

The Value of Building Commissioning Study



Working Together. Building Excellence.

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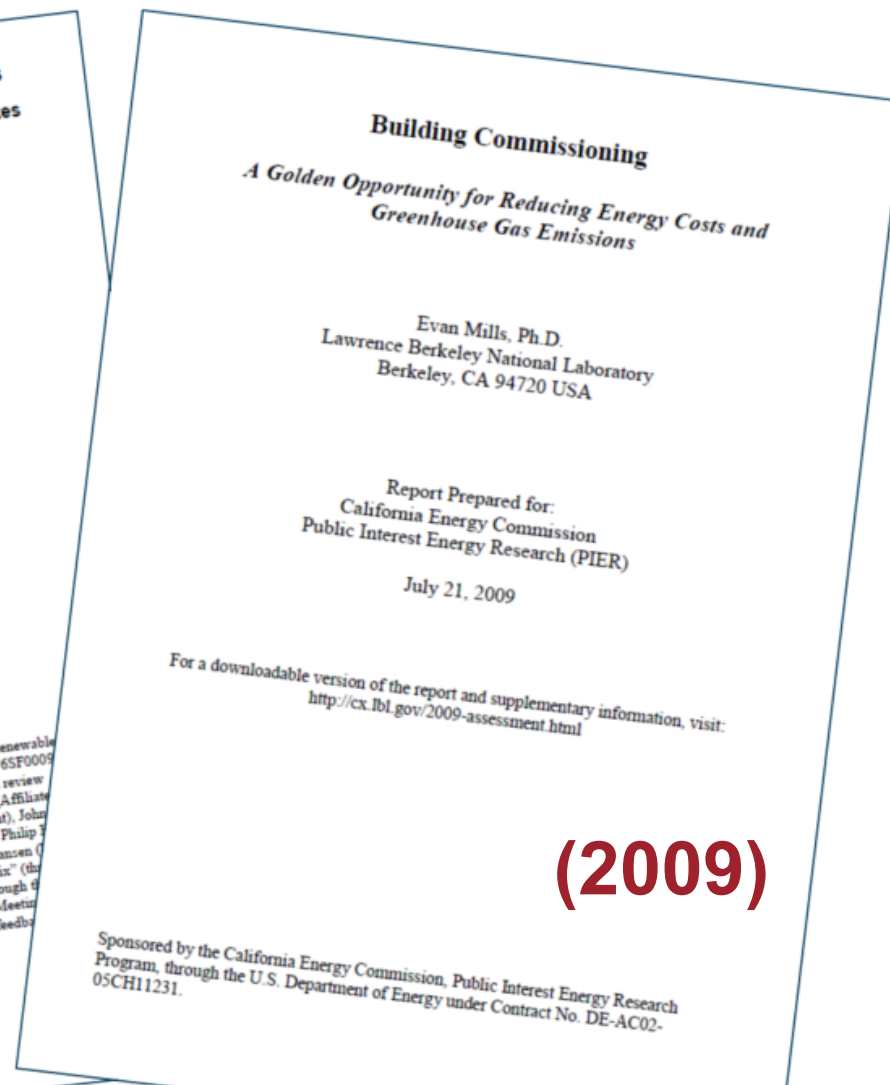
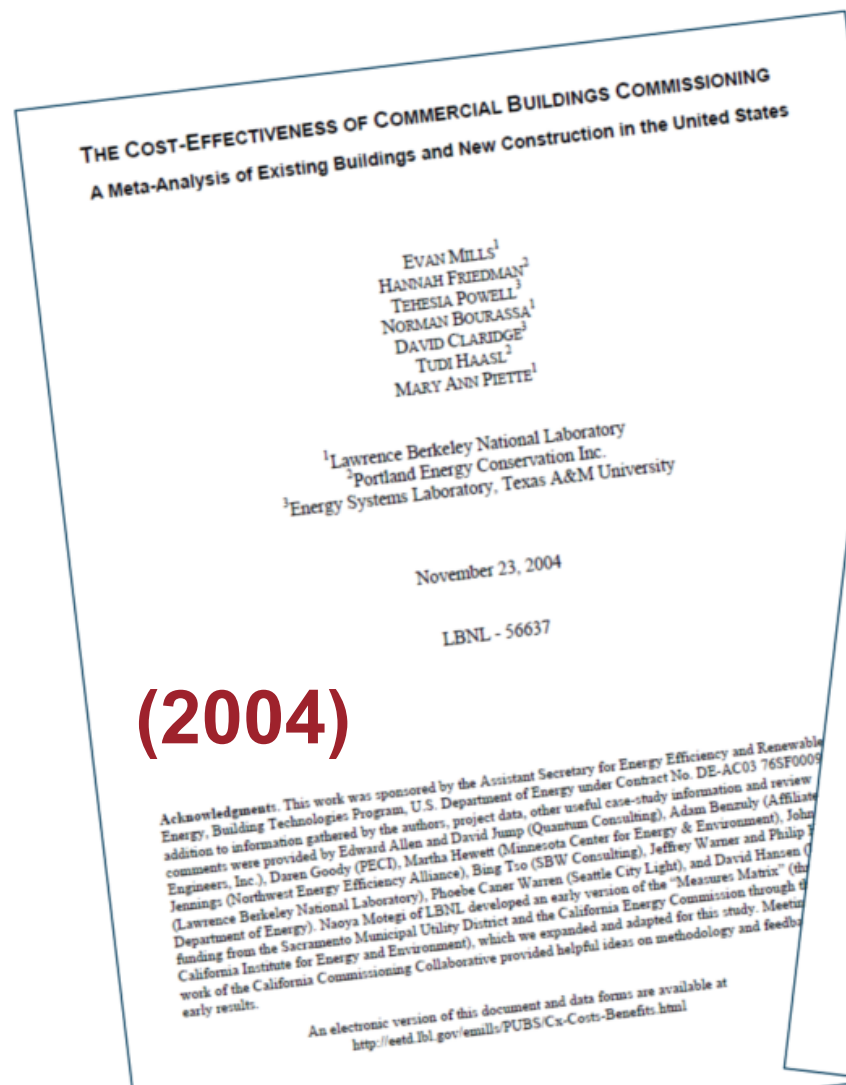


Learning Objectives



1. Present the results of a joint BCxA/LBNL study that provides updated metrics on the value of commissioning.
2. Provide data that can be used by commissioning stakeholders to promote the industry.
3. Understand market opportunities to improve the commissioning industry.
4. Understand Cx scope of work improvements to improve delivery process.

Prior LBNL Studies – Cost Effectiveness of Commercial Building Commissioning





Value of Commissioning Study - Goals

- Refresh the LBNL 2009 survey
 - Maintain consistency in the dataset
 - Reflect changes to the industry due to maturity
 - Define effects of changes to Cx approach (such as Ongoing Cx)
 - Include economics for Cx of new and additional systems
 - Expand database for different building types, markets
- Establish new baseline for Cx metrics
- Identify appropriate level of data to gather
- Create an iterative process for data gathering
- Engage industry to provide more feedback over time on project level and market level trends

Data Survey Statistics

New Construction Cx	2009 Study	2018 Study
# of Buildings	82	101
# of Projects (w/cost data)	74	71
Floor Area (SF)	8,813,925	22,217,059
Construction Cost	\$2.2B	\$10.1B
# of States Represented	10	18

Existing Building Cx	2009 Study	2018 Study
# of Buildings (total)	562	738
# of Projects (w/energy savings data)	300	705
Floor Area (SF)	90,410,884	252,159,847
# of States Represented	21	18



Value of Cx (NCCx) Study Results

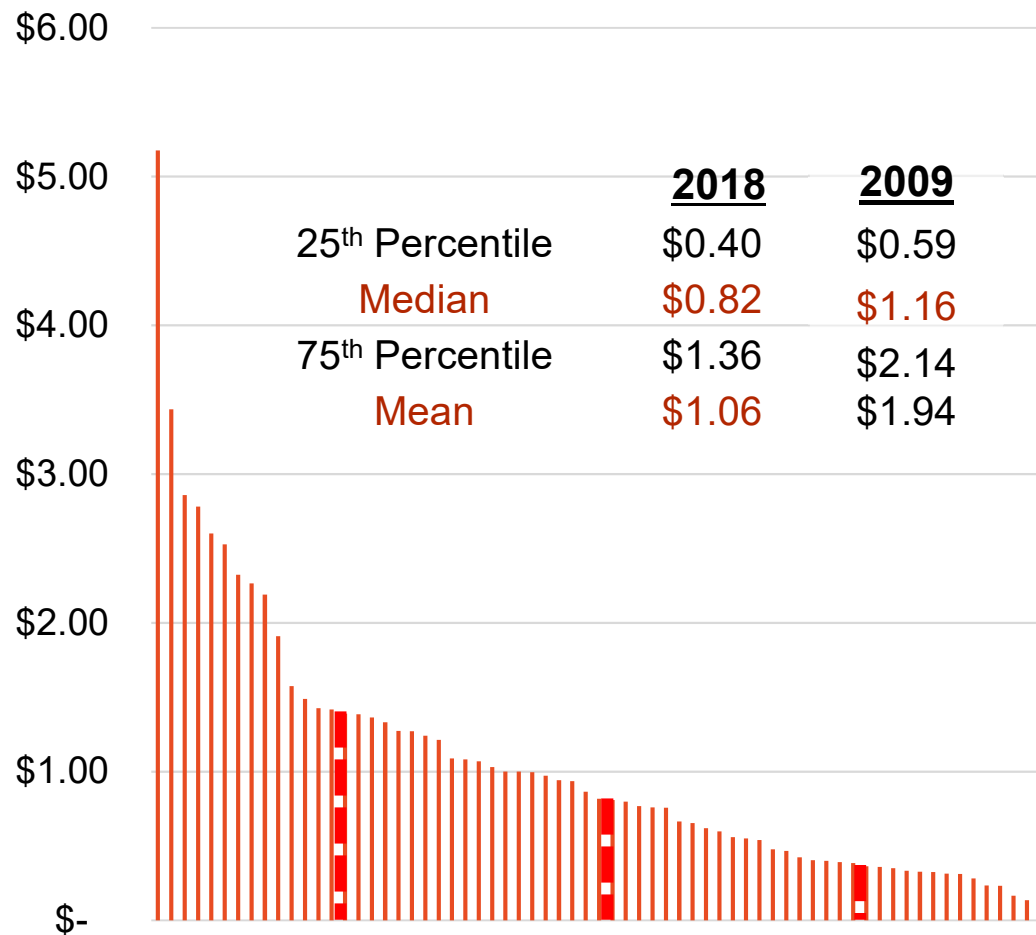
Cost Summary

Market Demand Factors

Scope of Work Observations

NCCx Cost per Square Foot

New Construction Commissioning Cost
(\$2018/sq.ft.) (n=67)

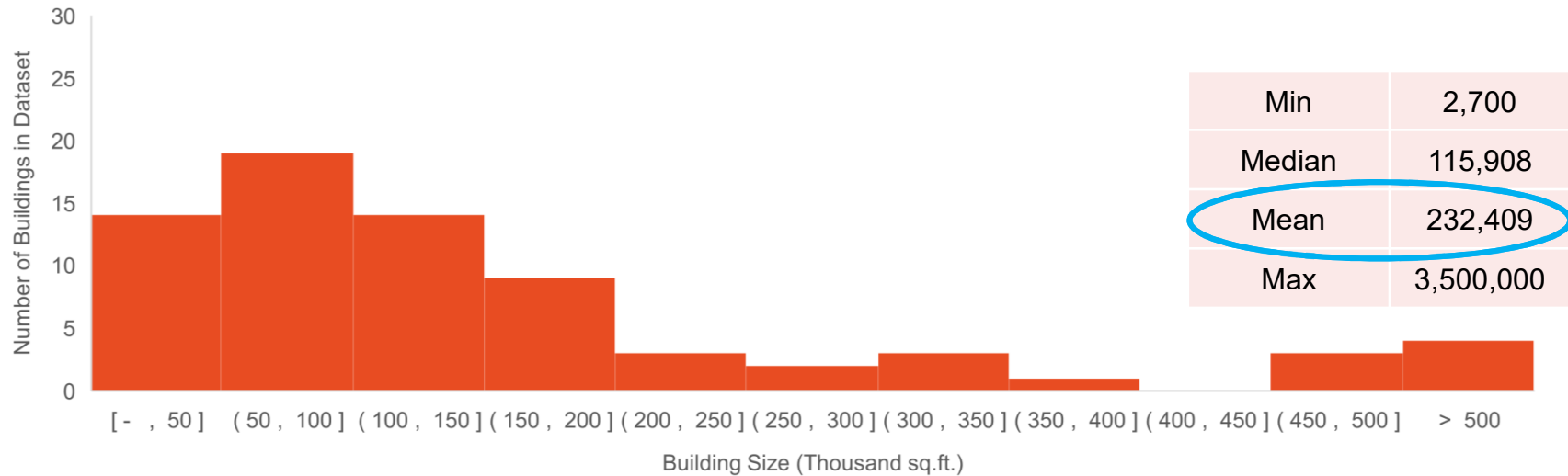


NCCx Cost/SF Comparison
(2009 to 2018)

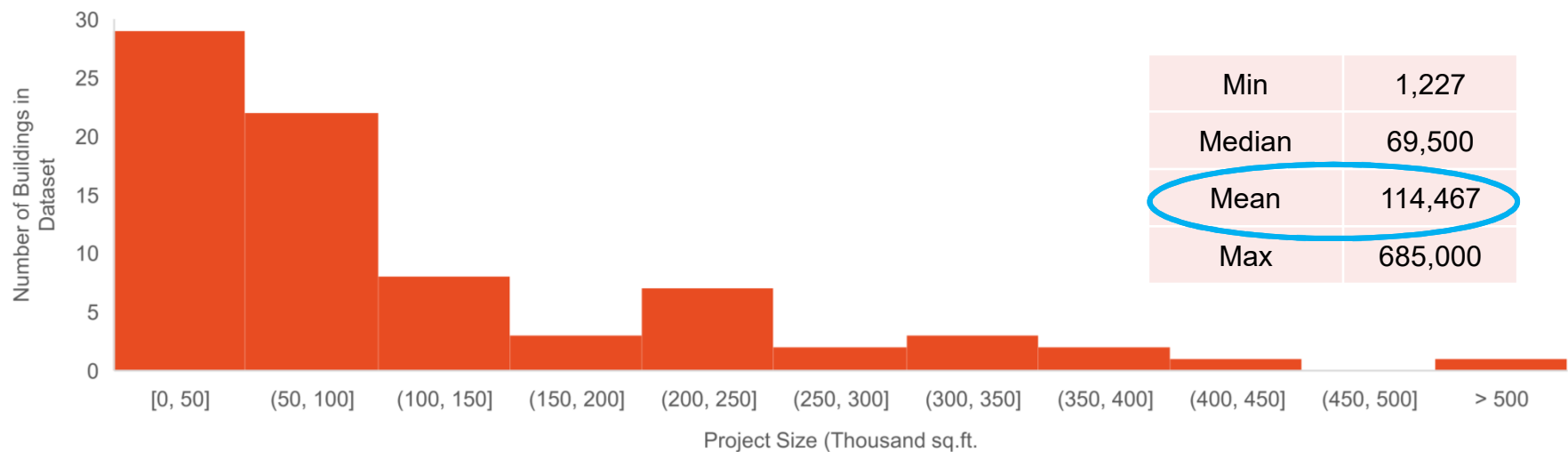


Building Size Distribution: NCCx

NCCx Building Size Distribution - 2018 (n=71)

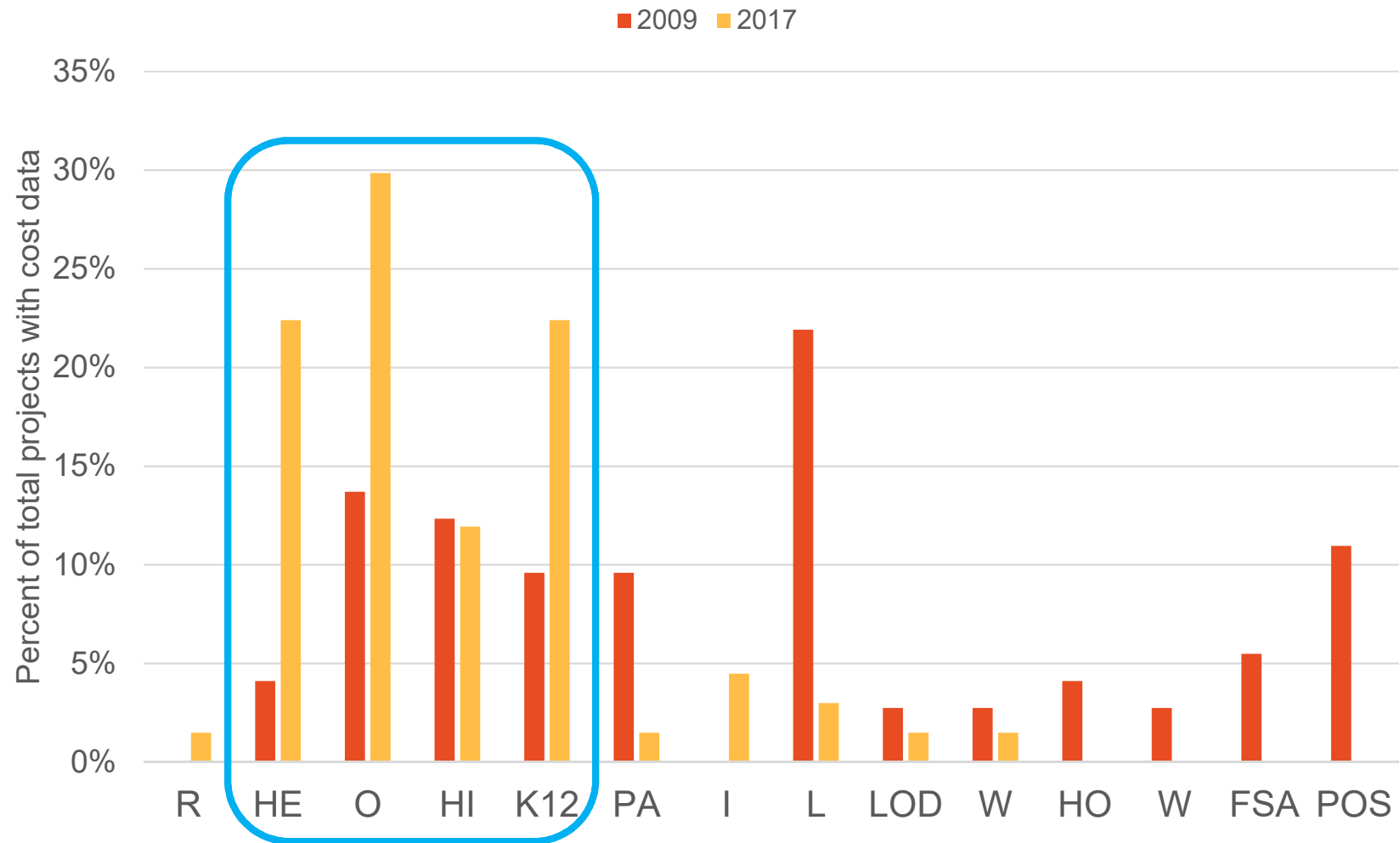


NCCx Project Size Distribution – 2009 (n=77)



