



Non-Energy Impacts of Energy Efficiency Measures and Programs

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Session Agenda

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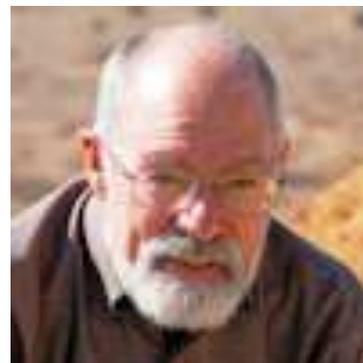
Chrissi Antonopoulos, PNNL

Non-Energy Benefits: Understanding the Imperative and the Opportunity

Skip Laitner, Economic and Human Dimensions Research Associates

Incorporating Non-energy Benefits and Community Goals into Utility Cost Effectiveness Framework

Brian Tholl, Fort Collins Utilities



What is a Non-Energy Impact?

- Impacts not directly, or commonly recognized as associated with energy production, transmission and distribution
- Impacts not easily quantified as cost or energy savings



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How Do NEIs Benefit Industry?

Utility	Participant	Society
<p>Shutoffs/Reconnects, Emergency service calls, transmission/distribution savings, power quality, etc.</p>	<p>Comfort, noise, health/safety, resilience, aesthetics, etc.</p>	<p>Economic development, tax effects, emissions, waste, national security, healthcare costs, etc.</p>



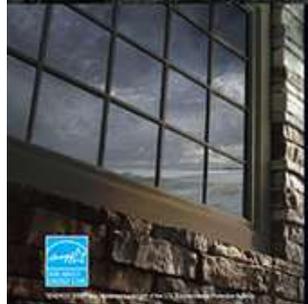
Industry Uses NEIs, Not Home Technologies

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Utility Programs Use NEIs Too...



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How Do Programs Value NEIs?

Technical Resource Manuals (TRMs) are the typical standard for valuing improvements to systems and materials. They typically include:

1. **Energy Savings Calculations:** Methods for determining energy savings, demand reductions, and environmental impacts for different types of efficiency measures.
2. **Program Design Guidelines:** Best practices and approaches for designing and implementing energy efficiency programs.
3. **Data Collection and Evaluation Methods:** Standardized processes for gathering data, monitoring, and assessing program performance.
4. **Technical Assumptions:** Pre-established assumptions about equipment performance, energy usage, and savings based on industry standards.
5. **Quality Assurance:** Protocols for ensuring accuracy and consistency in program implementation and reporting.

Program Benefits & Monetization

- TRM values are used to monetize upgrade benefits and justify program costs
- Typical approaches include cost/benefit analysis and return on investment (ROI) to value retrofit benefits.
- NEIs don't fit “nicely” into these types of assessments.

An Example: Air Sealing in New York

heat. Annual Electric Energy Savings, Summer Peak Coincident Demand Savings and Annual Fossil Fuel Energy Savings are calculated as below.

$$\Delta kWh = units \times \left(\frac{\Delta CFM_{50}}{F_n \times F_h} \right) \times (\Delta kWh/CFM)$$

$$\Delta kW = units \times \left(\frac{\Delta CFM_{50}}{F_n \times F_h} \right) \times (\Delta kW/CFM) \times CF$$

$$\Delta MMBtu = units \times \left(\frac{\Delta CFM_{50}}{F_n \times F_h} \right) \times \frac{(\Delta therms/CFM)}{10}$$

units = 1, from application

ΔCFM_{50} = 1,300, from application

F_n = 19, from Summary of Variables and Data Sources table

F_h = 0.81, from Summary of Variables and Data Sources table based on building type from application

$\Delta kWh/CFM$ = 1.5, from Appendix E based on HVAC type and city from application

$\Delta kW/CFM$ = 0.004, from Appendix E based on HVAC type and city from application

$\Delta therms/CFM$ = 2.4, from Appendix E based on HVAC type and city from application

CF = 0.69, from Summary of Variables and Data Sources table

$$\Delta kWh = 1 \times \left(\frac{1,300}{19 \times 0.81} \right) \times 1.5 = 126.71 kWh$$

$$\Delta kW = 1 \times \left(\frac{1,300}{19 \times 0.81} \right) \times 0.004 \times 0.69 = 0.34 kW$$

$$\Delta MMBtu = 1 \times \left(\frac{1,300}{19 \times 0.81} \right) \times \frac{2.4}{10} = 20.27 MMBtu$$

Calculations provide basis for valuing Air Sealing based on only two parameters:

- Energy savings
- Fossil fuel energy savings

No method for estimating NEIs.

