



DRIVING TRANSFORMATION

Behavior, Energy & Climate Change (BECC) / November 12-15, 2023 / Sacramento, CA

Co-Convened by

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Environmental and Energy
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ACEEE ::

You Don't Always Get What You Measure: The Importance of Non-Energy Benefits

November 15, 2023

Miya Kitahara, StopWaste

Ann Gibbs, Skumatz Economic Resource Associates

Elizabeth Schussler, The Recycling Partnership

Thomas Decker & Christian Mergel, Weihenstephan-Triesdorf University of Applied Sciences

Convened by:

What could be better than MTCO_{2e}? Seeking more effective metrics

November 15, 2023

Miya Kitahara, StopWaste

Convened by:

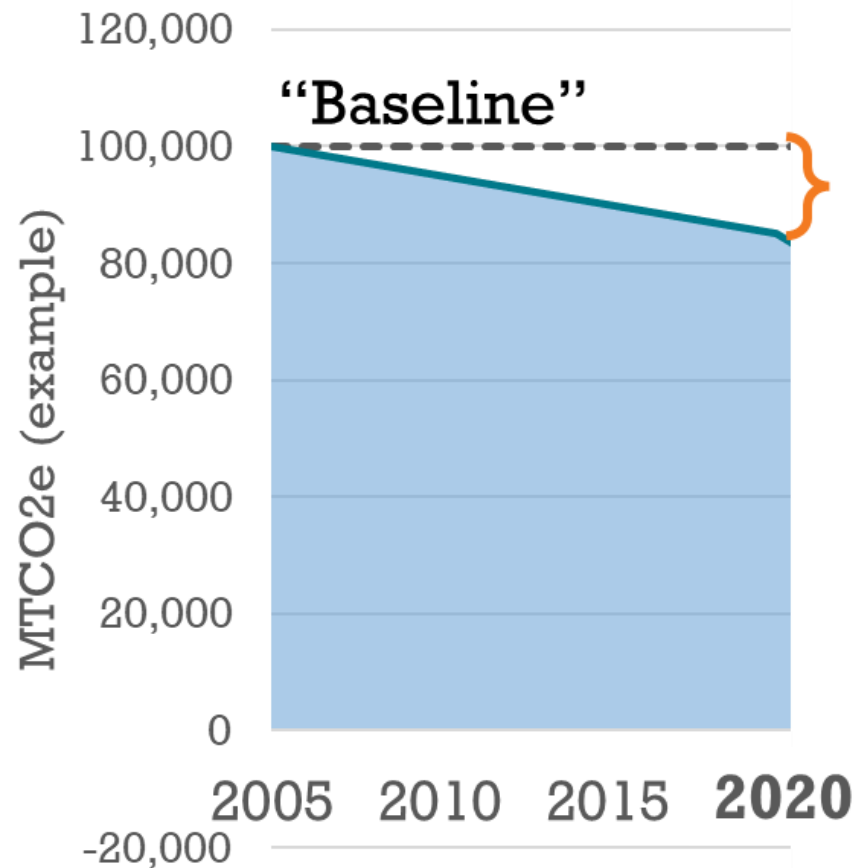


What is one
MTCO_{2e}
?



An Inflection Point: from Incremental Reductions to Comprehensive Transformation

Change We Can Barely Measure

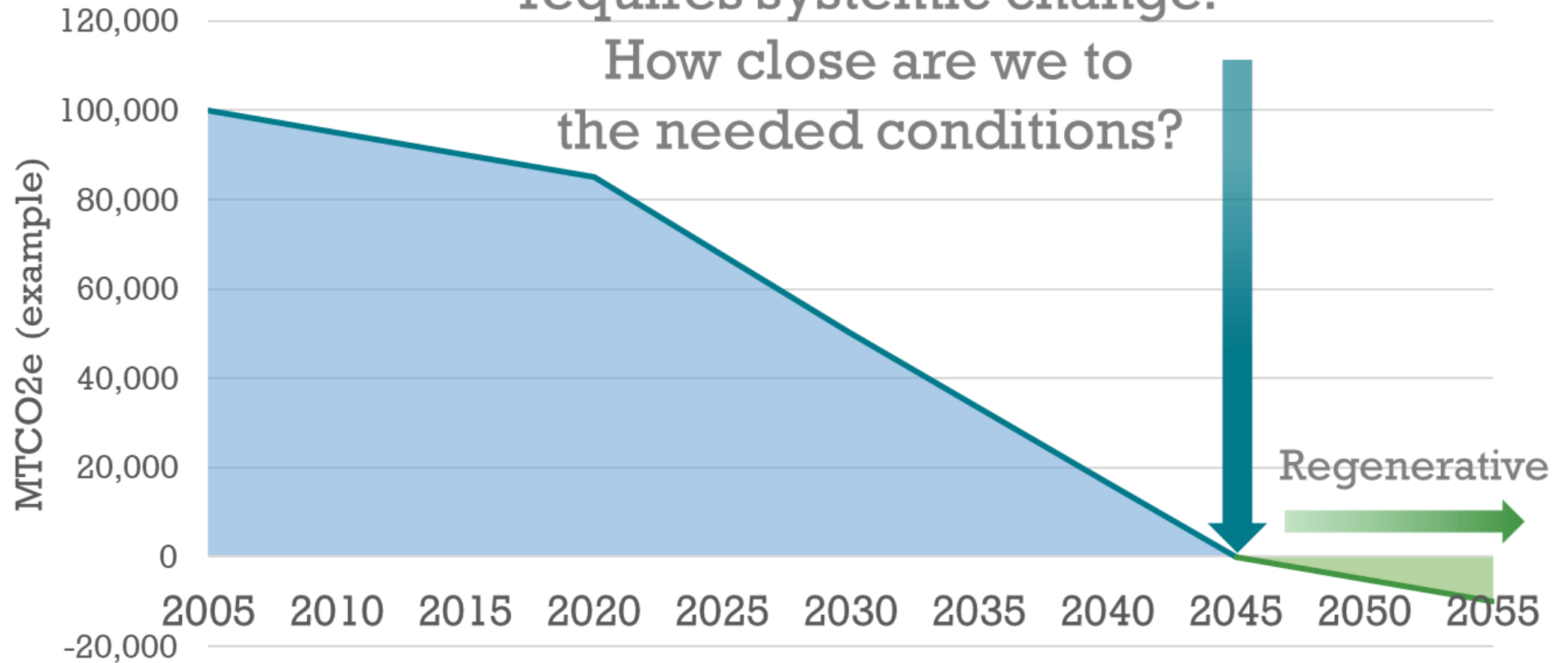


With an incremental goal e.g. 15% “below baseline” the **exact MTCO2e** matters a lot, and what’s **in** the baseline matters a lot.



