NON-ENERGY BENEFITS (NEBs):

Status, Findings, Next Steps, & Implications for Low Income Program Analyses in California

Workshop for LIEE NEBs Project, May 25, 2010

Project Team: Skumatz Economics (SERA) & The Cadmus Group

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AGENDA

- Welcome and Introductions (10-10:15)
  - Brenda Gettig, SDG&E
- Presentation of Draft Report & Recommendations (10:15-11:45)
  - Lisa Skumatz, SERA
- Lunch Break (11:45-1:00pm – on your own)
- Continued Discussion (1:00-1:45)
  - Brenda Gettig, Lisa Skumatz, Sami Khawaja (Cadmus Group)
- Summary and Next Steps (1:45-2:00)
  - Brenda Gettig, SDG&E

AGENDA

- NEB background
- Measurement, progress
- Values and patterns
- Weaknesses and Recommendations
- Discussion / Summary

BACKGROUND AND THEORY

- Project background
- NEBs background
  - Theory
  - NEBs –decisions (and impacts) not solely based on energy savings / energy features – “bundle”
  - Name
- Sources and Uses

NEBS "DRIVERS" …

Utility/Ratepayer	Societal	Participant (all)
❑Payments/financial ❑Debt collection efforts / calls ❑Emergencies / insurance ❑T&D, power quality, reliability ❑Subsidy (LI) ❑Other	☐Economic development / job / multipliers ☐Tax impacts ☐Environmental ☐Emissions ☐Health ☐Water & other resources / utilities ☐National security ☐Wildlife/Other	☐Payments & coll'n ☐Education ☐Building stock ☐Health ☐Equipment service incl. productivity, comfort, maint, etc. ☐Other utilities (water, etc.) ☐Other (transactions, enviro, psychic, etc.)

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

Source: (Skumatz/SERA, 2004)

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BACKGROUND – WHAT NEBs CAN TELL US

- "Net" NEBs; term, non-zero
- Perspectives
  - Agency, societal, participant;
- Esoteric? Many program-related applications

NEBS – NOT SO ESOTERIC TO MANY AUDIENCES…

- Three audiences out there that should care…
  - **Program**: Utilities, agencies, regulators, program planners, cities
    - ➔ Omitted / attributable effects; benefit-cost, program effects, design, barriers, progress, goals; program refinements, econ dev'p
  - **Sales**: Builders, retailers, designers, vendors, mfg
    - ➔ Features that "sell"; marketing; barriers; reaching buyers; understanding / influencing decisions
  - **Users**: Owners, occupants, decision-makers
    - ➔ Decision-making / payback; fuller effects

UTILITY BENEFITS – INDIVIDUAL CATEGORIES

Utility Benefits – changes in… … valued at utility marginal costs, or similar	
• Carrying cost on arrearages • Bad debt written off • Shutoffs • Reconnects • Notices • Customer calls / bill or emergency-related • Other bill collection costs	• Emergency gas service calls (for gas flex connector and other programs) • Insurance savings • Transmission and distribution savings (usually distribution) • Fewer substations, etc. • Power quality / reliability • Reduced subsidy payments (low income) • Other

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

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SOCIETAL BENEFITS – INDIVIDUAL CATEGORIES

Societal Benefits – changes in…

… Valued at relevant societal values for the category.

- Economic development benefits – direct and indirect multipliers
- Tax effects
- Emissions / environmental (trading values and/or health / hazard benefits)
- Health and safety equipment
- Water and waste water treatment or supply plants
- Fish / wildlife mitigation
- National security
- Health care
- Other

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

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PARTICIPANT BENEFITS – RESIDENTIAL

Residential Participants – changes in…
…Valued at household marginals.

- Water / wastewater bill savings
- Operating costs (non-energy)
- Equipment maintenance
- Equipment performance (push air better, etc.)
- Equipment lifetime
- Shutoffs / Reconnects
- Property value benefits / selling
- (Bill-related) calls to utility
- Comfort
- Aesthetics / appearance
- Fires / insurance damage (gas)
- Lighting / quality of light
- Noise
- Safety

- Control over bill
- Understanding / knowledge
- "Care" or "hardship" (low income)
- Indoor air quality
- Health / lost days at work or school
- Fewer moves
- Doing good for environment
- Savings in other fuels or services (as relevant)
- GHG and environmental effects

- NEGATIVES include: Installation hassles / mess, negative values from items above.