NEIs are Missing from the Program Valuation Picture



Standard TRM valuation methods often don't "pencil" out.



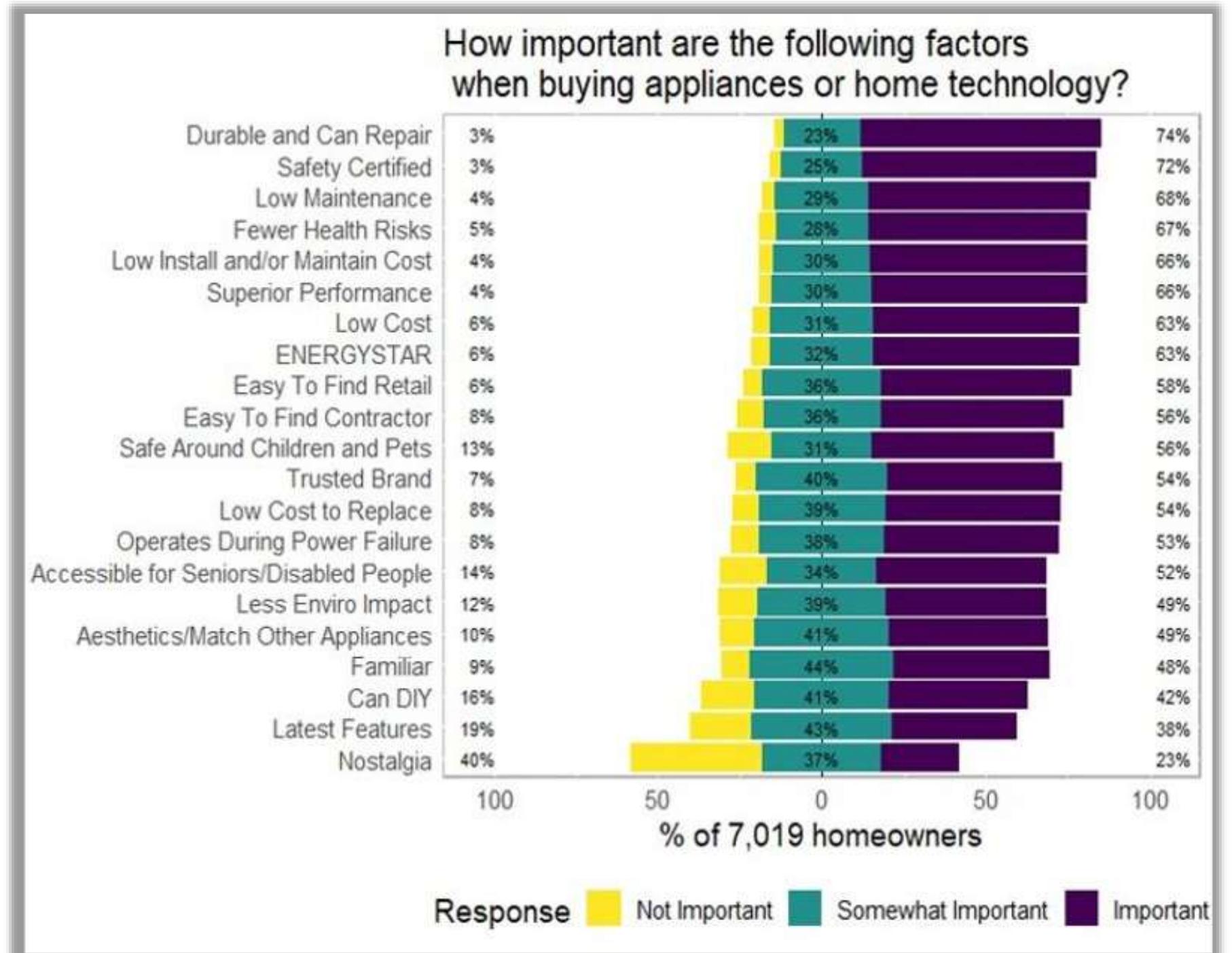
Cost/benefit ratios or ROI is often not favorable for supporting the measure.