Change We Can't Deny

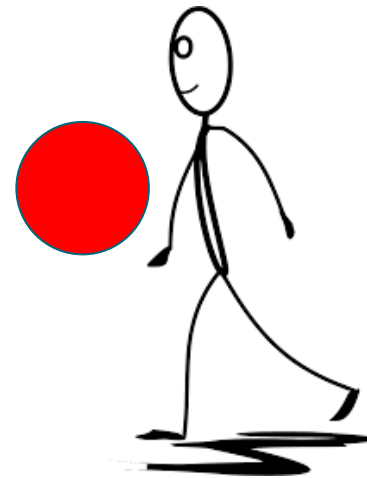
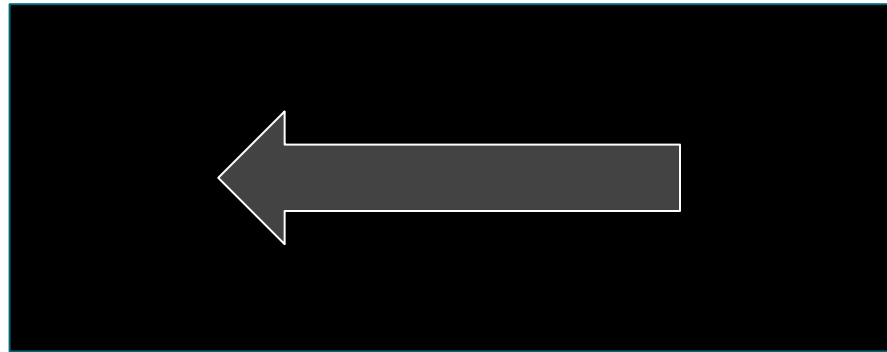
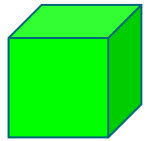
A "neutrality" goal
requires systemic change.
How close are we to
the needed conditions?





Evolving Our Metaphors: from Individual Attribution to Collective Contribution

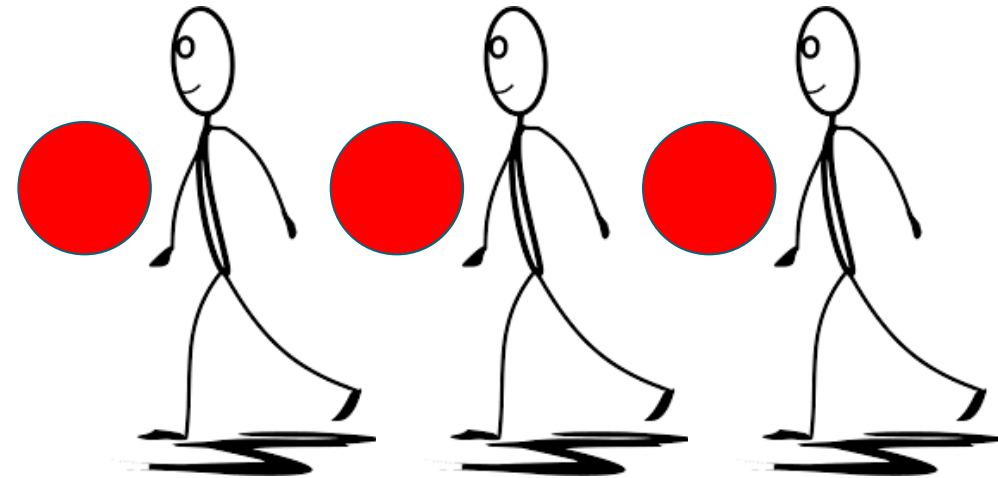
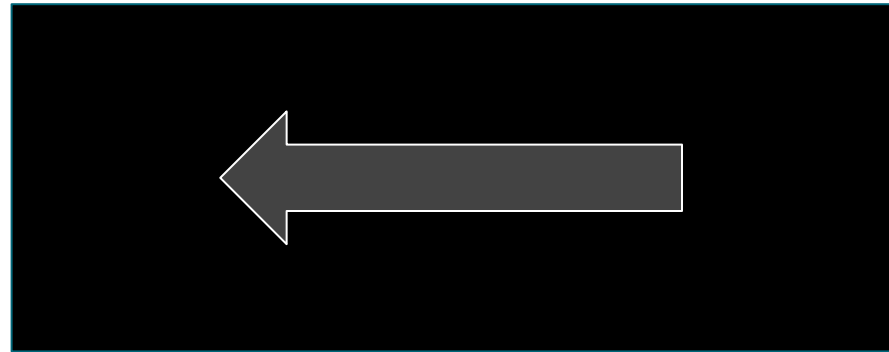
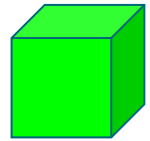
Intervention as a Machine



“My Rebate”



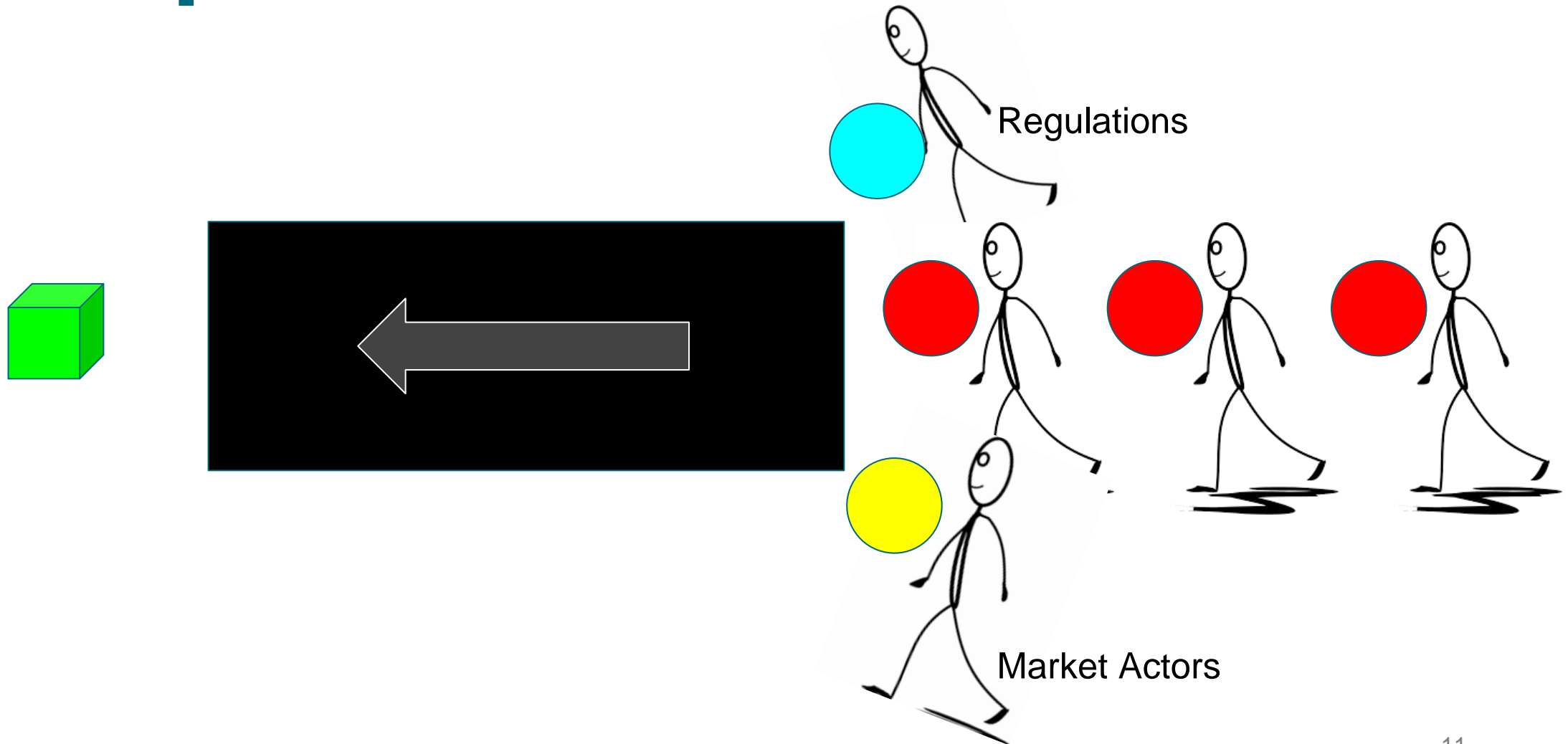
Intervention as a Machine: Layering Rebates + Incentives



