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U.S. DEPARTMENT OF
ENERGY

Office of Science

Getting to Scale for Decarbonizing Homes in the US

The State of Practice in Residential Decarbonization — Recent Survey Findings



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Three Principles For Building Decarbonization

Principle #1: Homes have to be electrified

Principle #2: We can't “efficiency” our way to zero emissions

Principle #3: Solutions need to be scalable and affordable

Equity and Decision Making

TOTAL US Homes = 123.5 millions*

Housing Units

- ▶ **68% Single Family**
26% Multifamily
6% Mobile homes

Ownership

- ▶ **SF = 88% units owned**
SF = 28% units rented
MF = 5% units owned
- ▶ **MF = 69% units rented**

Low-Income

- 9% Single Family
- 27% Multifamily

Who pays ?
Who benefits ?
Solutions for renters?

*eia data from 2020/2021



HOW TO GET **AFFORDABLE** SOLUTIONS?



HOW TO **SCALE** ENERGY RETROFITS?

Problem ► to **SCALE** energy retrofits, needs:



motivated building industry **and motivated** households

SURVEYS to assess and understand:



What are **Building Industry** concerns? → What motivated them?

What are **Household** concerns? → What motivates them?

What do Industry Professionals Think?

Survey originally for Deep Energy Retrofits (DERs) – but most answers apply to decarbonization also

Market Survey

- ▶ Qualtrics survey platform
- ▶ 20-minute online survey to gather information from building energy professionals on their experiences and opinions
 - What motivates and deters energy retrofit projects in today's market?
 - Promising strategies and technologies
 - Non-cost aspects of retrofit measures
- ▶ 73 survey participants
 - Home performance contractor (25%)
 - Consultant (15%)
 - Program manager (14%)
 - Researcher (12%)
 - General contractor (11%)
 - Other (23%), e.g., engineer, architect, energy rater



Market Survey

Survey Questions Organized By Main Sections Of Topic:

- ▶ Background information about past experiences of the respondent
- ▶ Consumer perspective on energy retrofit projects
- ▶ Home performance contractor perspective on challenges
- ▶ Promising technologies and approaches to advance carbon savings
- ▶ Work scope and approaches from past experiences
- ▶ Project costs



Survey: Customer Perspective

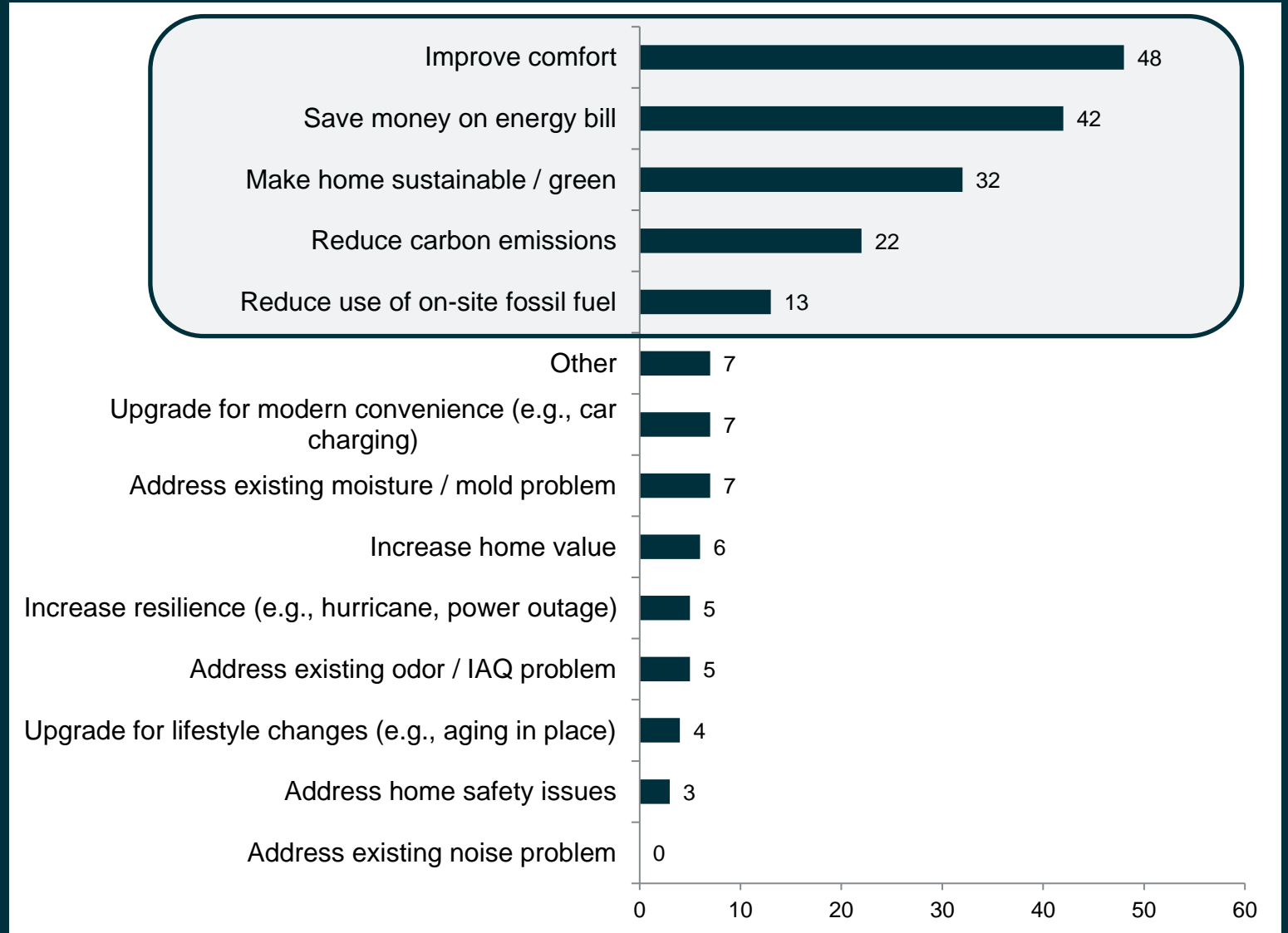
What are the main motivations of homeowners / building owners?

Residential <> Commercial

Profit is not the motive

ROI, payback and other traditional investment metrics are misleading and the wrong ones to use.

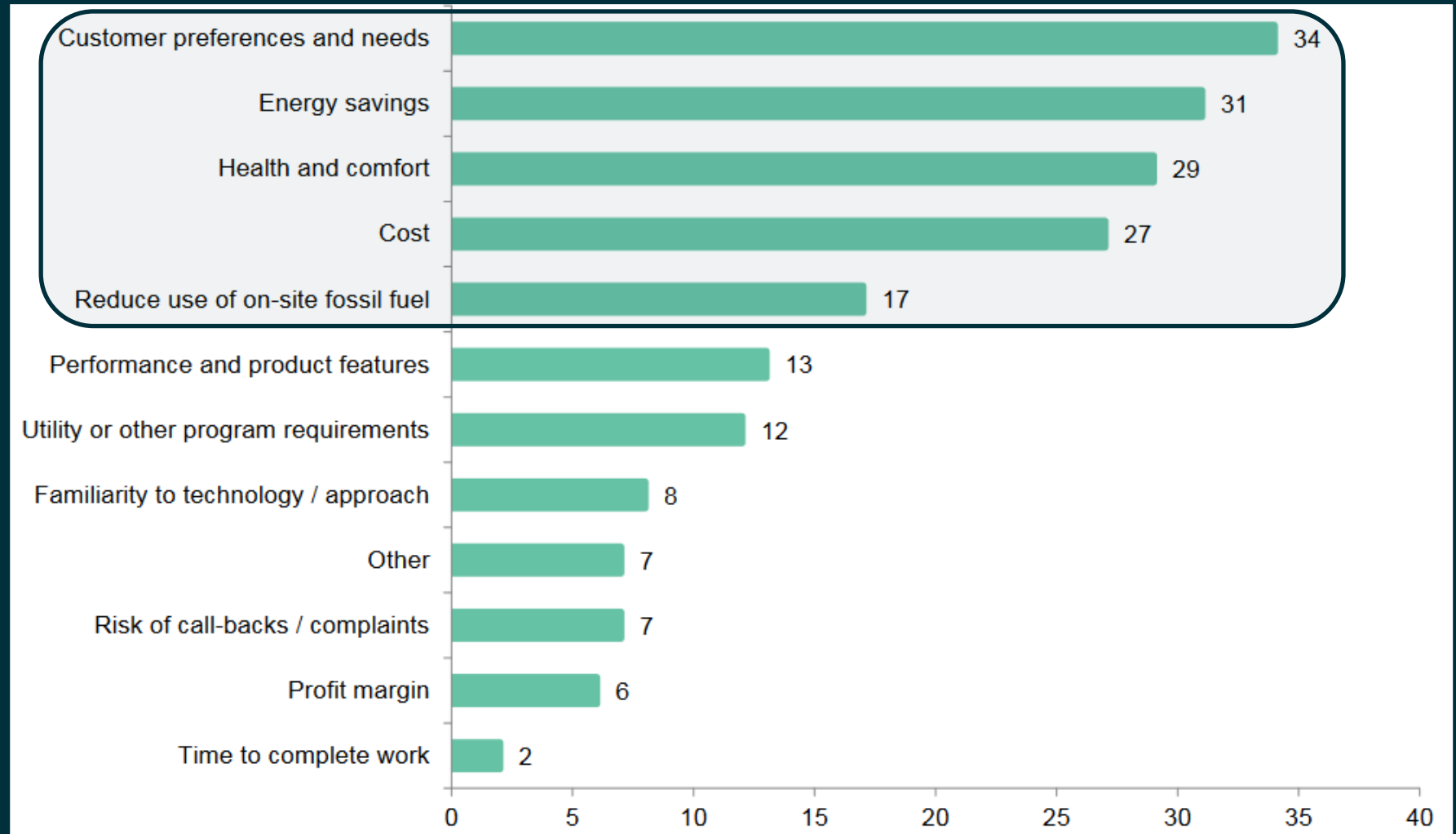
Affordability and financing are key.



Survey: Industry Perspective

What are the factors that significantly influence the **decision-making** process among contractors?

- ▶ Households' needs
- ▶ Households' wellbeing
- ▶ CO₂ reduction
- ▶ Energy savings

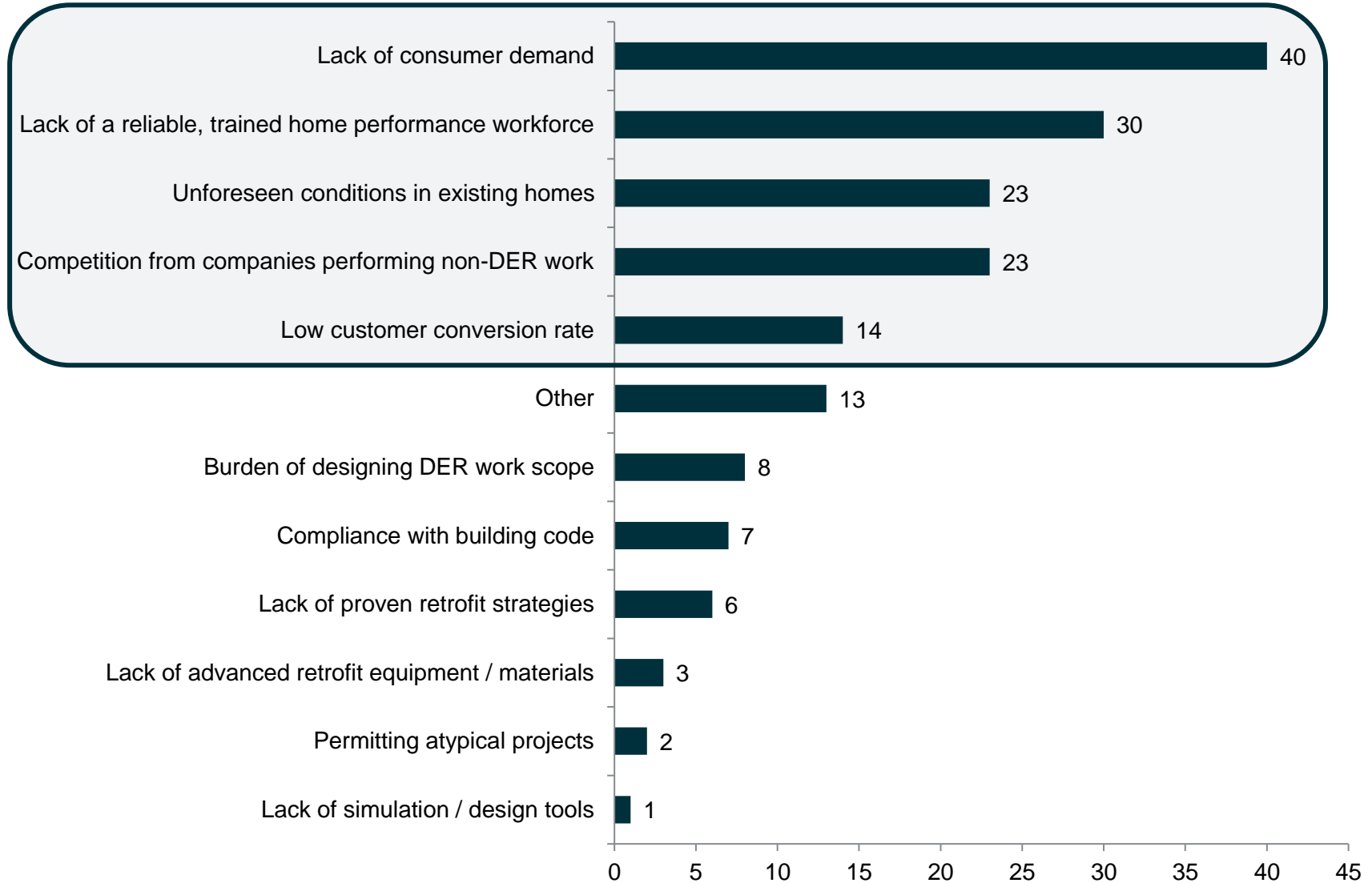


Survey: Industry Perspective

Aside from costs:

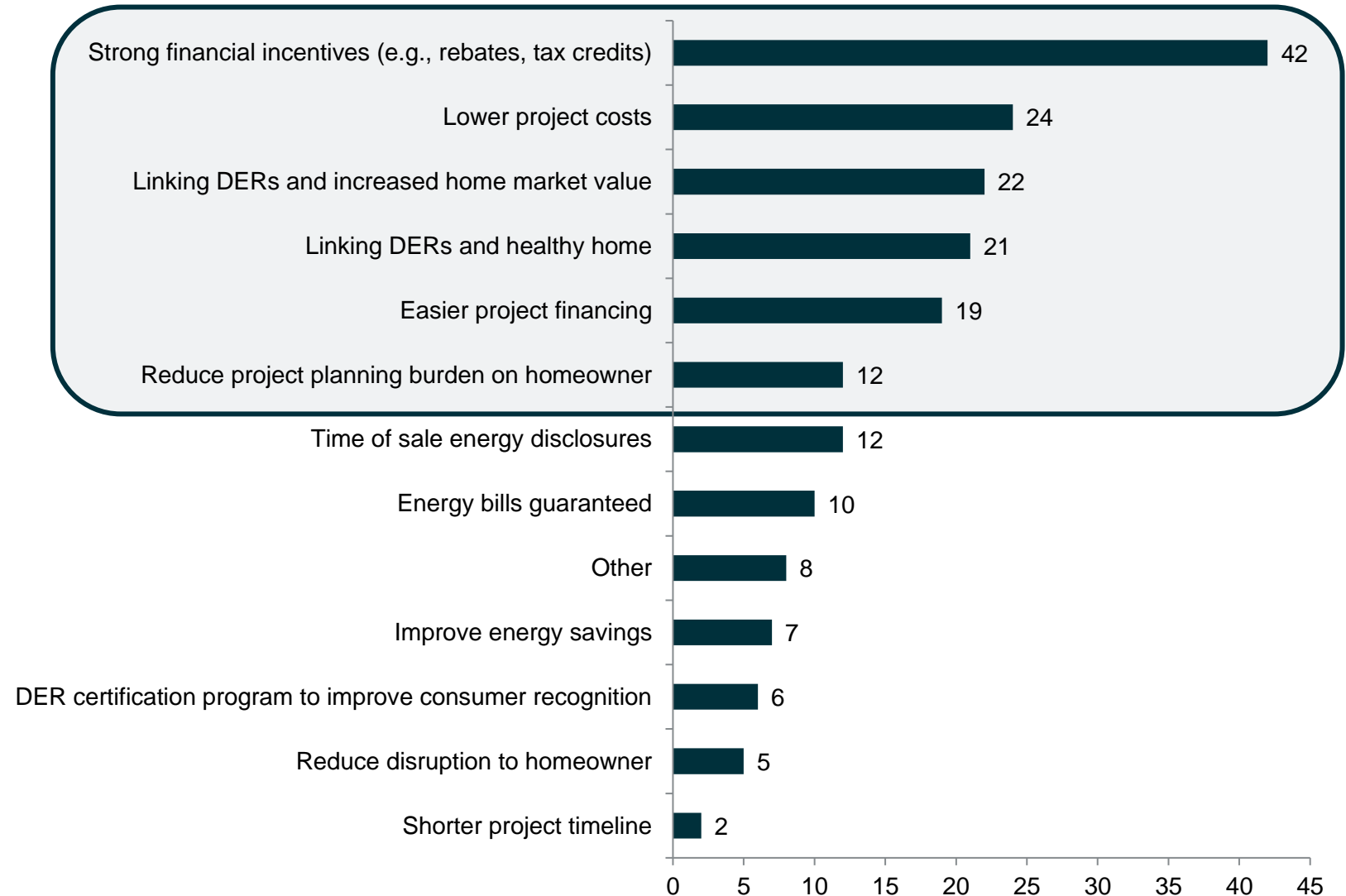
What are the biggest barriers?

- ▶ Lack of consumer demand
- ▶ Lack of workforce



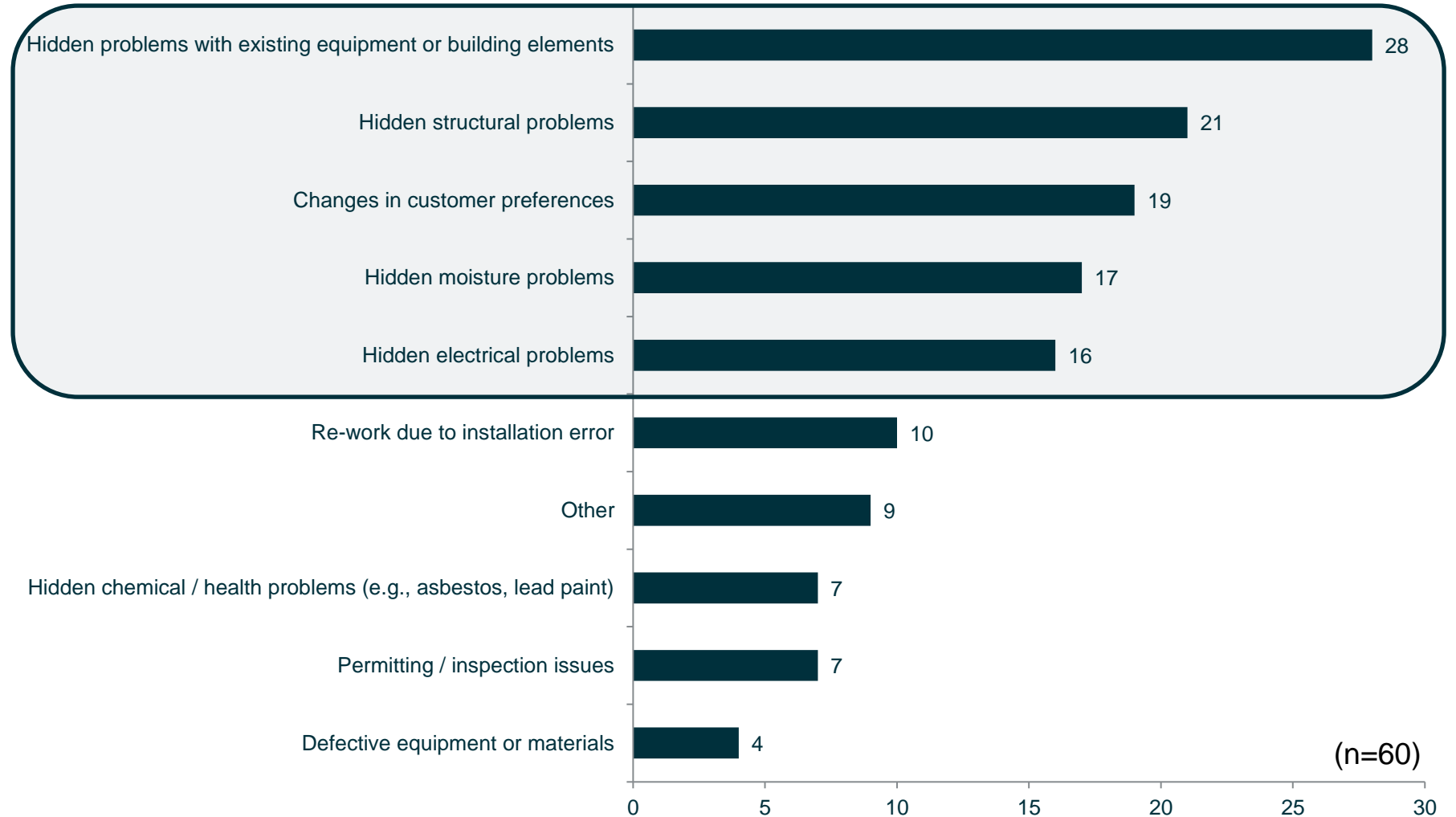
Survey: Industry Perspective

Aside from costs:
What are the most effective ways to increase customer demand?

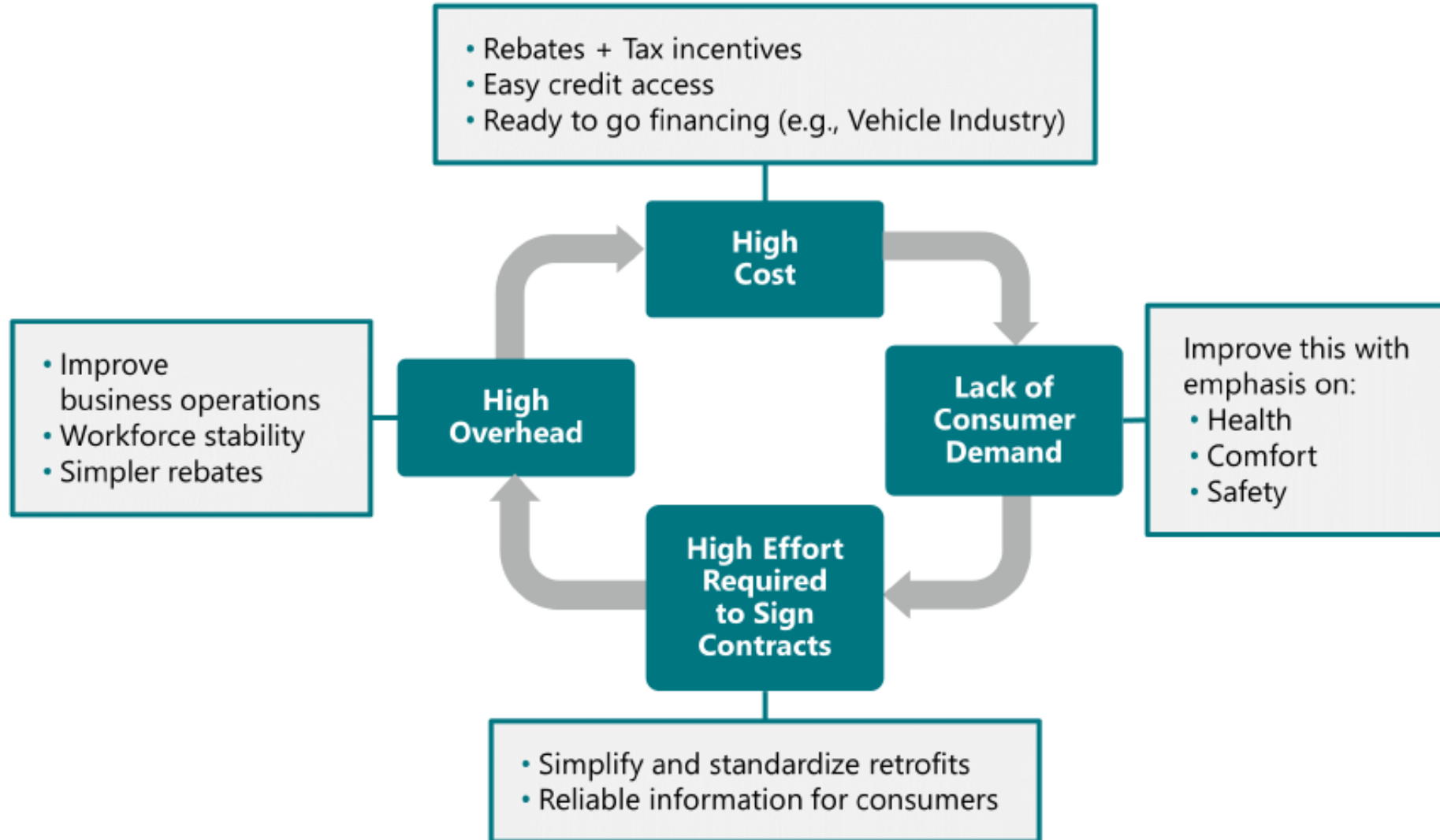


Survey: Project Cost Estimates

Common causes of project cost increase.

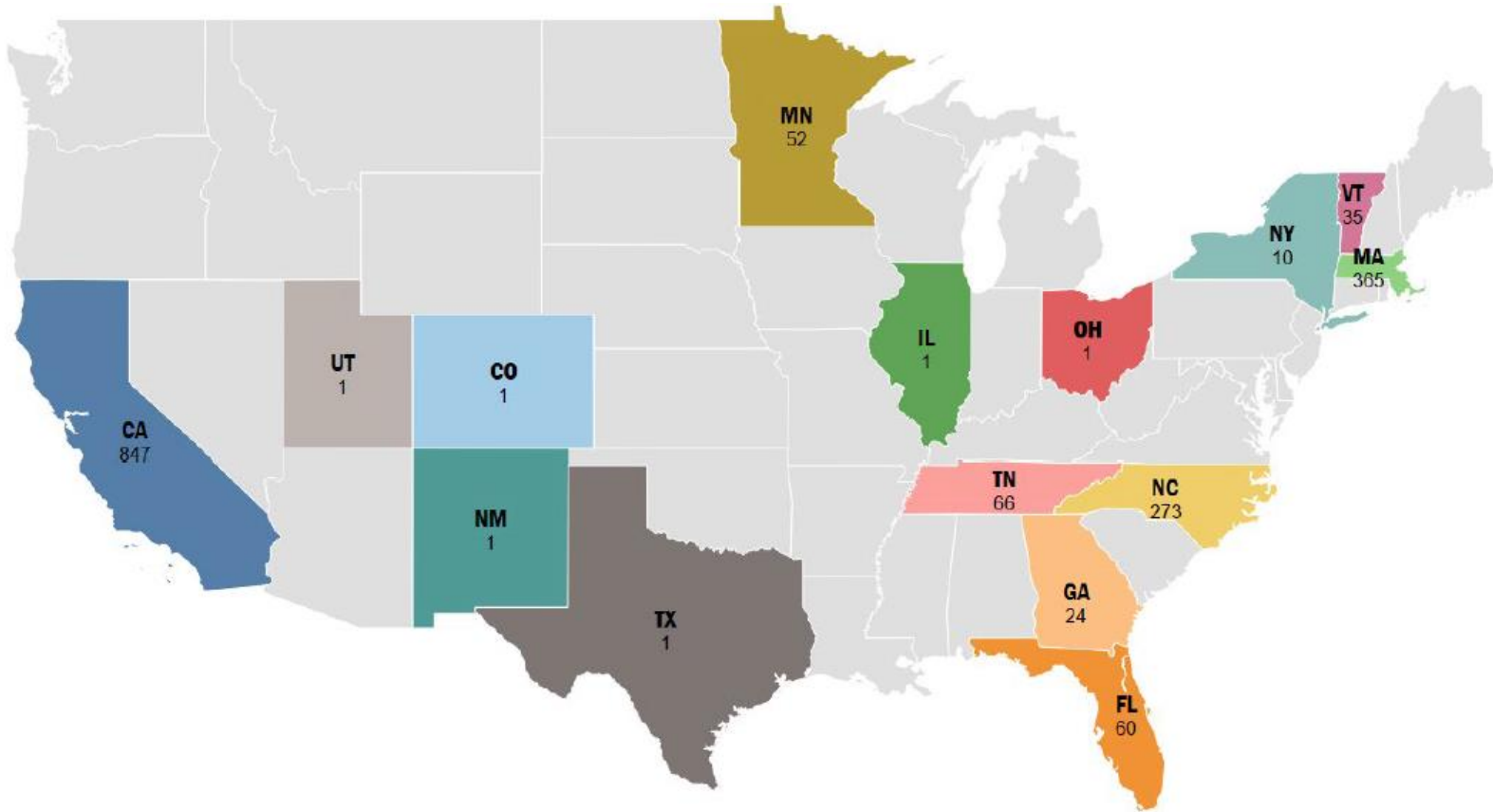


Addressing “Lack of Demand” issues for the Building Industry



Assessing the Cost of Decarbonization / Electrification

Database Summary



Sample of Convenience:

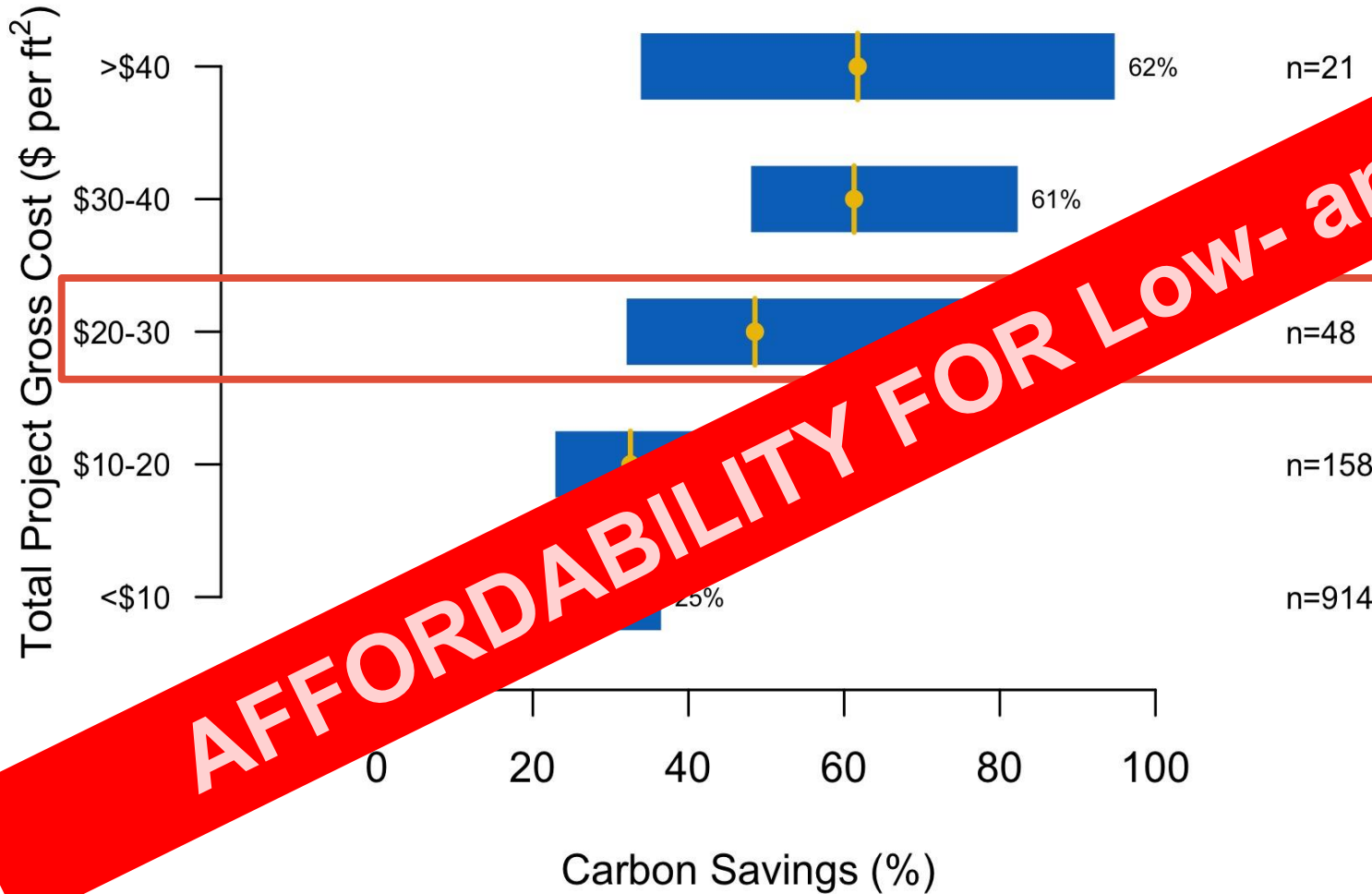
- Most data voluntarily provided by energy programs
- Paid contributions for 475 homes

Data Included:

- Costs - Broken down by measure
- Energy (and calculated CO₂) savings
- All costs in \$2019 and nationally averaged

12 Programs 1,739 Projects 10,512 Measures 3,294,946 ft² \$24,689,213

Project Cost vs Carbon Savings



AFFORDABILITY FOR Low- and Mid-Income

- Carbon reductions currently cost at least \$20-\$30 per ft² (\$35k - \$50k or more per home)
- Costs are too high for adoption at-scale

Home Energy Upgrade Cost Reduction Survey

Cost Reduction Survey

- **Survey details**
 - Respondents offered incentive of \$50 for completing survey
 - Final sample: 167 full surveys (96 partial surveys)
- **Target respondent population**

Residential building professionals (e.g., contractors, consultants, manufacturers, program managers)
- **Recruitment**
 - Direct outreach: survey e-mailed to existing contacts from LBNL residential cost data project
 - Indirect outreach: survey shared with numerous residential energy organizations/networks to post in e-mail newsletters

Home Energy Upgrade Cost Reduction Survey

Welcome

Welcome to the Lawrence Berkeley National Laboratory (LBNL) Home Energy Upgrade Cost Reduction Survey.

Thank you for your interest in participating in our survey on cost reduction opportunities for home energy upgrades. Past research by LBNL has demonstrated that such upgrades are technically feasible but up-front costs are a barrier to implementation. We are conducting this survey to understand the potential for reducing those costs through new approaches and technology innovations.

We are looking for the following participants who work in single- and/or multi-family housing:

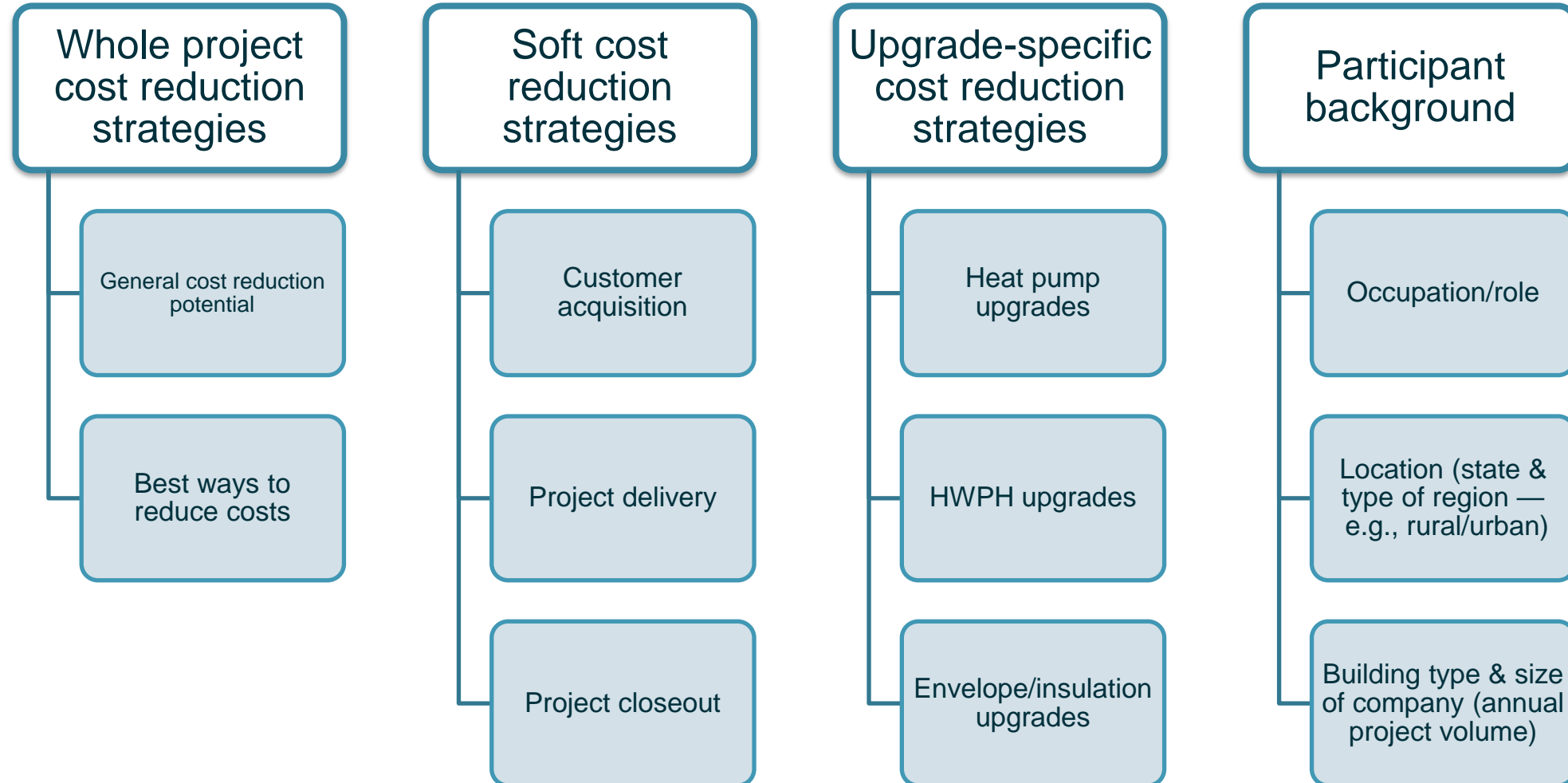
- Contractors (general, remodeling, insulation, HVAC, electrical, home performance)
- Consultants (HERS raters, BPI professionals)
- Manufacturers/distributors
- Program managers
- Others with expertise in home energy efficiency or electrification upgrades

If you work in one of these areas and would like to participate, please continue to the next page. The survey should take around 15 minutes to complete, and the first 250 respondents who complete the full survey will receive a \$50.00 eGift card as compensation for their time.

Before proceeding, please answer the three questions below to prove that you are a human responding to this survey.

Thank you!

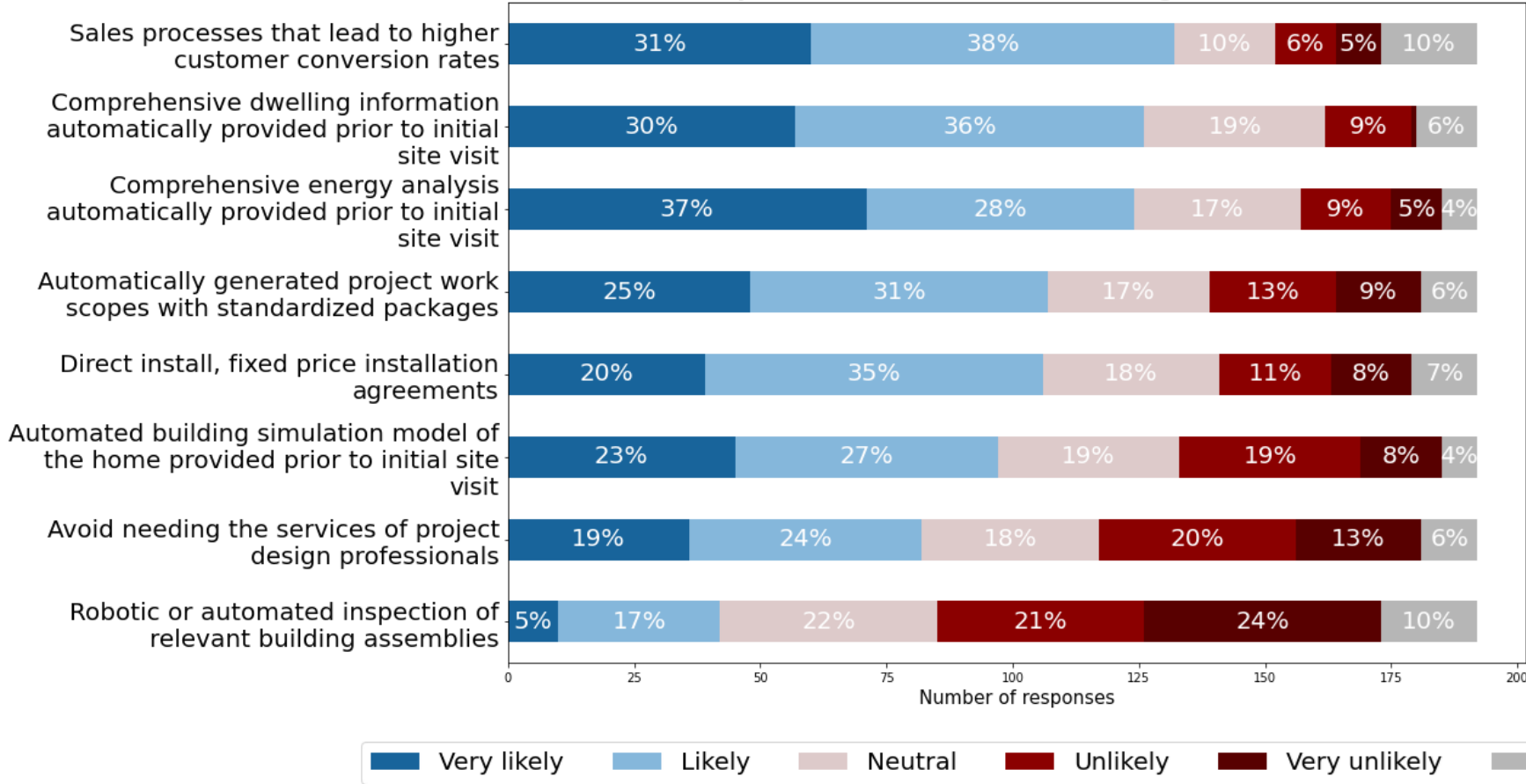
Survey Overview and Data Collection Process



Customer Acquisition

How likely are you to use the following strategies or tools to reduce costs at the customer acquisition stage of a typical home energy upgrade project?

Customer Acquisition Cost Reduction Strategies (Likelihood to use)



Ranked by combined % "Very Likely" or "Likely" to use

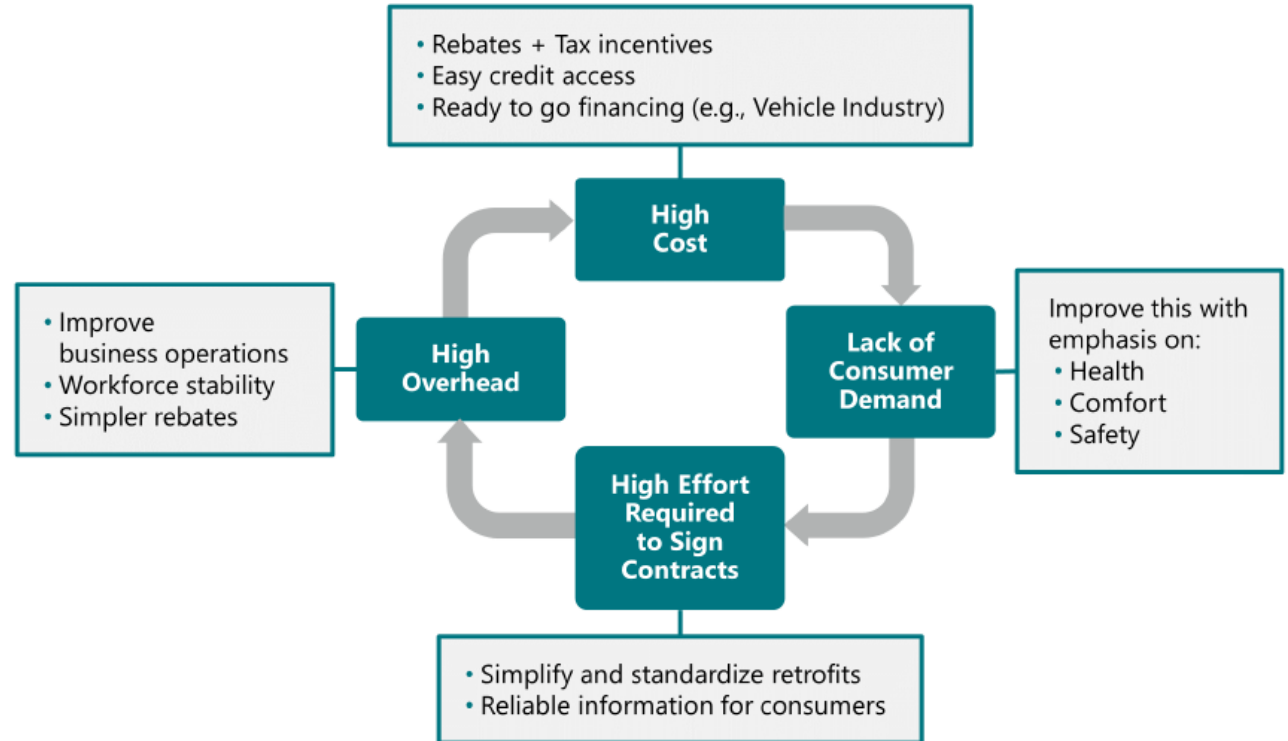
Summary

Industry perspective

- Lack of workforce
- Lack of customer demand
- Too much overhead (current market far too customized)
 - Customer acquisition
 - Streamline gathering information about a home/planning work
 - Direct install programs
 - Bulk purchasing

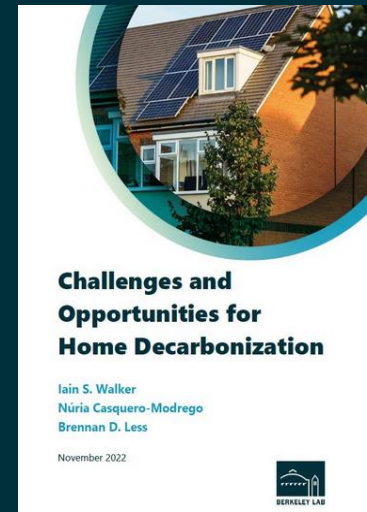
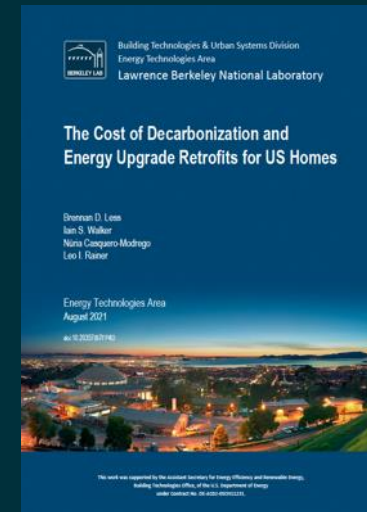
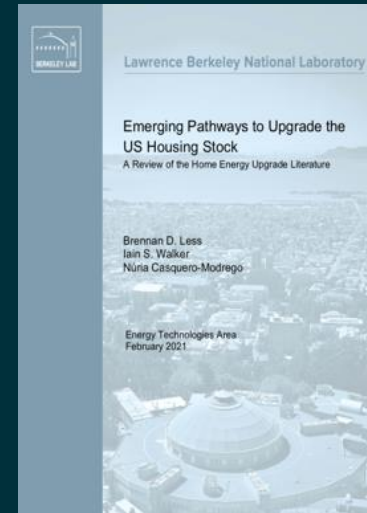
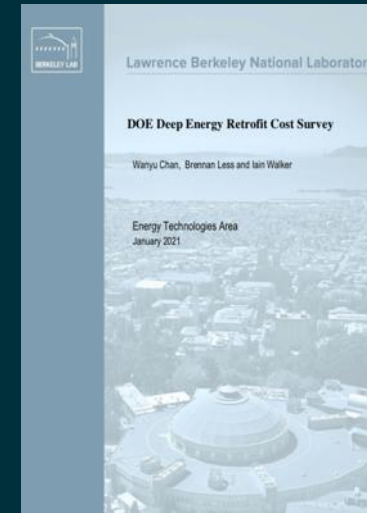
Household (from Industry perspective):

- Motivated by bill savings, sustainability, NON-ENERGY BENEFITS (e.g., health, thermal comfort, safety, etc.)
 - ▶ NOT traditional investment metrics
- Major barrier is affordability
- Solutions would include easy readily available financing



LBLN Resources @ homes.lbl.gov

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- Less, B. D., Casquero-Modrego, N., & Walker, I. S. (2022). Home Energy Upgrades as a Pathway to Home Decarbonization in the US: A Literature Review. *Energies*, 15(15), 5590. <https://doi.org/10.3390/en15155590>
- Walker, I. S., Less, B. D., & Casquero-Modrego, N. (2022). Carbon and energy cost impacts of electrification of space heating with heat pumps in the US. *Energy and Buildings*, 259, 111910. <https://doi.org/10.1016/j.enbuild.2022.111910>
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**Thank You...!
Questions?**