

New research from Lawrence Berkeley National Laboratory (LBNL) and the Building Commissioning Association (BCxA) shows that building commissioning remains a cost-effective way to improve building operations and mitigate risks associated with poor building performance.

Building Commissioning Overview

Commissioning (Cx) is a systematic approach for verifying that building systems are performing according to their original design and meeting the needs of building owners and occupants. Using a Cx process can help building operators identify HVAC or lighting control issues, maintenance problems, and indoor air quality issues.

To better understand trends in the delivery of Cx, LBNL conducted a cost/benefit study in 2018, expanding on past findings from a widely cited 2009 report. With the new 2018 data, LBNL was able to analyze the value of Cx for almost 1,500 buildings across the U.S. and parts of Canada. Additional data was gathered from a BCxA national market survey that helped to contextualize analysis results.



NOMENCLATURE

Cx	Commissioning (generic, representing applications to new as well as existing buildings)
EBCx	Existing building commissioning
MBCx	Monitoring-based commissioning (a sub-process of EBCx, employing data analytics software)
NCCx	New construction commissioning

KEY TAKEAWAYS

- ▶ Cx projects in existing buildings offered cost-effective savings with a **median payback of 1.7 years**.
- ▶ The cost of Cx for new construction decreased by nearly half since 2009.
- ▶ The top 4 reasons for implementing Cx in existing buildings have remained the same since 2009: 1) capturing energy savings, 2) ensuring system performance, 3) improving thermal comfort, and 4) maintaining proper indoor air quality.
- ▶ Utility-sponsored EBCx programs are delivering significant whole building energy savings at scale

Findings from the report have been summarized below.

Existing Building Commissioning (EBCx) Energy Savings and Drivers

Cx projects in existing buildings offered cost-effective savings with a median payback of 1.7 years and a median project cost of \$0.26 per sq. ft. However, compared to the 2009 data, there was a decrease in median EBCx project energy savings for the more recent data. This is partly due to the composition of the data collected in 2018, which was dominated by utility-sponsored EBCx projects, and may also be affected by a general increase in energy efficiency in the U.S. building stock. Further, a larger proportion of buildings in the 2018 data set were LEED-compliant suggesting that they had higher efficiency and pursued Cx during construction.

EBCx projects conducted outside of utility programs achieved appreciably higher energy savings (14%) compared to those within utility programs (5%). The data did not explain this difference, however, anecdotally, this could be attributed to the stringent documentation requirements that utility programs have to follow, leaving less budget towards identifying energy-saving improvements.

Since 2009, the top 4 reasons for implementing Cx in existing buildings have remained the same: 1) capturing energy savings, 2) ensuring system performance, 3) improving thermal comfort, and 4) maintaining proper indoor air quality.

New Construction Commissioning (NCCx) Energy Savings and Non-Energy Benefits

Median NCCx costs were significantly reduced for the 2018 data set (\$0.82 per sq. ft.) as compared to the 2009 dataset (\$1.55 per sq. ft.). This could suggest that the costs of commissioning in new construction projects has decreased, potentially due to market competition, software implementation, and a skilled and growing workforce. Additionally, 82% of respondents in the BCxA survey indicated that they were maintaining or increasing profitability and were optimistic about future business.

While the scope for NCCx projects has become more comprehensive, quantifying energy savings is not commonly included. Even though energy savings are likely important to building owners, determining savings requires costly modeling to estimate. According to BCxA survey results, over 75% of respondents reported non-energy benefits from Cx projects. These benefits included improvements to system design, thermal comfort, ease of maintenance improvements, and facility staff training and education.

COST/BENEFIT METRIC	MEDIAN VALUES	
	EBCx	NCCx
Energy savings	6.4%	13%
Cost per sq. ft.	\$0.26	\$1.03
Simple payback	1.7 years	4.2 years

Looking Ahead

The 2018 expansion of Cx project data reaffirms the savings potential and cost effectiveness of commissioning. However, there is still a lack of data on addressing enclosure Cx, lighting controls Cx, renewable energy, energy storage, and demand response technologies. These gaps highlight the relative rarity of commissioning beyond HVAC systems and the potential for pursuing monitoring-based commissioning (MBCx) in the future. As building systems become more integrated and grid-interactive, large-scale deployment of Cx will become even more critical in ensuring that buildings can satisfy occupant needs and meet sustainability goals.

Crowe, E., Mills, E., Curtin, C., Bjørnskov, D., Fischer, L., & Granderson, J. (2020). [Building commissioning costs and savings across three decades and 1500 North American buildings](#) (pp. 1-10, Rep.). Berkeley, California: Lawrence Berkeley National Laboratory. DOI: 10.1016/j.enbuild.2020.110408