Source: (Skumatz/SERA) ACEEE1997&others)

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MEASUREMENT OF NEBS

Practices from the Literature

MEASUREMENT OF NEBS

- Attribution to programs – "NET" NEBs
  - Positive and negative
  - Net beyond standard efficiency – except for some Low Income
  - Net above what would have happened (NTG)
  - Redundancy
  - Overlap
- Mix of measurement approaches
  - Straightforward computations (some)
  - Primary / secondary data
  - Options / bounding
  - Detailed specific modeling (GHG, Econ)
  - Participant NEBs - more challenging

MEASUREMENT METHODS – UTILITY PERSPECTIVE

- Arrearage studies for most financial and collections NEBs
  - Not much change since LIPPT model
- Gaps / limited progress in:
  - Line loss reductions
  - TOD / capacity / avoided infrastructure
  - Safety & health
  - Future risk / liability

MEASUREMENT METHODS – SOCIETAL PERSPECTIVE

- Climate change / emissions –models & literature – significant activity
  - System avg *vs*. margin *vs*. hourly dispatch
    - For enhanced use, issues of additionality, program vs. project, uncertainty/risk.
  - Results dependent on region, fuel, TOD, etc.
  - In CA, embedded in adders in avoided cost figures
  - ➔ Modeling, or periodically updated "deemed" ranges for fuel, vintage, peak by territory (margin)
  - Uses: cap & trade (refined); B/C; marketing, performance tracking.

MEASUREMENT METHODS – SOCIETAL PERSPECTIVE

- Economic Development / jobs – models & literature – significant activity
  - Alternative case issue
  - Range of results – dependent on program / measures, region / industries
  - ➔ Third party models available / reviewable.
  - Uses: auxiliary benefits; B/C; optimizing program selecting measures / programs / portfolios

MEASUREMENT METHODS – SOCIETAL PERSPECTIVE

- Other societal NEBs - some work
  - Health & safety –some recent work at National level on IAQ
  - Low income / hardship
    - Impacts on resident illness, job retention, disposal illness, payments
    - Effects from avoided moves
    - Recent survey
- Other societal NEBs – little work
  - Water infrastructure – little work
  - National security, infrastructure, other – little progress

MEASURING PARTICIPANT NEBS

PARTICIPANT NEBS

- Computational approaches (little progress / change)
- Data collection from phone, mail, web, on-site, email, records…
- Survey-based methods – much attention
  - 45+articles published
  - Controversies from method / confidence, and appropriate uses
  - To date, mostly per-participant

PARTICIPANT NEBS – ANALYSIS APPROACHES

- Computational
  - Primary computation, valuation (A)
  - From secondary sources (B)
  - Regression (C)
- Contingent valuation (D)
  - Open-ended CV, WTP/WTA
  - Discrete CV questions
  - Double-bounded etc.
- Relative scaling (E)
  - Percentage
  - LMS
- Ranking-based (F)
  - Analytic Hierarchy
  - Ranking, ordered
- Other
  - Hedonic decomposition (G)
  - Reported motivations (H)

Advantages / Disadvantages with each…

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NEB VALUES FOR LOW INCOME PROGRAMS – UTILITY PERSPECTIVE

Key: HH-household; ES-energy savings
Red = high values.

NEB	LIPPT $	Range of Values from Other Studies
Arrearage	$3.76	20-30% decrease; $2-4/participant; some $32/participant but discount by interest rate (6-7% of ES)
Bad debt	$0.48	20-35% decrease; not many studies; Values $60+ for those affected / translates to $2/hh ($0.50-$3.50)
Shutoffs	$0.05	Values on order of $2 or less for many utils / some cite high values. ($0.05-$0.13)
Reconnects	$0.02	Net values from pennies to $50+ reconnect charge (many did not multiply times incidence) ($0.02-$0.13)
Notices	$1.49	Few studied separately; ($0.30-1.50)
Calls	$1.58	Values on order of $0.50 ($0.40-$1.60)
Emerg. Gas	$0.07	Based on 2 main studies; some say 23-57% decrease incidence ($0.10-$0.40)
Insurance	-	Rarely examined
T&D	$0.94	Not often separately studied; embedded in utility avoided cost for some or rules of thumb est % ($0.13-$2.60)
Rate subsidy	$3.32	Clear program & rates / subsidy relationship ($3.30-$24)
Other		Few study bill coll'n, insurance savings, infrastructure
TOTAL	$11.71	Lowest of the 3 perspectives – Totals range from ~$4-$31/hh; 7-15% of NEBs (higher if key categories elsewhere excluded)