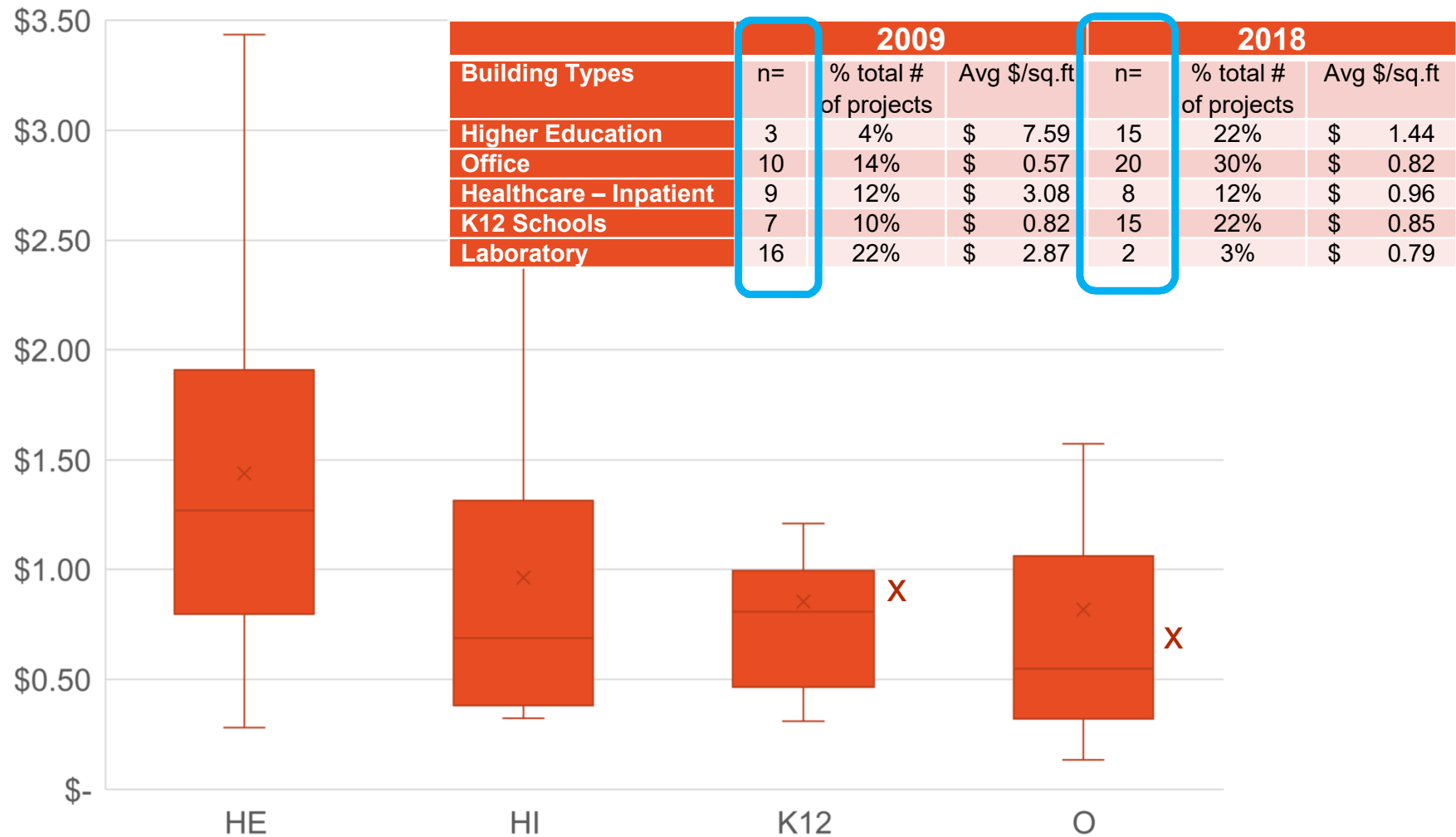
NCCx Cost by Building Type

Market Segment Breakdown (Projects with Cost Data)



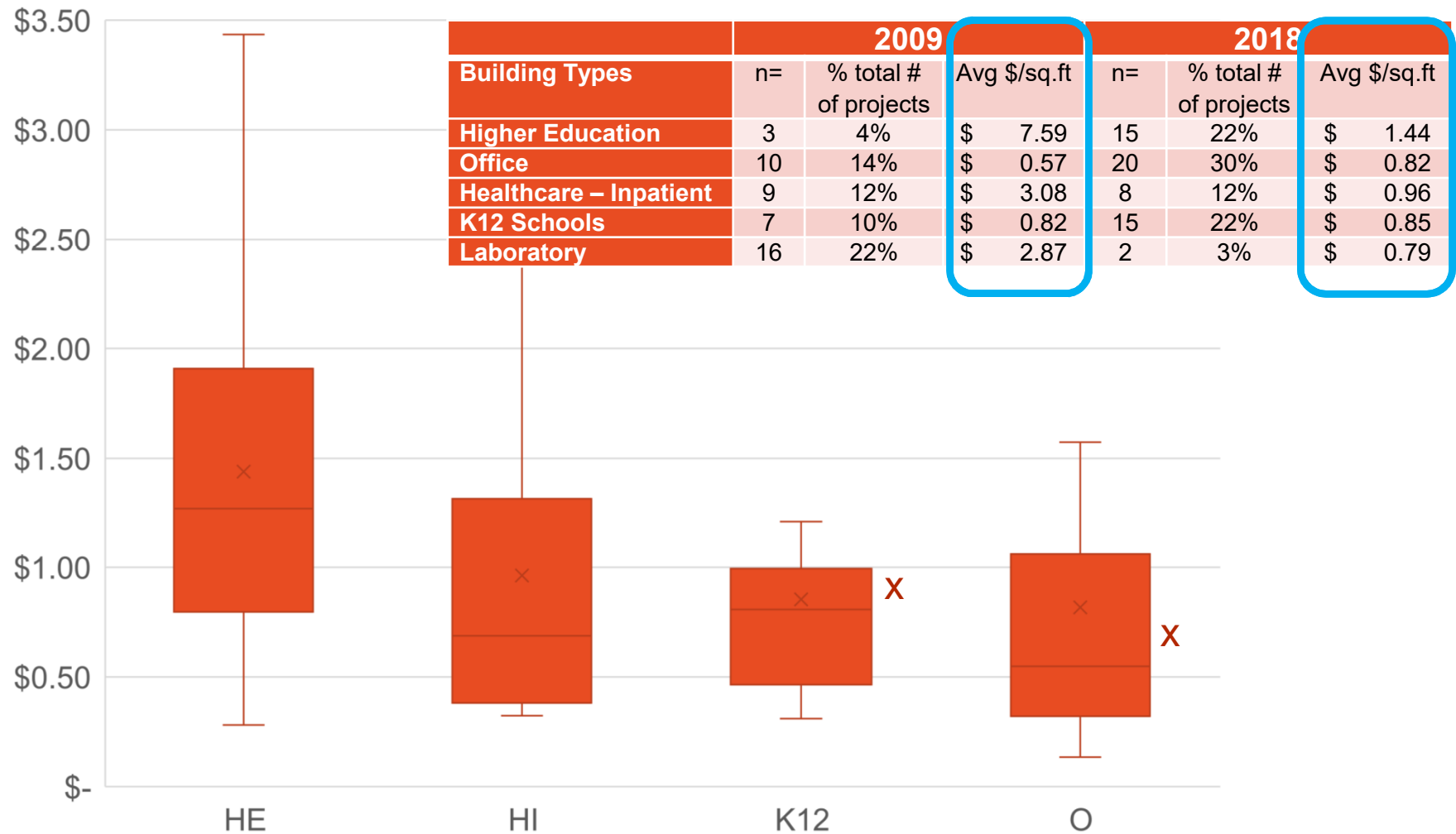
NCCx Cost by Building Type

New Construction Commissioning Cost



NCCx Cost by Building Type

New Construction Commissioning Cost





NCCx Commoditization Concerns

1. Overall **NCCx costs/SF** appear lower, but.....
2. 2018 data field contains 2X more **SF per building**
3. **Building type** mix is different. Less data for Public Assembly, Laboratories, and Public Safety (higher \$/SF in 2009).
4. NCCx fee ranges for higher education and healthcare are less volatile than 2009. NCCx fee ranges for office and schools are more stable (and increasing).
5. Over 40% of NCCx work is selected based on **qualifications vs. price**
6. Cx firms are reporting stable/increased **project profitability**
7. ***Be very careful to qualify NCCx costs using other metrics than just overall \$/SF***
8. ***Use a range to report NCCx costs***



Value of Cx (NCCx) Study Results

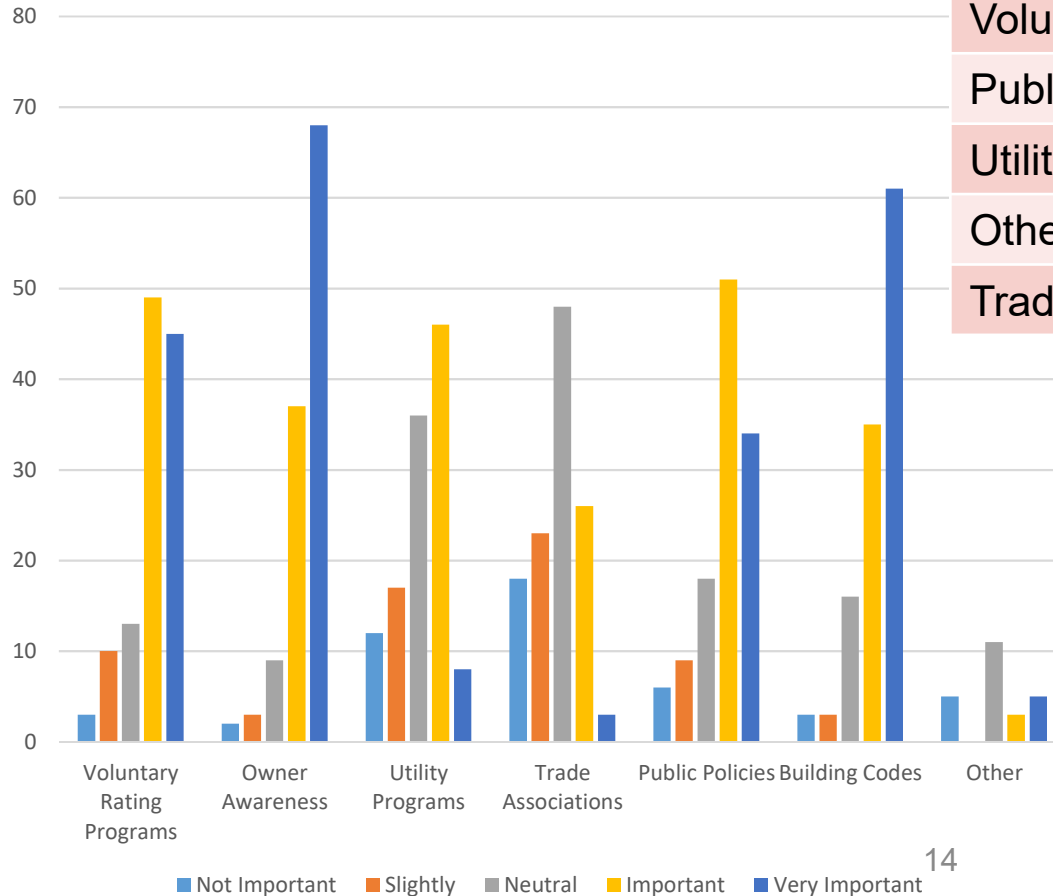
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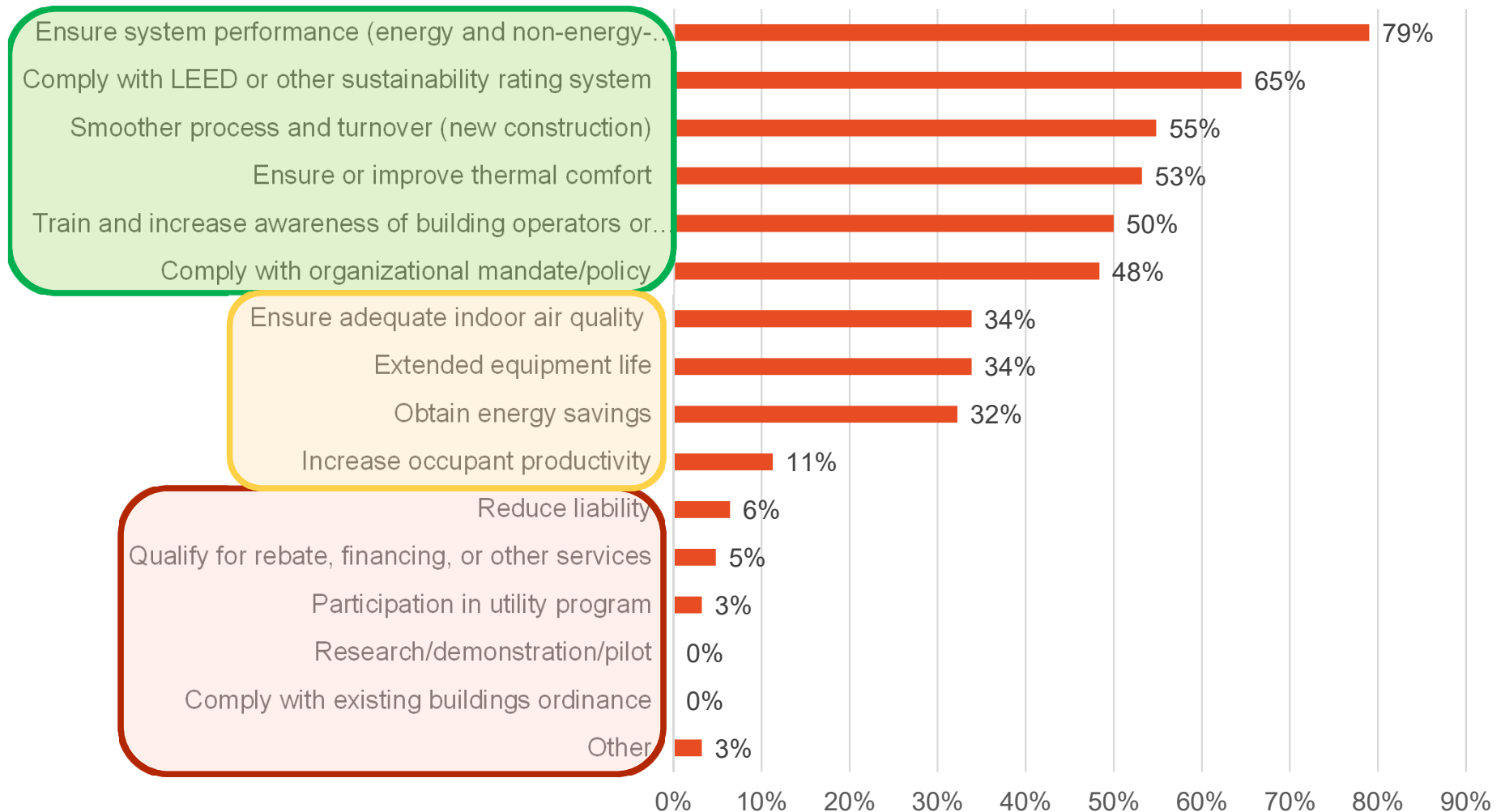
Reasons for Executing NCCx

Factors that Drive Cx?	(Out of 5.0)
Owner Awareness	3.82
Building Codes	3.74
Voluntary Rating Programs	3.65
Public Policies	3.54
Utility Programs	3.11
Other	2.92
Trade Associations	2.75



Reasons for Implementing NCCx

Fraction of reporting projects with reason (New Construction)





Reasons for Implementing NCCx

Reasons that Increased (2009 to 2018)

Fraction of reasons to embark on NCCx	2009	2018	Difference
Comply with LEED or other sustainability rating system	15%	65%	50%
Comply with organizational mandate/policy	0%	48%	48%
Smoother process and turnover (new construction)	26%	55%	29%