Many Rebates



Intervention as a Machine: Full Spectrum of Interventions



Intervention as Ecosystem

- Complex interactivity
- Impacts beyond our borders
- Measuring system health & capacity to evolve



Intervention as Ecosystem Consequences > Direct Impacts





Relatable and Actionable: from Intimidating Data to Compelling Storytelling

What We Care About

- Healthy environments
 - Outdoor air pollution
 - Indoor air pollution
- Safety & convenience
 - Active mobility & transit
 - Access to daily needs: jobs, schools, shops, parks
- Economic security & livelihoods
 - Percent of GDP in extractive economies
 - Percent of jobs reliant on fossil fuels
 - Cost of living, housing, & healthy options

Summary

| From | To |
|--------------------------------|--------------------------------------|
| I ncremental reductions | C omprehensive transformation |
| I ndividual attribution | C ollective contribution |
| I ntimidating data | C ompelling storytelling |

an **I**nvitation to **C**o-Create

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SERA

Advancing Program Evaluation with Measure- Based NEBs/NEIs

BECC November 15, 2023



Best programs & approaches, tradeoffs analyzed statistically



Recycling Data & Economics



Models: NEB-It



CO SWANA board, NRC Awards Committee



Measuring Hard-to-Measure metrics including Social TBL



PAYT and Rates



SERA - 150+ publications



Residential & Commercial Recycling, Organics & reduction; Contamination strategies



Ann Gibbs

SKUMATZ ECONOMIC RESEARCH ASSOCIATES

POLL QUESTION

What is not the focus of NEB/NEI studies?

- A. Energy savings for participants
- B. Impact on the environment
- C. Health & comfort benefits to participants
- D. Utility operation cost savings

NON-ENERGY BENEFITS (NEBs) / NON-ENERGY IMPACTS (NEIs)

- Net NEBs/NEIs – positive & negative effects beyond energy savings from energy efficiency measures
- Utility, Participant, Societal
- Units (\$, %, period)
- Uses of NEBs/NEIs:



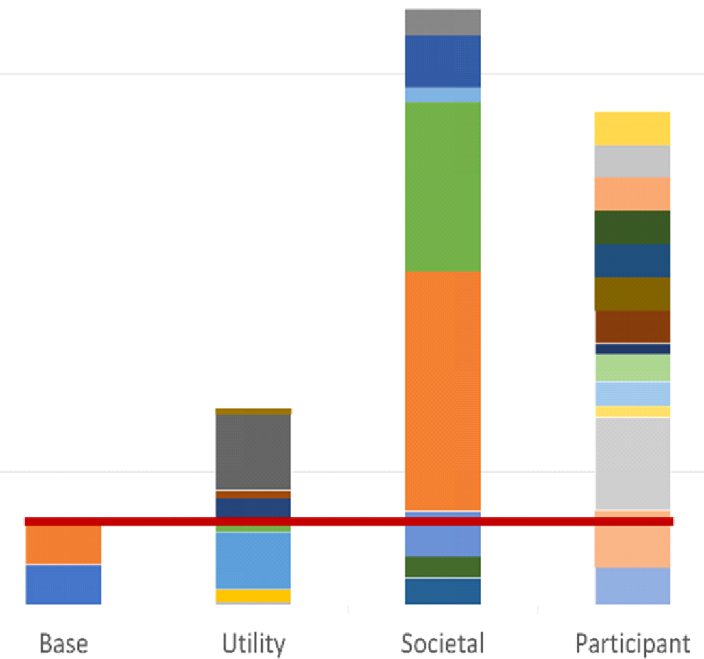
PROGRAM WIDE NEBs/NEIs

- Originally used for Low-Income programs
 - Policy goals related to hardship and do good elements
- “Batches” of measures
 - Lighting + air sealing + insulation +etc.
 - Can't tease out results from individual measures
 - Transferability – need similar measures mix and uptake, climate, target populations
 - Reporting and units

LOW INCOME NEB RESULTS

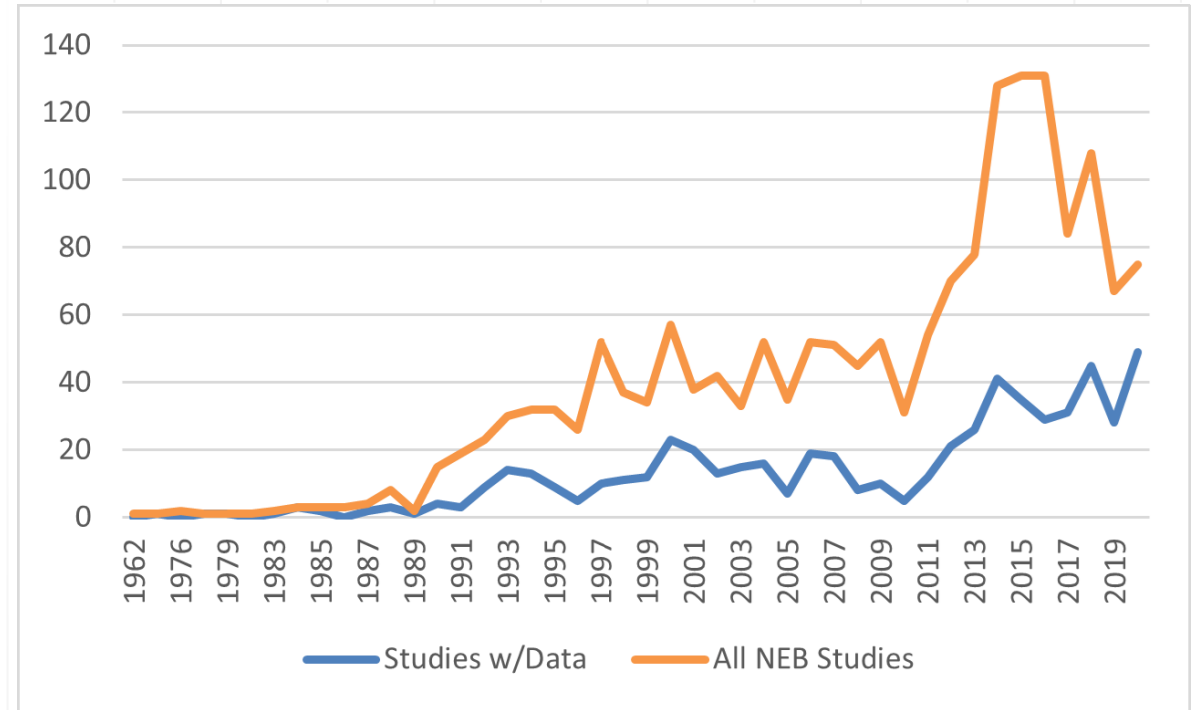
- Substantially More than the value of the energy savings – especially participants
 - P- Comfort, health effects, understanding and control of bill, reduced fires (gas leaks)
 - U- Arrearages, bad debt, shutoffs/reconnects, low-income rates
 - S- Job creation, emissions (deaths and illness)

Typical 30% adder



NOT JUST FOR LOW INCOME

- But aren't NEBs "Hard to Measure?"
 - Low income programs gave us the tools
- NEBs/NEIs can be applied to multiple programs
 - Non-Low income, Multi-family, Commercial
 - Cost-benefit analysis, program and measure screening, and marketing
- A lot of research in the last 25+ years
 - Res, C&I, R&D, solar, wind, etc.
 - "Program-wide" NEBs do not have enough granularity



Source: ©Skumatz / SERA

WHY THE EVOLUTION TO MEASURE BASED NEBs?