NEB VALUES FOR LOW INCOME PROGRAMS – SOCIETAL PERSPECTIVE

NEB	LIPPT $	Range of Values from Other Studies (later studies)
Econ Devp / Jobs	$35.95	Very dependent on measures, program type, money spent, local industries. Examples for Wx vary 0.4 – 1.2; individual measures can be negative if manufactured elsewhere ($180-340) (13-320%/120% average time savings)
Tax effects (unempl)	-	Rarely studied ($150-$200; 5% times savings)
Tax effects – tax credits	-	Not studied
Emissions	$7.71	Depends on fuel mix, TOD. In CA, included in avoided cost adders. ($130-$180; some larger – not used CA)
H&S	$0.29	Rarely studied (less than 1%)
Water/WW	$28.10	Not studied this perspective
Health Care	-	Rarely studied; a few at national level / not this program type.
Reduced dependency	-	Studied a little – important for Low Income
Other	-	Fish / wildlife, national security not studied.
TOTAL	$72.05	Potentially valuable, depending on NEBs included (jobs, GHG); dependency important for goals (range often 18-45%)

NEB VALUES FOR LOW INCOME PROGRAMS – PARTICIPANT PERSPECTIVE

NEB	LIPPT $	Range of Values from Other Studies
Water/WW	$15.48	Variable with region's water rates, measures; ($4-15/hh/yr; 3%)
Op Costs (non-energy)		Rarely studied
Maintenance		Survey-based; $17-22 /hh/yr estimates
Performance		Many studies; important; values cluster around $14-18/hh/yr
Lifetime		Few quantitative studies separate from surveys
Shutoffs	$0.60	Survey or time value; small values because low incidence; Few cents to $12/hh/yr varying with procedures at utility and fees ($0.20-0/60)
Reconnx	$0.08	($0.03-0.08); depends on procedures
Calls	$0.16	Time value of data; decreases from arrears; generally around ($0.18-$0.30); some higher
Property val. / aesthetics	$17.80	Potentially important but hard to estimate; varies few dollars to $20+
Comfort	$6.70	Value in almost all studies; up to $50+ in one study; commonly one of top benefits; Watch for overlap; commonly $15-20/hh/yr (2-12%)
Fires/insur.		Seldom studied; indirect; incidence data very thin. ($0.02-$0.16)

NEB VALUES FOR LOW INCOME PROGRAMS – PARTICIPANT PERSPECTIVE

NEB	LIPPT $	Range of Values from Other Studies
Light		Survey based; depends on measures; one study showed $25/hh/yr
Noise (inside / outside)		Survey; depends on measures; $13-20/hh/yr
Safety		Few incidence studies – values about $20/hh/yr
Control/ knowledge		Survey based; values ~$30
Hardship / reduced dependence	$2.68	Important for further exploration; initial work not in same value terms so hard to compare
Fewer moves	$1.30	Value potentially high; incidence studies few. One found value more than $60/hh/yr; most use more conservative numbers (<$1); omitted effects ($1-$50)
IAQ / Health / sick days	$3.78	IAQ not often recognized separately; health effects (school / work) important with values $4-$12/hh/yr
Good for enviro		Highly valued by participants; usually one of top 3 impacts / perceptions
Other and negatives		TBD; negatives not usually found in low income programs
TOTAL	$48.58	Majority of value for some programs; 35-65% of NEB value

PATTERNS IN NEBS RESULTS - UTILITY

- Small share <10% of total NEBs
  - **Program Type**: Larger for low income because of arrearage impacts / collection, and reduced subsidy. Higher if targeted at high arrears customers
  - **Low Income**: as above and "goals" focus
  - **Variation by region**: Potential CZ patterns for arrears; gas utilities may realize higher NEBs (few studied)

PATTERNS IN NEBS RESULTS - SOCIETAL

- Medium to large share of total NEBs (18-45%)
  - **Program Type**: Improvements over last 5 years show significant variations by program & measures
  - **Low Income**: depends on program, measures
  - **Variation by region**: Important patterns in both GHG and jobs based on airshed and fuel mix (GHG) and local industrial mix and sphere of influence (jobs).

