs | Negative
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>New Range</td>
<td>~100%</td>
<td>Comfort, Light, Tenant Satisf, Ops, Productivity, Green, Leasing, Maintenance</td>
<td></td>
</tr>
<tr>
<td>NF New Construction</td>
<td>~100%</td>
<td>Operations/Perf, Green, comfort, Satisf, Ops, Productivity, Green, Leasing, Maintenance</td>
<td></td>
</tr>
<tr>
<td>Technical Resistance</td>
<td>&lt;100%</td>
<td>Performance, lifetime, comfort, safety, Maintenance, labor, lighting</td>
<td></td>
</tr>
<tr>
<td>Audit</td>
<td>&lt;100%</td>
<td>Water, Performance, Safety, Light, Productivity</td>
<td></td>
</tr>
<tr>
<td>Commission</td>
<td>&lt;100%</td>
<td>Operational deficiencies, O&amp;M knowledge, comfort, Satisf, Ops, Productivity</td>
<td></td>
</tr>
<tr>
<td>Lighting</td>
<td>Range</td>
<td>Green, comfort, control</td>
<td></td>
</tr>
<tr>
<td>Real time, Zero &amp; low energy, education, renew, many others</td>
<td>Range</td>
<td>Green, comfort, control</td>
<td></td>
</tr>
<tr>
<td>Windows</td>
<td>Range</td>
<td>Noise, comfort, control</td>
<td></td>
</tr>
<tr>
<td>Real time, Zero &amp; low energy, education, renew, many others</td>
<td>Range</td>
<td>Noise, comfort, control</td>
<td></td>
</tr>
</tbody>
</table>

Source: Skumatz Economic Research Associates research
May be used with permission of author

NEBS – WIDELY RESEARCHED

- >20 years, >100 programs & portfolios, many states in model
  - Methods, gaps, priorities, applications
  - NEB-It Model to assemble results, quickly analyze
  - Transferability of results – depends
    - Measures
    - Climate
    - Targets
    - Inclusions
  - Policy - Deliberations in multiple states

NEBS PRIORITY RESEARCH

- Greatest progress – beyond "lists" (SERA)
  - Utility
  - Societal
  - Participant

- Needs more work / gaps (SERA)
  - Utility
  - Society
  - Participant
  - Overall

Source: Skumatz / SERA research
May be used with permission of author

NEBS IN POLICY CONTEXT: BENEFIT-COST / COST-EFFECTIVENESS APPLICATIONS
**NEBS IN TESTS – REDUCE BIAS**

- Benefit Cost / Cost-Effectiveness Tests - TRC / Societal, Participant, UCT, RIM... NEBs
  - Tests already include all costs (easily tracked); use NEBs to provide truer representation of Benefits to address bias... NOT ABOUT “BELIEVING” IN NEBS...  
- Better guide measure, program, portfolio investment
- **Address by:**
  1. include monetized NEBs or
  2. exclude all costs associated with achieving NEBs
  3. or use UCT (utility cost test)
- B/C early, then “conservative” awaiting evidence

**POLICY: US STATES WITH NEBS IN COST-EFFECTIVENESS TESTS**

- A number of states include some subset of NEBs – multiple options

**NEBS IN COST-EFFECTIVENESS TESTS**

- Updated definitions for all BC tests to incorporate appropriate NEBs & refined tests, starting in 2000
- **Chicken & Egg** – NOT about “believing” in NEBs. Important uses ↔ trusted values; money if “serious” application; evidence
- Much investment, data, expertise, increments in 20 years... Dominoes...

**HOW ACCURATELY TO MEASURE NEBS? TRADEOFFS**

- **Tradeoffs** – How much to improve tests?
  How accurately to estimate NEBs? Look at costs & benefits of NEB improvements
  1. What **value range (low to high)** arises from reasonable cost measurement of important / biggest NEBs (evaluation budget)
  2. Does inclusion of LOW vs. HIGH end of the RANGE change the decision or B/C conclusion?

  - IF NO, You’re done & bias addressed sufficiently
  - IF YES, Refine measurement up to value or cost of “wrong” decision

Source: SERA, all rights reserved
TAKEAWAYS

- 20 years of literature & methods research
- Measured / measurable / high value
  - Methods / best practices / skills
  - Relative to...
  - Patterns / transferability
  - Attribution to measures
  - Most questions already answered...
- Monetizing vs. case studies...
- Multiple applications; audience issues
- Important to reducing bias in decision-making
- Dominos, choices in approach

Source: SERA, all rights reserved

THANK YOU!!

Questions?

Lisa A. Skumatz, Ph.D.
Skumatz Economic Research Associates (SERA),
Phone: 303/494-1178
skumatz@serainc.com