- Most obvious in the commercial sector
- What does an “average” participant installation look like – if there even is one!
- Variation in measures installed
- NEBs vary in type, category, and size
- Transferability advantages – specific map/mix of measures, adaptable to size of participant, measures installed, and saving achieved, mix and match
- Measure-based NEBs form a better basis for “forward looking” NEBs, more literature is better

WHAT IS NEEDED FOR MEASURE BASED NEBs?

- Utility Program Participation/Tracking Data – who received which measures
 - Either one measure or very distinct measures (only one HVAC and one water heating or lighting, etc.)
 - If any measures were generally delivered in a linked way, (pipe wrap and tightening or insulation)
 - Multiple measures that would lead to the same effects (comfort)

HOW TO CALCULATE MEASURE BASED NEBs?

- Direct (participant company records, labor costs, productivity etc.)
- Secondary or financial (change in incidence * value from secondary source)
- Models (largely jobs / econ and societal health / emissions)
- Survey-based
 - Willingness to pay (WTP/WTA) Labeled Magnitude Scaling (LMS)

WTP AND LMS

- WTP – “How much are you willing to pay for X”
 - Difficult for most to assign a value
- LMS – “More or Less valuable than X”
 - Comparison value concept LMS
 - We know the value of X
 - Literature to help translate the labels into multipliers
 - Also ask overall value and scale results (usually down)
 - Specialized surveys

WIFI & SMART THERMOSTAT NEBs/NEIs

- New SERA Research - Not utility-based study (CT, MA, NH)
- Survey:
 - Multi-purpose, at-large surveys, screener, 369 responses, web, cleaning
- LMS & incidence
- List from literature

WIFI & SMART THERMOSTAT NEBs/NEIs

| NEI | % savings |
|----------------------------------|-----------|
| Comfort | 26 |
| Asthma* | 4 |
| Cold symptoms* | 7 |
| Missed time from work* | 22 |
| Missed time from School* | 27 |
| Noise from inside home | 14 |
| Installation / ease of operation | 22 |
| Aesthetics | 21 |
| Safety | 21 |
| Doing good for environment | 25 |
| Total | 189% |

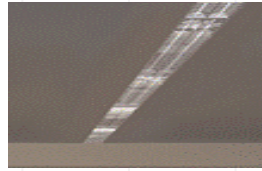
- Net NEB multipliers
- Wi-Fi and smart thermostats compared to older programmable thermostats
- High values: Comfort, Health
- Barriers (negative NEBs):
 - Comfort – ability to control / override / get immediate response
 - Noise – equipment cycling
 - Aesthetics – visible, lighting up

* Incidence calculated NEB

NEXT GEN LEDs

- Study for DOE and PNNL
- Assign a dollar value to indicate the extra amount that purchasers might be willing to pay for LEDs with specific advanced features
- Model - changes in market share for new technologies and resulting changes in energy use from the adoption of advanced LEDs in the future
- LMS and WTP

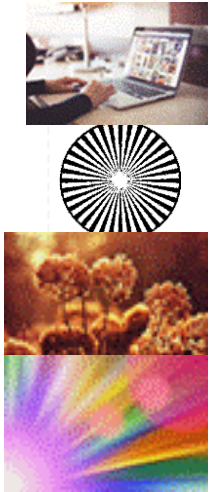
SECTORS AND FEATURES OF INTEREST



| Feature | Commercial 4' Linear | Residential Lamps | Street/Roadway |
|---------------------------------|----------------------|-------------------|----------------|
| Glare | ✓ | | |
| Flicker | ✓ | ✓ | |
| Color Rendition | ✓ | ✓ | ✓* |
| Adjustability (intens. & color) | ✓ | ✓ | |

Methods

- LMS
- Ranking & value



Survey responses

184+400+104

104+400

79

**Streetlighting - Color, warmer, no blue, human visibility, wildlife, night sky, 50% higher LER/80% LER/ 10% EE*
 Near- and longer-term variations in the technologies; Price and EE variations compared to baseline

Sources of benefits: occupant comfort, productivity, tenant calls, comfort, daily rhythm/sleep, human safety, animal protection, other

Source: Skumatz, et al, 2019, "Study of the Value of Advanced LED Lighting Features", included as Appendix B in Ledbetter, et.al. "Energy Saving Opportunity from Advanced LED Research, October 2019.

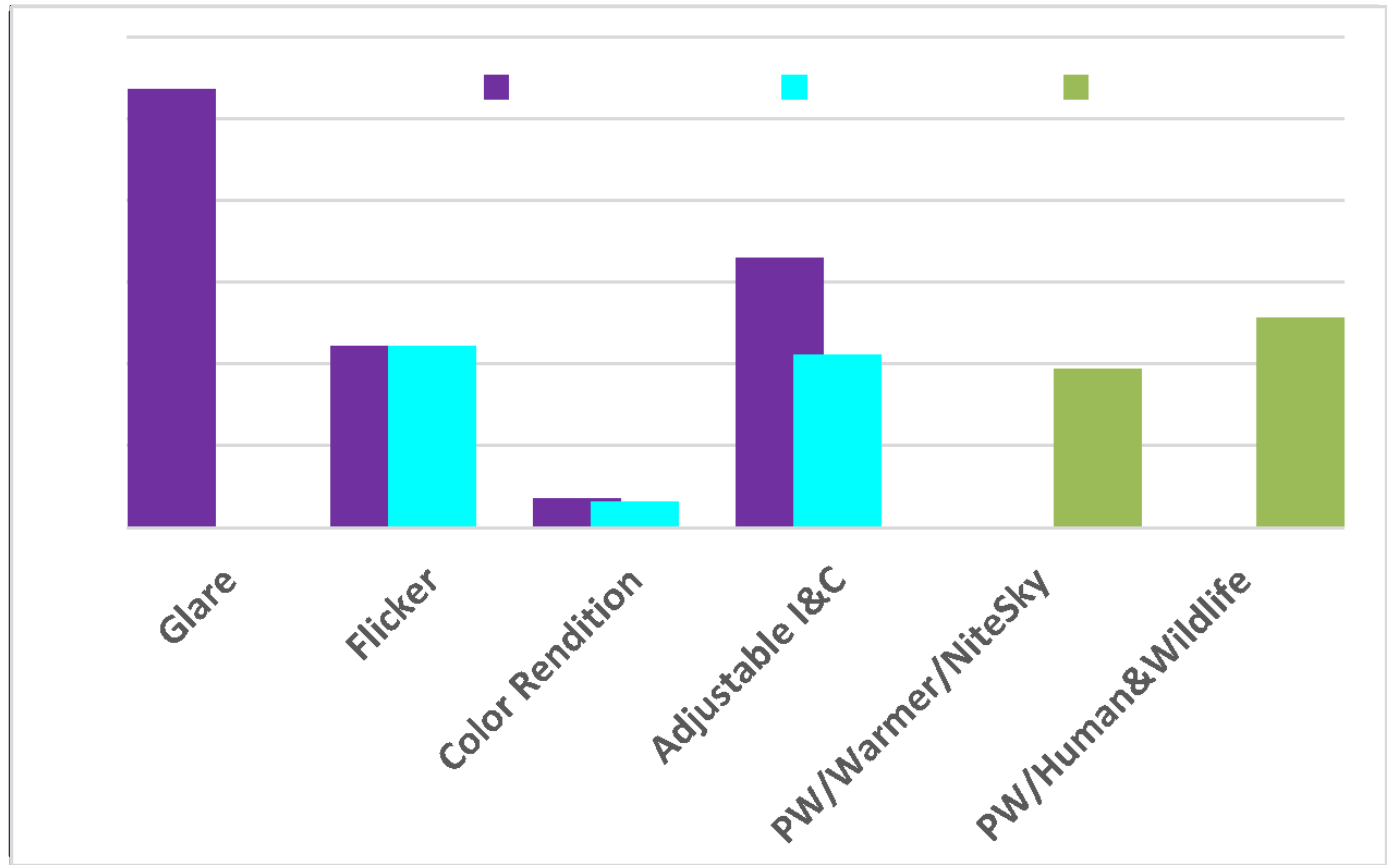
NEXT GENERATION LEDs

SERA

Feature Rankings / Relative Premiums (extracting EE/Price components)