PATTERNS IN NEBS RESULTS - PARTICIPANT

- Medium to large share of total NEBs – often equal to value of energy savings, depending on program
  - **Program Type**: Higher for whole building than individual measures (highest if affects comfort)
  - **Low Income**: Important positive and negative NEBs; education / control effects strong for low income; few negatives / barriers
  - **Variation by region**: Strong variations because of influence on comfort (can be 15% of all participant NEBs)

PATTERNS IN NEBS RESULTS - TOTAL

- For low income programs, total NEB values have wide range – 30% - 5x energy savings; most in range of 60-150%
  - Depends primarily on NEBs included; some utilities more conservative than others
  - Program, measure, climate influences

RESULTS FOR LOW INCOME PROGRAMS

- Financial
  - NEBs more than outweighed energy benefits in majority
  - Improved payback
  - Progress toward goals
  - Low income customers strongly valued program – high benefits to them
- Regional and Program-related variations (measures, climate zones)
- Indications of strong health impacts, sensitive subgroups
- Caveats / use
  - Not all NEBs are used for all applications
  - Tailored subsets – especially for B/C work… perspective

NEBS TREATMENT

- Alternatives
  - Adder
  - Readily measured
  - All measured NEBs
  - Hybrid
- Benefits and risks
  - Important uses ←→ trusted metrics
  - Some NEBs can ONLY be measured from user perceptions; some most practically measured from surveys; modeling work progressed as well…
- Subsets / tests
  - TRC, Total market effects (TMET), other

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CONTEXT AND CURRENT USAGE OF NEBS

Inclusion	Discussion	State
GHG, Prop value, tax, health, jobs in formal B/C for low income req'd for legislature; only Low income	Also used for marketing / outreach – adapted from LIPPT; updates	VT
Variety of NEBs for all 3 perspectives; scenarios including percentages of NEB values examined / presented for regulators	Also marketing / outreach	NY
B/C model used includes utility and some participation NEBs		MA
10% environmental "adders" included if allowed by regulators	Limited arrearage analyses, some other NEBs allowed if low income programs don't meet threshold	CA, ID, OR, UT, WA (in past) WY, other
20% electricity adder; 5% gas adder for all programs	Re-examining	CO
TRC calcs include GHG; also Trust allows "readily measured"	Measure-specific so some low income measures	PNW, BPA, Trust, NEEA
Not officially incorporated or not required and thus not measured		Others

WHAT HAS BEEN LEARNED? STATE OF MEASUREMENT

- Arrearage based
- Readily measured
- Model based societal
- Survey based participant
  - Some values ONLY from perceptions
  - Some most readily from surveys
  - Surveys fastest for multiple NEBs
- Explore financial computations
- Weak / unexplored NEBs
- Weak on across-program comparisons (methods & values)
- Missing:
  - Measure-based
  - kW based

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PAST LIPPT MODEL

Basic approach

LIPPT MODEL ESTIMATION APPROACH

Check ONE - Local Multiplier	Check ONE - State Multiplier	Check ONE - National Multiplier	Value	Source
☐	☐	☐	105%	Average
☐	☐	☐	69%	Median
☐	☐	☐	13%	Minimum
☐	☐	☐	320%	Maximum

	Realtor EZ Checkup	Computation Description	Source
Item 1	$1,000.00	Program Expenditures per Participant	Program Assumptions Table
Item 2	156%	Times Direct and indirect economic Multiplier for County, if selected	Selected Research Value (see Yellow table for value and alternates)
Item 3	$1,564.00	Result for County	Selected Research Value (see Yellow table for value and alternates)
Item 4	49%	Times direct and induced multiplier for State, if selected	Selected Research Value (see Yellow table for value and alternates -- for Item 4, farther right table)

Source: LIPPT – all NEB model dev'p, estimation, program work by Skumatz / SERA (as subcontractor to TecMarketWorks)

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LIPPT MODEL OPERATION

		AGENCY/UTILITY-RELATED BENEFITS: BENEFITS VALUED AT UTILITY COSTS AND SAVINGS			
☑	7A	Reduced Carrying Cost on Arrearages (interest)	10	10	$0
☑	7B	Lower Bad Debt Written Off	10	10	$41,918
☑	7C	Fewer Shutoffs	10	10	$2,751
☑	7D	Fewer Reconnects	10	10	$1,289
☑	7E	Fewer Notices	10	10	$26,018
☑	7F	Fewer Customer Calls	10	10	$12,203
☐	7G	Lower Collection Costs	10	10	$0
☐	7H	Red'n in emergency gas service calls	10	10	$0
☐	7I	Utility Health & Safety - Insurance savings only	10	10	$0
☑	7J	Transmission and/or distribution savings (distribution only)	10	10	$44,771
☑	7K	Utility Rate Subsidy Avoided (CARE) payments	10	10	$0
☐		Space for other entries			
☐		Space for other entries			
	Subtotal				$128,950
		SOCIETAL / PUBLIC / CITY BENEFITS: BENEFITS BEYOND UTILITY AND PARTICIPANTS			
☑	8A	Economic impact (direct and indirect employment) - National	1	10	$5,100,335
☑	8B	Economic impact (direct and indirect employment) - State	1	10	$0
☑	8C	Economic impact (direct and indirect employment) - County	1	10	$0
☑	8D	Tax impacts on County economic impacts	1	10	$0
☑	8E	Emissions / Environmental	10	10	$84,350

