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Building Commissioning 2020 Long-Term Monitoring and Tracking Report

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Executive Summary

The Northwest Energy Efficiency Alliance's (NEEA) Commercial Building Commissioning Initiative promoted commissioning in the Northwest from 1999 to 2004. Starting in 2005, NEEA began tracking the market activities and trends of commercial building commissioning via its long-term monitoring and tracking (LTMT) efforts. In preparing this report of the 2020 findings, The Cadmus Group (Cadmus) collected data to meet three main objectives: estimate the total floor area of commissioned commercial space, determine the total market size of commercial buildings, and calculate the market penetration of commercial commissioning in the Northwest in 2020.

Summary of Key Findings

Cadmus surveyed 97 commissioning professionals and received data from 37 about their 2020 activities. Table 1 contains the study results for the Northwest region (Idaho, Montana, Oregon, and Washington).

Table 1. 2020 Region-Wide Commissioning Activity and Market Penetration

Commissioning Type	New Construction/ Existing Floor Area (sq. ft.)	Commissioned Space (sq. ft)	Market Penetration (2020)	Market Penetration (2019)
New construction commissioning	71,621,125	56,846,677	79%	64%
Retro-commissioning[1]	3,335,161,546	18,445,624	0.55%	0.56%
Recommissioning[2]	3,335,161,546	7,196,861	0.22%	0.19%
Ongoing commissioning[3]	3,335,161,546	11,446,644	0.34%	0.46%

[1] Commissioning of existing buildings that have never been commissioned.

[2] Commissioning of existing buildings that were commissioned during the construction phase

[3] Fine tuning commissioned buildings repeatedly over time

Sources: NEEA 2014 (CBSA); Cadmus analysis of 2019 and 2020 survey data.

Summary of Discussion

Despite reported COVID-19 impacts, new building commissioning activity increased in each Northwestern state. Firms reported more activity in each state than in 2019 and the Cx market penetration of 79% for the region is the highest ever reported for this LTMT study.

Montana's new building commissioning activity has increased in each of the past two years, which is an encouraging indicator of the market's response to the state building code. The past two years of Montana's data showed a very high market penetration of new building commissioning.

Though the majority of commissioning providers agree that HVAC and lighting systems are the most commonly commissioned systems, many providers believe commissioning is evolving or will evolve in the future to include more systems. Consistent with the 2020 Lawrence Berkeley National Laboratory (LBNL) Commissioning Study (based on data up through 2018), providers surveyed for the NEEA study said HVAC and lighting systems are the most commonly commissioned systems. However, over half of the respondents also said they expect this trend to change. They anticipated adoption of building codes that require commissioning for additional systems and technologies and increased awareness of energy saving opportunities within components like plumbing, building envelopes, and renewable energy among building owners.

Key 2020 Commercial Building Commissioning Findings

Introduction

This Long-Term Monitoring and Tracking (LTMT) report, prepared by Cadmus, presents the 2020 findings for the Northwest Energy Efficiency Alliance's (NEEA) Commercial Building Commissioning Initiative, which promoted commissioning in the Northwest from 1999 to 2004 and entered LTMT in 2005.[1] The 2020 LTMT study had three objectives:

- Estimate the total floor area of commissioned commercial space (square footage) for new and existing buildings by state and by each of four commissioning types
- Determine the total market size of new and existing commercial buildings
- Calculate the market penetration of commercial commissioning and track changes in penetration over time

This 2020 study meets these objectives and also provides findings on the types of buildings and systems being commissioned, costs of commissioning, barriers to existing building commissioning, drivers of the varying impacts of new state building codes, areas of opportunity in the Northwest commissioning market, and insights on impacts of COVID-19. This study also includes findings from Cadmus' review of the 2020 (LBNL) study[2] which used data up through 2018 to update the LBNL's landmark 2009 study on commissioning costs and savings.

This LTMT report contains key findings and recommendations followed by five appendices with further detail on the research methodology, references, historical data, survey recruitment, and the survey instrument.

Summary of Research Approach

For the 2020 study, Cadmus used the most recently updated sample frame from 2019. The 2019 list contains 97 firms active in the Northwest. Cadmus emailed an online survey to the full population and received responses from 37 individual commissioning professionals (representing 37 firms), which reflected a 38% response rate. Cadmus also analyzed data from Dodge Data and Analytics (Dodge) and from NEEA's 2014 *Commercial Building Stock Assessment* (CBSA) to estimate market size in square footage of floor area for both new and existing construction buildings. Appendix A provides a detailed description of the research methodology.

Cadmus received survey data on four types of commissioning activity from commissioning providers:

- Commissioning (Cx)—Commissioning of new buildings during the construction phase
- Retro-commissioning (RCx)—Commissioning of existing buildings that have never been commissioned

[1] The Northwest is comprised of Idaho, Montana, Oregon, and Washington.

[2] E. Crowe et al. 2020. "Building commissioning costs and savings across three decades and 1500 North American buildings." Energy & Buildings 227: Issue 110408.

- Recommissioning (ReCx)—Commissioning of existing buildings that were commissioned during the construction phase
- Ongoing/continuous commissioning (OCx)—Fine-tuning commissioned buildings repeatedly over time

Key Takeaways

- For the Northwest as a whole, market penetration rates (in terms of floor area) for commissioning of new commercial buildings during the construction phase (Cx) increased from 64% in 2019 to 79% in 2020.[3]
- For the region, the total floor area reported for all types of existing building commissioning activity combined decreased slightly. The only commissioning type that saw a substantial decrease in activity in 2020 was OCx, which decreased by 23% compared with activity in 2019. Meanwhile, regional ReCx increased by 16%, and RCx stayed consistent with 2019 levels, showing a 2% growth.

Results for New Building Commissioning (Cx)

From 2019 to 2020, for the Northwest as a whole, there was a 7% decrease in commercial new construction across the region and the floor area of new buildings that were commissioned increased by 15%, resulting in a Cx market penetration rate increase from 64% in 2019 to 79% in 2020. Table 2 summarizes the 2020 findings for Cx compared with the 2019 findings.

Each state saw an increase in market penetration from 2019 to 2020. Idaho, where market penetration rates have been highly variable and lower than those of other Northwest states, saw a 17% increase this year. Though Idaho, Montana and Washington have commissioning requirements in their state codes, Idaho continues to lag the other states in new building commissioning activity.

Montana's 2020 Cx activity, as reported by respondents to the survey, actually resulted in a calculated market penetration rate that exceeded 100% for the second year in a row. For that reason, Cadmus used the 2017 market penetration rate of 93% and calculated square footage accordingly.[4]

Table 2. 2020 Estimates for Commercial New Building Commissioning

State	New Construction Floor Area (sq. ft.)	Commissioned Space (sq. ft)	Market Penetration (2020)	Market Penetration (2019)
Idaho	7,946,575	1,866,971	23%	5%
Montana	2,774,850	2,580,611	93%*	93%*
Oregon	20,738,950	12,714,363	61%	50%
Washington	40,160,750	39,684,732	99%	82%
Total	71,621,125	56,846,677	79%	**64%**

*Montana's 2019 and 2020 Cx activity reported in the survey resulted in a calculated market penetration rate that exceeded 100%. For that reason, Cadmus used the 2017 market penetration rate of 93% and calculated square footage accordingly.
Sources: Dodge 2019 and 2020 data; Cadmus analysis of 2019 and 2020 survey data.

[3] Includes all nonresidential building types and sizes except industrial. For further detail on methodology, see Appendix A.

[4] This is consistent with the 2019 approach.

Results for Existing Building Commissioning (RCx, ReCx, OCx)

For the Northwest as a whole, the total floor area for all types of existing building commissioning activity combined decreased slightly. However, the only commissioning type that saw a substantial decrease was OCx, which decreased by 23% from 2019 to 2020. This dip was driven by a 53% decrease in OCx activity in Washington; all other states saw an increase in OCx. Meanwhile, regional ReCx activity increased by 16% and RCx increased 2%. This growth in ReCx and RCx is a result of increased activity in Washington and Oregon.

Table 3 summarizes 2020 findings for existing building commissioning activities.

Table 3. 2020 Estimates for Existing Building Commissioning

Type	State	Existing Floor Area (sq. ft.)	Commissioned Space (sq. ft)	Market Penetration (2020)	Market Penetration (2019)
RCx	Idaho	319,280,087	398,778	0.12%	0.46%
	Montana	256,497,291	1,748,021	0.68%	1.08%
	Oregon	991,966,460	5,564,028	0.56%	0.38%
	Washington	1,767,417,707	10,734,798	0.61%	0.59%
	Total*	**3,335,161,546**	**18,445,624**	**0.55%**	**0.56%**
ReCx	Idaho	319,280,087	-	0.00%	0.01%
	Montana	256,497,291	538,889	0.21%	0.22%
	Oregon	991,966,460	808,333	0.08%	0.01%
	Washington	1,767,417,707	5,849,639	0.33%	0.32%
	Total	**3,335,161,546**	**7,196,861**	**0.22%**	**0.19%**
OCx	Idaho	319,280,087	753,741	0.24%	0.06%
	Montana	256,497,291	1,519,667	0.59%	0.00%
	Oregon	991,966,460	3,448,889	0.35%	0.25%
	Washington	1,767,417,707	5,724,347	0.32%	0.71%
	Total	**3,335,161,546**	**11,446,644**	**0.34%**	**0.46%**
	Total (All)*	3,335,161,546	37,089,129	1.11%	1.20%

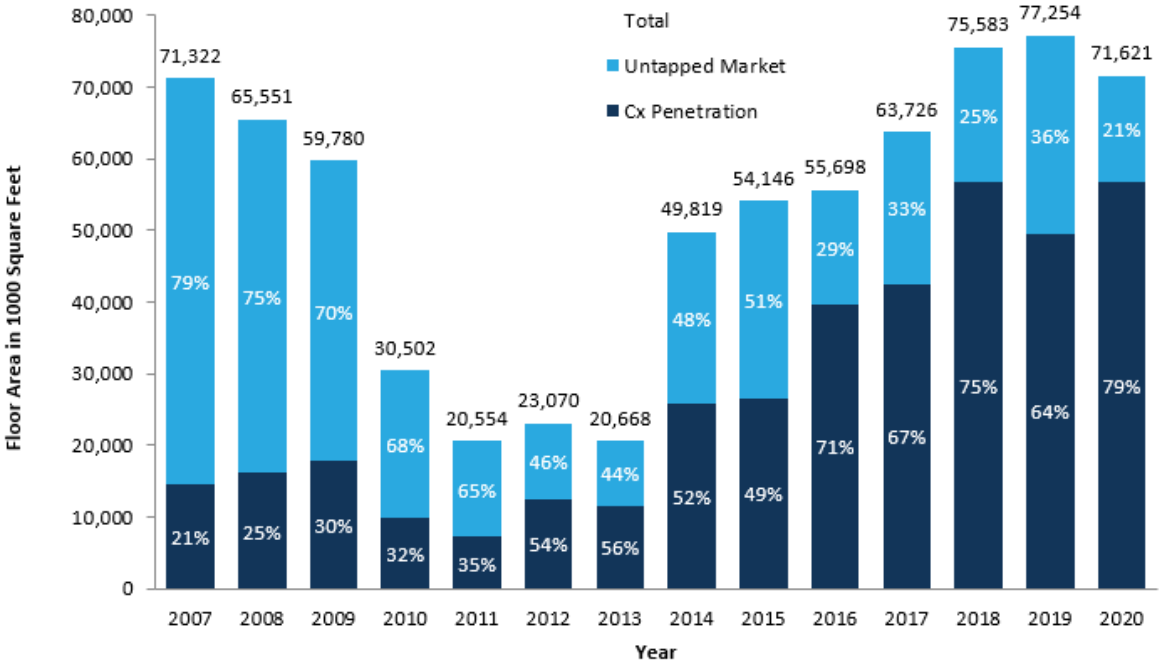
*Totals may not equal the sum of column due to rounding.

Sources: NEEA 2014 (CBSA); Cadmus analysis of 2019 and 2020 survey data.

Historical Data and Trends

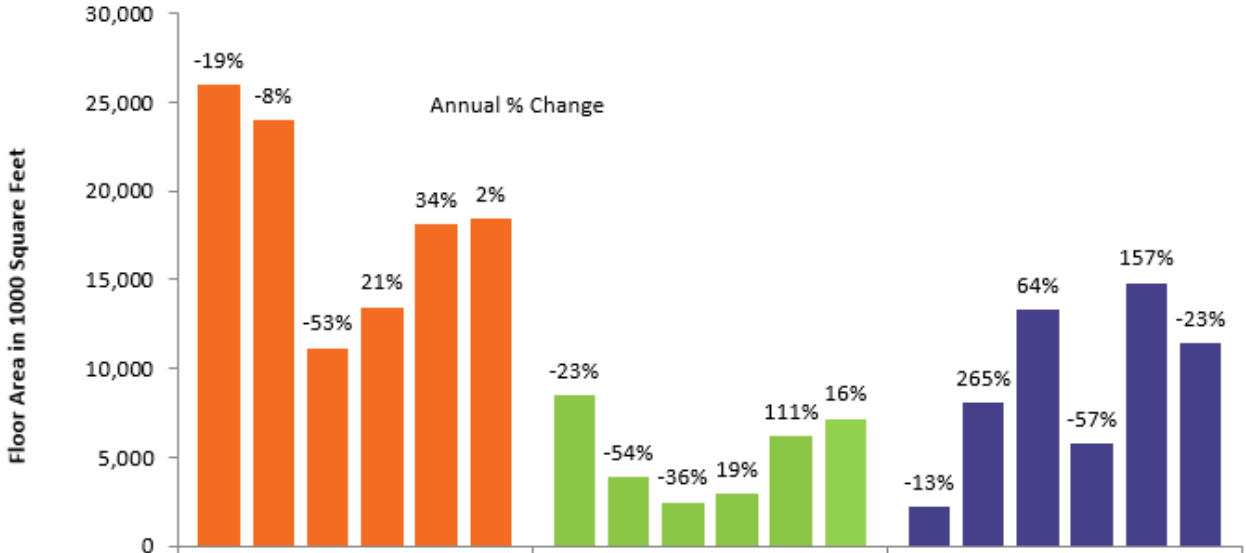
The charts below illustrate historical, region-wide commissioning activity and market penetration for Cx (Figure 1.) and for RCx, ReCx, and OCx (Figure 2.). Appendix C provides historical data on a state-by-state basis.

Figure 1. Historical Estimates for New Building Commissioning Market Penetration: Northwest Region



Sources: Summit Blue Consulting 2006–2008; Navigant 2010–2012; Cadmus 2014–2019; Cadmus analysis of 2020 survey data.

Figure 2. Historical Estimates for Existing Building Commissioning Activity: Northwest Region



	RCx Activity	ReCx Activity	OCx Activity
2015	25,997	8,499	2,218
2016	23,980	3,895	8,088
2017	11,152	2,474	13,292
2018	13,478	2,951	5,770
2019	18,087	6,217	14,827
2020	18,446	7,197	11,447

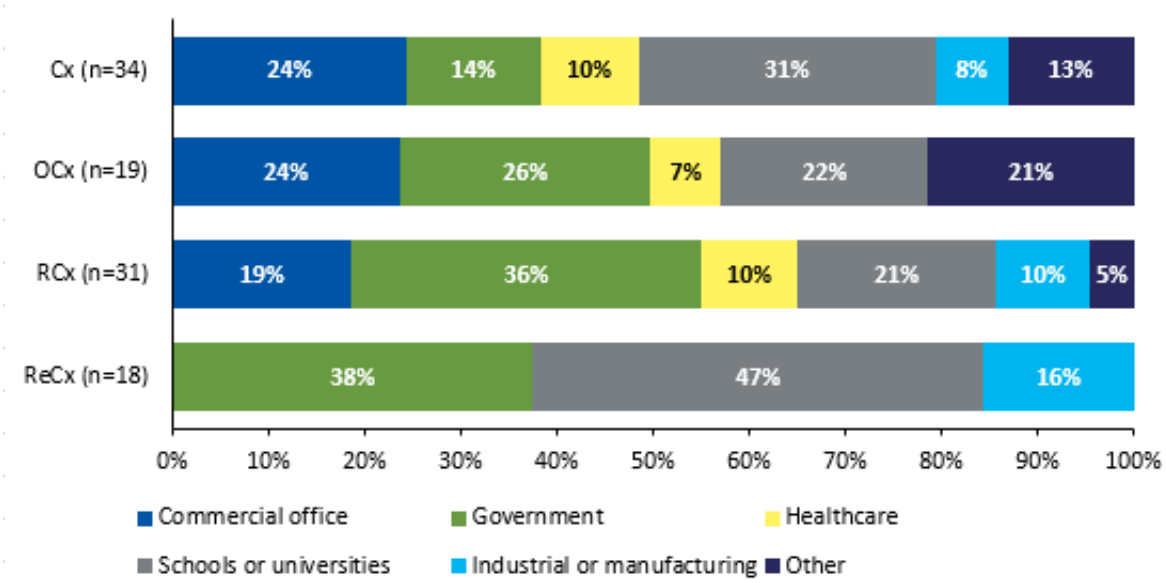
Sources: Cadmus 2015–2019; Cadmus analysis of 2020 survey data.

Market Insights

Commissioned Building Types

Cadmus asked commissioning firms about the share of commissioned floor area by building type; Figure 3 displays this data. Firms most commonly performed Cx and ReCx in schools or universities and most commonly performed OCx and RCx in government buildings.

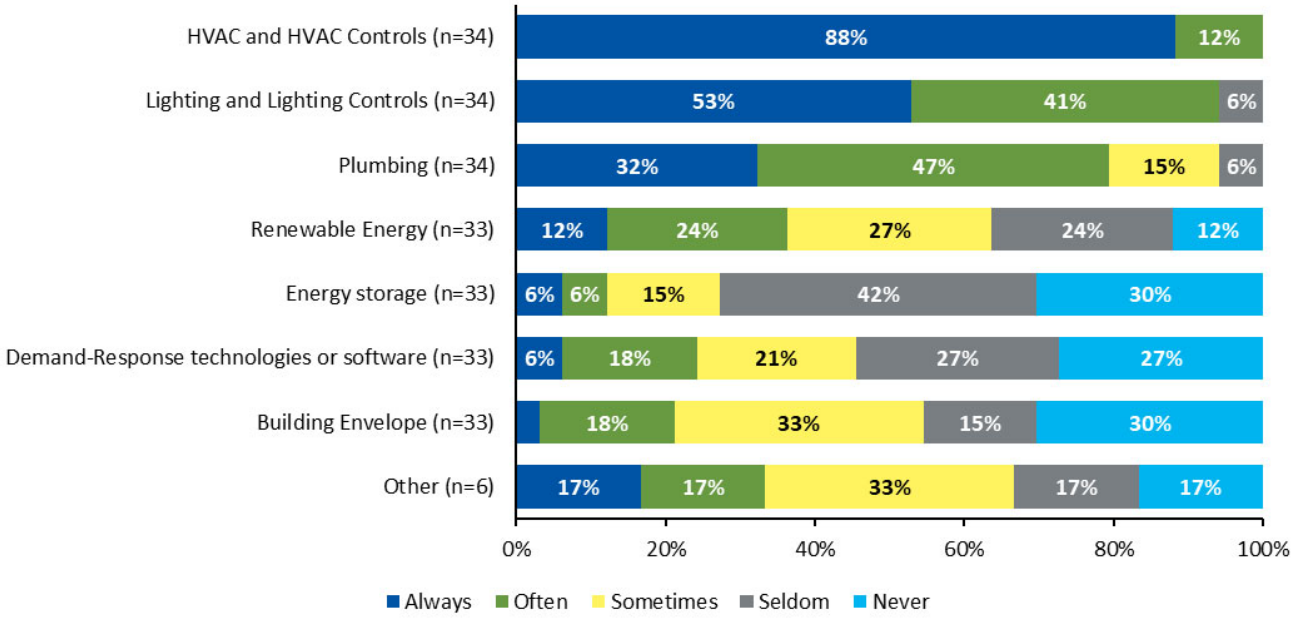
Figure 3. Distribution of New and Existing Building Commissioning by Building Type



Source: Cadmus survey questions D4, D9, D12, and D15. "For the new/existing space your firm commissioned in 2020, what was the approximate percentage breakdown of square footage by the building types below?" Percentages may not total to 100% due to rounding. n = the number of firms who offered the specific commissioning services and responded to the question. Respondents who answered "other" were not asked a follow up question asking for clarification.

Cadmus asked how frequently providers commission certain pieces of equipment and systems during new and existing building commissioning projects. As shown in Figure 4, most firms said that during Cx projects they *always* commission HVAC and HVAC controls (88%; n=34), and over half said they *always* commission lighting and lighting controls (53%; n=34). Conversely, 30% of firms said they *never* commission the building envelope (n=33) and energy storage (n=33).

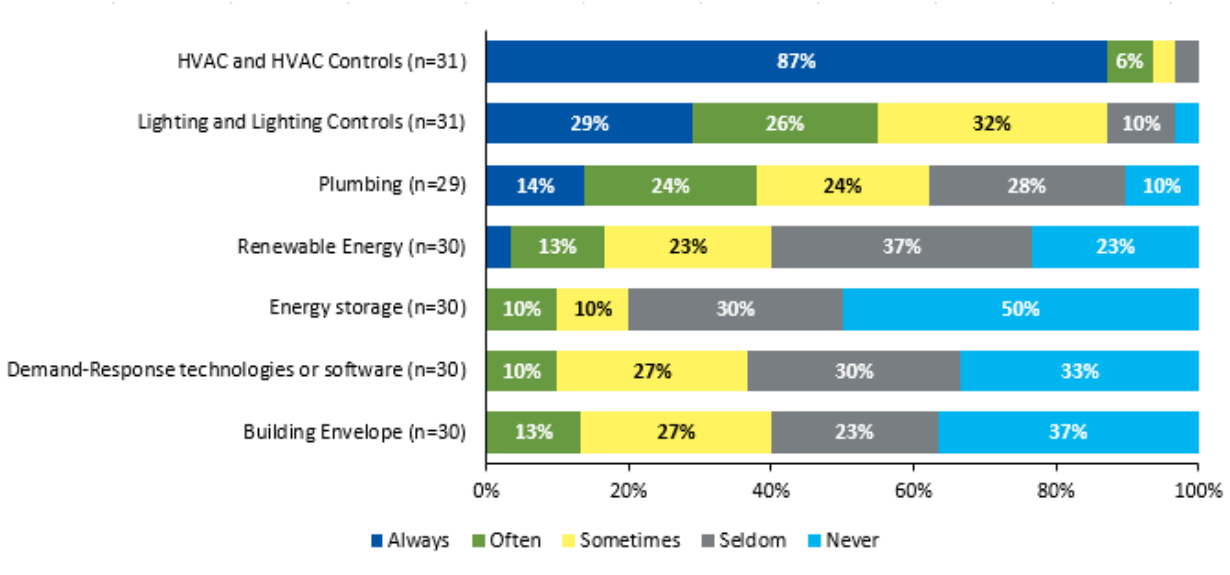
Figure 4. Frequency of Commissioning by Equipment/System Type During New Building Commissioning (Cx)



Source: Cadmus survey question D5. "How frequently does your firm commission the following systems in new building commissioning projects?" Percentages may not total to 100% due to rounding.

Compared with Cx projects, nearly the same number of firms said they *always* commission HVAC and HVAC controls during existing building commissioning (RCx, ReCx, and OCx) projects (87%; n=31), while fewer reported that they *always* commission lighting and lighting controls (29%; n=31). This is consistent with findings from 2019. Also similar to Cx, building envelope and energy storage systems were the least frequently commissioned during existing building commissioning.

Figure 5. Frequency of Commissioning by Equipment/System Type in Existing Building Commissioning



Source: Cadmus survey question D16. "How frequently does your firm commission the following systems in existing building commissioning projects? These projects could include retro-commissioning, re-commissioning, or ongoing/continuous commissioning." Percentages may not total to 100% due to rounding.

Commissioning Project Costs

Cadmus asked firms that commission new and existing buildings about their typical project cost range. Each respondent supplied a lower-bound and an upper-bound cost for typical projects. Cadmus calculated the average of reported lower bounds and the average of reported higher bounds per square foot, which ranged from $0.52 to $1.41 for a new building (n=20) and $0.34 to $1.04 for an existing building (n=19). These findings were generally consistent with findings in 2019, though the average cost for new buildings decreased to $0.97 from $1.15 last year.

The 2020 LBNL study also examined costs. Though the study reported median costs whereas this study summarizes the average lower bounds and upper bounds, the results are interesting to compare. NEEA's study found similar costs for new building commissioning, but higher costs for existing building commissioning than the national median reported by LBNL.[5] This difference could be due to a number of factors, including the differences in the study samples or different definitions of what kinds of commissioning are included within the umbrella "existing building commissioning." For example, LBNL reported that building size and building type both influence cost, but this study did not gather data on the size of the buildings commissioned or the building type, which makes it difficult to assess reasons behind the cost difference.

Table 4. Commissioning Cost Comparisons

	2020 Range: LTMT Study	2018 Median: LBNL Study	2009-2018 Combined Range from 25th–75th percentile: LBNL Study
New Building Cx Costs per Sq. Foot	$0.52 - $1.41	$0.82	$0.53–$2.21
Existing Building Cx per Sq. Foot	$0.34 - $1.04	$0.26	N/A

Barriers to Commissioning

Commercial building codes in Idaho, Montana, and Washington each require new building commissioning, but this study has shown varying Cx rates across these states. Cadmus asked respondents several questions to gain a better understanding of this variability. Cadmus also asked respondents a question to explore current trends in existing building commissioning.

New Commissioning

In previous years of this study, Idaho and Montana showed varying levels of new building commissioning and typically lower than Washington, despite the fact that these three markets have adopted commercial building codes that require new building commissioning in 2020. During the 2020 survey, we asked respondents whether they had observed anything that might explain the disparity among the rates of commissioning in Idaho, Montana, and Washington. The majority of respondents (70%, n=23) reported lack of code enforcement in Montana and Idaho as the main cause of lower rates in those states. Twenty-two percent of respondents believed the Authority Having Jurisdictions[6] (AHJs) in Montana and Idaho were unfamiliar with the code requirements, and one respondent commented that codes are only as effective as local jurisdiction

[5] E. Crowe, Ibid.

[6] "Authority Having Jurisdiction" means the organization, office or individual responsible for enforcing the requirements of a code or standard.

enforcement. Other explanations of this disparity included owners' and architects' lack of familiarity with the code (17%), codes being different in each state (13%), cost (13%), and urban versus rural environments (9%)

The 2020 Cx rate for Idaho was again low at 23% (it had been 5% in 2019). However, both the 2019 and 2020 Cx rates for Montana were 93% (the rate had been 33% in 2018); this may indicate that the market is beginning to comply more consistently with the state building code.

In a follow up question, Cadmus asked respondents to describe what they thought would help increase new building commissioning in Idaho and Montana. At the time of the survey, respondents did not have any information about the 2020 market penetration in Montana. Sixty percent (n=30) said education, of which 50% mentioned educating building owners and 10% mentioned educating government officials. One respondent who mentioned additional education highlighted the difference between education in Washington, Idaho, and Montana:

> "Owners in Washington have absorbed the [value of commissioning] through educational seminars. A more concerted effort to provide the same level of information and education to owners and developers in Idaho and Montana may help."

Just over half (53%) of respondents said better code enforcement would improve new building commissioning in Montana and Idaho. Other suggestions included promoting quantifiable benefits (20%), adoption of more stringent codes (10%), and increased incentives (7%). Respondents who cited increased code enforcement regularly cited AHJs and noted some barriers AHJs may face:

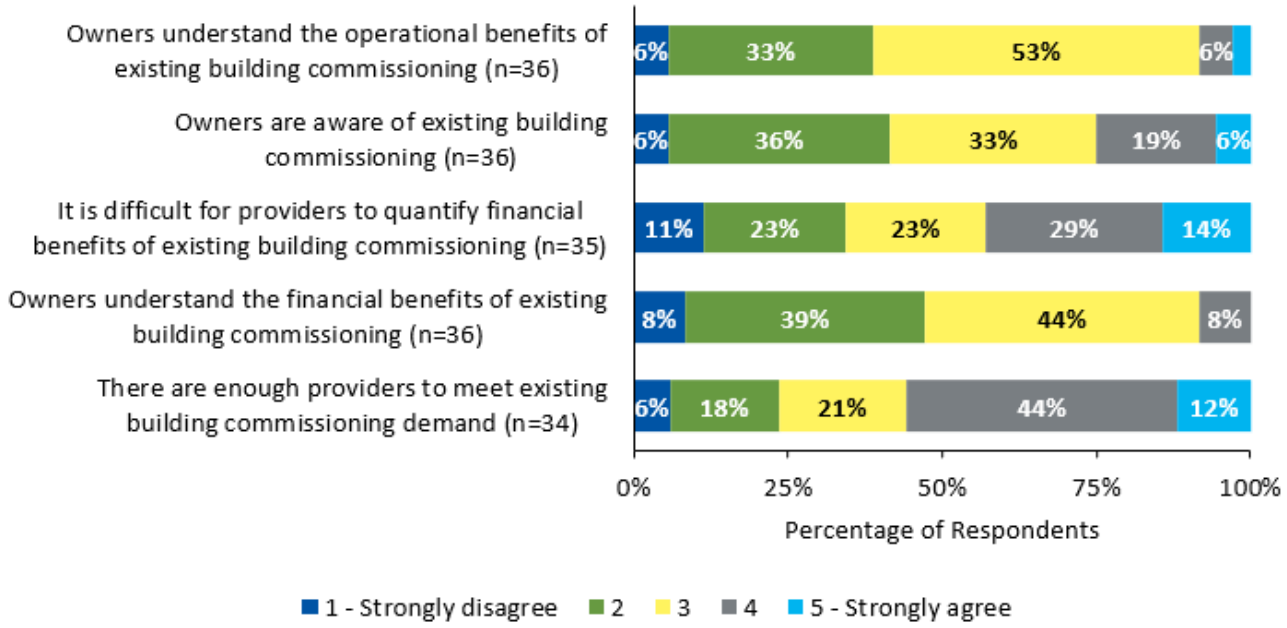
> "[There is a need to] increase the general awareness [that commissioning is] a requirement, as well as work with the local AHJs in understanding how to enforce [commissioning]. Most of the rural AHJs are working with very limited resources, and additional enforcement activities can be very difficult to manage and balance. Additional government requirements are often not always well received."

> "Stronger enforcement by local code authorities would likely increase new building commissioning. This may require additional training for plan-checkers and inspectors, as well as ensuring commissioning documentation (commissioning plan, [specifications], [*et. cetera*]) are submitted to show this required process is underway."

Existing Building Commissioning

Cadmus asked respondents to rate their level of agreement with several statements about existing building commissioning. As shown in Figure 6, almost half of respondents did not agree that *building owners understand the financial benefits of existing building commissioning* (47%, n=35), nor with the statement *owners are aware of existing building commissioning* (42%, n=36), indicating that these are key barriers.

Figure 6. Respondent Agreement with Statements about Existing Building Commissioning



Source: Cadmus survey question E6. "Using a scale from 1 to 5 where 1 means *strongly disagree* and 5 means *strongly agree*, please rate whether you agree with the following statements about existing building commissioning." Percentages may not total to 100% due to rounding.

Building and System Commissioning Trends

Cadmus asked respondents questions about trends surrounding future commissioning of certain building types.

Building Type Trends

When asked to identify what types of commissioning or building types their firm planned to focus on in 2021, 41% (n=32) said new building commissioning, 31% reported OCx, and 16% said RCx. Several firms said that increased focus on Cx and OCx in the future was a result of COVID-19 ramifications, which is discussed below in the section *COVID-19*.

Most commonly, respondents who mentioned building types suggested their firms would focus on government buildings (19%, n=32), educational institutions (16%), and healthcare facilities (3%). Some firms detailed why:

> "[We will focus on government projects] and public bid projects since the commissioning requirements and budgets are firmly established."
>
> "Retrocommissioning for K-12 and higher [education] will be our focus due to the incentives from utilities and government agencies."

Systems Trends

In previous study years, firms have reported that HVAC and lighting systems are the most commonly commissioned systems, while other systems, such as plumbing, building envelopes, renewable energy, energy

storage, and demand response technologies are less frequently commissioned. Cadmus asked respondents whether this was true for their firm and if they expected this to change in the future.

This year's survey confirmed previous years' findings: close to three-quarters of 2020 respondents (76%, n=34) said that the systems they most commonly commission are HVAC and lighting. This finding was consistent with the 2020 LBNL study which found a lack of data for emerging technology commissioning and concluded that "[these] gaps reflect the continuing rarity of commissioning beyond HVAC systems."[7]

However, just over half of NEEA's study respondents (57%, n=28) said they have already noticed a change in systems being commissioned or they expect a change in the future. These 16 respondents cited a number of drivers of change including sustainability policies and protocols, increased awareness among building owners, code updates, stricter enforcement, and potential energy savings.

> "…Energy code and Leadership in Energy and Environmental Design (LEED) requirements are driving more plumbing commissioning and LEED is driving commissioning of building envelope and renewables. We believe that as codes evolve, more and more systems will be required to be commissioned by codes since research is showing the benefits of total building commissioning."
>
> "Plumbing and renewable energy are nearly always included in our scope. I imagine that as codes evolve and the need for verification increases, that we will see… [energy storage, demand-response, and building envelope, etc.] included more often."

On the other hand, 12 of the 28 respondents expected that HVAC and lighting systems would continue to be the most commonly commissioned systems because they are more complex and energy intensive compared to other systems:

> "…[I] don't see it changing. HVAC especially can have complex controls and interactive factors that can cause big energy and [operational and management] issues. Plumbing and building envelopes are less so. I do think solar arrays, energy storage, and demand-response technologies need to be commissioned, and we do so as a design-build contractor, but those are certainly easier to commission than a new HVAC and controls system."

> "I don't believe it will change much. […] HVAC installations seem to have the greatest return on the service, and the issues found and resolved typically have a decent energy impact. Thermal comfort is always very noticeable in our climate. Lighting is similar but to a lesser extent…. Envelope systems take specialized equipment and awareness of this service is still low. Not many renewable or energy storage projects in [our state of service] to-date because utility cost is so low."

Luminaire Level Lighting Control systems

Cadmus asked respondents whether they had heard of Luminaire Level Lighting Controls (LLLC). About two thirds of respondents (69%, n=36) said they had. Respondents were subsequently asked if they had ever

[7] E. Crowe, Ibid, page 9.

commissioned an LLLC system in a project; a little less than half (42%, n=26) said they had. The 11 respondents who said they had commissioned an LLLC system were asked to rate the difficulty of commissioning an LLLC system compared with a typical code-compliant lighting system. Five of the 11 respondents said commissioning an LLLC system was *more difficult*, six of the 11 reported it being *about the same difficulty;* none found it *less difficult*. Some respondents who found LLLC systems to be *more difficult* said this is because LLLC systems have more components, making them more complex. Others said that since they are a relatively new technology, installers are less likely to install them correctly on the first try, which can lead to multiple iterations of review and increased coordination among the various parties involved in the project.

COVID-19

Seventy percent of respondents (n=37) said COVID-19 had impacted their firm in 2020. Close to half of these respondents (47%) said the pandemic *delayed projects*, while 27% reported a *reduced ability to do commissioning due to social distancing requirements*. To a lesser extent (14%), respondents reported *lower demand for commissioning services*, and 12% listed *other* impacts.

Additionally, Cadmus asked respondents how COVID-19 would impact commissioning in the Northwest in 2021. Just under half of respondents (44%, n=25) believed lower demand for commissioning services would persist into 2021, 16% of respondents predicted more project delays, 12% believed social distancing would reduce their firm's ability to do commissioning, and 12% said uncertainty about the regulations enacted in response to COVID-19 would continue in the future. Other less frequent responses included a prediction of reduced new construction (8%, and client budget uncertainty (8%). Only 4% said there would not be continuing impact. On the other hand, several firms (16%) mentioned how COVID-19 has led to new opportunities in terms of procedural updates, which may continue into 2021.

In an open-ended question, Cadmus asked respondents how COVID-19 impacted market segments, customers, building systems, types of equipment, or commissioning types. There was no consensus on the most impacted service. Three respondents mentioned OCx was impacted, two mentioned RCx, and one mentioned Cx (n=21). Respondents offered varying viewpoints, such as:

> "The on-going pandemic has made existing commissioning more challenging due to issues of site access and building occupants working remotely. For 2021, we will focus on commissioning of new buildings for institutional clients (military, primarily)."

> "We plan to pursue more existing building commissioning opportunities in 2021. Historically we have had plenty of new building commissioning work to keep us busy, but with the fallout due to COVID, we feel that new construction may slow down and building owners will be more motivated to extend the life and improve efficiency of their current facilities."

Three respondents said the government market segment was impacted by COVID-19, and two respondents cited the healthcare, education, and private market segments (n=21).

Discussion and Recommendations

Despite reported COVID-19 impacts, new building commissioning activity increased in each Northwestern state.

While commercial new construction in the region decreased by 7%, firms reported more activity in each state than in 2019. Combined with a lower overall market size, this resulted in an increase in Cx market penetration. The Cx market penetration in 2020 of 79% for the region is the highest ever reported for this LTMT study.

Montana's new building commissioning activity was higher in 2019 and 2020 than in 2018, which is an encouraging indicator of the market's response to the state building code.

Though Montana's market penetration rates are historically variable, the past two years of data showed an increase in new building commissioning. This could be cautiously interpreted as evidence that the commercial new construction market and local Montana jurisdictions have adapted to the commissioning code requirement and Cx has become standard practice in new buildings, as intended. Future years of this LTMT study will confirm or refute this preliminary trend. Meeting commissioning requirements of the state building code in Idaho, however, still remains a challenge, as demonstrated by direct experience from providers active in that market as well as the low market penetration rate calculated in this study.

Though the majority of commissioning providers agree that HVAC and lighting systems are the most commonly commissioned systems, many providers believe commissioning is evolving or will evolve in the future to include more systems.

Close to three-quarters of respondents (76%, n=34) said that HVAC and lighting systems are most commonly commissioned because these systems will yield the most energy savings, are complex enough to warrant commissioning, and are generally known to require commissioning by building owners. Just over half of the respondents (57%, n=28) said they expect this trend to change as updates to state codes require commissioning for additional systems and technologies, and as building owners become more aware of additional energy saving opportunities within components like plumbing, building envelopes, and renewable energy.

Appendix A. Methodology

This is the eighth year that Cadmus has conducted this study. Each year, the methods have remained consistent to provide a reliable measure of market activity, although NEEA and Cadmus have made refinements based on the study's findings, NEEA's priorities, and the best available information.

Data Collection Methodology

NEEA had four major objectives for the 2020 study:

- Update the total floor area of commissioned space (square footage) by state and by each commissioning type
- Determine the total market size in square footage of new and existing commercial buildings
- Calculate market penetration and determine how it has changed over time
- Update the number of certified and uncertified commissioning professionals by state

Table 5 summarizes the methodology and sources used for meeting each of these objectives. The next section describes the methodology for the online survey. In later sections of the appendix, Cadmus discusses in detail the steps taken to develop the 2020 estimates.

Table 5. Data Collection Methodology

Objectives	Method	Population*	Target Sample Size	Achieved Sample Size	Data Source for Task
Floor area of commissioned building space	Online survey of professionals	97 Firms	35 Firms	37 firms	Sample frame constructed from public data from certification bodies* and internet search
Market size (floor area of new and existing buildings)	Secondary sources	n/a	n/a	n/a	Dodge data and 2014 CBSA data provided by NEEA
Number of certified and uncertified commissioning professionals by state	Online survey of professionals	271 professionals	35 respondents	37 respondents	Number of certified professionals from public data per certification bodies* and internet search; number of uncertified professionals obtained from survey

*Population is based on number of professionals certified with one or more of the following: BCxA, AABC Commissioning Group, American Society of Heating, Refrigerating, and Air-Conditioning Engineers, Association of Energy Engineers, and the National Environmental Balancing Bureau.

Cadmus calculated precision for floor area at 80% confidence with ±16% precision for Cx, and 80% confidence with ±28% precision for existing building commissioning (RCx, ReCx, and OCx).[8] Despite similar achieved sample sizes in 2019 and 2020, the precision level for existing building commissioning changed significantly from ±47% in 2019 to ±28% in 2020. This shows that the level of variability in reported existing building commissioning floor areas has decreased in 2020.

Online Survey

Cadmus used an online survey platform, designed and administered through Qualtrics, to collect square footage for commissioning activities. Appendix E provides the online survey instrument. Cadmus contacted all commissioning professionals from the commissioning firm population, targeting 35 responses.

Survey Sample

In 2020, Cadmus used the list that was developed in 2019. The list included California-based engineering firms and professionals who might have serviced the Northwest in 2019. Three reported they had, and those firms were counted in the final population. Altogether, 37 commissioning professionals completed the survey, representing 37 firms.

Survey Recruitment

In the 2018 study, Cadmus worked with NEEA to design a three-year Incentive Agreement, under which professionals receive an escalating incentive for completing the survey each year. If professionals opted out of the Incentive Agreement, they could still complete the survey and receive a one-time incentive. As a result, 16 firms signed the agreement to participate again in the 2019 and 2020 study.

Throughout the survey fielding period from mid-November of 2020 to mid-January of 2021, Cadmus sent three reminder emails to all commissioning professionals and made at least 25 reminder phone calls. Cadmus also worked with NEEA and the BCxA to create a post for its December 2020 e-newsletter to advertise the study and to invite commissioning professionals to complete the survey (see Appendix D).

Including the 16 Incentive Agreement participants, 37 commissioning firms participated in the 2020 study. Seven firms that participated in the 2019 study did not participate again; however, Cadmus recruited nine firms that did not participate in the 2019 study. Table 6 summarizes the number of participating firms by the channel through which they were contacted and the incentive options they chose.

Table 6. Participating Firms by Incentive Option and Recruitment Channel

Recruitment Channel	Incentive Option	
	Three-Year Incentive Agreement	2019 Participation Only
Cadmus Email Invitation	16	21
Total	**16**	**21**

[8] Cadmus calculated one measurement of confidence and precision for all combined types of existing building commissioning. Sample sizes were too small to provide meaningful precision results for RCx, ReCx, and OCx separately.

Determination of Market Size

NEEA measures market penetration of new and existing building commissioning activity using the total new and total existing commercial building floor area by state. New commercial building floor area in square feet serves as the metric for Cx market size, and existing commercial building floor area in square feet serves as the metric for RCx, ReCx, and OCx market size.

NEEA provided Cadmus with new construction floor area from Dodge for 2019 and 2020. Data from both years were necessary to arrive at the most accurate 2020 market size for Cx because Cadmus lagged the construction start data by nine months to account for the long duration between construction starts and completions. The 2020 new building floor area estimate consisted of 75% of the 2019 new construction starts' floor area, and 25% from 2020. Cadmus also removed the floor area of parking garages from this estimate as these structures typically do not undergo commissioning.

To determine the 2020 existing commercial building floor area in each state, Cadmus used NEEA's CBSA building stock floor area estimates from 2014 and added 2015, 2016, 2017, 2018, 2019, and 2020 new construction floor area.[9] Appendix C shows new and existing building stock by state and by year.

Floor Area of Demolitions

NEEA's cost-effectiveness model requires estimates of demolished building floor area. In the 2018 study, Cadmus applied the 2013 study's established demolition rate of 0.63% to 2018's existing building floor area for each state to calculate the demolished building floor area. For the 2019 study, we conducted additional secondary data research and updated each state's demolition rate based on the commercial building square footage forecast in the Northwest Power and Conservation Council's *Seventh Northwest Power Plan* (2016). We used these updated 2019 demotion rates again in 2020. Table 7 reports the square footage of demolished building floor area for 2020.

Table 7. 2020 Demolished Square Footage

State	2020 Existing Floor Area (sq. ft.)[10]	Demolition Rate (updated 2019)	Demolished Floor Area (sq. ft.)
Idaho	319,280,087	0.45%	1,437,061
Montana	256,497,291	0.44%	1,124,973
Oregon	991,966,460	0.46%	4,574,980
Washington	1,767,417,707	0.41%	7,265,448

Source: Council (2016); Cadmus analysis.

Market Penetration

Cadmus determined commissioning market penetration by collecting commissioning firms' estimates of floor area (in square feet) commissioned in 2020, by state and commissioning type.

[9] Lagged by nine months.

[10] 2019 Existing Floor Area + 2020 New Construction Floor Area from Dodge Data.

Cadmus' market penetration methodology involved the following steps:

1. Collect data on commissioned floor area from professionals through the online survey
2. Estimate the population of commissioning firms by state and commissioning type
3. Adjust for commissioning in manufacturing and industrial facilities
4. Extrapolate the sample data collected to the firm population to arrive at total commissioned floor area
5. Calculate market penetration by state and commissioning type

Table 8 contains the final estimated population of firms by state and commissioning type. In this case, "service population" means the number of firms that Cadmus estimated serviced customers in that state for each specific commissioning type. The study used these population estimates as a multiplier to generate total floor area for the Alliance Cost-Effectiveness model.

Table 8. Total Estimated Population of Commissioning Firms by State and Commissioning Type

State	Cx Service Population	RCx Service Population	ReCx Service Population	OCx Service Population
Idaho	26	15	6	6
Montana	16	10	3	4
Oregon	7	3	0	1
Washington	4	2	1	3

Source: Cadmus analysis of 2019 survey data.

Adjustments

NEEA's commissioning initiative focused on the commercial building market. However, the survey asked respondents to provide data on building commissioning, which may include industrial and manufacturing (I&M) buildings. To measure respondents' inclusion of I&M commissioning, Cadmus included survey questions to inform the square footage of commissioned floor area from I&M buildings for each of the four commissioning types, then adjusted the final commercial square footage to remove floor area for these buildings, as presented in this report.[11] I&M buildings comprised 7% of reported Cx square footage, 6% of reported RCx square footage, 3% of reported ReCx square footage, and no OCx square footage.[12]

[11] NEEA also captures savings from I&M commissioning but uses a different savings rate.

[12] See questions **Error! Reference source not found.**, **Error! Reference source not found.**, **Error! Reference source not found.**, and **Error! Reference source not found.** in Appendix E.

Extrapolation of Sample Data to Population

To extrapolate sample square footage to the population of firms in each state and commissioning type, Cadmus applied the following formula:

$$NCxSqFt_{s,t} = \frac{\sum_{f=1}^{n} CxSqFt_{s,t}}{n_{s,t}} \times N_{s,t}$$

Where

- s = State (ID, MT, OR, or WA);
- t = Commissioning type (Cx, RCx, ReCx, or OCx);
- f = Commissioning firm;
- $N_{s,t}$ = Number of firms in the population in state (*s*) and commissioning type (*t*) (from Table 8);
- $n_{s,t}$ = Number of firms in the sample in state (*s*) and commissioning type (*t*) (Cadmus analysis of 2018 survey data);
- $CxSqFt_{s,t}$ = Adjusted commissioning square feet reported by firm (*f*) for state (*s*) and commissioning type (*t*) (Cadmus analysis of 2018 survey data); and
- $NCxSqFt_{s,t}$ = Total commissioning square feet for state (*s*) and commissioning type (*t*) (in Table 2 and Table 3).

Appendix B. References

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Appendix C. Historical Data

Table 9. New Building Commissioning 2013–2020 Market Size, Activity, and Penetration Estimates

State	Year	New Building Market Size (sq. ft.)	Cx Activity (sq. ft.)	Market Penetration
Idaho	**2020**	**7,946,575**	**1,866,971**	**23%**
Idaho	2019	9,969,082	457,357	5%
Idaho	2018	7,093,869	1,355,241	19%
Idaho	2017	8,101,275	1,620,375	20%
Idaho	2016	8,654,525	1,241,321	14%
Idaho	2015	5,626,275	1,971,336	35%
Idaho	2014	3,756,200	856,308	23%
Idaho	2013	2,659,925	376,000	14%
Montana	**2020**	**2,774,850**	**2,580,611**	**93%**
Montana	2019	3,032,119	2,829,509	93%
Montana	2018	2,401,198	787,315	33%
Montana	2017	2,801,875	2,614,650	93%
Montana	2016	2,935,250	1,038,165	35%
Montana	2015	2,556,625	768,214	30%
Montana	2014	2,060,825	794,779	39%
Montana	2013	1,401,725	499,021	36%
Oregon	**2020**	**20,738,950**	**12,714,363**	**61%**
Oregon	2019	19,841,759	9,861,966	50%
Oregon	2018	20,047,811	10,697,247	53%
Oregon	2017	15,927,975	5,576,794	35%
Oregon	2016	13,003,750	9,740,592	75%
Oregon	2015	12,600,125	9,421,714	75%
Oregon	2014	13,959,850	7,199,634	52%
Oregon	2013	5,842,325	3,192,334	55%
Washington	**2020**	**40,160,750**	**39,684,732**	**99%**
Washington	2019	44,410,612	36,330,884	82%
Washington	2018	46,040,446	43,988,029	96%
Washington	2017	36,895,250	32,748,574	89%
Washington	2016	31,103,975	27,608,184	89%
Washington	2015	33,363,025	14,344,043	43%
Washington	2014	30,041,975	16,950,747	56%
Washington	2013	10,763,625	7,562,522	70%
Total	**2020**	**71,621,125**	**56,846,677**	**79%**
Total	2019	77,253,572	49,479,716	64%
Total	2018	75,583,324	56,827,831	75%
Total	2017	63,726,375	42,560,393	67%
Total	2016	55,697,500	39,628,261	71%
Total	2015	54,146,050	26,505,308	49%
Total	2014	49,818,850	25,801,468	52%
Total	2013	20,667,600	11,629,876	56%

Sources: Dodge; Cadmus 2014-2019; Cadmus analysis of 2020 data.

Table 10. Retro-Commissioning 2013–2020 Market Size, Activity, and Penetration Estimates

State	Year	Existing Building Market Size (sq. ft.)	RCx Activity (sq. ft.)	Market Penetration
Idaho	**2020**	**319,280,087**	**398,778**	**0.12%**
Idaho	2019	309,313,486	1,425,346	0.46%
Idaho	2018	302,222,597	612,459	0.20%
Idaho	2017	294,267,364	21,250	0.01%
Idaho	2016	285,616,121	111,268	0.04%
Idaho	2015	279,993,579	449,365	0.16%
Idaho	2014	277,520,204	1,310,676	0.47%
Idaho	2013	251,819,745	231,000	0.09%
Montana	**2020**	**256,497,291**	**1,748,021**	**0.68%**
Montana	2019	253,466,056	2,743,714	1.08%
Montana	2018	251,065,572	699,176	0.28%
Montana	2017	248,264,039	1,300,500	0.52%
Montana	2016	245,330,092	620,702	0.25%
Montana	2015	242,774,686	1,922,118	0.79%
Montana	2014	241,278,586	2,895,373	1.20%
Montana	2013	73,404,096	1,256,700	1.71%
Oregon	**2020**	**991,966,460**	**5,564,028**	**0.56%**
Oregon	2019	972,126,746	3,687,386	0.38%
Oregon	2018	952,086,039	2,174,322	0.23%
Oregon	2017	936,163,951	5,299,538	0.57%
Oregon	2016	923,165,449	15,537,577	1.68%
Oregon	2015	910,569,540	14,787,244	1.62%
Oregon	2014	902,390,465	8,041,145	0.89%
Oregon	2013	700,587,203	5,490,747	0.78%
Washington	**2020**	**1,767,417,707**	**10,734,798**	**0.61%**
Washington	2019	1,723,026,775	10,230,729	0.59%
Washington	2018	1,677,004,284	9,992,108	0.60%
Washington	2017	1,640,126,291	4,531,116	0.28%
Washington	2016	1,609,038,937	7,710,523	0.48%
Washington	2015	1,575,691,205	8,838,009	0.56%
Washington	2014	1,558,742,105	19,810,255	1.27%
Washington	2013	1,175,723,736	12,494,182	1.06%
Total	**2020**	**3,335,161,546**	**18,445,624**	**0.55%**
Total*	2019	3,257,933,063	18,087,174	0.56%
Total	2018	3,182,378,491	13,478,066	0.42%
Total	2017	3,118,821,645	11,152,404	0.36%
Total	2016	3,063,150,599	23,980,068	0.78%
Total	2015	3,009,029,010	25,996,736	0.86%
Total	2014	2,979,931,360	32,057,449	1.08%
Total	2013	2,201,534,780	19,472,629	0.88%

*Totals may not equal the sum of column due to rounding.

Sources: Dodge; NEEA 2014 (CBSA); Cadmus 2014-2019; Cadmus analysis of 2020 data.

Table 11. Recommissioning 2013–2020 Market Size, Activity, and Penetration Estimates

State	Year	Existing Building Market Size (sq. ft.)	ReCx Activity (sq. ft.)	Market Penetration
Idaho	**2020**	**319,280,087**	**0**	**0.00%**
Idaho	2019	309,313,486	27,714	0.01%
Idaho	2018	302,222,597	74,118	0.02%
Idaho	2017	294,267,364	-	0.00%
Idaho	2016	285,616,121	276,159	0.10%
Idaho	2015	279,993,579	0	0.00%
Idaho	2014	277,520,204	523,243	0.19%
Idaho	2013	251,819,745	-	0.00%
Montana	**2020**	**256,497,291**	**538,889**	**0.21%**
Montana	2019	253,466,056	554,286	0.22%
Montana	2018	251,065,572	-	0.00%
Montana	2017	248,264,039	-	0.00%
Montana	2016	245,330,092	21,429	0.01%
Montana	2015	242,774,686	313,820	0.13%
Montana	2014	241,278,586	350,071	0.15%
Montana	2013	73,404,096	-	0.00%
Oregon	**2020**	**991,966,460**	**808,333**	**0.08%**
Oregon	2019	972,126,746	69,286	0.01%
Oregon	2018	952,086,039	787,871	0.08%
Oregon	2017	936,163,951	1,609,900	0.17%
Oregon	2016	923,165,449	1,934,324	0.21%
Oregon	2015	910,569,540	6,025,351	0.66%
Oregon	2014	902,390,465	3,897,020	0.43%
Oregon	2013	700,587,203	1,046,318	0.15%
Washington	**2020**	**1,767,417,707**	**5,849,639**	**0.33%**
Washington	2019	1,723,026,775	5,565,882	0.32%
Washington	2018	1,677,004,284	2,088,961	0.12%
Washington	2017	1,640,126,291	864,167	0.05%
Washington	2016	1,609,038,937	1,663,518	0.10%
Washington	2015	1,575,691,205	2,160,289	0.14%
Washington	2014	1,558,742,105	6,314,294	0.41%
Washington	2013	1,175,723,736	3,825,000	0.33%
Total	**2020**	**3,335,161,546**	**7,196,861**	**0.22%**
Total	2019	3,257,933,063	6,217,168	0.19%
Total	2018	3,182,378,491	2,950,950	0.09%
Total	2017	3,118,821,645	2,474,067	0.08%
Total	2016	3,063,150,599	3,895,430	0.13%
Total	2015	3,009,029,010	8,499,461	0.28%
Total	2014	2,979,931,360	11,084,628	0.37%
Total	2013	2,201,534,780	4,871,318	0.22%

Sources: Dodge; NEEA 2014 (CBSA); Cadmus 2014-2019; Cadmus analysis of 2020 data.

Table 12. Ongoing/Continuous Commissioning 2013–2020 Market Size, Activity, and Penetration Estimates

State	Year	Existing Building Market Size (sq. ft.)	OCx Activity (sq. ft.)	Market Penetration
Idaho	**2020**	**319,280,087**	**753,741**	**0.24%**
Idaho	2019	309,313,486	185,686	0.06%
Idaho	2018	302,222,597	221,426	0.07%
Idaho	2017	294,267,364	-	0.00%
Idaho	2016	285,616,121	246,377	0.09%
Idaho	2015	279,993,579	10,714	0.00%
Idaho	2014	277,520,204	246,947	0.09%
Idaho	2013	251,819,745	-	0.00%
Montana	**2020**	**256,497,291**	**1,519,667**	**0.59%**
Montana	2019	253,466,056	415,714	0.16%
Montana	2018	251,065,572	225,132	0.09%
Montana	2017	248,264,039	-	0.00%
Montana	2016	245,330,092	30,612	0.01%
Montana	2015	242,774,686	321,429	0.13%
Montana	2014	241,278,586	86,171	0.04%
Montana	2013	73,404,096	-	0.00%
Oregon	**2020**	**991,966,460**	**3,448,889**	**0.35%**
Oregon	2019	972,126,746	2,405,600	0.25%
Oregon	2018	952,086,039	2,332,976	0.25%
Oregon	2017	936,163,951	6,853,125	0.73%
Oregon	2016	923,165,449	5,909,100	0.64%
Oregon	2015	910,569,540	1,114,286	0.12%
Oregon	2014	902,390,465	1,766,511	0.20%
Oregon	2013	700,587,203	1,806,000	0.26%
Washington	**2020**	**1,767,417,707**	**5,724,347**	**0.32%**
Washington	2019	1,723,026,775	12,235,857	0.71%
Washington	2018	1,677,004,284	2,990,647	0.18%
Washington	2017	1,640,126,291	6,438,750	0.39%
Washington	2016	1,609,038,937	1,901,991	0.12%
Washington	2015	1,575,691,205	771,429	0.05%
Washington	2014	1,558,742,105	458,271	0.03%
Washington	2013	1,175,723,736	2,345,000	0.20%
Total	**2020**	**3,335,161,546**	**11,446,644**	**0.34%**
Total	2019	3,257,933,063	15,242,857	0.47%
Total	2018	3,182,378,491	5,770,182	0.18%
Total	2017	3,118,821,645	13,291,875	0.43%
Total	2016	3,063,150,599	8,088,080	0.26%
Total	2015	3,009,029,010	2,217,857	0.07%
Total	2014	2,979,931,360	2,557,901	0.09%
Total	2013	2,201,534,780	4,151,000	0.19%

Sources: Dodge; NEEA 2014 (CBSA); Cadmus 2014-2019; Cadmus analysis of 2020 data.

Appendix D. Survey Invitation

Cadmus Email Invitation

To: [EMAIL ADDRESS]
From: NEEA and Cadmus
Subject: Annual Paid Survey Opportunity - NEEA Commissioning Study

Dear [FIRST NAME]:

Greetings! The non-profit Northwest Energy Efficiency Alliance (NEEA) is conducting its annual study on new and existing building commissioning in the Northwest. According to our research, your firm provides commissioning services in our region and so we'd like to invite you to participate in this paid research opportunity. If you had participated in this study in the past, thank you for your continued support!

This survey will take you about 20 minutes and will ask you to share your firm's square footage of whole-building, energy-focused commissioning projects completed in 2020 in Idaho, Montana, Oregon, and Washington, and a few other questions. As always, individual results remain anonymous, but firms participating in the research can indicate in the survey if they wish to list their firm name as a contributor in the report.

If your firm participates this year, we are offering a **$150** Visa gift card as a thank you for completing the survey.

When you are ready to complete the survey, follow this link to the survey: [SURVEY LINK]
Or copy and paste this URL into your internet browser: [SURVEY LINK]

Your responses are saved automatically. You can return to the survey at any time by clicking on the survey link provided above. Please access the survey from the same device and complete the survey by **December 31st, 2020.**

If you have any questions about this research, please feel free to contact me or Jennifer Stout, the project manager for this study at NEEA. She may be reached at 503-516-7370 or jstout@neea.org.

Sincerely,
Kaitlyn Teppert
Cadmus
720 SW Washington St
Portland, OR 97205
303-389-2530

BCxA Newsletter Invitation

Available online at: https://www.bcxa.org/blog/neea-annual-regional-cx-study-respond-by-12/31/2020-$150.html

Appendix E. Survey Instrument

A. *Survey Start Screen*

[DISPLAY NEEA LOGO]

A0. In 2020, did your firm provide commissioning services in the Northwest (Washington, Oregon, Idaho, or Montana)? [FORCED RESPONSE]

1. Yes [continue]
2. No [terminate]
3. Don't know [terminate]

[Termination message: "Only commissioning providers who have worked in the Northwest in 2020 are eligible for this study. Thank you for your interest. To learn more about NEEA, please visit www.neea.org"]

[SURVEY CONTINUES IF A0=1]

A1. Did you (or your firm) sign the three-year participation Agreement with NEEA in 2018?

1. Yes
2. No
3. Don't know

[IF 26 NOT YES]

Welcome! The Northwest Energy Efficiency Alliance (NEEA) is conducting its annual study on new building and existing building commissioning markets. Your responses are very important to us and we will keep them confidential. Complete the survey by **December 31, 2020** to receive a **$150 Visa gift card**. The survey will take you about 20 minutes.

This survey saves your responses automatically and responses will be submitted when you complete the survey. You can return to the survey at any time by clicking on the survey link provided to you in the email. Please access the survey from the same device.

More about this study: This survey will ask you to share your firm's square footage of whole-building, energy-focused commissioning projects completed in 2020 in Washington, Oregon, Idaho and Montana, and a few other questions. As always, individual results remain anonymous. The purpose of the research is to help NEEA understand more about the building commissioning industry and market trends.

[IF 26=YES]

Welcome! The Northwest Energy Efficiency Alliance (NEEA) is conducting its annual study on new building and existing building commissioning markets. Thank you for signing the three-year participation Agreement with NEEA back in 2018. Your participation in this year's study marks the third year of the three-year participation Agreement. Your responses are very important to us and we will keep them confidential. Complete the survey by **December 31, 2020** to receive a **$400 Visa gift card**.

The survey will take you about 20 minutes. This survey saves your responses automatically and responses will be submitted when you complete the survey. You can return to the survey at any time by clicking on the survey link provided to you in the email. Please access the survey from the same device.

More about this study: This survey will ask you to share your firm's square footage of whole-building, energy-focused commissioning projects completed in 2020 in Washington, Oregon, Idaho and Montana, and a few other questions. As always, individual results remain anonymous. The purpose of the research is to help NEEA understand more about the building commissioning industry and market trends.

[DISPLAY BEGIN SURVEY BUTTON]

B. Introduction

B1. Name: ☐
Firm Name: ☐
Job Title: ☐
Phone Number: ☐

B2. From which of the following do you hold a current commissioning certification? (Select all that apply)

1. ACG (AABC Commissioning Group)
2. AEE (Associations of Energy Engineers)
3. ASHRAE (American Society of Heating, Refrigerating, and Air-Conditioning Engineers)
4. BCxA (Building Commissioning Association)
5. NEBB (National Environmental Balancing Bureau)
6. TABB (Testing, Adjusting and Balancing Bureau)
7. UWM (University of Wisconsin-Madison)
8. Other, please specify ☐
9. None

98. Don't know

C. About Your Firm

For this study, the term "commissioning" is defined as ***whole-building energy-focused commissioning*** (as opposed to commissioning focusing only on selected systems such as lighting or water.)

In this section, we will ask you about the types of ***whole-building energy-focused commissioning*** your firm provides, as well as about other services.

[DISPLAY COMMISSIONING DEFINITION GRAPHIC WITH THE FOLLOWING DEFINITIONS]

Definition of Commissioning Types

- **New building commissioning** (Cx) is the process of commissioning new buildings during the construction phase.
- **Retro-commissioning** (RCx) is the commissioning of existing buildings that have not previously been commissioned.
- **Re-commissioning** (ReCx) is the commissioning of existing buildings that have previously been commissioned.
- **Ongoing/continuous commissioning** (OCx), sometimes referred to as continuous commissioning, is the process of monitoring and fine-tuning commissioned buildings repeatedly over time.

C1. What types of commissioning services does your firm provide? For the purposes of this study, please note the definitions of the various commissioning types above. (Select all that apply)

1. New building commissioning
2. Retro-commissioning
3. Re-commissioning
4. Ongoing/continuous commissioning
5. Other, please specify ☐
98. Don't know

C2. Which best describes your firm?

1. My firm specializes in commissioning and that is the main service we offer.
2. My firm provides commissioning as one of many services.
98. Don't know

C3. About how many employees does your firm have? ☐

C4. How many people does your firm employ who work a significant amount of time on commissioning projects? Only count employees who spend at least 25% of their time on commissioning projects.

☐

C5. Of this group, how many people hold individual professional commissioning certifications? Use your best guess.

☐

C6. Does your firm hold any firm-level commissioning certifications?

1. Yes
2. No
98. Don't know

[ASK IF C6=1]

C7. Which **firm-level** commissioning certifications does your firm hold? (Select all that apply)

1. BCxA's Certified Commissioning Firm
2. AEE's Certified Building Commissioning Firm
3. NEBB's Building Systems Commissioning Firm
4. Other, please specify ☐
5. Don't know

D. Project Square Footage and Characteristics

In this section, we will ask you to enter square footage data for ***whole-building energy-focused*** commissioning projects your firm completed in 2020 for the Northwest states of Washington, Oregon, Idaho, and Montana. We are seeking data by state and by commissioning type. If you do not have square footage data available now, please collect the information at your convenience and come back to this survey. Clicking on the survey link provided to you in the email will resume this survey.

[ASK IF 28=1]

D1. Please enter the total square footage of **new building commissioning*** projects your firm completed in 2020 for each state. Use whole numbers. Enter "0" if you did not complete projects in that state.

**New building commissioning is the process of commissioning new buildings during the construction phase.*

☐ Washington
☐ Oregon
☐ Idaho
☐ Montana

[ASK IF 28**Error! Reference source not found.**=1]

D2. If any of the square footage you just entered for **new building commissioning** are estimates, please use the drop down menu(s) to indicate how accurate you think your estimates are. [DROP DOWN SELECTION MENU WITH RESPONSE CHOICES: 0-100%, in 5% increments, plus DK] [Note: If respondent enters "zero" in one of the states above, the state will not show here.]

Washington
Oregon
Idaho
Montana

[ASK IF 28=1]

D3. About what percentage of the **new building commissioning** projects were major **renovations**?

Washington
Oregon
Idaho
Montana

[ASK IF 28=1]

D4. For the **new building** space your firm commissioned in 2020, what was the approximate percentage breakdown in square footage by the building types below? (For industrial or manufacturing facilities, please only consider new **building space**, not **equipment**.) [MANUAL % INPUT IN ORDER TO MAINTAIN VALIDATION; ADDITIONAL VALIDATION CODING TO ENSURE IT ADDS UP TO 100%]

Commercial office
Government
Healthcare
Schools or universities
Industrial or manufacturing
Other

[ASK IF 28=1]

D5. How frequently does your firm commission the following systems in **new building commissioning** projects? [ONLY ONE RESPONSE PER ROW; NOT FORCED]

	Never (1)	Seldom (2)	Sometimes (3)	Often (4)	Always (5)	Don't know (98)
HVAC and HVAC controls						
Lighting and lighting controls						
Plumbing						
Building envelope						
Renewable Energy						
Energy storage						
Demand-Response technologies or software						
Other (please specify): [TEXT ENTRY]						

[ASK IF 28=1]

D6. What is the typical project cost range ($/sq. ft.) for your firm's **new building commissioning** projects? Please leave blank if you don't know. [ALLOW NUMERIC ENTRY, PLUS DK; NOT FORCED]

From $ [ ] /sq. ft.
To $ [ ] /sq. ft.

[ASK IF 28=2]

D7. Please enter the total square footage of **retro-commissioning*** projects your firm completed in 2020 for each state. Use whole numbers. Enter "0" if you did not complete projects in that state. **Retro-commissioning is the commissioning of existing buildings that have not previously been commissioned.*

[ ] Washington
[ ] Oregon
[ ] Idaho
[ ] Montana

[ASK IF **Error! Reference source not found.**=2]

D8. If any of the square footage you just entered for **retro-commissioning** are estimates, please use the dropdown menu(s) to indicate how accurate you think your estimates are. [DROP DOWN SELECTION MENU WITH RESPONSE CHOICES: 0-100%, in 5% increments, plus DK] [Note: If respondent enters "zero" in one of the states above, it will not show here.]

Washington
Oregon
Idaho
Montana

[ASK IF 28=2]

D9. For the existing building space your firm **retro-commissioned** in 2020, what was the approximate percentage breakdown in square footage by the building types below? (For industrial or manufacturing facilities, please only consider **building space**, not **equipment**.) [MANUAL % INPUT IN ORDER TO MAINTAIN VALIDATION; ADDITIONAL CODING TO ENSURE IT ADDS UP TO 100%]

Commercial office
Government
Healthcare
Schools or universities
Industrial or manufacturing
Other

[ASK IF 28=3]

D10. Please enter the total square footage for **re-commissioning*** projects your firm completed in 2020 for each state. Use whole numbers. Enter "0" if you did not complete projects in that state.
**Re-commissioning is the commissioning of existing buildings that have previously been commissioned.*

Washington
Oregon
Idaho
Montana

[ASK IF 28=3]

D11. If any of the square footage you just entered for **re-commissioning** are estimates, please use the dropdown menu(s) to indicate how accurate you think your estimates are. [DROP DOWN SELECTION MENU WITH RESPONSE CHOICES: 0-100%, in 5% increments, plus DK] [Note: If respondent enters "zero" in one of the states above, it will not show here.]

Washington
Oregon
Idaho
Montana

[ASK IF 28=3]

D12. For the existing building space your firm **re-commissioned** in 2020, what was the approximate percentage breakdown in square footage by the building types below? (For industrial or manufacturing facilities, please only consider **building space**, not **equipment**.) [MANUAL % INPUT IN ORDER TO MAINTAIN VALIDATION; ADDITIONAL CODING TO ENSURE IT ADDS UP TO 100%]

Commercial office
Government
Healthcare
Schools or universities
Industrial or manufacturing
Other

[ASK IF 28=4]

D13. Please enter the total square footage for **ongoing/continuous commissioning*** projects your firm completed in 2020 for each state. Use whole numbers. Enter "0" if you did not complete projects in that state.
**Ongoing commissioning, sometimes referred to as continuous commissioning, is the process of monitoring and fine-tuning commissioned buildings repeatedly over time.*

Washington
Oregon
Idaho
Montana

[ASK IF 28=4]

D14. If any of the square footage you just entered for **ongoing/continuous commissioning** are estimates, please use the dropdown menu(s) to indicate how accurate you think your estimates are. [DROP DOWN SELECTION MENU WITH RESPONSE CHOICES: 0-100%, in 5% increments, plus DK] [Note: If respondent enters "zero" in one of the states above, it will not show here.]

Washington
Oregon
Idaho
Montana

[ASK IF 28=4]

D15. For the existing building space your firm conducted **ongoing/continuous commissioning** in 2020, what was the approximate percentage breakdown in square footage by the building types below? (For industrial or manufacturing facilities, please only consider **building space**, not **equipment**.) [MANUAL % INPUT IN ORDER TO MAINTAIN VALIDATION; ADDITIONAL CODING TO ENSURE IT ADDS UP TO 100%]

Commercial office
Government

Healthcare ☐
Schools or universities ☐
Industrial or manufacturing ☐
Other ☐

[ASK IF 28=2, 3, OR 4]

D16. How frequently does your firm commission the following systems in **existing building commissioning** projects? These projects could include retro-commissioning, re-commissioning, or ongoing/continuous commissioning. [ONLY ONE RESPONSE PER ROW; NOT FORCED]

	Never	Seldom	Sometimes	Often	Always	Don't know
HVAC and HVAC controls						
Lighting and lighting controls						
Plumbing						
Building envelope						
Renewable Energy						
Energy storage						
Demand-Response technologies or software						
Other (please specify): [TEXT ENTRY]						

[ASK IF 28=2, 3, OR 4]

D17. What is typically the project cost range ($/sq. ft.) for your firm's **existing building commissioning** projects? These projects could include retro-commissioning, re-commissioning, or ongoing/continuous commissioning. Please leave blank if you don't know. [ALLOW NUMERIC ENTRY, PLUS DK; NOT FORCED]

From $ ☐ /sq. ft. to $ ☐ /sq. ft.

D18. Have you ever heard of a "Luminaire Level Lighting Controls" or LLLC Systems?

1. Yes
2. No **[SKIP TO BLOCK E]**

D19. Have you ever commissioned an LLLC System in any **commissioning** project?

1. Yes
2. No **[SKIP TO BLOCK E]**

D20. Compared to a typical code-compliant lighting system, was commissioning an LLLC system…

1. More difficult
2. About the same difficulty
3. Less difficult

D21. Why is that? **[OPEN-ENDED, NOT FORCED]**

E. Market Trends and Opportunities

E1. [ASK IF 29: WASHINGTON > 0; OR 29:WASHINGTON > 0; OR 29: WASHINGTON > 0; OR 29: WASHINGTON > 0] Based on your experience and observations, what percentage of all the **new building space** would you say was commissioned in **Washington** in 2020?

1. More than 95% of new building space was commissioned
2. More than 90% of new building space was commissioned
3. More than 85% of new building space was commissioned
4. 85% or less of new building space was commissioned

98. I don't know

E2. [ASK IF **Error! Reference source not found.**: MONTANA > 0; OR **Error! Reference source not found.**:MONTANA > 0; OR **Error! Reference source not found.**: MONTANA > 0; OR **Error! Reference source not found.**: MONTANA > 0] Based on your experience and observations, what percentage of all the **new building space** would you say was commissioned in **Montana** in 2020? **[DROP-DOWN MENU WITH THE FOLLOWING CHOICES]**

1. 90%-100% of new building space was commissioned
2. 80-89% was commissioned
3. 70-79% was commissioned
4. 60-69% was commissioned
5. 50-59% was commissioned
6. 40-49% was commissioned
7. 30-39% was commissioned
8. 20-29% was commissioned
9. Less than 20% was commissioned

I don't know

E3. [ASK IF **Error! Reference source not found.**: IDAHO > 0; OR **Error! Reference source not found.**:IDAHO > 0; OR **Error! Reference source not found.**: IDAHO > 0; OR **Error! Reference source not found.**: IDAHO > 0] Based on your experience and observations, what percentage of all the **new building space** would you say was commissioned in **Idaho** in 2020? **[DROP-DOWN MENU WITH THE FOLLOWING CHOICES]**

1. 90%-100% of new building space was commissioned
2. 80-89% was commissioned
3. 70-79% was commissioned
4. 60-69% was commissioned
5. 50-59% was commissioned
6. 40-49% was commissioned
7. 30-39% was commissioned
8. 20-29% was commissioned
9. Less than 20% was commissioned

I don't know

E4. The building codes in Washington, Idaho, and Montana all require most **new buildings** to be commissioned. However, over the past two years, this study has indicated that in Washington the percentage of new building space commissioned is very high, while in Montana and Idaho the percentages are much lower.

If you or your firm have experience working across these three Northwest states, why do you think the percentages of new building space commissioned are different among them even though all three require commissioning? What have you observed or heard about that might explain this? [OPEN END; NOT FORCED]

E5. What do you think would help increase **new building commissioning** in Idaho and Montana? [OPEN END; NOT FORCED]

E6. Using a scale from 1 to 5 where 1 means "strongly disagree" and 5 means "strongly agree," please rate whether you agree with the following statements about **existing building commissioning**. [RANDOMIZE ORDER] [DROP DOWN SELECTION MENU WITH RESPONSE CHOICES: 1-5, plus DK]

A. Building owners in the Northwest are aware of existing building commissioning
B. Building owners in the Northwest understand the financial benefits of existing building commissioning
C. Building owners in the Northwest understand the operational benefits of existing building commissioning
D. There are enough qualified commissioning providers to meet Northwest demand for existing building commissioning
E. It is difficult for commissioning providers to quantify the financial benefits of existing building commissioning for customers

E7. What focus will your firm have in 2021, if any? For example, will you be focusing on one kind of commissioning versus others or on certain building types? Why? [OPEN END; NOT FORCED]

E8. Research has shown that HVAC and lighting are most commonly commissioned. Some other systems are less commonly commissioned (such as plumbing, building envelopes, renewable energy, energy storage, and demand-response technologies). Is this true for your firm? Do you think this will change for your firm in the future? Why?

E9. Has the global pandemic COVID-19 impacted your firm's commissioning practices this year?

1. Yes
2. No **[SKIP TO BLOCK F]**

E10. How so? Select all that apply.

1. Lower demand for commissioning services
2. Delayed projects
3. Reduced ability to do commissioning due to social distancing requirements
4. Some other way(s): ☐
5. **[EXCLUSIVE RESPONSE]** COVID-19 has not impacted our firm's commissioning practices this year.

E11. **[IF E10 =/= E10.5]** Does your firm see this impact more in certain market segments, among certain customers, for certain building systems, certain types of equipment, or commissioning types (e.g., ongoing/continuous commissioning, etc.)? [OPEN END; NOT FORCED]

E12. Do you anticipate COVID-19 to impact commissioning in the Northwest into 2021? How so? [OPEN END; NOT FORCED]

F. Thank You!

A1. Thank you so much for participating in the survey. The data you have provided will be aggregated with data from other firms and reported anonymously in the study report. Does your firm wish to have its name published as a contributor to this study? The report is available to the public and posted on NEEA's website. [FORCED RESPONSE]

1. Yes
2. No

A2. Please provide your mailing address to receive your Visa gift card. [FORCED RESPONSE]

Name	☐
Street Address	☐
City	☐
State	☐
Zip Code	☐

[IF 26 NOT YES]

A3. Are you interested in being contacted for future annual research on this topic?

1. Yes
2. No

[END OF SURVEY SCRIPT] Your responses have been submitted. Thank you for participating. Your gift card will be mailed out in a few weeks. Please be on the lookout for a business-size envelope from CADMUS. To learn more about NEEA, please visit www.neea.org