Uses:

- R&D-rank
- ROI – WTP vs. cost
- Pricing – value-related



Value from multiple
features are *not*
additive

SUMMARY

- SERA's "NEB-It™" database and model
 - 1800+ studies, 44,000 NEBs and NEB Inputs
- Recent study for a utility – able to match 77% of the measures in their program portfolio
- Program wide nebs very useful for multiple uses (b/c, marketing, roi, etc)
- Measure based nebs more flexible but can be more complicated to measure in some cases (mix & match, forward looking)
- Need good reporting and units for transferability
- Measure based NEBs are measurable both for current and next generation technology

THANKS!

Questions?

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BECC 2023

Recycling: A Classic Intention-Action Gap

Elizabeth Schussler
*Sr Dir Social Change, Behavior &
Impact*

11/15/23



**The Recycling
Partnership**
Solving for Circularity

We mobilize people, data, and solutions across the value chain to reduce waste and our impact on the environment while also unlocking economic benefits.

SHOW OF HANDS

Raise your hand if you agree with this statement

“Recycling has a positive impact”

When It Comes to Recycling, There is a SAY-DO Gap

8/10 believe recycling has a positive impact



15M residential tons go unrecovered each year due to behavior gaps

63 million metric tons of carbon dioxide
17,500 jobs and \$834 million in landfill savings.



Our Data Highlights the Urgent Need to Effectively Support People



People Support Recycling, But They Are Confused

Half say plastic bags go in household recycling when that is true in only 2% of programs.

Recycling Matters, But Confidence Is In Decline

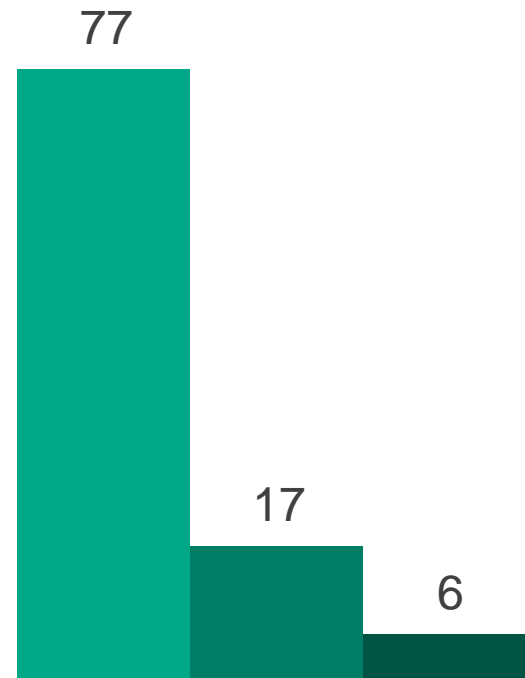
Less than half believe their recyclables are made into new things.

Communication, From Purchase To Disposal, Is Critical

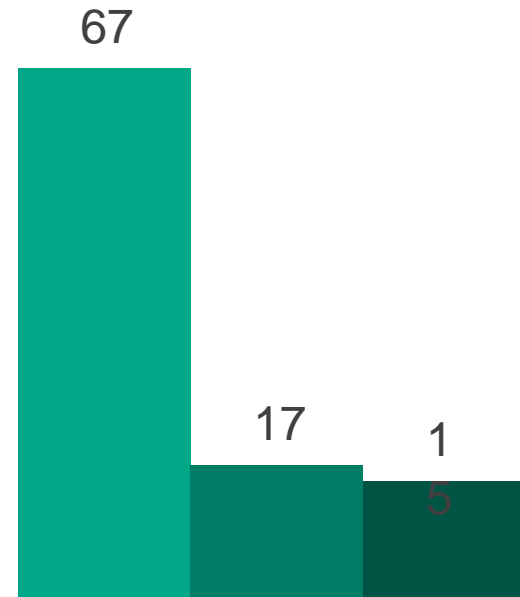
75% don't recall communication about their recycling program.

The Idea of Recycling Resonates. The Reality of Recycling Is Unclear.

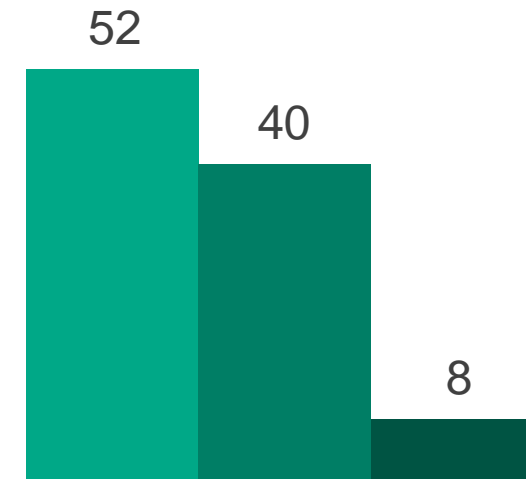
Most think recycling **makes a difference**



Most think recycling is **worth the effort**



Only **half** believe items they recycle are **made into new things**



YES MAYBE NO



The Recycling Confidence Index

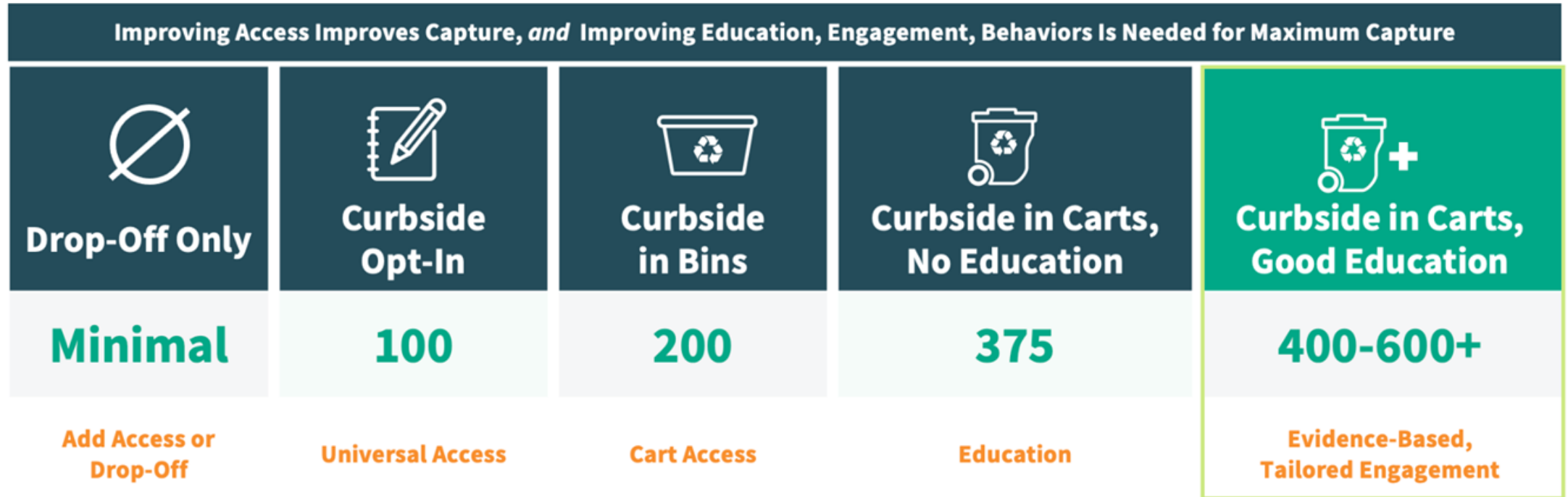
This inaugural **Index** is based on national qualitative and quantitative research