Source: LIPPT - Skumatz /SERA

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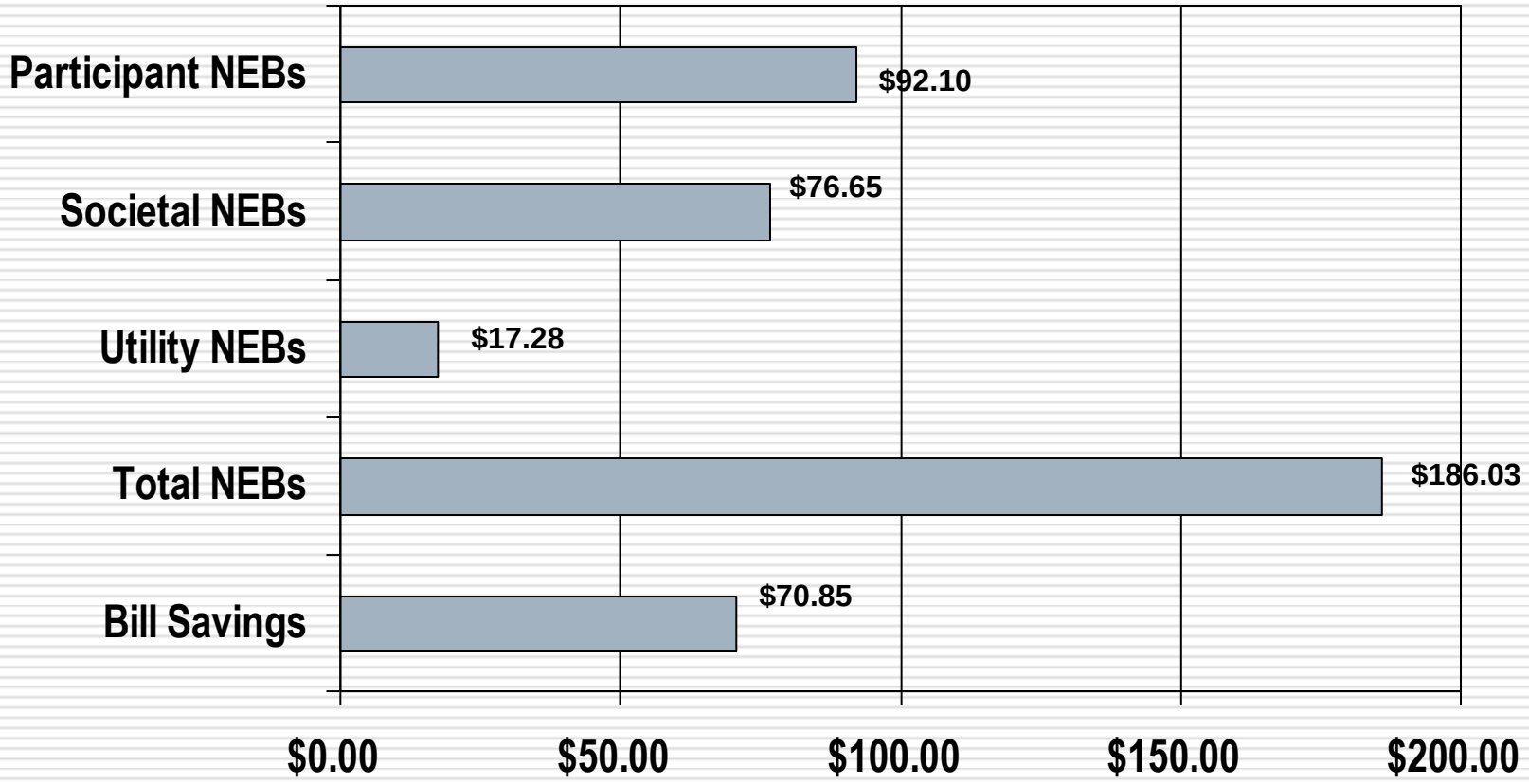
EXAMPLE NEB RESULTS FROM MODEL

50% Partic, 41% Soc, 9% Util; Total NEB mult=2.6



(Source: Adapted / updated From Skumatz, ACEEE)