Leaves a gap in "true" value of the upgrade

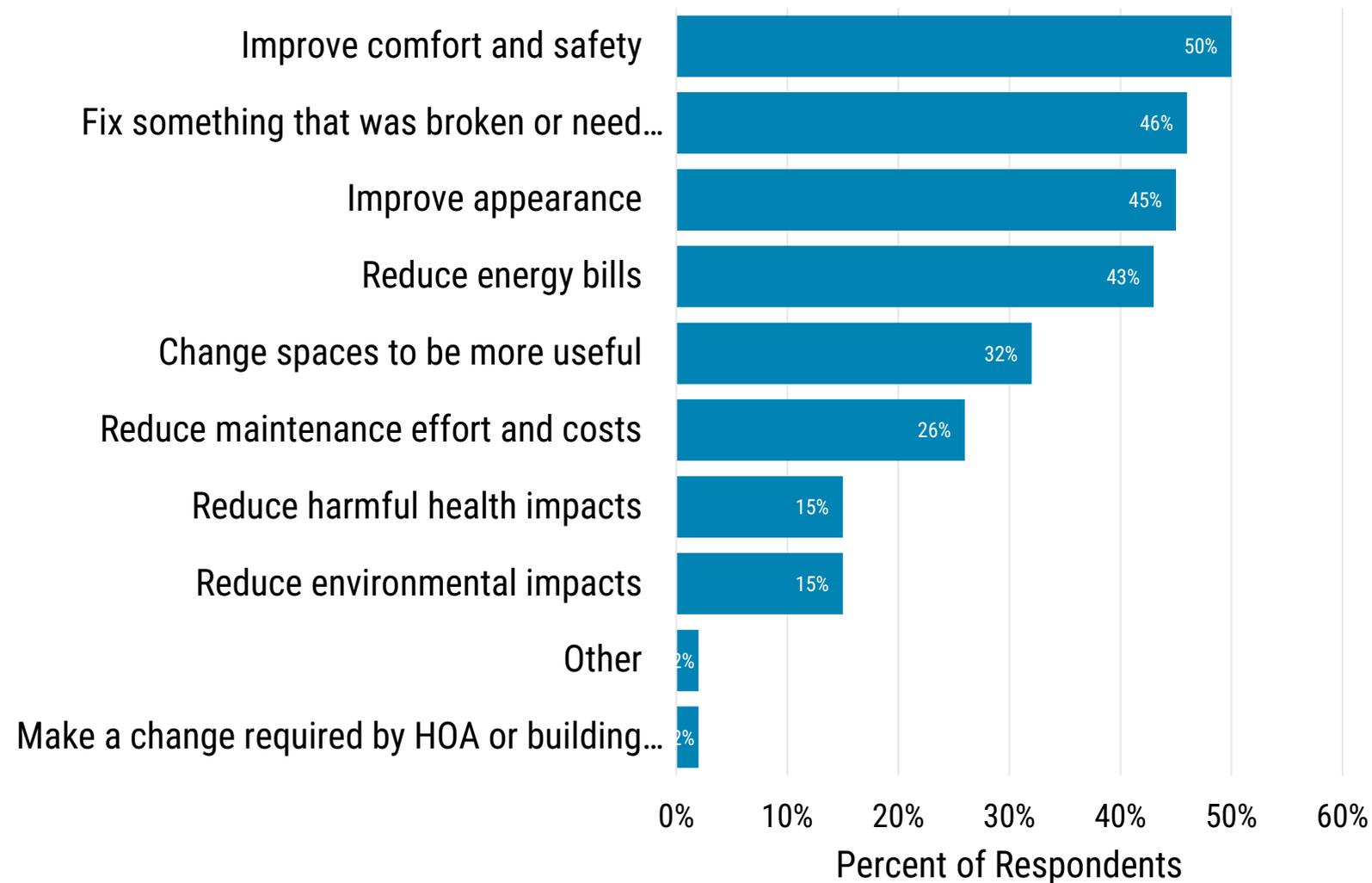
Households Place Significant Value on NEIs

- When buying new technologies, NEIs are more important than cost to average consumers, especially:
 - Durability/repairability
 - Safety
 - Low maintenance
 - Health
 - Superior performance



NEIs Can Be Big Motivators for Home Upgrades

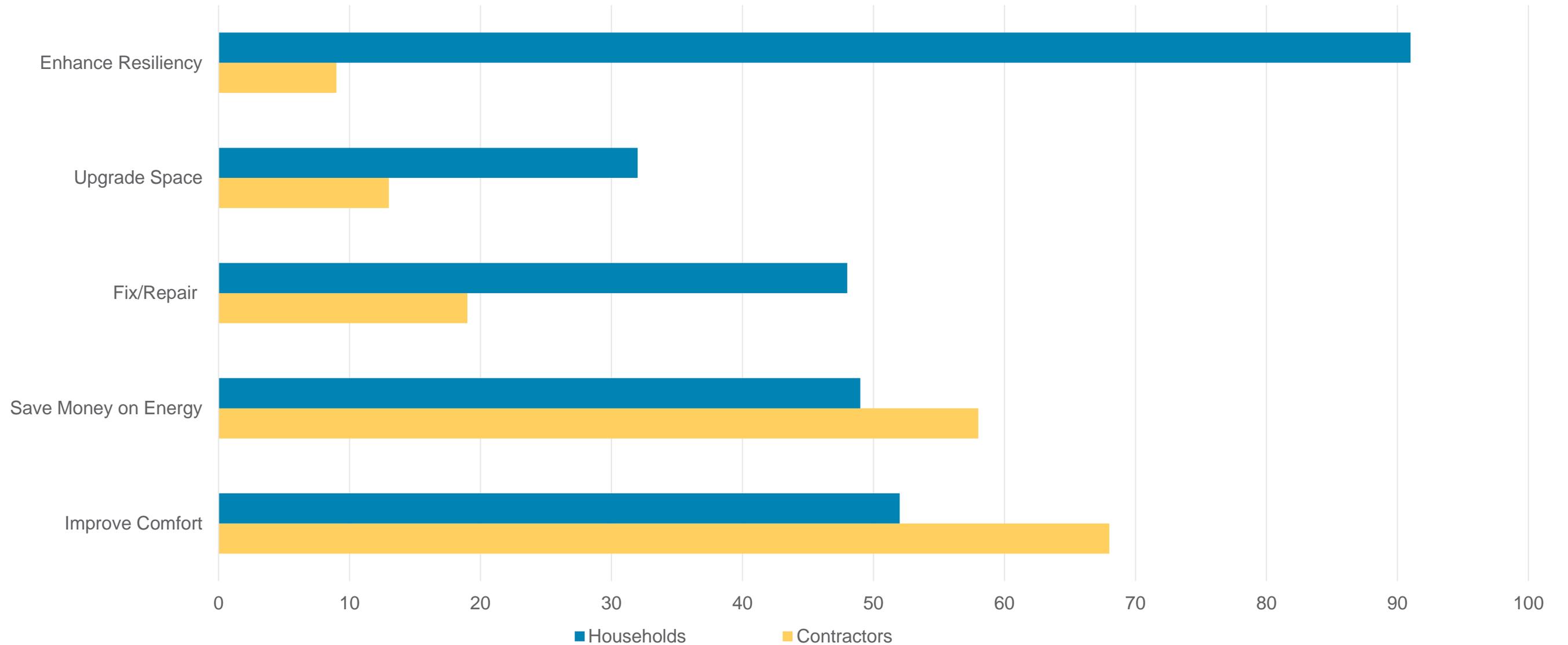
Motivations for Making Changes in their Home



- The most important motivators for making changes in homes:
 - Comfort & safety
 - Repairs
 - Improving appearance
 - Reducing energy bills

Households and Contractors are Misaligned

Household Motivations versus Contractor Perception of Household Motivations (%)



Consortium for Energy Efficiency Focus on NEIs

NEI Category	Definition
Comfort	Includes thermal comfort, noise reduction, improved light
Health and Safety	Includes improved well-being due to reduced incidence of illness, medical costs, sick days, deaths and insurance costs (e.g., from reduced fire risk)
Asset Value	Includes equipment functionality/performance improvement, equipment life extension, change in building value, change in ease of selling building
Productivity	Included changes in labor costs and productivity, waste streams, spoilage/defects, operations and maintenance, and changes in product sales as a result of changes in aesthetics, comfort, etc.
Increased Reliability	Value of reduced probability and/or likely duration of customer service interruptions from efficiency, which lowers loads on the grid
Environmental Impacts	The range of environmental costs and benefits that result from efficiency resources
Public Health	The range of public health impacts resulting from efficiency resources

Programs

The good news:

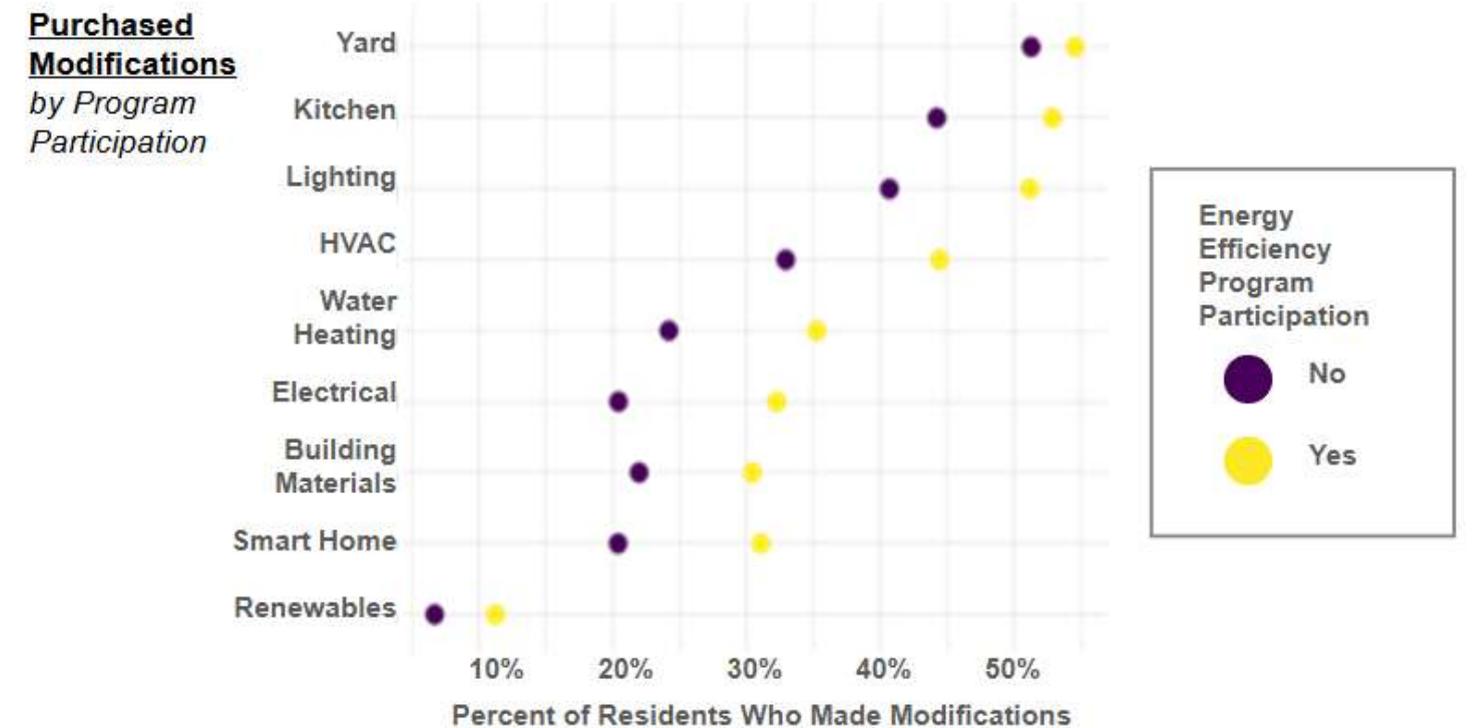
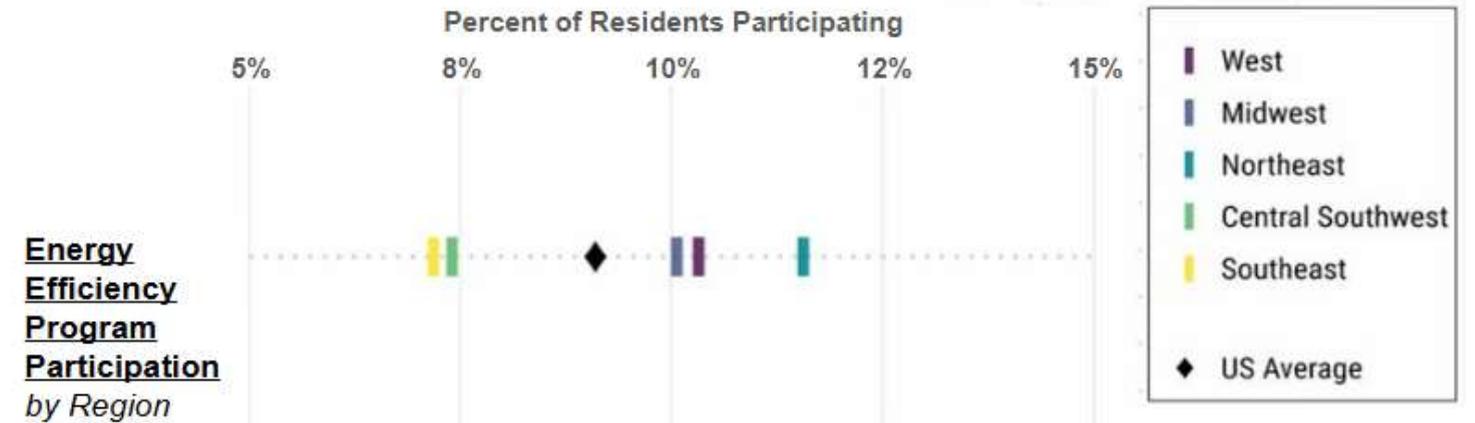
- Programs work! More people make modifications when they participate in energy efficiency programs compared to those that don't.