It will track **confidence over time** and identify influential factors



We Must Clear the Way for People to Act

Single-family households generate an average of **750-800lbs of recyclables each year.**

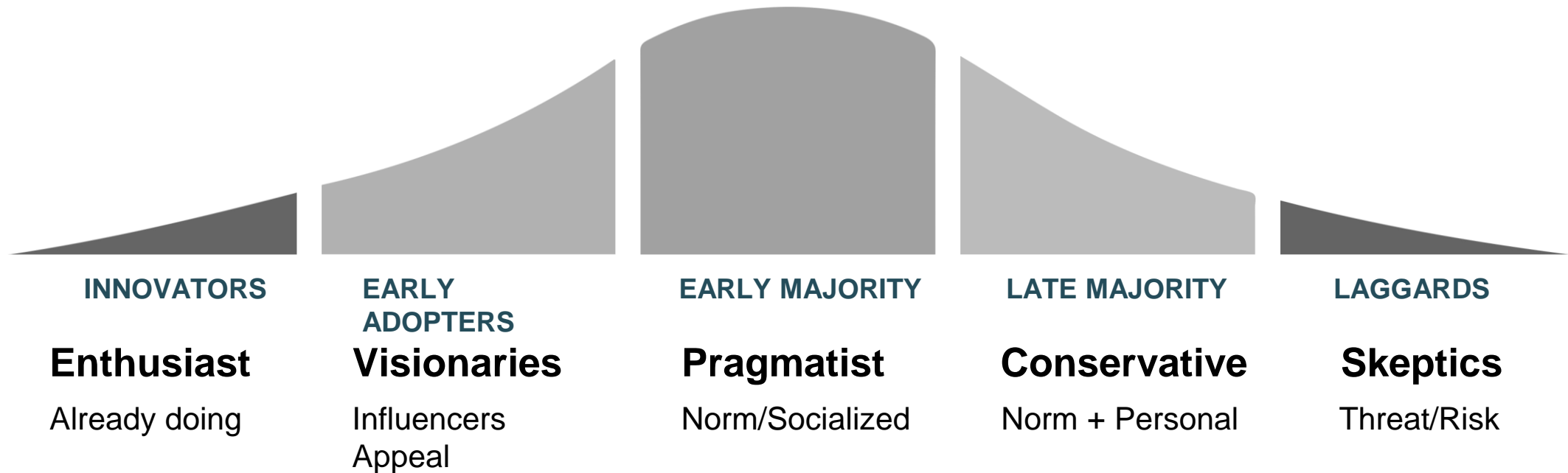


THE STANDARD ADOPTION CURVE

Some people are eager, attentive and engaged.

Others wait until it looks and feels like the norm.

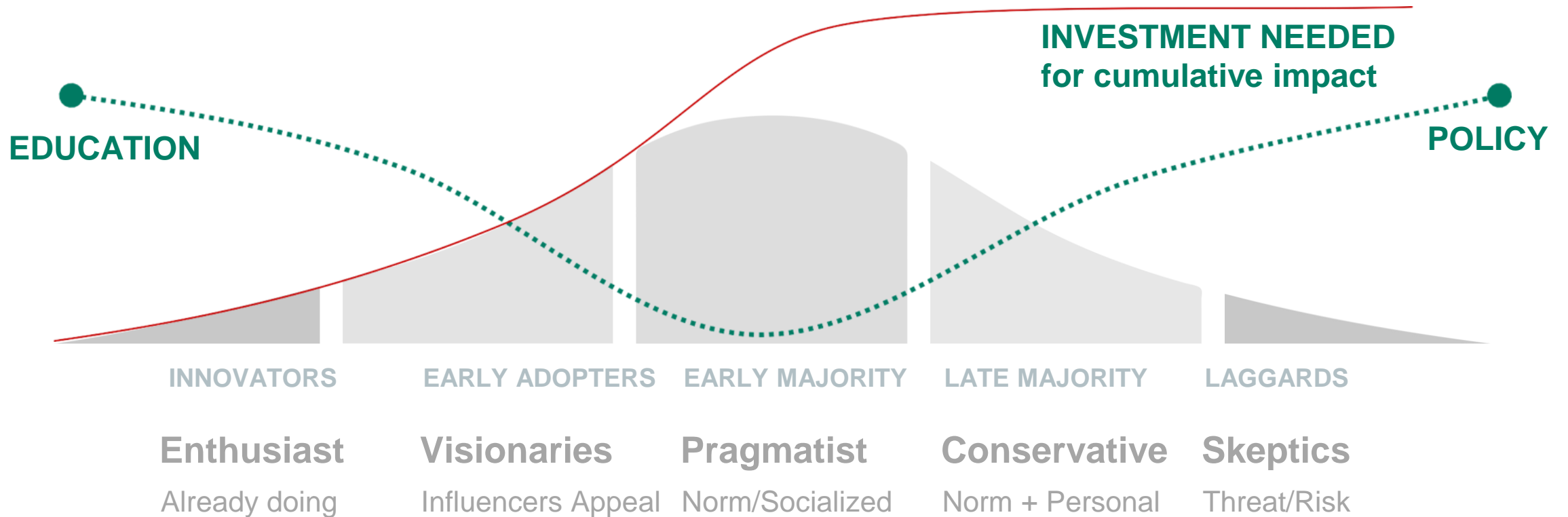
Some need to be held accountable, feel threatened.



Based on the work of Everett Rogers

ENGAGEMENT AND THE INVERSE OF REACH

Typical outreach and mandates address the ends of the spectrum, but the "movable middle" needs more engagement, social proof, personal reasons. Investment will have cumulative impact.



Based on the work of Everett Rogers, Geoffrey Moore, and Nancy Lee

Segmentation Identified 5 Groups, Each With A Few Key Traits (Single Family, Curbside)

49% Dedicated

51% Frustrated, Confused, & Less Dedicated



25%

Eco
Activators



24%

Committed
Followers



18%

Discouraged
Self-Doubters



16%

Detached
Abiders



16%

Conflicted &
Overwhelmed

Motivational Messaging Informed by Audience Segmentation



Top Messages



Empathy "We get it. It can be confusing."




Logic "Recycling makes sense."



Emotion "We have to do better!"

Demonstrated Success in Reynoldsburg, OH

38% 

Increase in average route tons when provided with empathetic messaging

Takeaways

- 1** Motivational messaging matters.
- 2** Empathetic and emotional messages both yielded statistically significant increases.
- 3** After we replicate this study, we will create free resources for communities to use.