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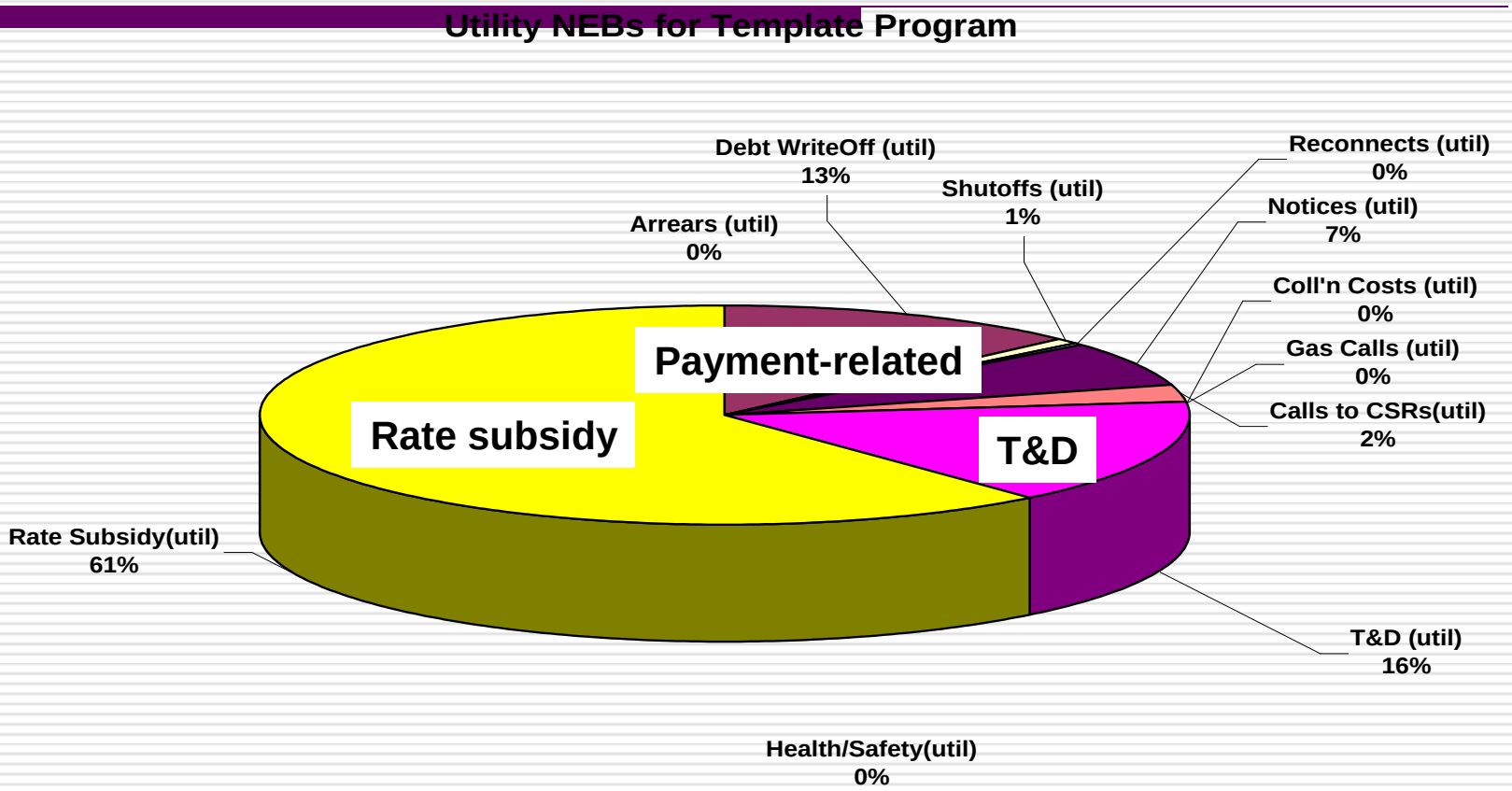
UTILITY NEBS EXAMPLE - LIPPT



(Source: Adapted / updated From Skumatz, ACEEE)