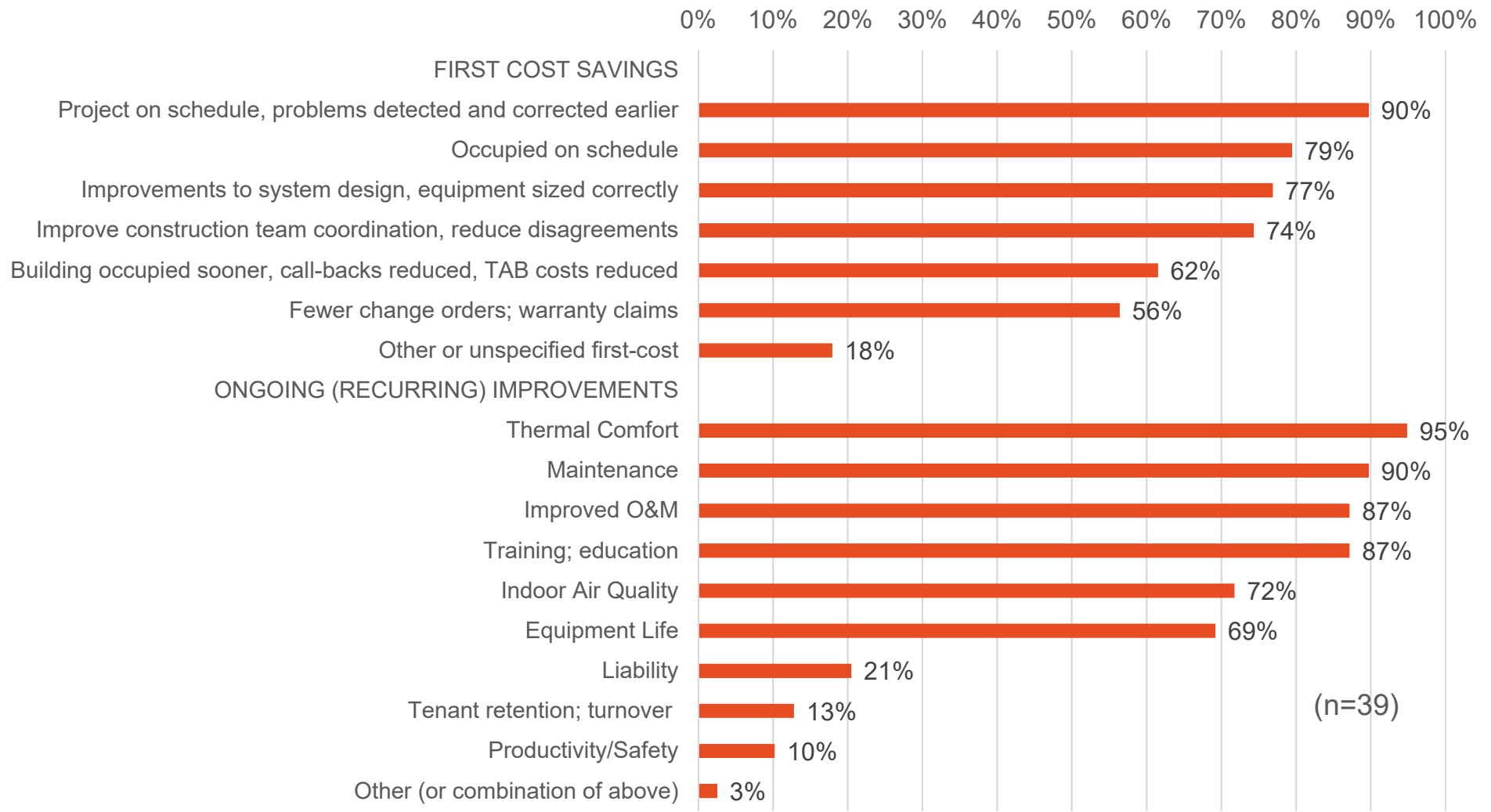


Reasons for Implementing NCCx

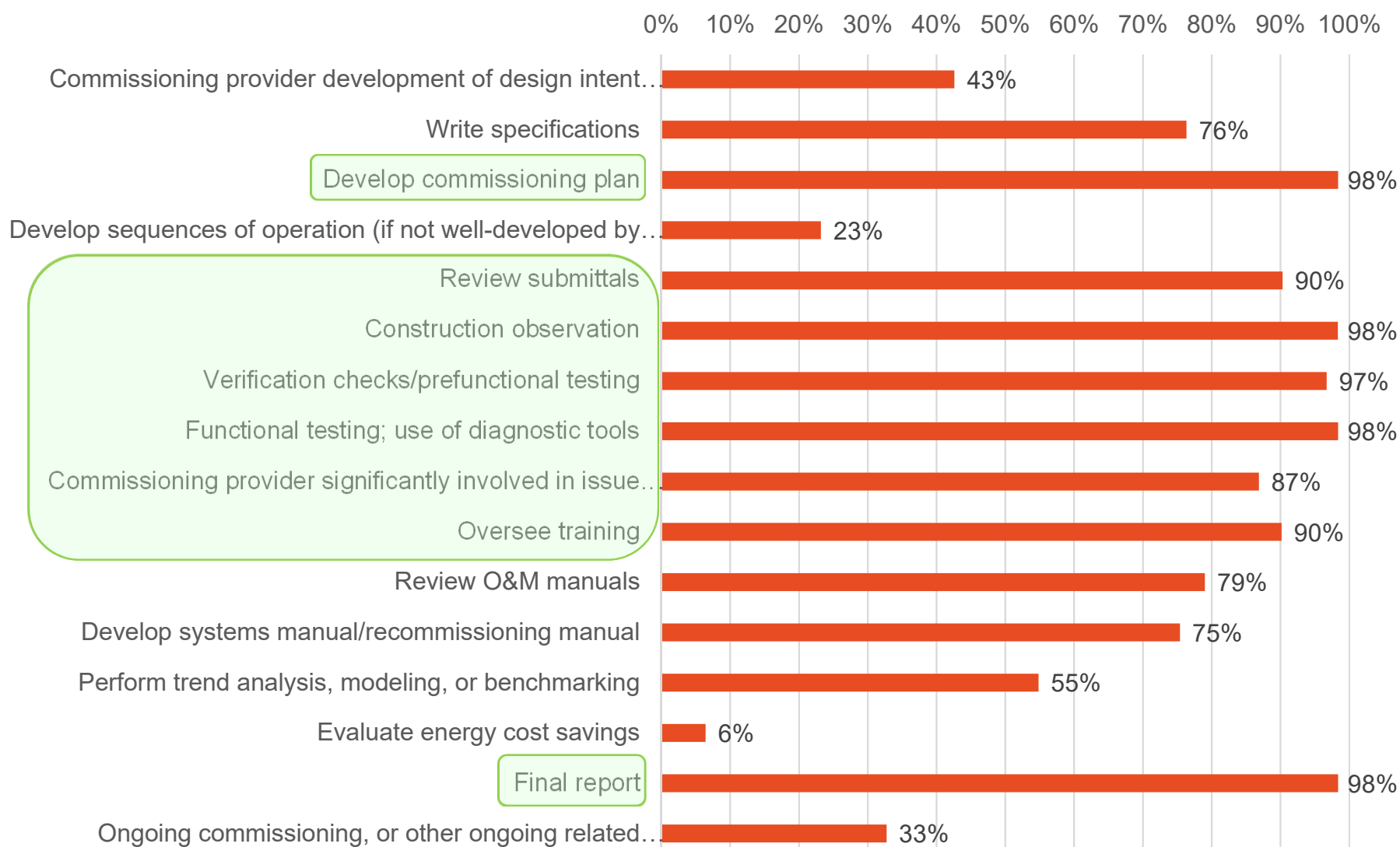
Reasons that Decreased (2009 to 2018)

Fraction of reasons to embark on NCCx	2009	2018	Difference
Ensure adequate indoor air quality	75%	34%	-41%
Participation in utility program	42%	3%	-39%
Obtain energy savings	65%	32%	-33%
Ensure or improve thermal comfort	72%	53%	-19%
Train and increase awareness of building operators or occupants	61%	50%	-11%

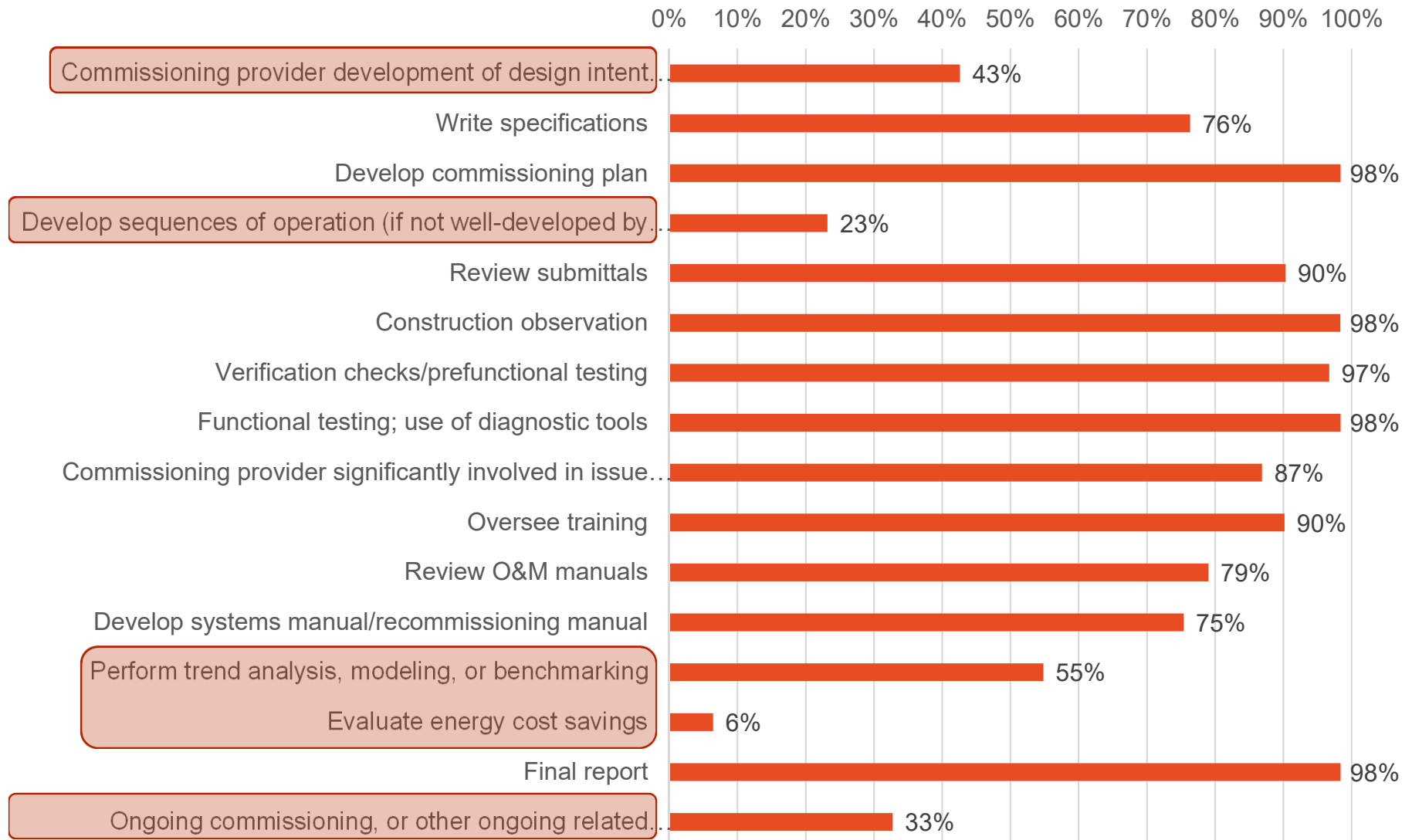
NCCx: Projects Reporting Non-Energy Benefits



Activities included in New Construction Commissioning Scope (n=62)



Activities included in New Construction Commissioning Scope (n=62)





NCCx Market Factors

1. Owner awareness – highest driving factor
2. NCCx demand driven by regulation and codes
3. Several non-energy benefits obtained thru NCCx
 - a) Schedule improvement
 - b) Smooth turnover
 - c) Training
4. Building performance metrics (energy, IAQ) has lost some emphasis
5. Core Cx scope of work is performed on each project
6. Opportunity to improve frequency of scope items:
 - a) OPR/Design Intent document
 - b) Controls sequence development
 - c) Energy cost calculations
 - d) Post-occupancy tasks