Recent Research and Pilots: Identifying Key Trends, Motivations, and Barriers

~10,000 surveyed ~ 80+ interviews

23 interventions 7 jurisdictions 52,127 households

Audience Segmentation

Equity Gap Analysis


Confidence Index

U.S. BIPOC

Ethnography

Packaging / Labeling

| | Motivational Messaging | Motivational Interviewing | Educational Messaging | In-home Bins |
|--|------------------------|---------------------------|-----------------------|--------------|
|  Chicago, IL | • | | • | • |
|  Reynoldsburg, OH | • | | • | |
|  Hammonton, NJ | | • | • | |
|  Collier County, FL | | • | • | • |
|  Baldwin Park, CA | | | • | • |
|  Elgin, IL | | | • | • |
|  Cincinnati, OH | • | | • | • |

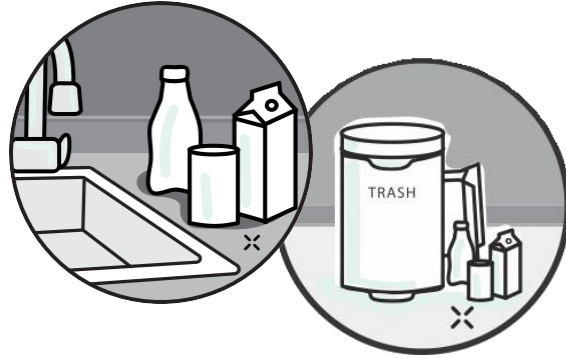
 Sarasota County, FL. Case study their high participation, capture, and quality.

Supporting In-home Recycling Behavior - Collection Styles? or Material Flow?

COLLECTION STYLES:

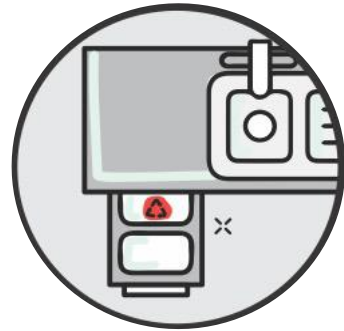
1 CENTRALIZED, BIN-FREE

Recyclables gathered without a bin. Taken out frequently.



2 CENTRALIZED, CONTAINED

Recycling bin mirrors trash bin in central location.



3 DISTRIBUTED GATHERING

Multiple bins or gathering spots for access and visibility.

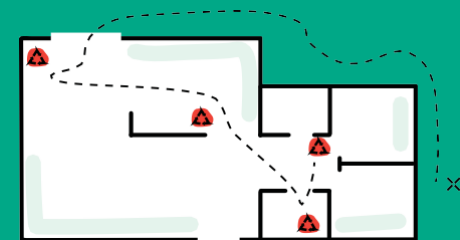
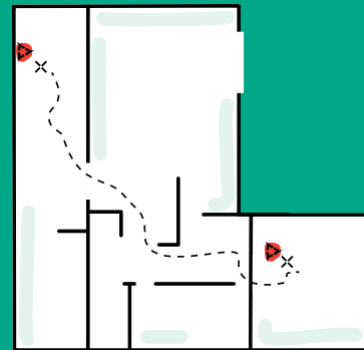
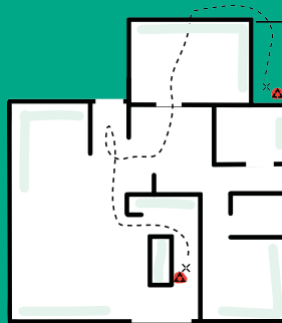
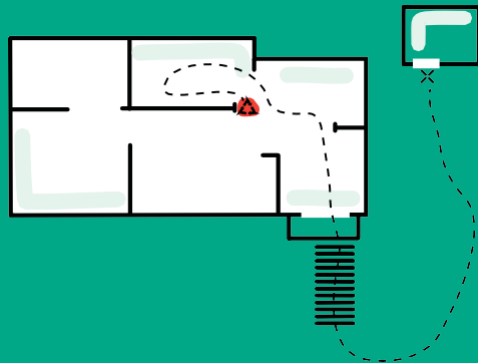
4 OUT-OF-SIGHT, ISOLATED

Recycling container is out-of-sight and isolated from central living areas.



FLOW:

The collection styles influence the flow. The flow can influence the capture of recyclables.





**Consumers Are
Confused About
Packaging**

78%
Look at labels
to know if a
product is
recyclable

63%
say they are
confused by
recycling
information
on labels.

People Intend to Recycle. We Must Clear the Way for Them to Act



Behavior Change – Greater pounds per HH



Infrastructure

We can't implore the public to recycle without providing them with the **ability to actually and reasonably recycle.**



Education

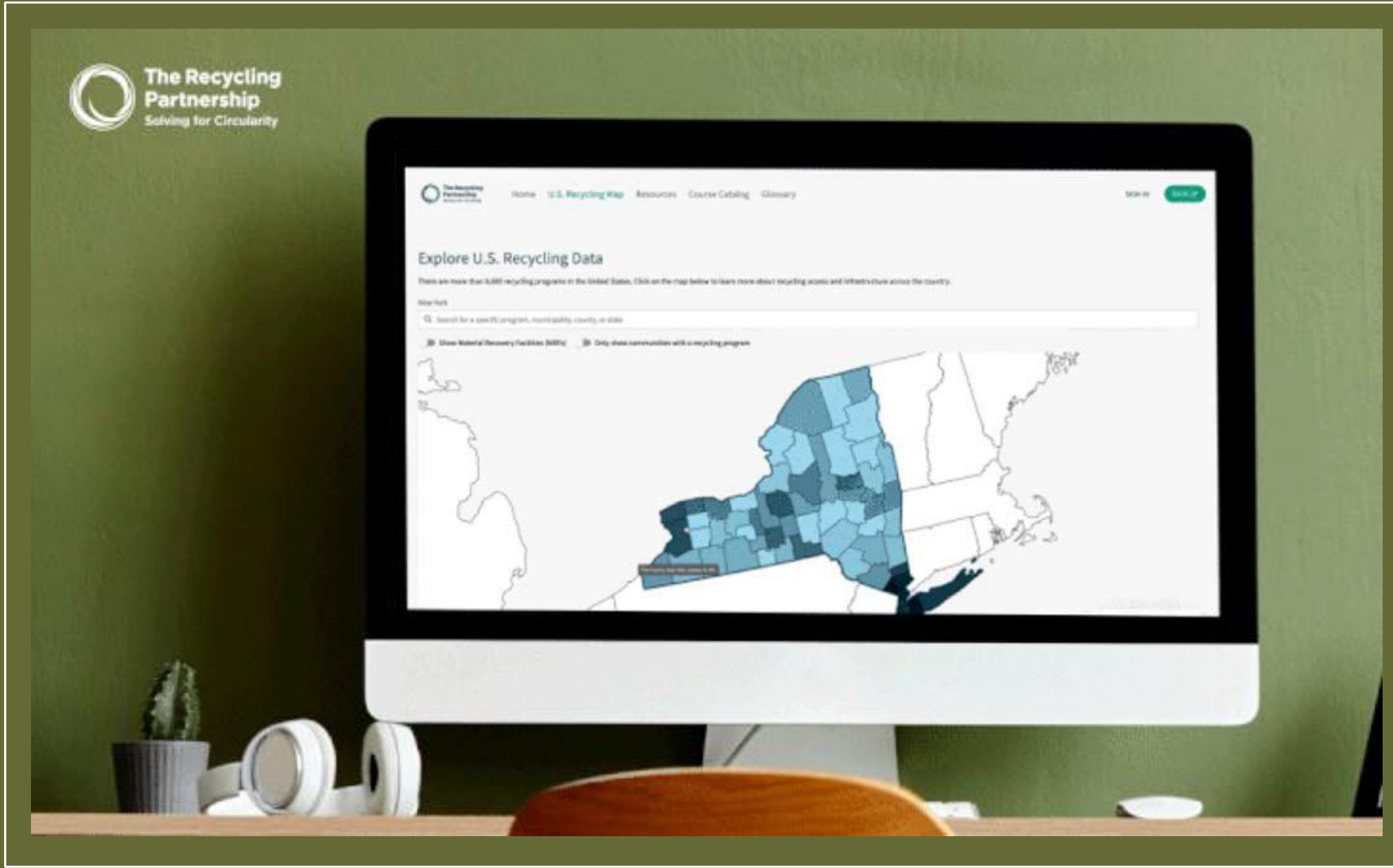
We can't expect people to recycle well without providing **information on what and how to recycle.**