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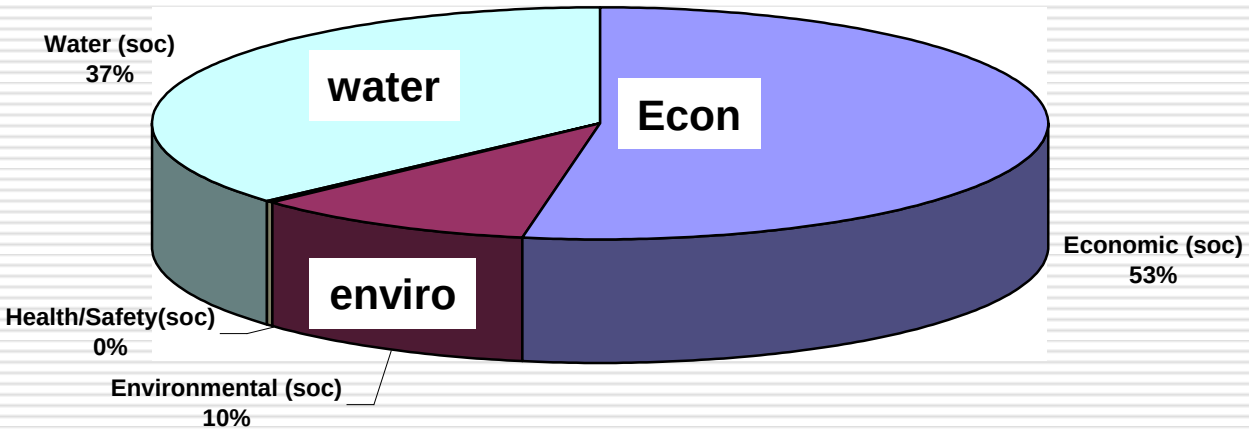
SOCIETAL NEBS – LIPPT EXAMPLE

Societal NEBs for Template Program



(Source: Adapted / updated From Skumatz, ACEEE)

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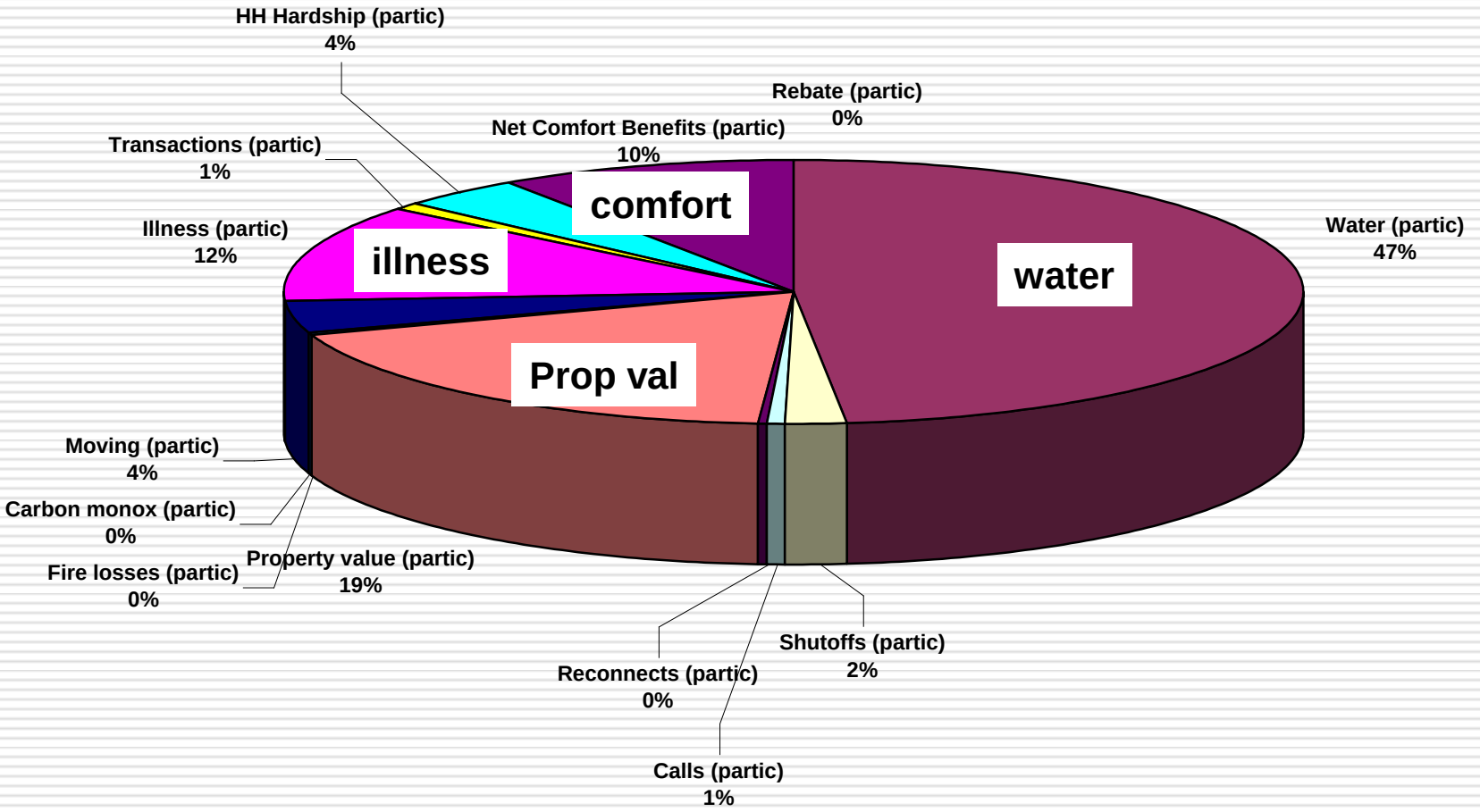
PARTICIPANT NEBS-LIPPT EXAMPLE

Participant NEBs for Template Program



(Source: Adapted / updated From Skumatz, ACEEE)

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WEAKNESSES OF CURRENT CA LOW INCOME NEBS MODEL

- Update data
- Need measure, not participant basis
  - Support unincluded measures
- Coordination / consistency / ease of use for scenarios & documentation
  - Work better with other steps, models
  - Consistency between utilities, consistency with protocols
- Incorporate climate zones
  - Weather-sensitive measures
- Incorporate regulatory tests
- Limited interest in societal; increased interest in participant
- kW; more than one avoided cost / year, more than 1 year
- Consider options beyond models
- Focus on fewer, more important NEBs

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RECOMMENDATIONS AND NEXT STEPS

RECOMMENDATIONS / NEXT STEPS (PART 1)

- Research on high/very high priority NEB categories
  - Relevant to low income, potentially high value, gaps in research
  - Primary / secondary research, surveys
- Create measure-based values for NEBs
  - Strategies listed; most straightforward, some need additional research

NEB VALUES RESEARCH PRIORITIES

Very High	High	Medium	Low
Relevant to Low Income; little work			Not relevant to Low Income, or well-known
•Health, IAQ (S, P) •Social / hardship (S, P)	•Health / days lost (P) •Stability / moves (P) •Prop value / neigh.(S, P) •H&S, fires, insurance (P, S) •Emergency calls (U) •Insurance (U) •Infrastructure	•Knowledge/control (P) •Subsidies (U) •Jobs (S) •Water (P) •Other bills (P) •GHG (elsewhere) •Participant effects (comfort, etc.) (PI •Negative effects	•Arrears-related •Fish / wildlife (S) •National security

U=Utility perspective; S=Societal; P=Participant

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STRATEGIES TO TRANSLATE TO "MEASURE" BASIS

Difficulty	NEBs Categ.	NEBs Categ.
Easy – *(kWh-related)*	•Arrears, financial •Subsidy	•T&D •Social indic.
Easy – *(kWh with possible peak/off-peak)*	•T&D, infrastructure / quality	
Easy – *(related to job income)*	•Tax effects – unemployment (S)	
Harder / "depends" *(threshold, measures, local economy – not direct relationship – "share out")*	•Water – infrastructure •Property value / neighborhood improvement	•Job creation •Emergency gas calls •Participant effects (comfort, etc.)
Complicated *(little data)*	•Insurance, H&S	•Health care
Possibly easy *(needs testing)*	•Financial calcs for lifetime, maintenance,…	

RECOMMENDATIONS / NEXT STEPS (PART 2)

- Survey with embedded tests, modules, comparisons
  - Identify "best" estimation methods / consistency
  - Comparisons
- Additional analysis in health & safety (multiple perspectives) Which measures, impact, value of effect;
  - Potentially will take engineering, inspections, health research, etc.
- Potential for deemed values for economics at state level (modeling)
- Peak / off-peak enhancements for some NEBs (T&D, infrastructure)
- Utilities define "hardship" and develop metrics and survey – Important – initial progress made
  - Independently estimated vs. survey
  - Goals-related

RECOMMENDATIONS / NEXT STEPS (PART 3)

- Revised, more user friendly, credible method of associated NEBs to measures
  - Possibly "deemed" tool or "adder" for some; some require measurement
  - Hybrid likely best
- Integrated steps / better-linked models
  - (E3, DEER, etc.)
- Whatever tool, add climate zones, missing measures, make multi-year, easier scenarios (settings in one place)
- Easy tracking / consistent settings between utilities
- Develop consistent list of which NEBs included for specific uses (more consistent values)
- Revisit appropriate B/C tests, computational integration

WRAP-UP - NEBS

- Effects are large
- Progress made – focus of literature / tracks at conferences
- Movement on uses by different utilities / regulators
- Some additional research needed to:
  - Make tools more practical
  - Make estimates more trusted
  - Integrate / better incorporate omitted effects into decisionmaking

PROJECT CONTACT INFORMATION

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