The bad news:

- Only 9% of occupants participate in programs nationally. Some regional variation is observed.

The opportunity:

- Develop consistent, market-facing NEI quantification methods to inform Americans about the benefits of resilient housing.



Why Develop NEI Calculation Metrics?

- Individual analyses are expensive
- Methods and data are often kept in a black box
- Methods are not necessarily replicable between entities/organizations
- Many outcomes end up as apples-and-orange comparisons
- Lack of standard approaches for Technical Resource Manuals (TRMs) and other important programmatic and technical documentation
- Energy savings alone does not “sell” EE – need better quantification methods

Approach

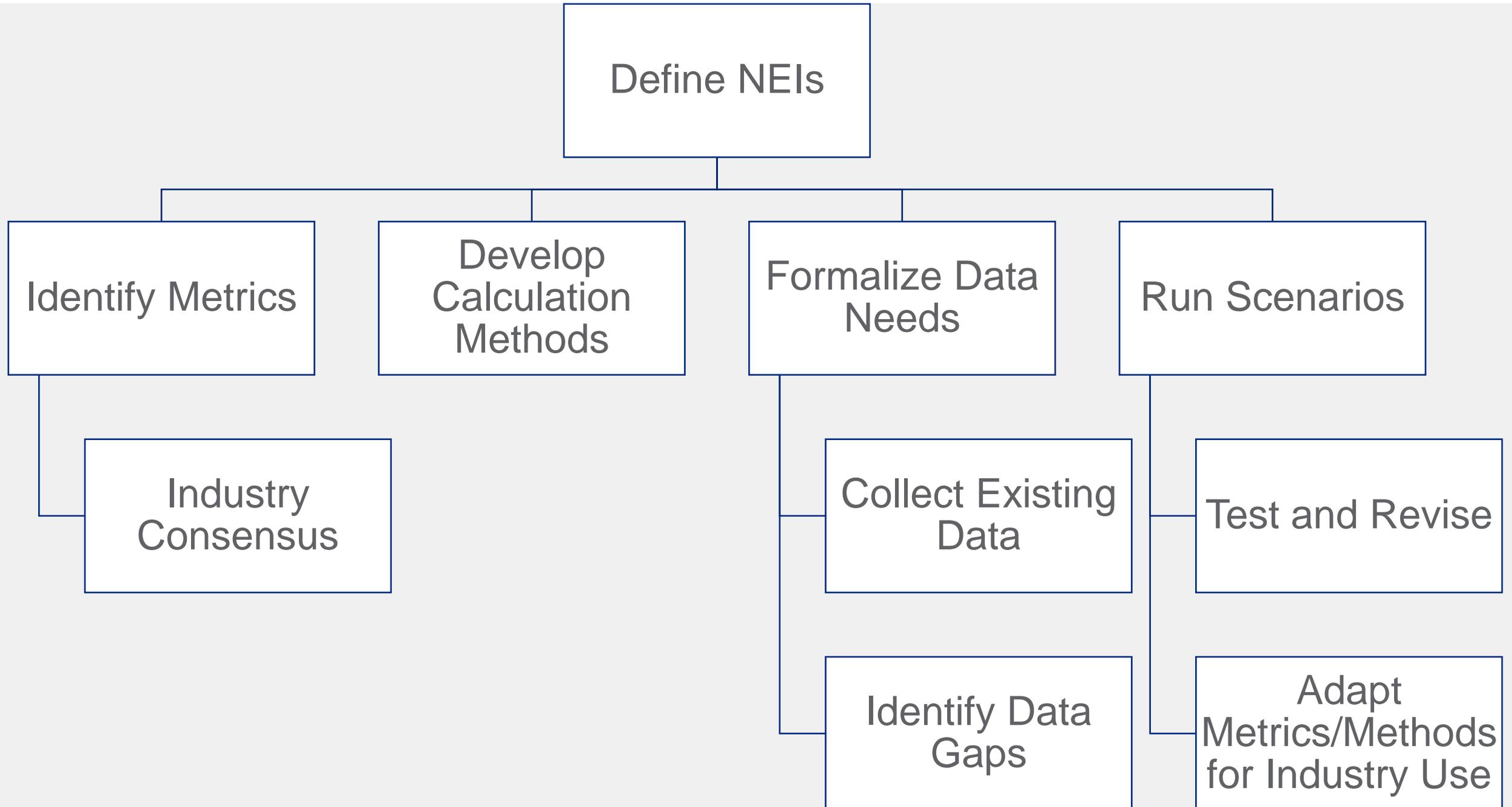
Initial NEIs of Interest:

1. Thermal Comfort
2. Noise
3. Health
4. Resiliency

Prioritization Criteria:

- Transferability
- Quantification
- Driver of Program Participation
- Magnitude
- Evaluation Cost
- Transferability
- Data/Research Availability
- Time Horizon of Impact

Where to Start

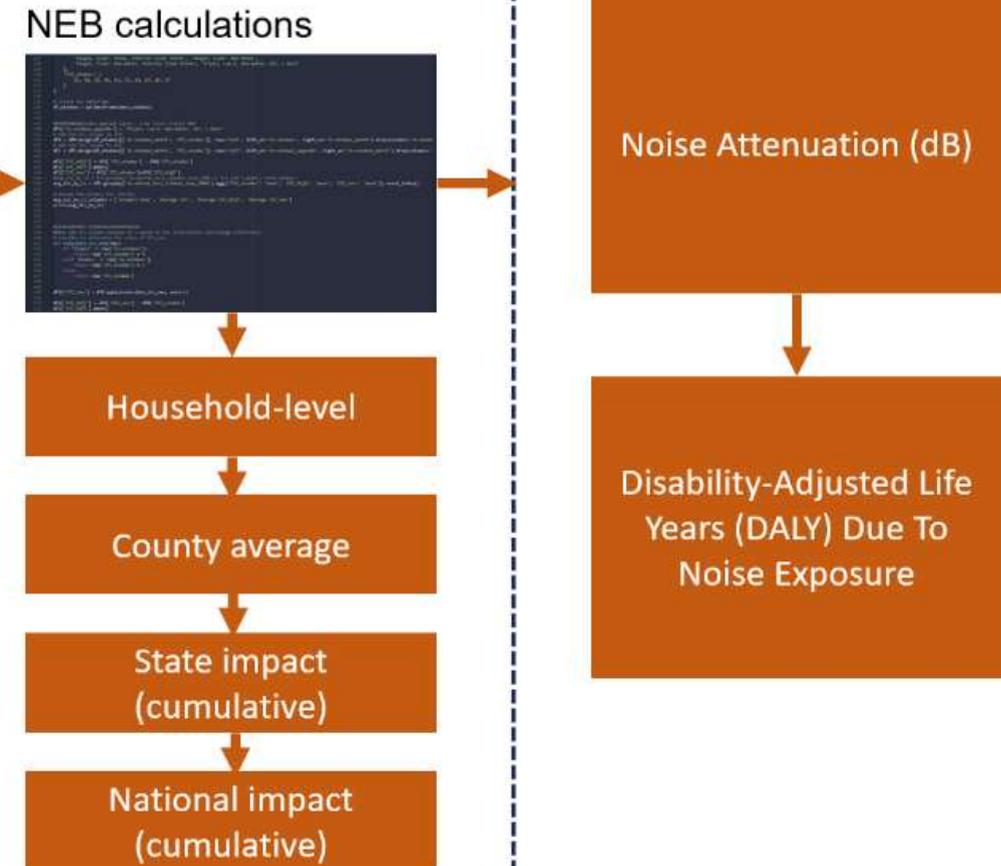


Example Workflow: Noise

Inputs



Outputs



Thank you