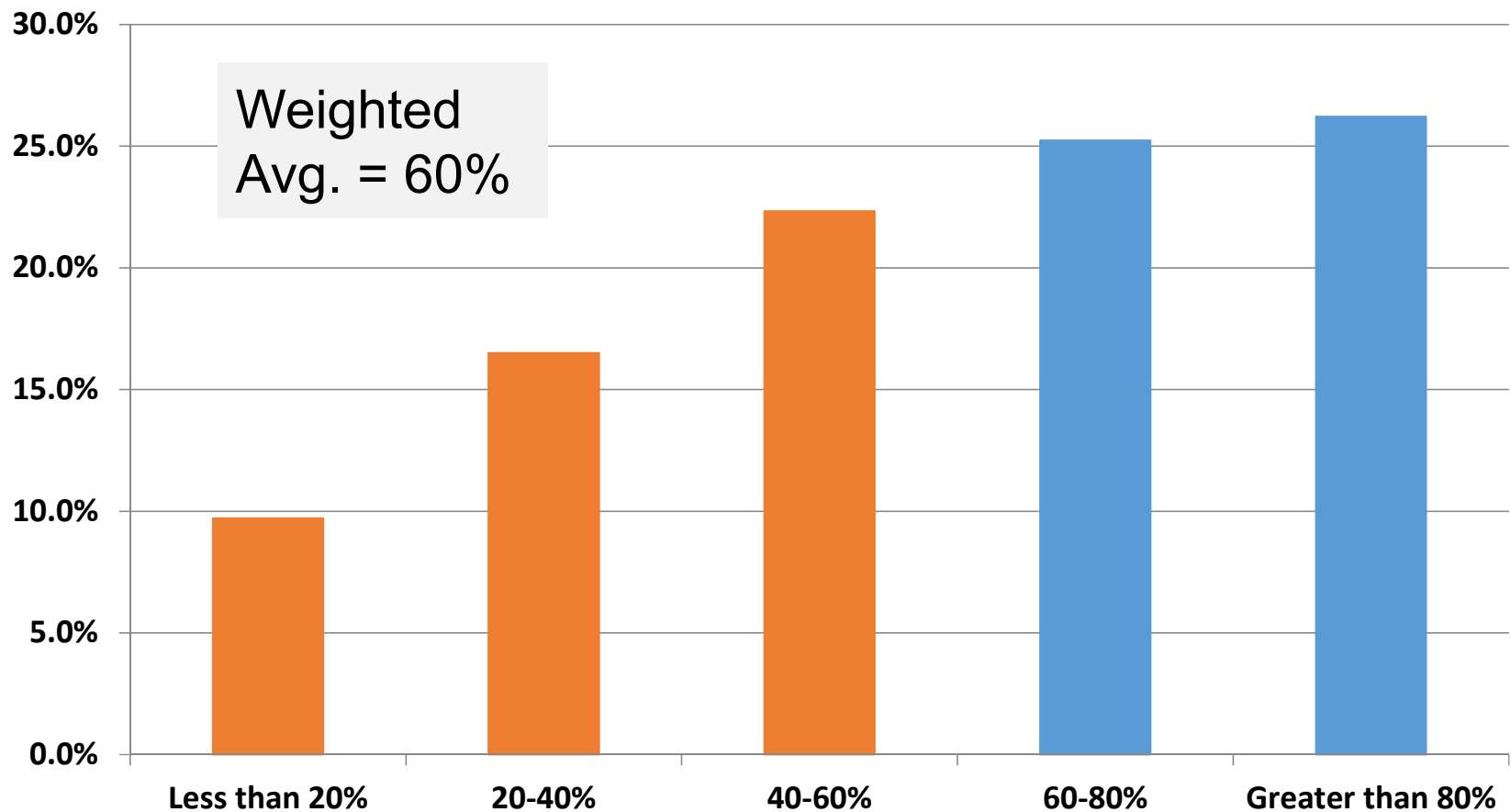
Value of Cx (NCCx) Study Results

Cost Summary

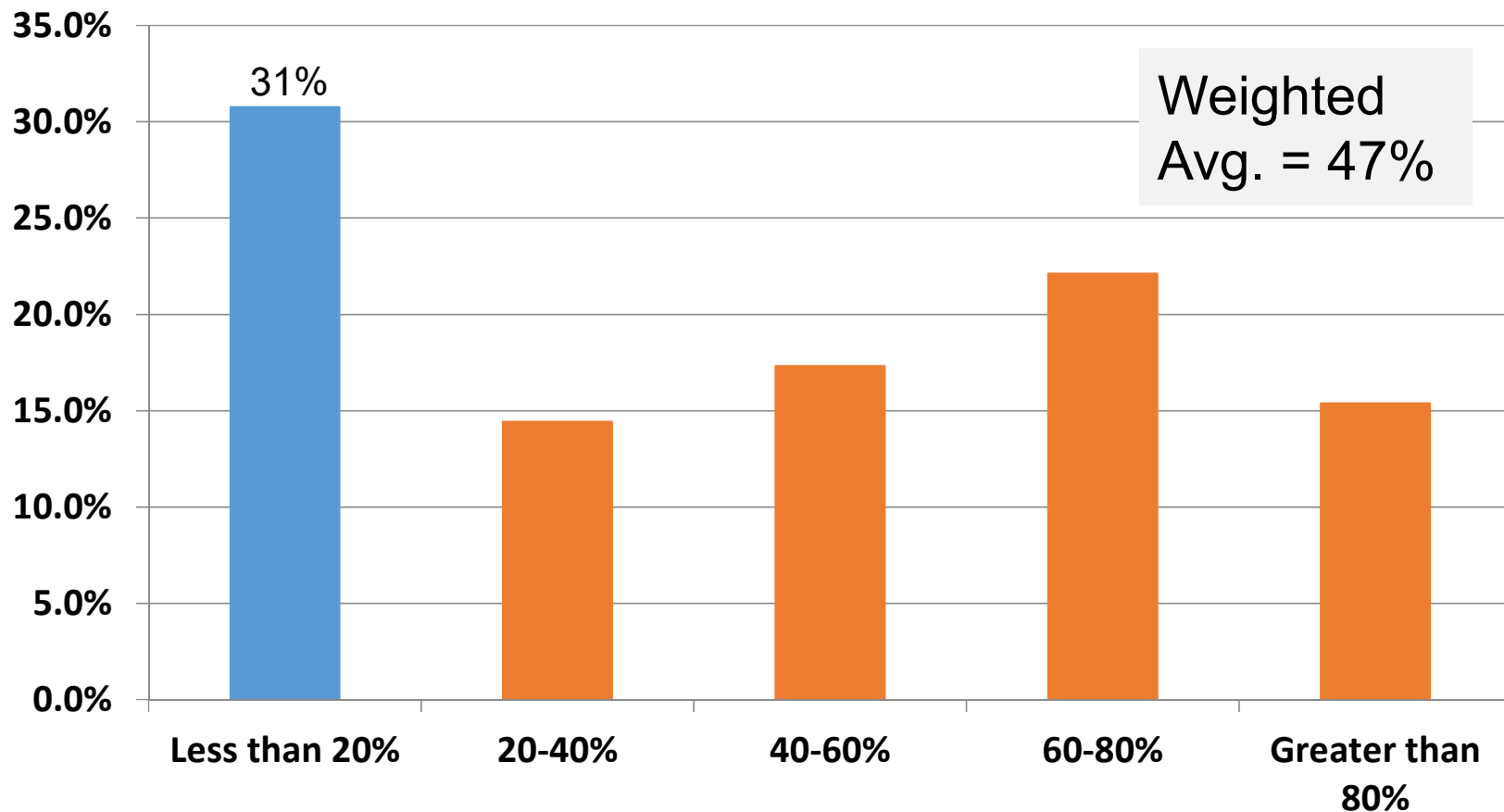
Market Demand Factors

Scope of Work Observations

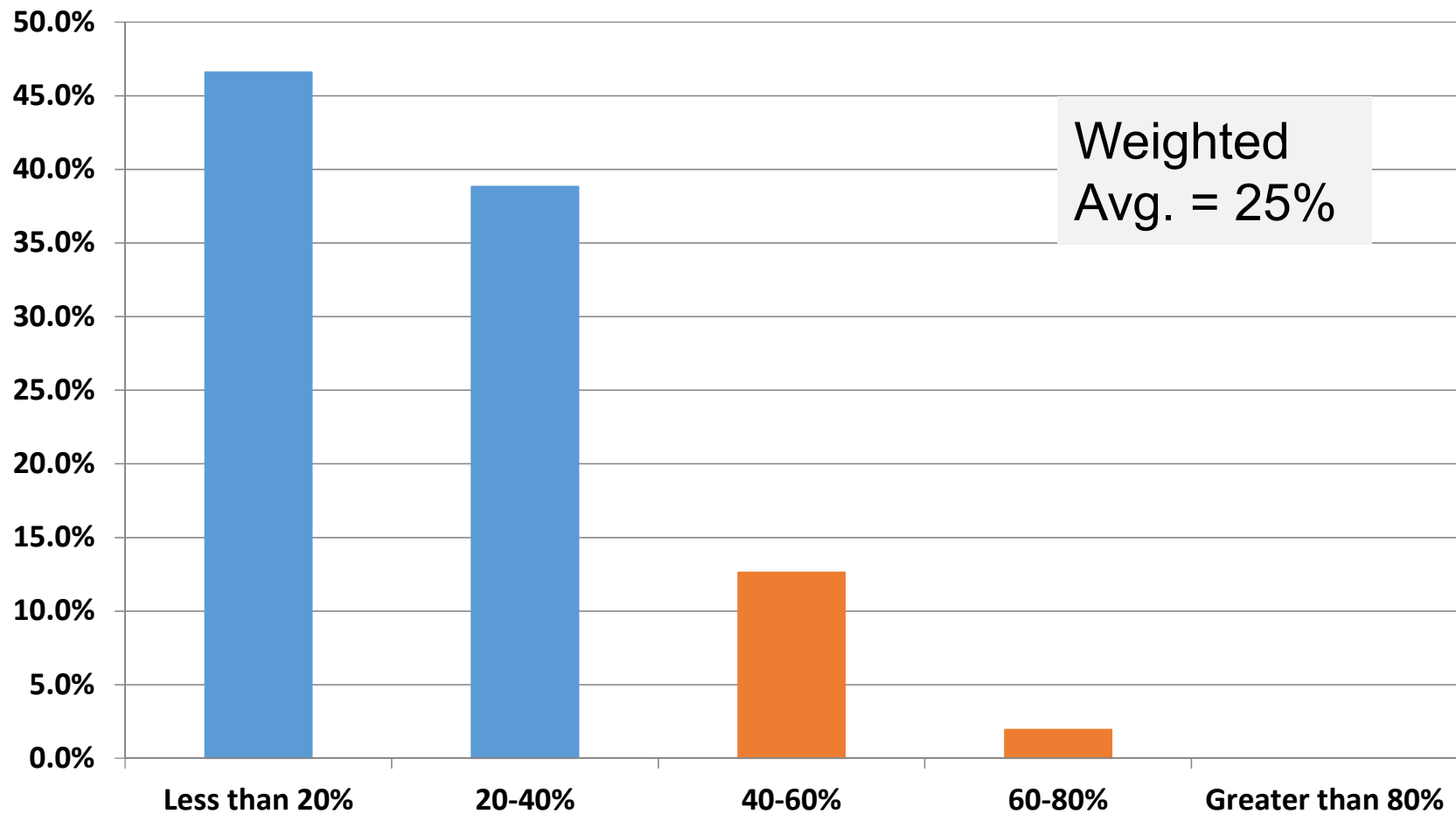
Percentage of NCCx Projects include Design Phase Cx Services? ⁽²⁶⁾



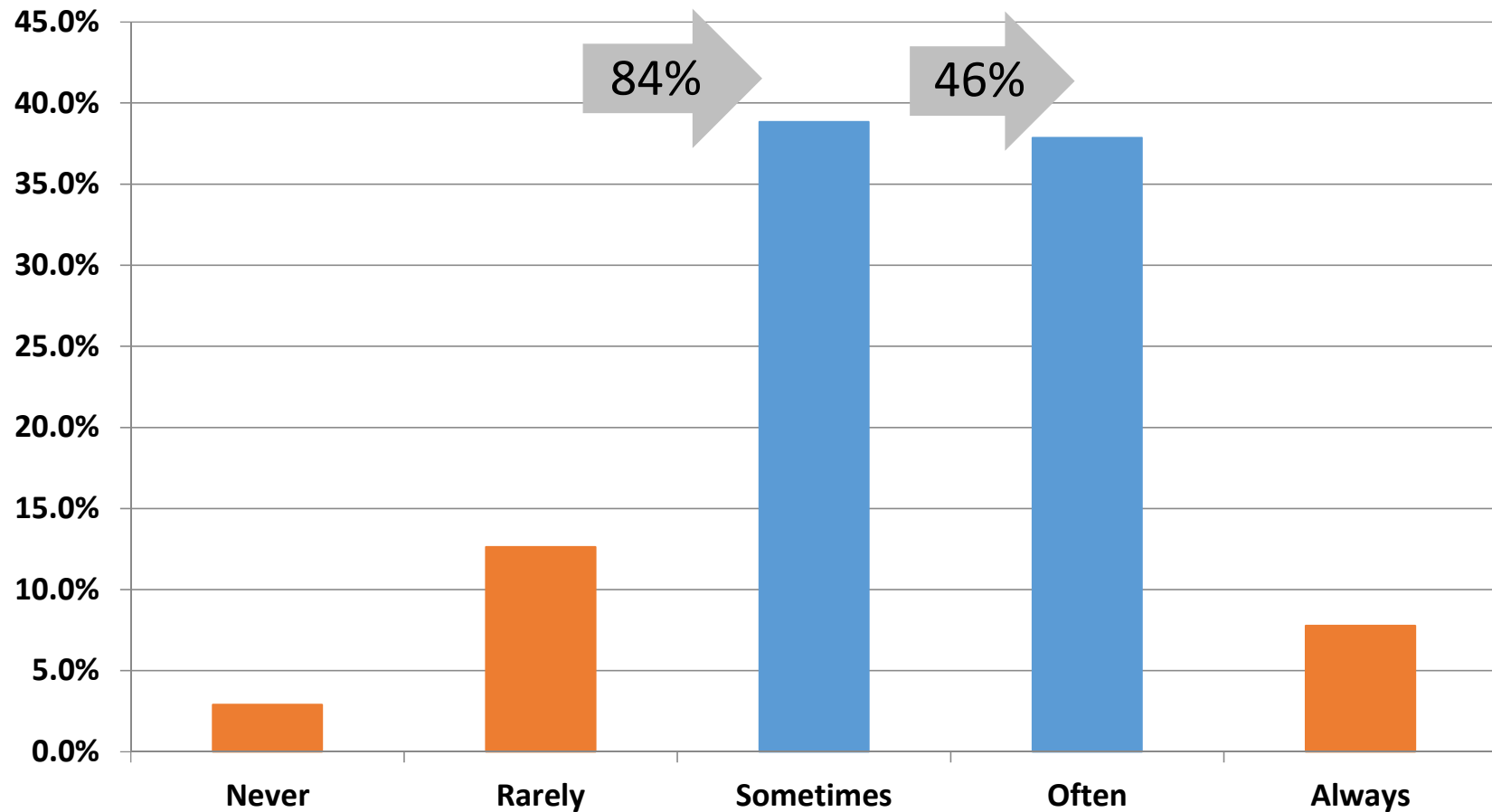
Percentage of NCCx Projects where OPR is Developed for Owner? ⁽³⁰⁾



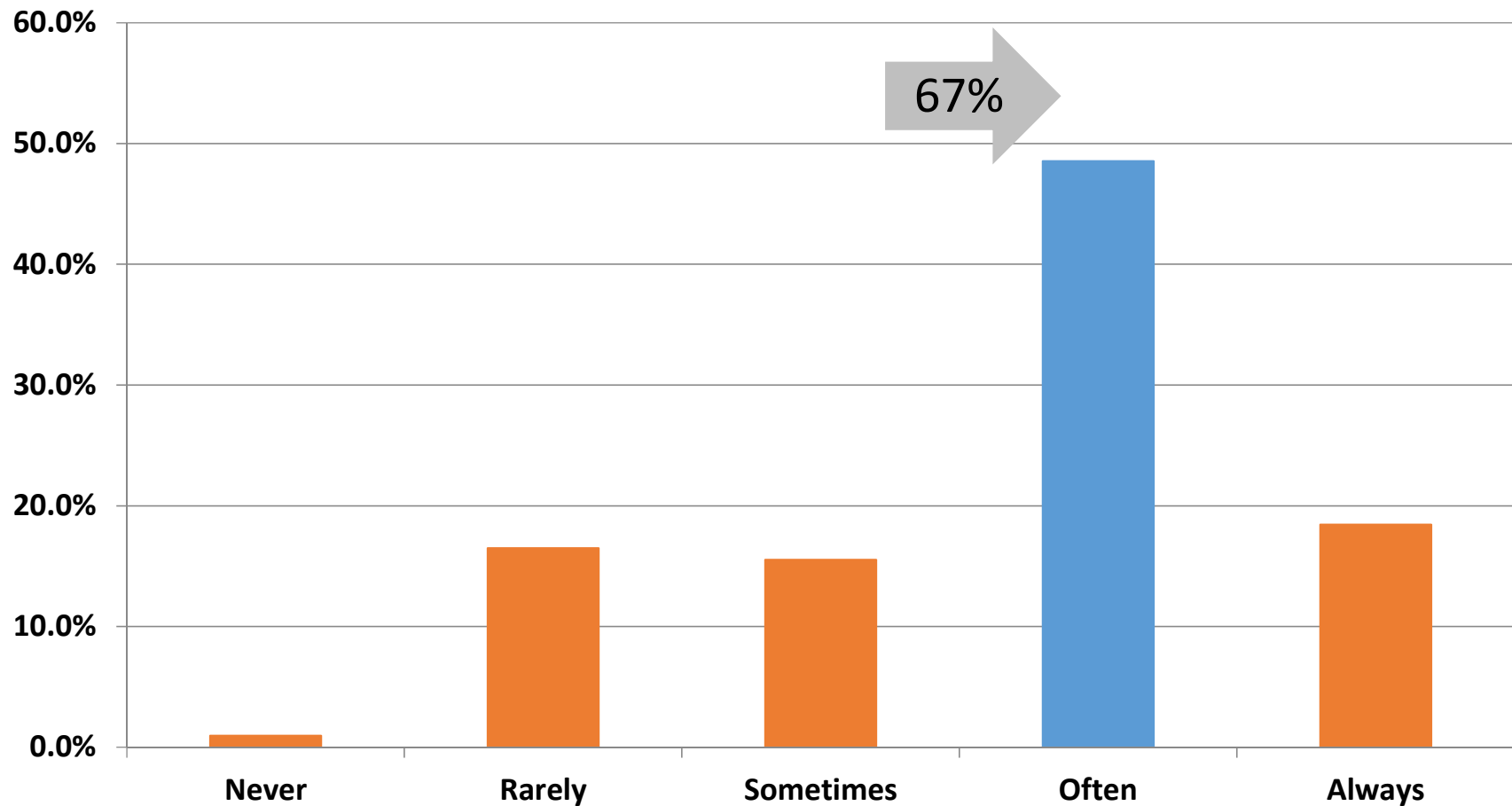
Percentage of Cx Issues Discovered during Design Phase? ⁽³³⁾



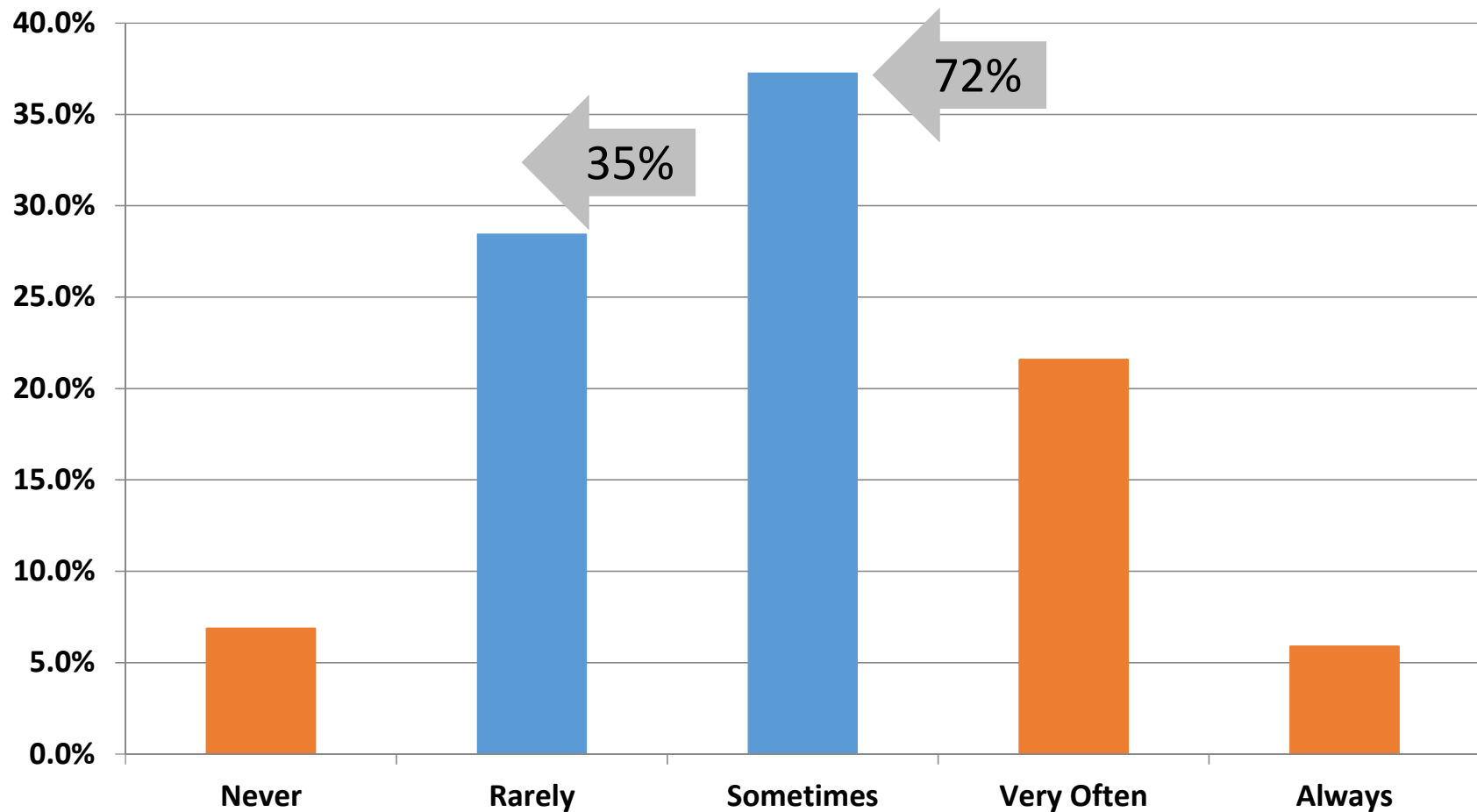
How often are Cx Review Comments in Design Phase incorporated into Contract Docs? ⁽⁴³⁾



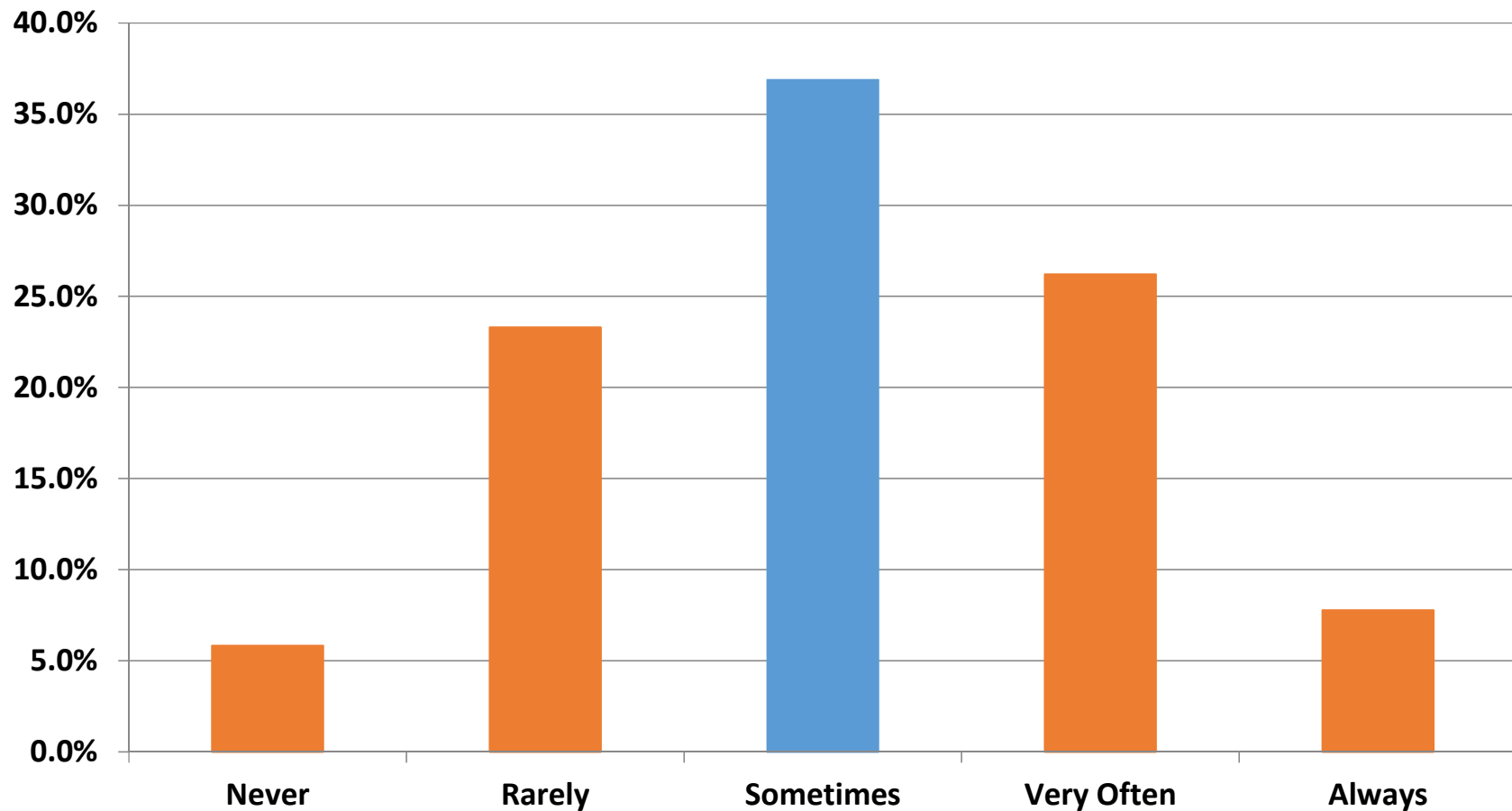
How often were control sequences created without collaboration between design and Cx? ⁽³⁹⁾



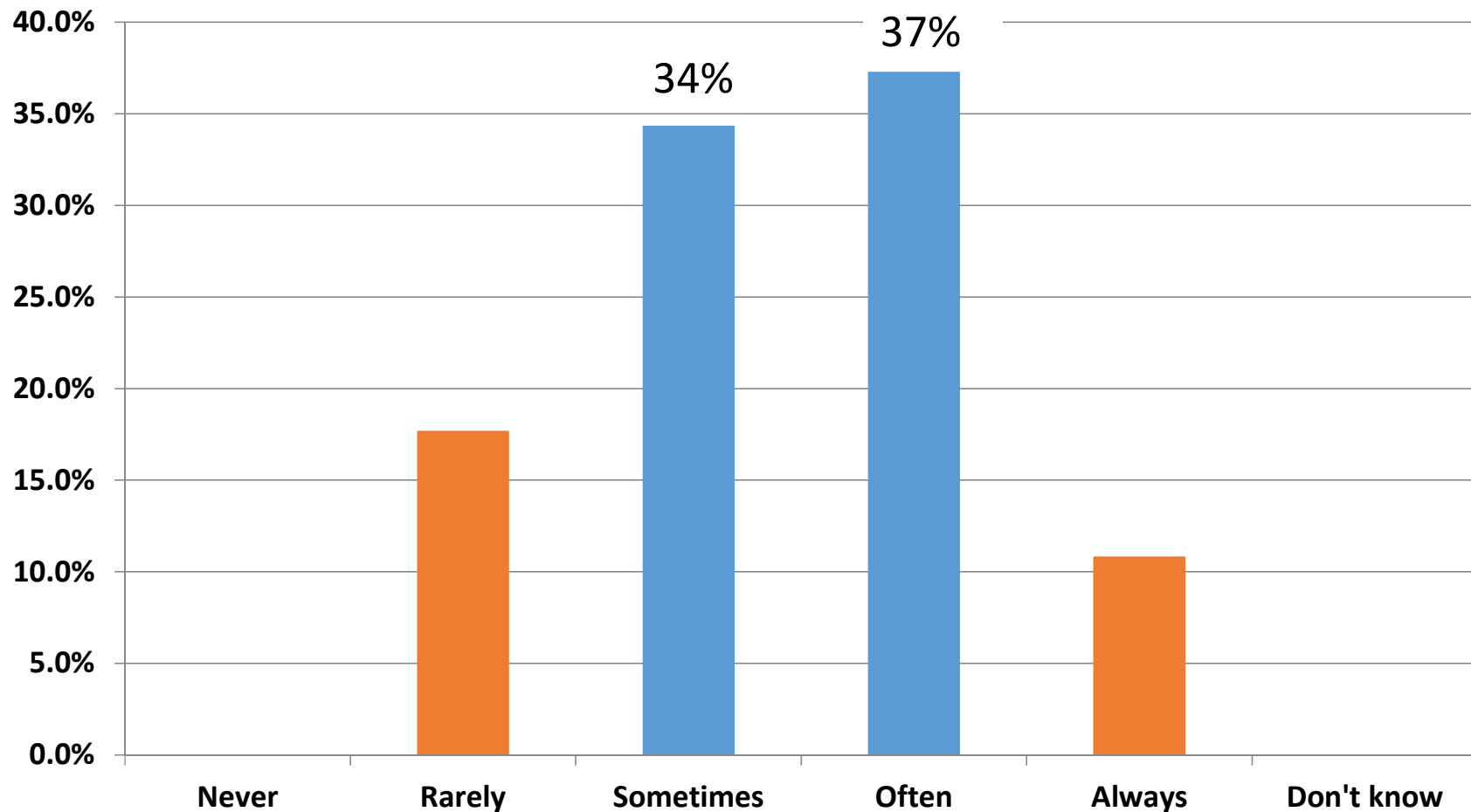
How often does NCCx meet with facility personnel during design? (41)



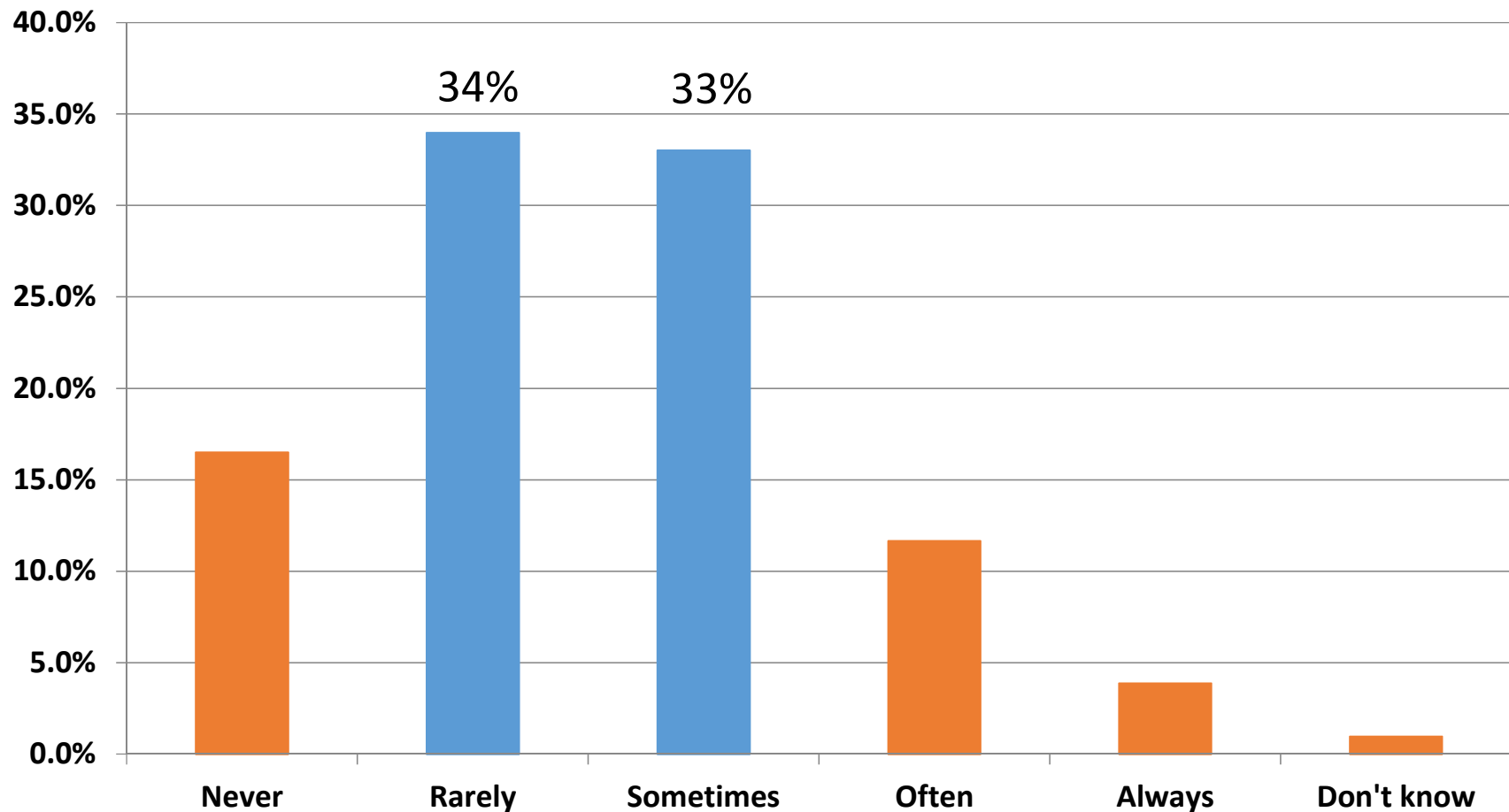
How often do controls coordination meetings occur (engineer, contractor, Cx)? ⁽⁴⁵⁾



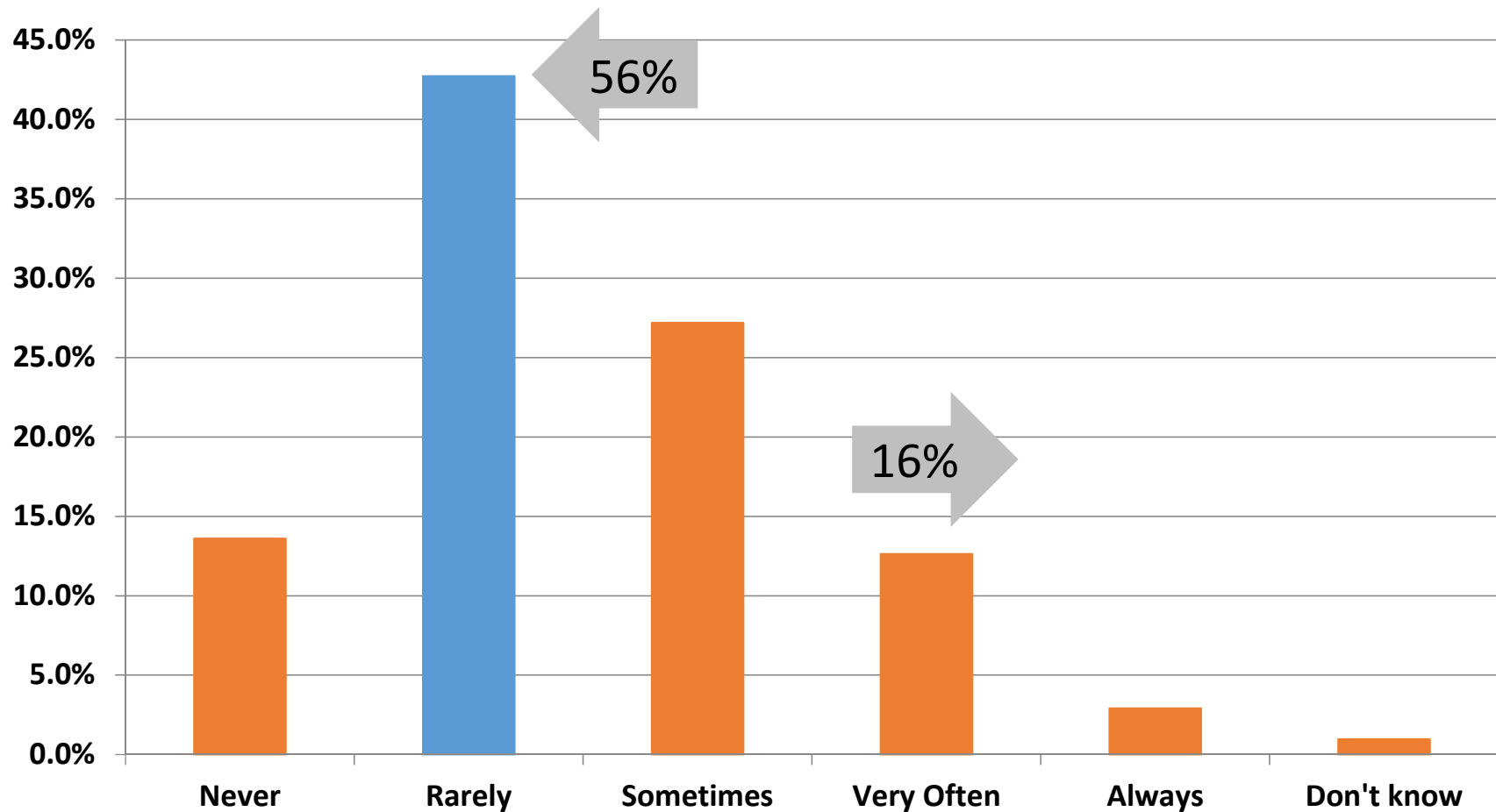
How often do Cx issues remain open after Beneficial Occupancy? ⁽⁵²⁾



How often is a Post-turnover occupant survey of satisfaction conducted? ⁽⁵³⁾



How often are OCx tasks included after Warranty is complete? ⁽⁵⁴⁾





NCCx Market Survey – SOW Takeaways

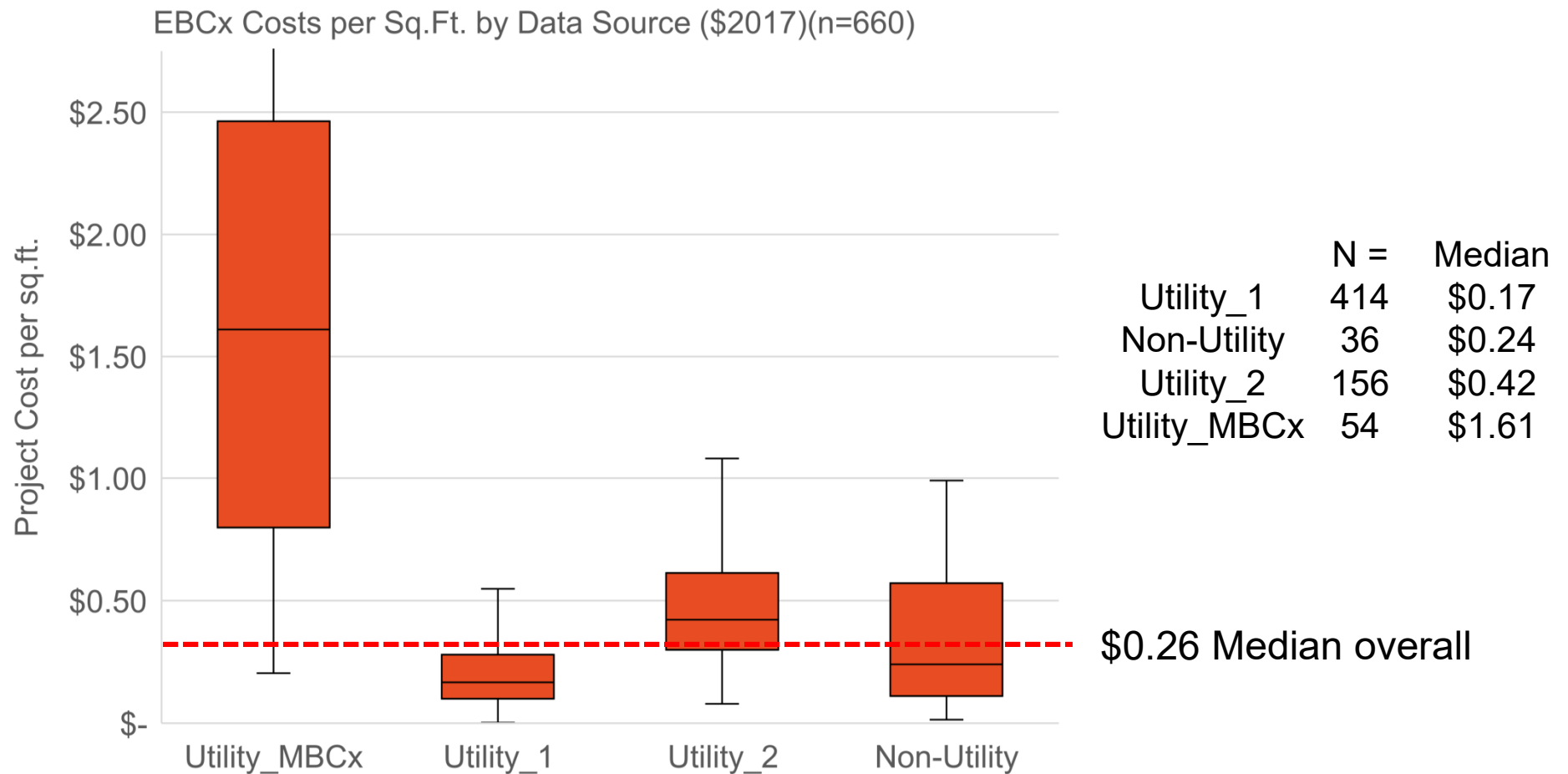
1. Design phase Cx services are included in over 60% of NCCx projects.
2. Design phase Cx review comments are incorporated in contract documents over 80% of the time.
3. Design phase issues constitute $\approx 25\%$ of all NCCx issues.
4. Opportunity to improve frequency of NCCx scope items:
 - a) OPR/Design Intent document
 - b) Controls sequence development/Controls coordination meetings during submittals
 - c) Scheduling/Equipment startup coordination
 - d) Collaboration with facility personnel/Follow-up with occupants
5. OCx SOW is included more often (44% = “sometimes” or better)



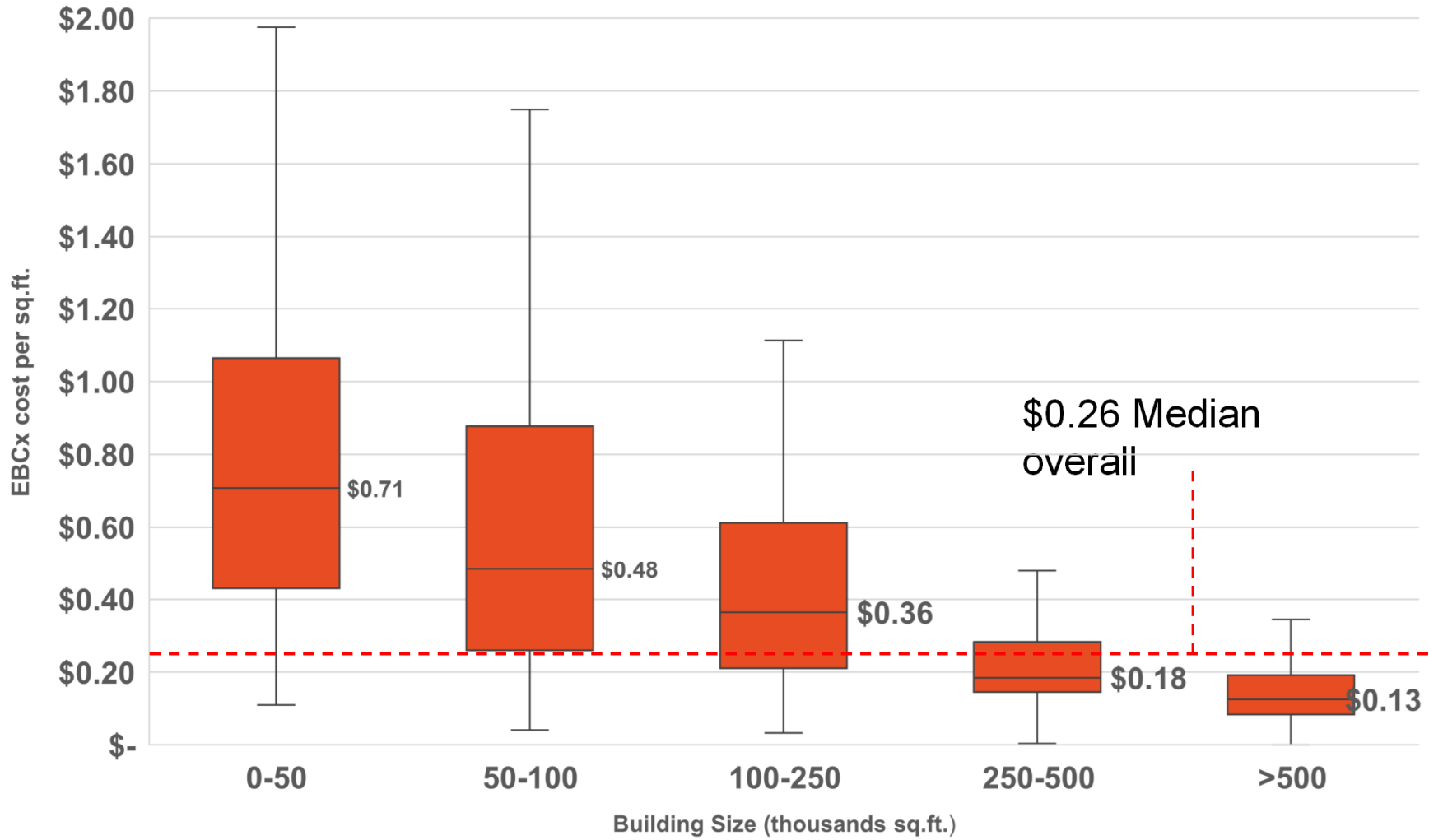
EBCx - Discussion Topics

- Building data: Preliminary narratives regarding Cx Value metrics
 - 1. EBCx – Cost Summary**
 - 2. EBCx – Market Demand Factors**
 - 3. EBCx – Scope of Work Observations**
- Review Data Survey Results
 - What's Changed?
 - Check Calibration
 - Market Drivers & Issues

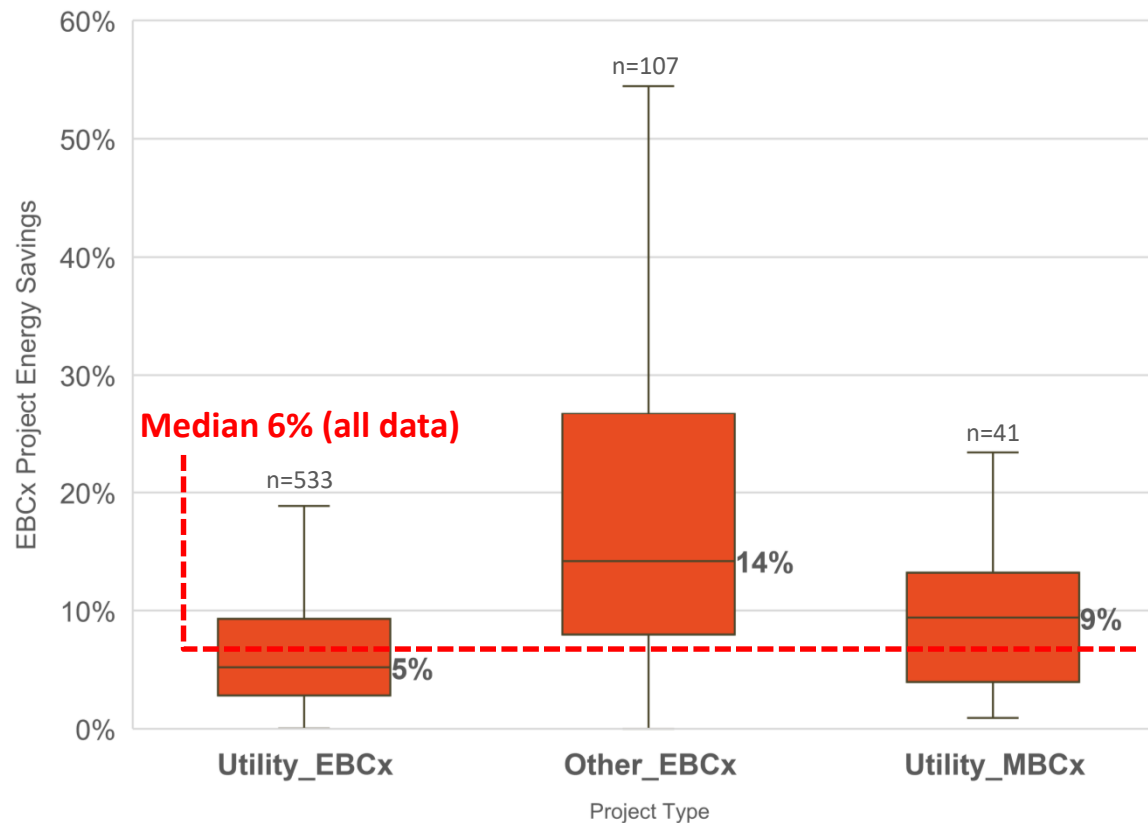
EBCx Cost per Square Foot



EBCx Cost per Square Foot (Bldg. Size)



EBCx Percent Savings by Project

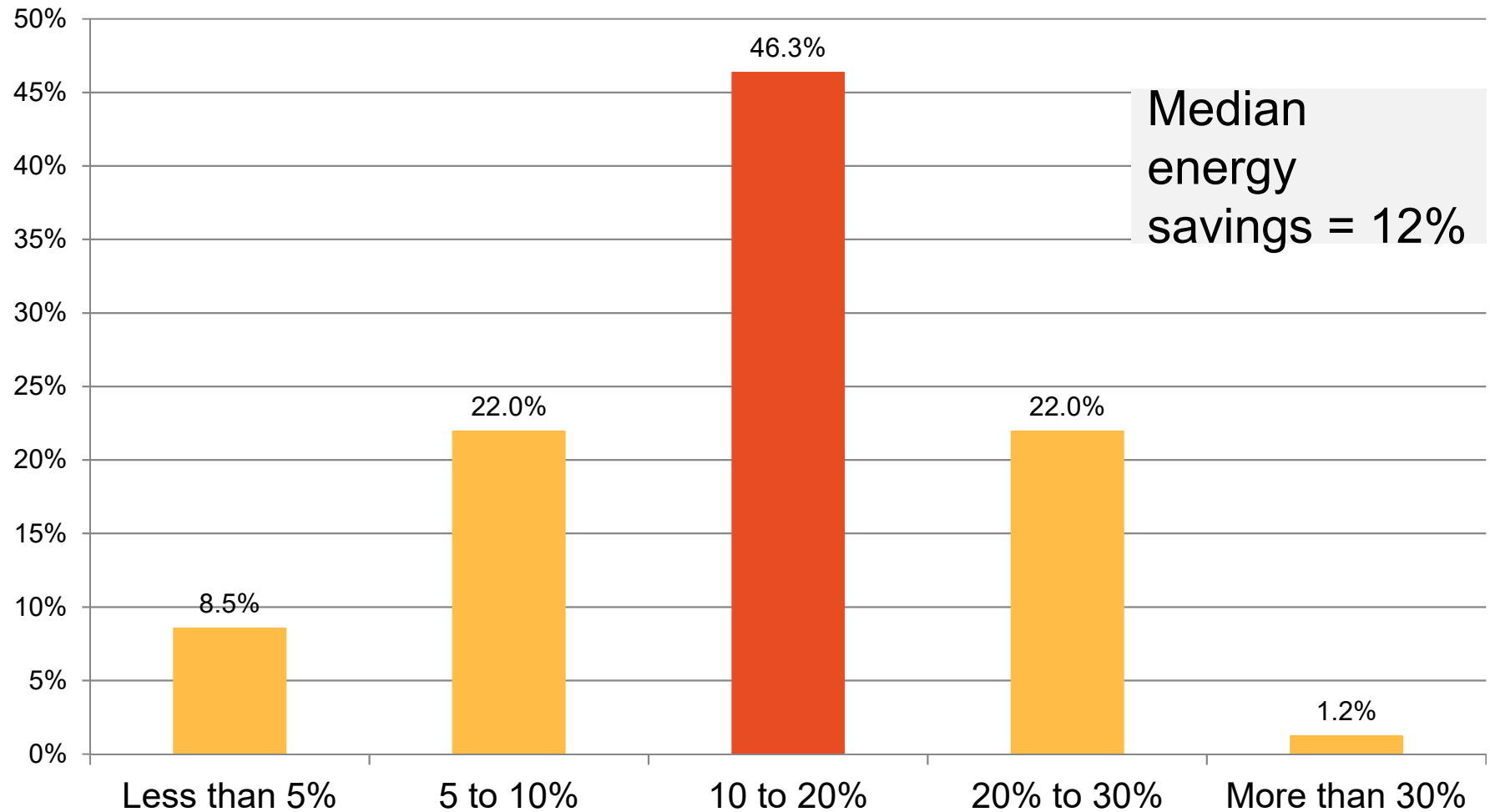


	Median	n
Utility_1	5%	326
Utility_2	7%	156
Utility_MBCx	9%	41
Other_EBCx	14%	107

- **Median energy savings = 6%**
- Utility typical range = 3 to 11%
- 2018 median less than 2009 savings of 10%

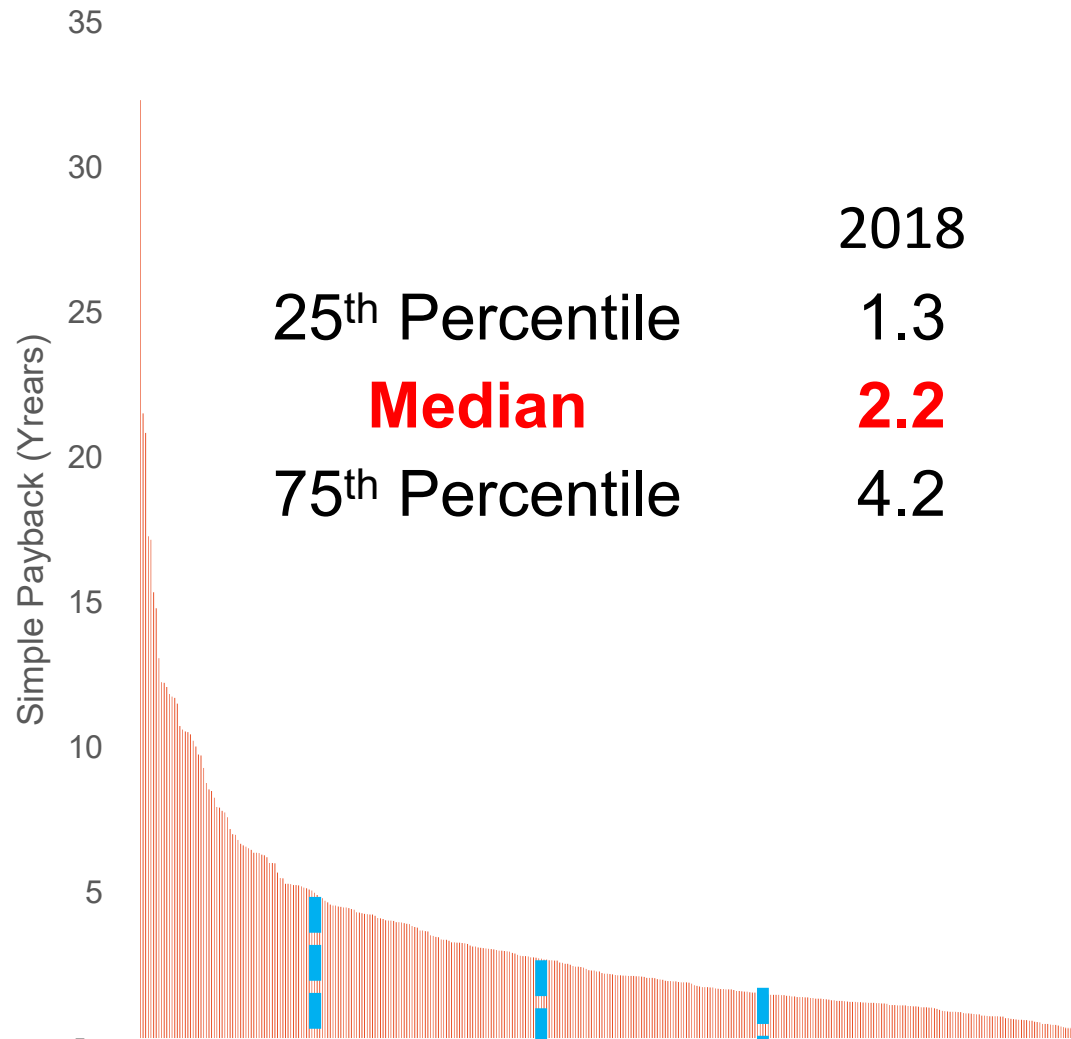


EBCx Percent Savings by Project

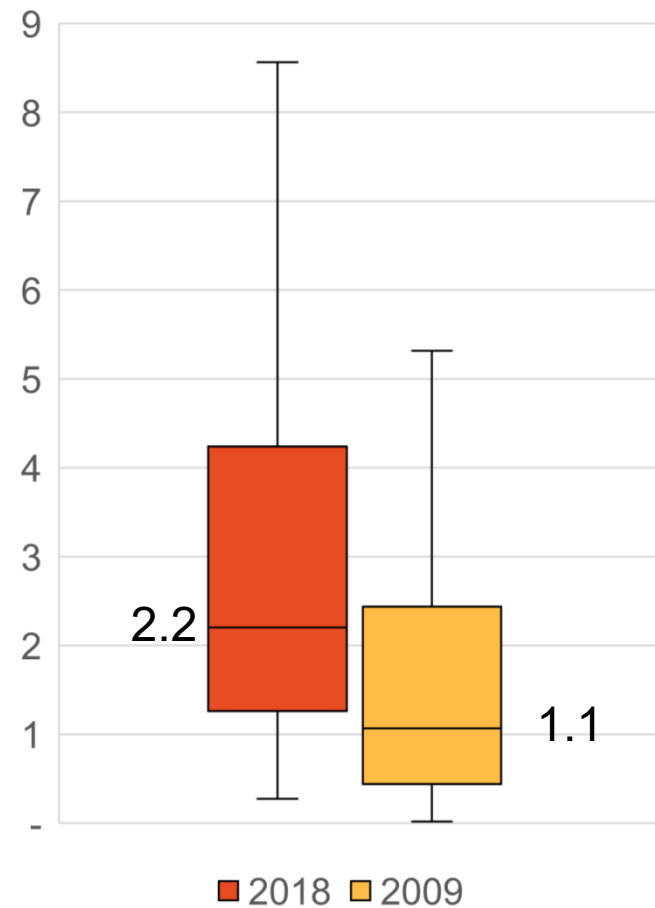


EBCx Simple Payback (Years)

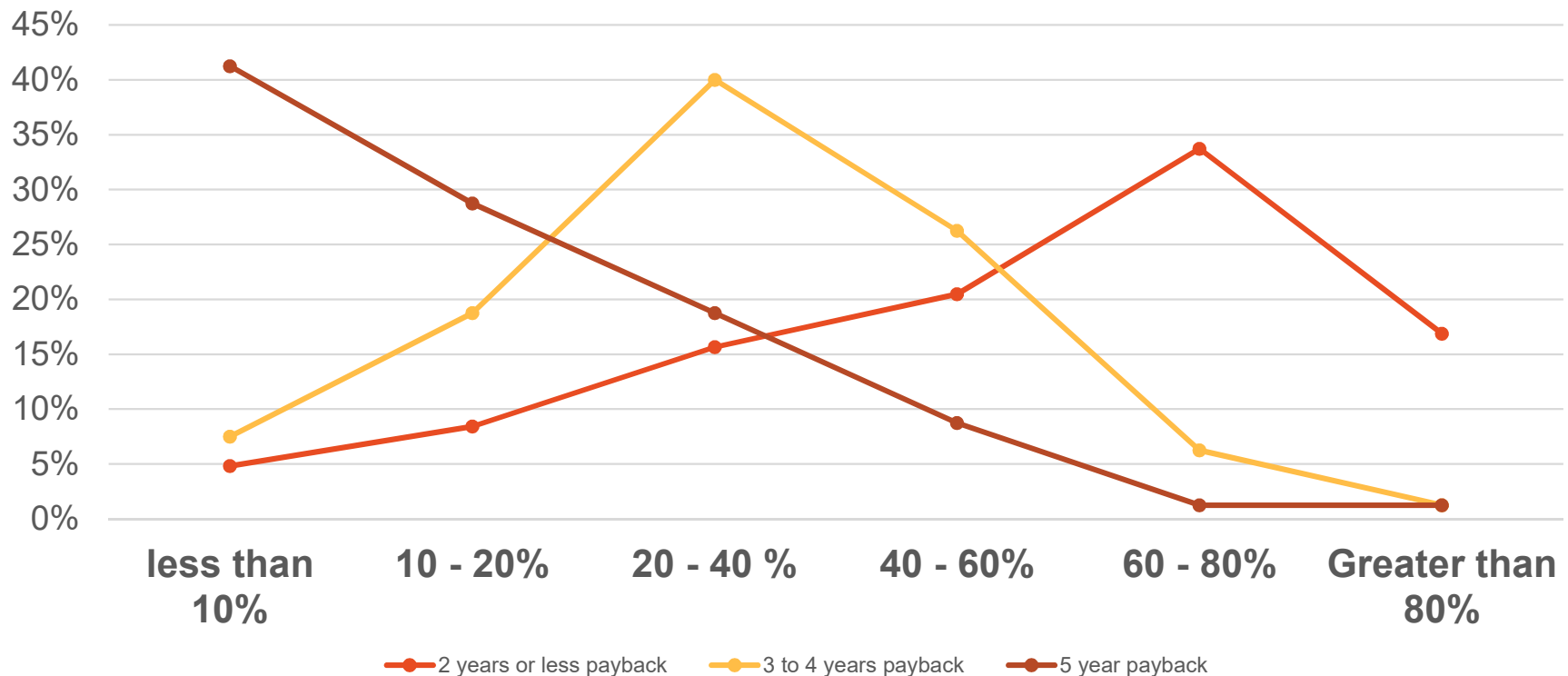
(n=300 bldgs.)



Simple Payback (Years),
2009 vs. 2018



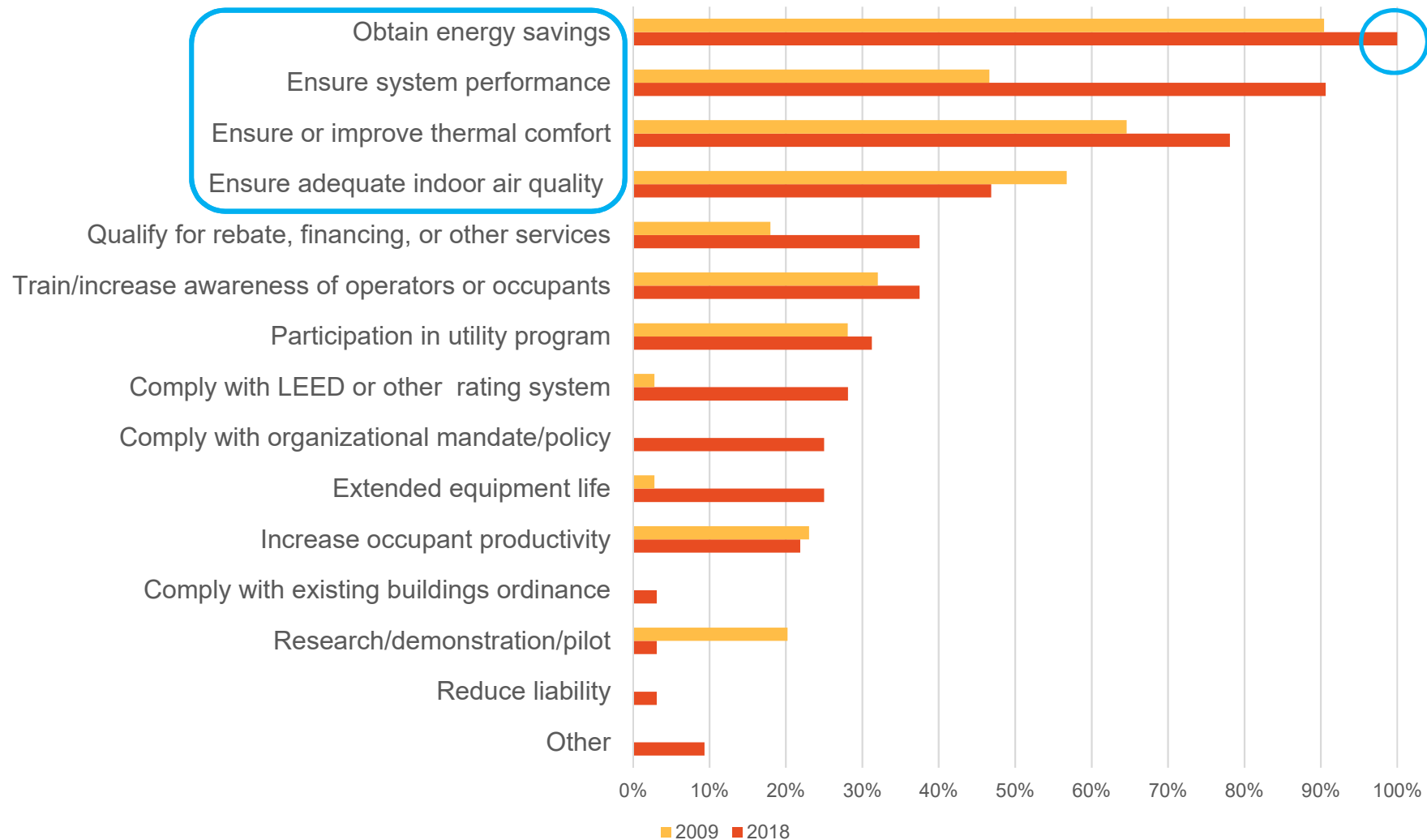
EBCx Implementation by Payback



- 2 year payback or less: Implemented 55%
- 3 to 4 year payback: 34%
- 5 year payback or greater: 18%

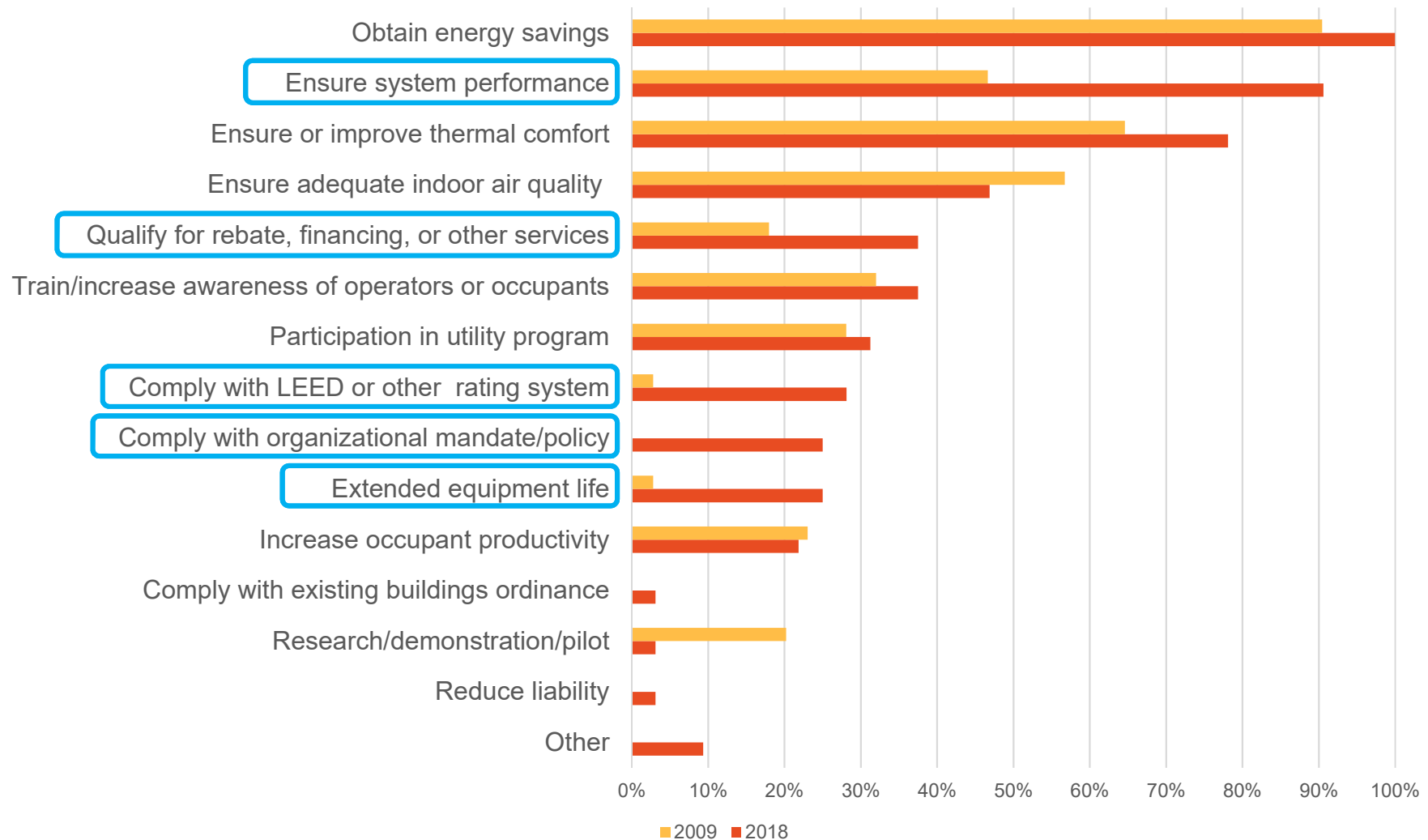
Reasons for Implementing EBCx

Fraction of reporting projects with reason (EBCx), 2009 vs. 2018

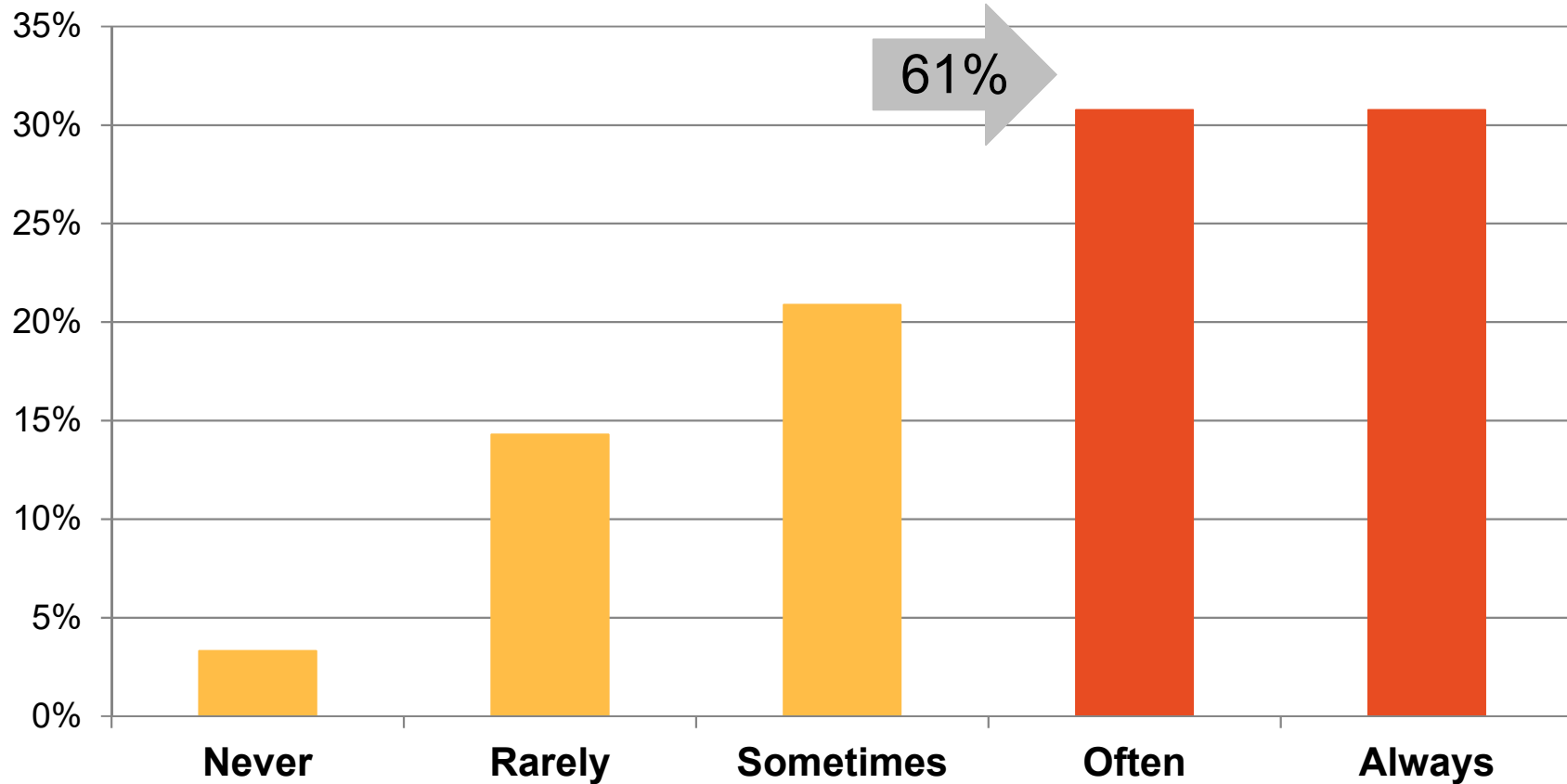


Reasons for Implementing EBCx

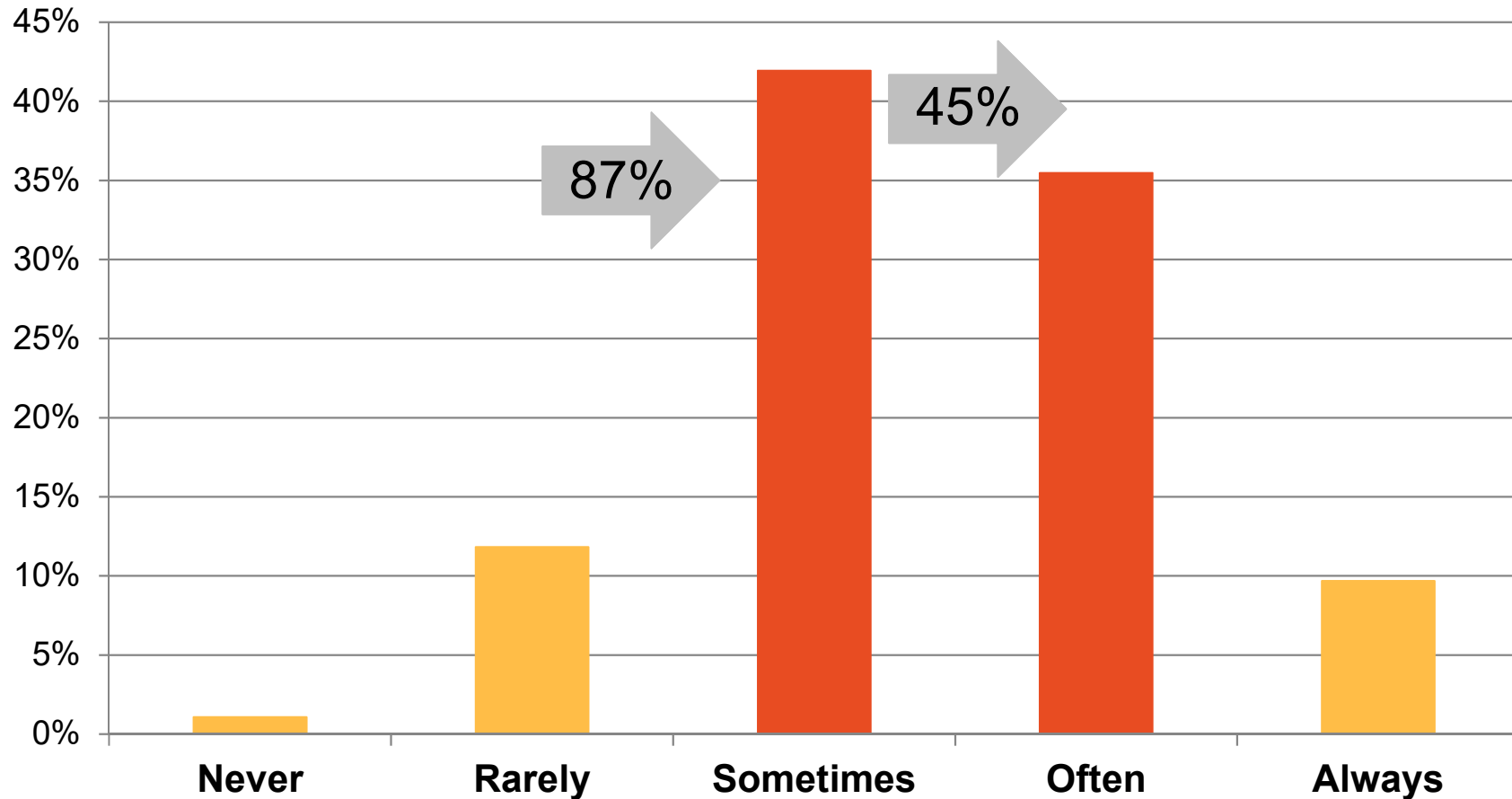
Fraction of reporting projects with reason (EBCx), 2009 vs. 2018



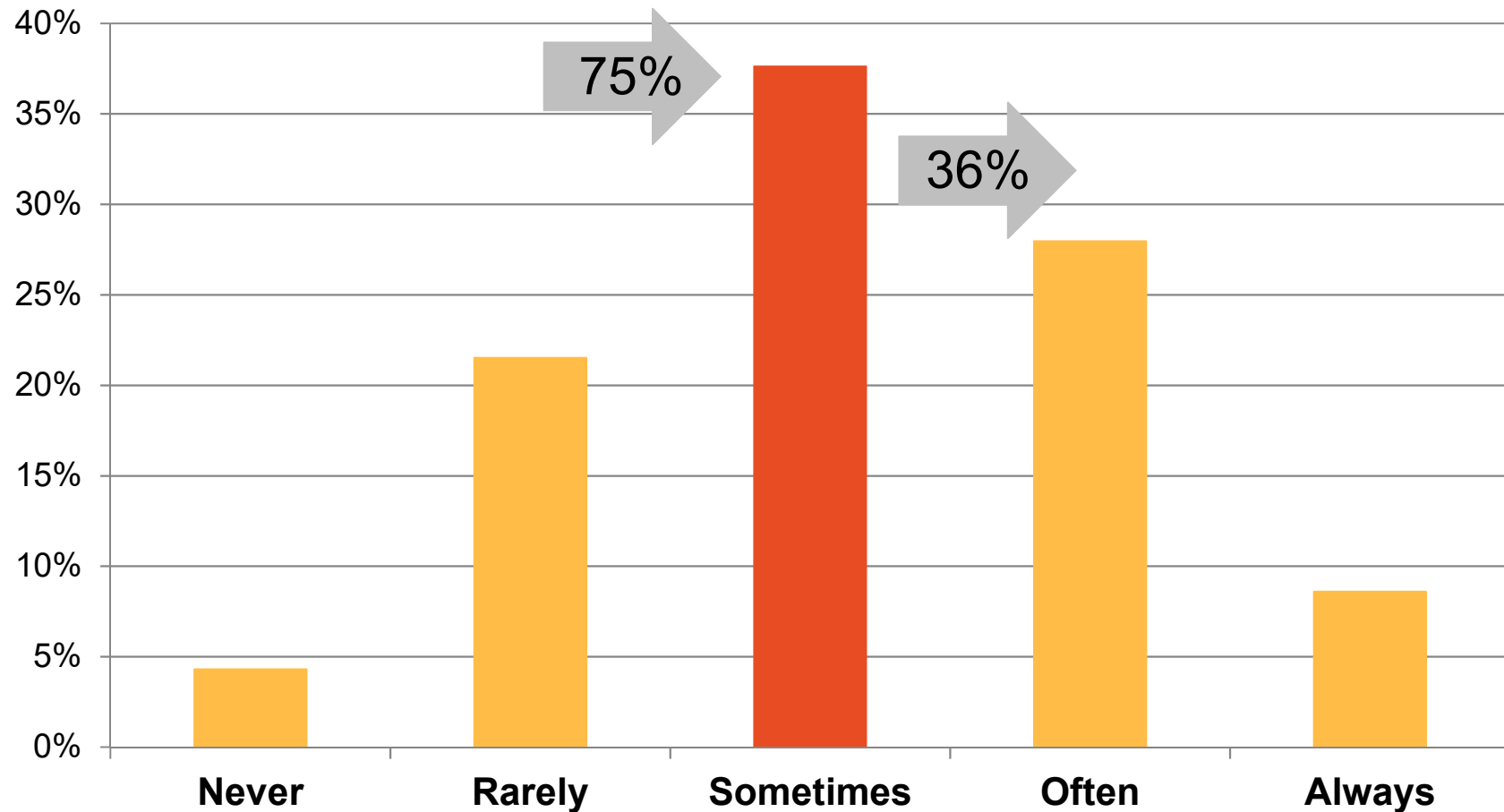
Were Cost and Energy Savings calculations included with EBCx?



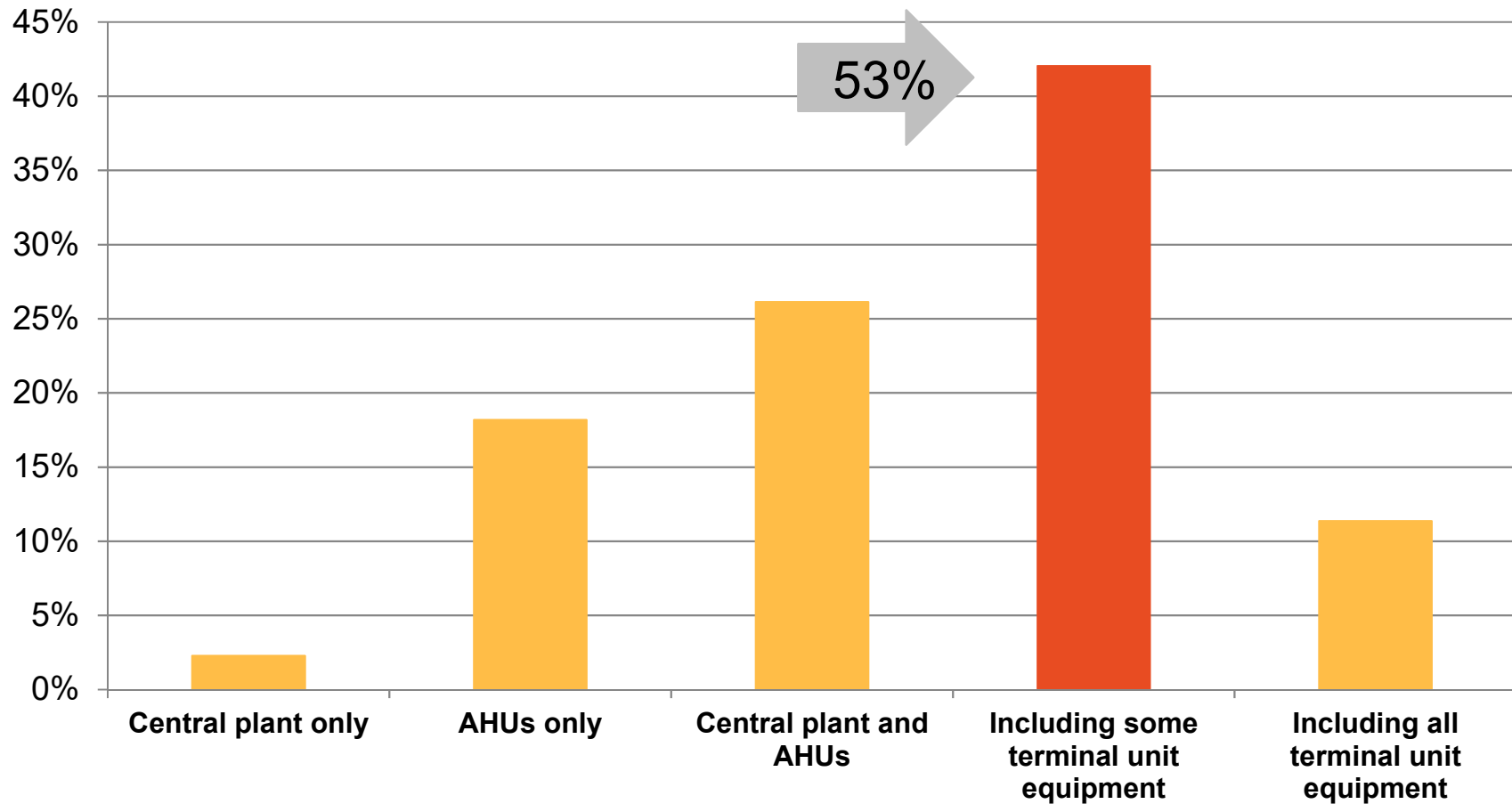
Significant repairs before EBCx?



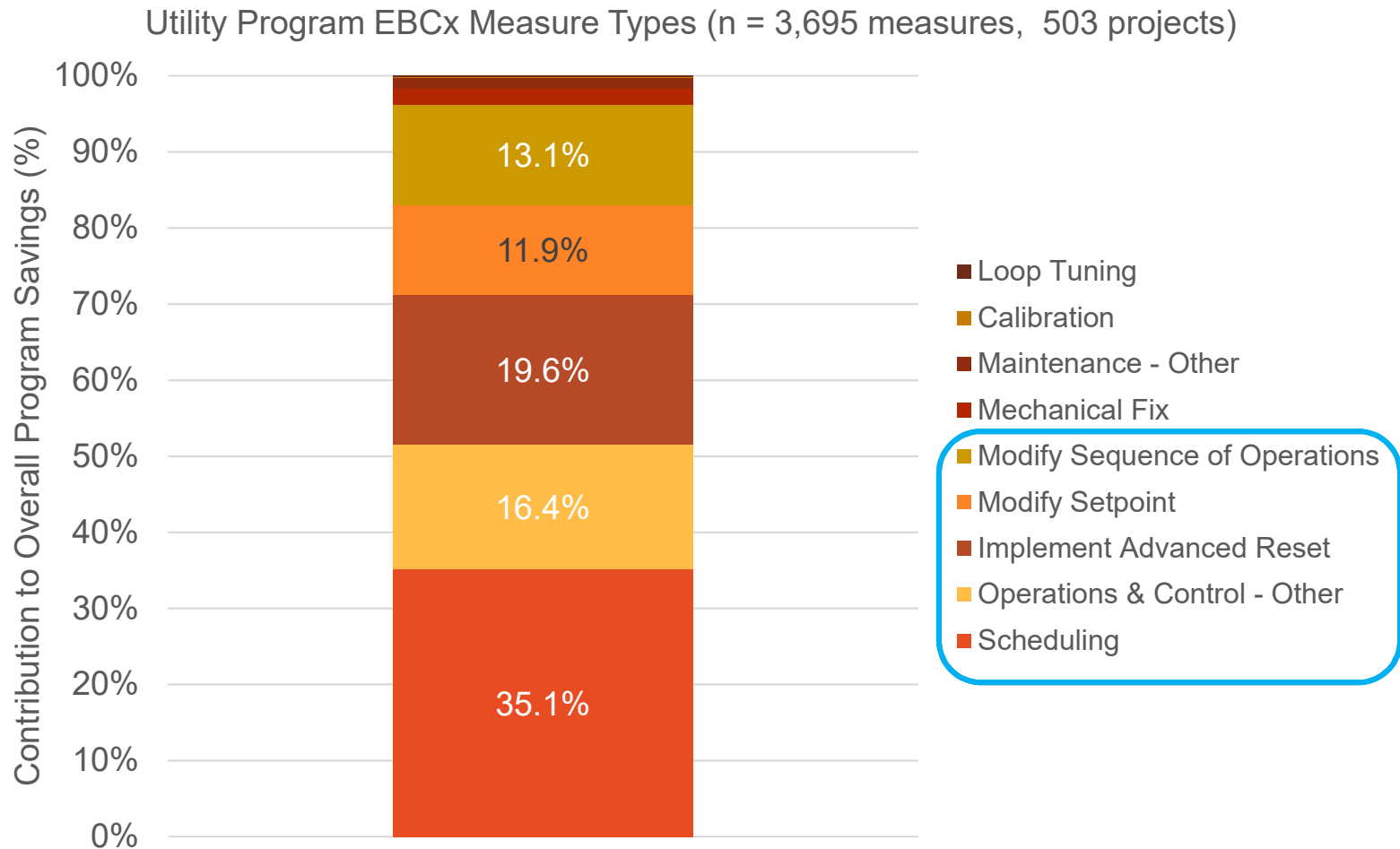
How often is TAB included?



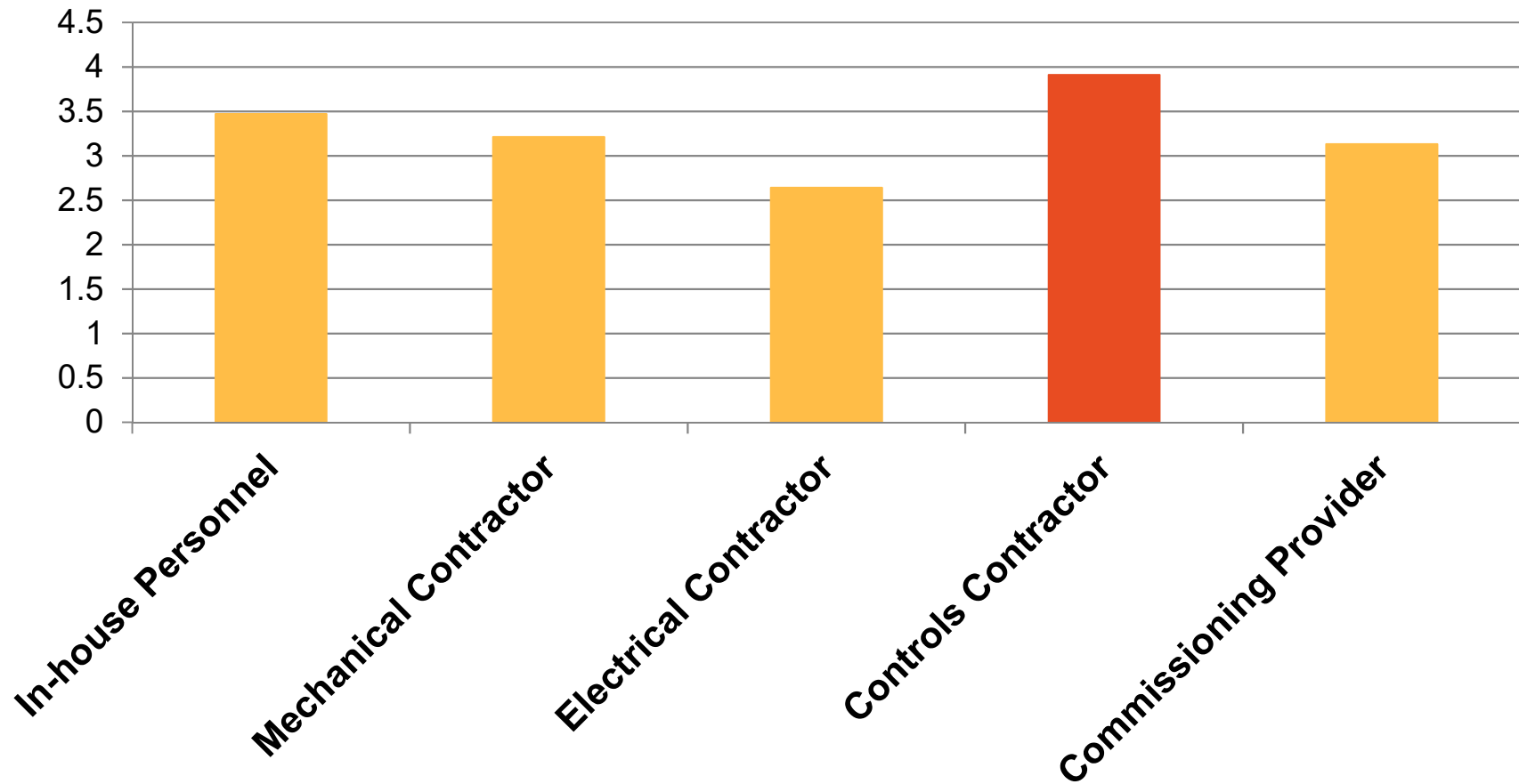
Level of TAB investigation



EBCx Measure Mix



How were EBCx issues addressed?





Conclusion

1. Energy Savings

- a. Median 6%, typical range 3% to 11% (combined utility and non-utility EBCx programs)
- b. EBCx outside utility programs could hit 10% to 25% range
- c. 2018 median down from 2009, though looking at project type suggests no major market shift

2. Simple Payback

- a. Median 2.2 years. Range generally 1 and 4 years payback
- b. Median \$0.26 project cost per sq.ft., with a typical range \$0.15 to \$0.56
- c. Projects at lower percent savings can still be highly cost-effective

3. Owner's reasons for implementing EBCx: Top 4 are unchanged from 2009 study

4. EBCx Measures: Top 5 measures account for 95% of all measures



Additional Information

Deliverables will be posted to website,

[https://www.bcxa.org/knowledge-center/
value-of-cx-project/](https://www.bcxa.org/knowledge-center/value-of-cx-project/)

- Technical Narratives
- Blogs
- Presentations
- Data, Research
- Related Surveys

Questions?

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