Engagement

For many, access and basic education are not enough. **They need to be equitably informed & feel recycling is relevant to their values.**

NEW RESOURCES



LOCAL RECYCLING INFORMATION

Our National Database. Your accepted list, controlled by your



**DOWNLOAD OUR
RECENT
KNOWLEDGE
REPORT**



DRIVING TRANSFORMATION

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Flexible Housing Units from the Consumer's Point of View

November 15, 2023

Thomas Decker | University of Applied Sciences Weihenstephan-Triesdorf

Christian Mergel | University of Applied Sciences Weihenstephan-Triesdorf

Convened by:

Agenda

- Housing Challenges
- Flexible Housing
- Research Questions & Methodology
- Results
- Conclusion
- Scientific Outlook



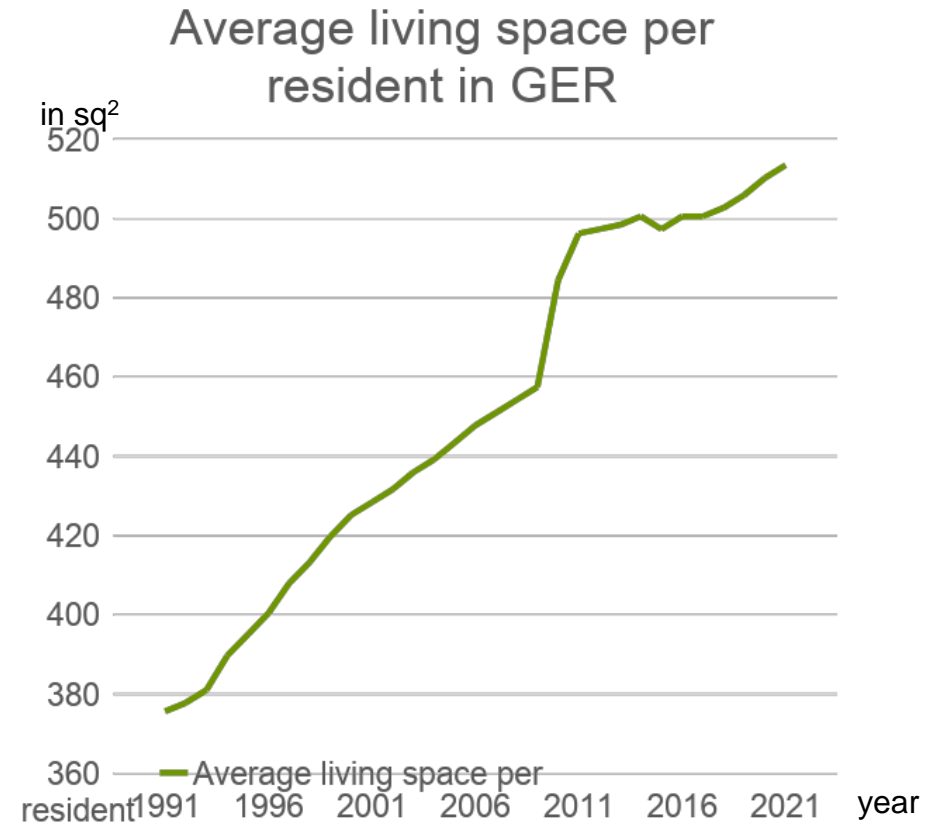
Housing Challenges

Current Housing Situation

- Housing shortages
- Expansion of urban areas
- Increased prices

Changes in Living Space

- Increase in average living space
- Residential unit expansion



(Source: Statistisches Bundesamt, 2022)



Flexible Housing

Definition

- Accommodating change in building function, capacity and flow
 - multi-functional spaces, modular units, adaptable designs

Benefits

- Cost-effective accommodation for:
 - changing family stages, market demands, technological needs
- promoting longer building lifespan
 - Sustainable



Research Question & Methodology

What factors predict the importance of flexible housing to homeowners?

Methodology

- Online survey with homeowners in Germany (Dec. 2021)
- Sample Size $n = 519$
- Index for importance of building flexibility (5-items) as dependent variable
- Multiple linear regression



Survey: Questions about...

Building Factors

- Wood offers superior flexibility, reuse and recycling
 - Q: Type of material, property, number of rooms, price etc.

Socio-demographic Influences

- Evolving needs based on age, lifestyle, household changes
 - Q: age, gender, education, income, household size, residential area

Building properties

- Strategy that enables avoid cost and obsolescence
 - Q: Importance of price, longevity, accessibility, value stability

Environmental Impacts

- Strategy for extending total life-time of buildings
 - Q: Importance of renewable material, recyclability, environmental awareness



Survey: Questions about...

Building Factors

- Wood offers superior flexibility, reuse and recycling
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 - Q: **age**, gender, education, income, **household size**, **residential area**

Building properties

- Strategy that enables to fend off cost and obsolescence
 - Q: Importance of price, **longevity**, **accessibility**, **value stability**

Environmental Impacts

- Strategy for extending total life-time of buildings
 - Q: Importance of **renewable material**, **recyclability**, **environmental awareness**



Results:

Factors predicting the importance

Importance of accessibility ($\beta=.219$)

Importance of high recyclability ($\beta=.182$)

Number of rooms ($\beta=.165$)

Importance of renewable material ($\beta=.163$)

Importance of longevity ($\beta=.129$)

Age of respondent ($\beta= -.128$)

Importance of value stability ($\beta=.102$)

Household size ($\beta=.096$)

Residential area size ($\beta=.092$)

Environmental awareness of respondent ($\beta=.078$)

Explanation:

The more important (the higher) the “statement” was rated, the more important was flexibility

The more important (the higher) the “statement” was rated, the less important was flexibility



Conclusion

Flexible Housing Benefits

- Adaptable to changing needs and longer building lifespan

Accessibility & Recyclability

- Main reasons for housing flexibility
- The design for everyone, with an eye on sustainability

Material Matters

- Importance of renewable material linked to flexible solutions
- But: No preferences for flexibility by timber-house owners yet

Essential Thought: Flexibility in housing is multi-faceted, with every respondent prioritizing based on personal circumstances and ecological awareness. The drive towards sustainable and adaptive housing is unmistakable.

Scientific Outlook

Current Study

- Research questions:
 - *How do respondents evaluate flexibility in real building plans?*
 - *How important are factors like human health, ecological aspects and resource consumption in the context of building a house?*
- Online survey with representative German population (Oct. 2023)
- Sample Size $n = \sim 3,000$
- Study design: e.g. Choice-Based Conjoint Analysis



| | 75 years† | 100 years† | 50 years† | |
|-----------------------|-----------|------------|----------------|---------|
| Expected useful life | 75 years† | 100 years† | 50 years† | |
| Costs | 550,000€† | 600,000€† | 500,000€† | |
| Construction material | Wood† | Wood† | Stone & Brick† | None† |
| Flexibility | No† | yes† | yes† | |
| Sustainability | Gold | Silber | Gold | |
| | Choose† | Choose† | Choose† | Choose† |



Thank you for your Attention!

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Convened by: