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Building Commissioning Long-Term Monitoring and Tracking: 2017 Square Footage and Market Penetration Update

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Key Findings

Introduction

As part of the Northwest Energy Efficiency Alliance's (NEEA's) long-term monitoring and tracking (LTMT) efforts on new and existing commercial building commissioning, Cadmus collected and analyzed data on 2017 commissioning activity in the Northwest.¹

Cadmus received data on four types of commissioning activity from 25 commissioning professionals representing 20 firms. The commissioning types are:

- Commissioning (Cx) – Commissioning of new buildings during the construction phase
- Retro-commissioning (RCx) – Commissioning of existing buildings that have never been commissioned
- Recommissioning (ReCx) – Commissioning of existing buildings that were commissioned during the construction phase
- Ongoing commissioning (OCx) – Fine-tuning commissioned buildings repeatedly over time

The report is comprised of a short six-page description of key findings, followed by three appendices with further detail on methodology and data, followed by a sample of the data collection instrument.

Summary of Research Approach

Using internet research, Cadmus updated the population of commissioning firms active in the Northwest from 77 firms in 2016 to 85 firms in 2017. Of these 85, three were based in California. The estimated population of certified commissioning professionals representing these firms was 119; uncertified professionals totaled 68. The estimated population of certified professionals has decreased for the second year in a row.

Cadmus sent an online survey to the full population of 85 commissioning firms and received data from 25 individual commissioning professionals representing 20 firms. Cadmus also analyzed data from Dodge Data and Analytics (Dodge) and NEEA's 2014 Commercial Building Stock Assessment (CBSA).

Cadmus estimated the following for new and existing building commissioning in the Northwest:

- Market size in square feet
- Market activity (area of commissioned space)
- Market penetration as a percentage of market size

For more detail on the research methodology, see Appendix A.

¹ Oregon, Washington, Idaho, Montana.

Results for New Building Commissioning (Cx)

For the Northwest as a whole, the 2017 Cx market penetration rate of 67% was similar to the market penetration rate in 2016 of 71%, but some individual northwest states had substantial year-to-year changes.

Table 1 summarizes the 2017 findings for Cx and compares them to the 2016 findings. As shown, in both 2016 and 2017, Washington had a very high Cx market penetration rate compared to the other three states. Cx market penetration increased in Idaho and Montana, with Montana exhibiting a particularly dramatic increase from 35% in 2016 to 93% in 2017. The high, stable penetration of new building commissioning in Washington, and the increases in market penetration in Idaho and Montana, may be linked to these states' building codes which require new building commissioning.² Research on the variation in Cx market penetration among states with similar code requirements could be useful.

By contrast, Oregon experienced a large decrease in the Cx market penetration rate in 2017. This appears to be from the combination of considerable growth in Oregon's commercial new construction, with a decrease in Oregon's Cx activity (total square footage of commissioned space). A possible driver of this decrease is that commissioning firms who work in multiple states are being drawn to states with more Cx opportunity.

More details on key drivers of these regional and state-by-state findings are in the section below *Discussion and Recommendations for Future Research*.

Table 1. 2017 LTMT Estimates for New Building Commissioning (Cx)

State	New Construction Floor Area (sq. ft.)	Commissioned Space (sq. ft)	Market Penetration (2017)	Market Penetration (2016)
Idaho	8,101,275	1,620,375	20%	14%
Montana	2,801,875	2,614,650	93%	35%
Oregon	15,927,975	5,576,794	35%	75%
Washington	36,895,250	32,748,574*	89%*	89%
Total	63,726,375	42,560,393	67%	71%

*Washington's 2017 Cx activity reported in the survey data resulted in a calculated market penetration rate that exceeded 100%. For that reason, Cadmus used the 2016 market penetration (89%) in the 2017 analysis and calculated square footage accordingly. Sources: Dodge; Cadmus analysis of 2017 survey data.

² Washington has adopted the 2015 International Energy Conservation Code (IECC) and Montana and Idaho have each adopted the 2012 IECC which require mandatory commissioning of mechanical services for newly constructed buildings.

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

For the Northwest as a whole, market penetration rates for existing building commissioning decreased for the second year in a row from 1.17% in 2016 to 0.86% in 2017. However, the year-to-year changes varied by the type of existing building commissioning: regionwide market penetration for RCx decreased by half, while the OCx market penetration increased by more than half. In fact, the regionwide OCx activity surpassed the RCx activity for the first time.

Possible drivers of the decrease in RCx include a shift to focus on Cx because of increased new construction and the presence of codes, along with the customary barriers to RCx of lack of demand and high cost. Cadmus recommends NEEA consider ways to support building regional awareness of the benefits of RCx. (See *Discussion and Recommendations for Future Research* for more detail.)

Table 2 summarizes the 2017 findings for existing building commissioning activities and compares them to the 2016 findings.

Table 2. 2017 LTMT Estimates for Existing Building Commissioning

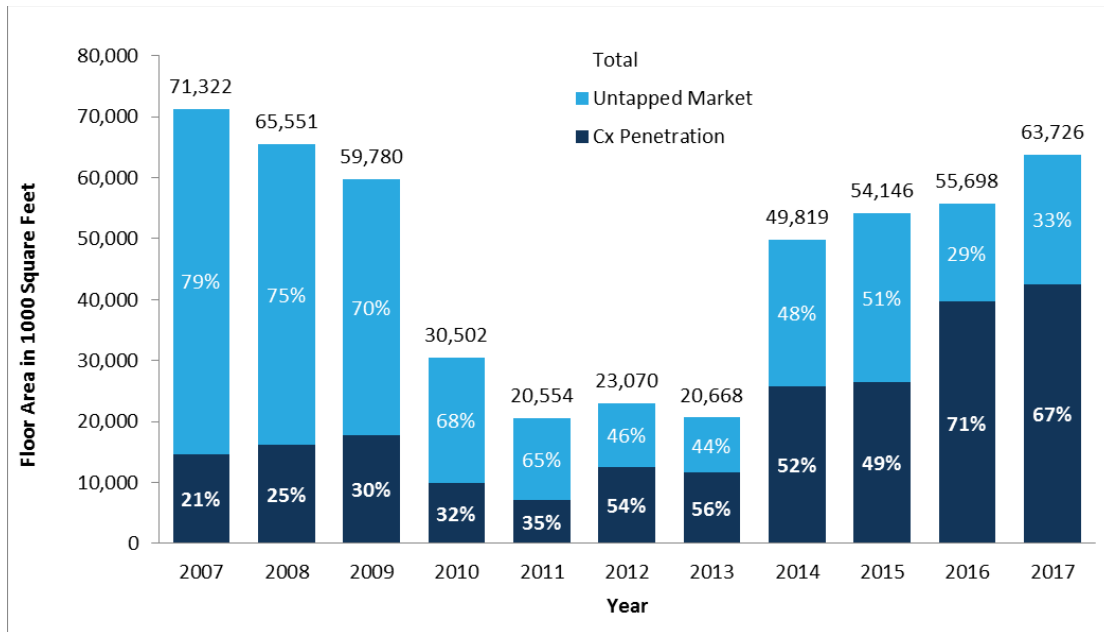
Type	State	Existing Floor Area (sq. ft.)	Commissioned Space (sq. ft)	Market Penetration (2017)	Market Penetration (2016)
Retro-commissioning	Idaho	294,267,364	21,250	0.01%	0.04%
	Montana	248,264,039	1,300,500	0.52%	0.25%
	Oregon	936,163,951	5,299,538	0.57%	1.68%
	Washington	1,640,126,291	4,531,116	0.28%	0.48%
	Total	3,118,821,645	11,152,404	0.36%	0.78%
Recommissioning	Idaho	294,267,364	-	0.00%	0.10%
	Montana	248,264,039	-	0.00%	0.01%
	Oregon	936,163,951	1,609,900	0.17%	0.21%
	Washington	1,640,126,291	864,167	0.05%	0.10%
	Total	3,118,821,645	2,474,067	0.08%	0.13%
Ongoing commissioning	Idaho	294,267,364	-	0.00%	0.09%
	Montana	248,264,039	-	0.00%	0.01%
	Oregon	936,163,951	6,853,125	0.73%	0.64%
	Washington	1,640,126,291	6,438,750	0.39%	0.12%
	Total	3,118,821,645	13,291,875	0.43%	0.26%
Total (All)	3,118,821,645	26,918,345	0.86%	1.17%	

Totals may not equal the sum of column due to rounding. Sources: NEEA 2014 (CBSA); Cadmus analysis of 2017 survey data.

Historical Trends

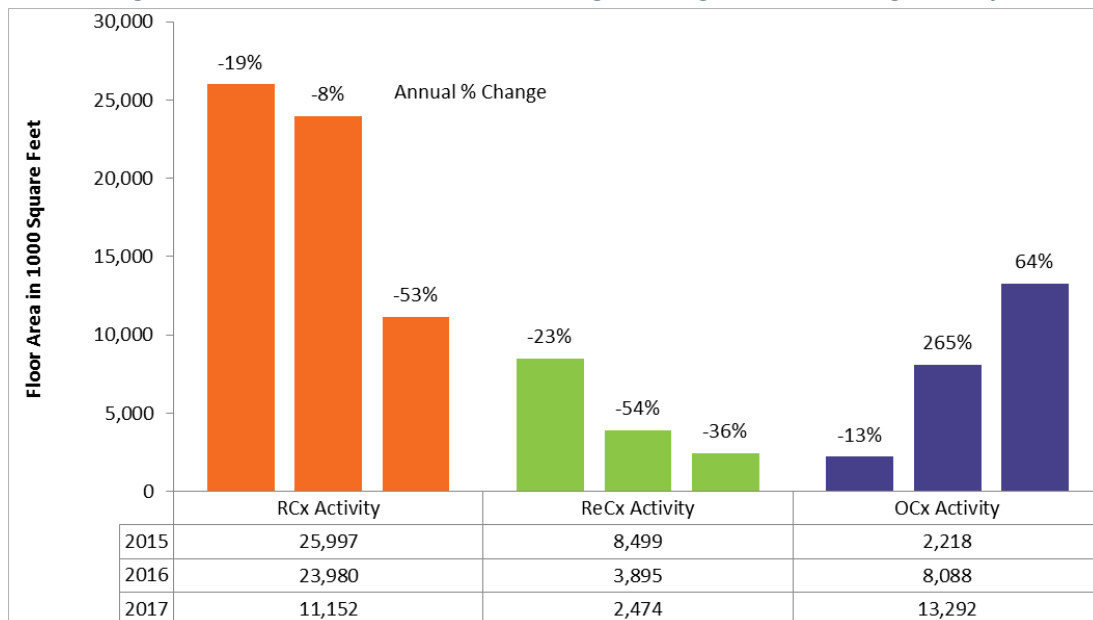
Figure 1 and Figure 2 illustrate the historical commissioning activity and market penetration for Cx, RCx, ReCx, and OCx, respectively. For historical data on a state-by-state basis, please see Appendix B.

Figure 1. New Construction: Historical Estimates for Market Size and Cx Penetration



Sources: Summit Blue Consulting 2006-2008; Navigant 2010-2012; Cadmus 2014-2017; Cadmus analysis of 2017 survey data.

Figure 2. Historical Estimates for Existing Building Commissioning Activity



Sources: Summit Blue Consulting 2006-2008; Navigant 2010-2012; Cadmus 2014-2017; Cadmus analysis of 2017 survey data.

Discussion and Recommendations for Future Research

- Drivers of decrease in Cx activity in Oregon and increase in Washington:** The market penetration for Cx in Oregon decreased substantially in 2017. This appears to be due to considerable growth in Oregon’s commercial new construction combined with a decrease in Oregon’s Cx activity (total square footage of commissioned space). The decrease in Oregon’s Cx activity may be due to Cx services being drawn from Oregon to Washington state; most firms work in both markets. This latter conclusion grew from additional data analysis as follows. Cadmus examined the survey data for firms who completed Cx projects in Oregon in 2016 and 2017 and found that almost all of them completed Cx projects in Washington as well. Moreover, the average share of these firms’ total new building commissioning activity in Oregon shrank from 52% in 2016 to just 28% in 2017, whereas their average share in Washington increased from 48% in 2016 to 72% in 2017. The high demand for new building commissioning services in Washington is undoubtedly linked to the Washington State Energy Code 2015 updates, which require commissioning to be conducted in new buildings.
- Drivers of increase in Cx activity in Idaho and Montana:** For Idaho, the Cx market penetration increased in 2017 due to an increase in Cx activity as well as a slight decrease in new building market size growth. Out of six firms who conducted Cx in Idaho, five reported that the 2012 International Energy Conservation Code—which became effective in Idaho in 2015—is the most important driver of Cx activity in Idaho. Montana experienced a much more substantial increase in Cx market penetration in 2017. Other than a slight decrease in Montana’s new building market size, one respondent pointed out that firms have “a general focus in the area on new construction” compared to existing building commissioning.
- Drivers of existing building commissioning activity changes:** For the Northwest as a whole, existing building commissioning activity decreased for the second year in a row. The regionwide market penetration for RCx decreased by half. Because of the small sample size, it is difficult to conclude whether this decrease in activity is due to incomplete data or trends in the market, but it is likely a combination of both. Cadmus examined the survey data on RCx activity and found that some providers who reported RCx projects in 2016 reported zero RCx projects in 2017. The average square feet per firm of those who did conduct RCx also decreased drastically in Idaho and Oregon. Survey respondents reported several significant barriers to the RCx market, including lack of demand (92% of all respondents), high costs for building owners (67% of all respondents), and commissioning firms’ shift in focus to Cx (64% of all respondents). One respondent explained this shift to Cx in Idaho as follows: “As the economy has continued to improve, and new construction has boomed, providers have focused their marketing and manpower on new construction ... [so] retro-commissioning has taken a back seat.” Cadmus recommends NEEA consider ways to support awareness-building in the region on the benefits of RCx, through its support of the Building Commissioning Association (BCA) or other industry efforts.
- Recommendations for future research:** Despite having an updated population of commissioning professionals and similar recruitment efforts, this year’s LTMT study only garnered responses

from 20 firms, continuing the trend of decreasing responsiveness in the past two years. Also, while all 27 responding professionals in 2016 (representing 25 firms) indicated interest in participating again, only 12 participated in this year's survey (along with seven new firms and one returning firm from two years ago). Because findings from the survey are extrapolated to the population (an estimated 85 firms) to determine overall market activity in the region, a robust sample size is necessary to produce reliable results. In particular, consistent, year-over-year participation among commissioning professionals in the region is important. In this and past years' LTMT studies, after sending the online survey to the population of commissioning professionals, Cadmus used a random sampling approach to conduct phone reminders. For future efforts, Cadmus recommends adopting a purposive sampling approach that targets those firms that have participated in the research in the past. Secondly, Cadmus recommends conducting outreach via phone and email in advance of sending out the 2018 online survey, to remind professionals about the annual research and secure early buy-in. Where possible, we suggest NEEA leverage professional relationships and channels of influence, such as asking the BCA to highlight information about the survey in its newsletter or other communications.

Appendix A. Methodology

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

Data Collection Methodology

NEEA had four major objectives for the 2017 LTMT study:

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

Table 3 provides a summary of 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 this report, Cadmus discusses detailed steps taken to arrive at the 2017 estimates.

Cadmus calculated precision for the square footage results at 80% confidence with $\pm 39\%$ precision for new building commissioning, and 80% confidence with $\pm 54\%$ precision for existing building commissioning.³ The level of precision for new building commissioning improved slightly compared to the level in the previous year. The poor precision for the existing building commissioning results was primarily driven by the small achieved sample size and the high variability of each of the reported square footage values, which impacted the standard error.

³ Cadmus calculated one measurement of confidence and precision for all types of existing building commissioning combined. Sample sizes were too small to provide meaningful precision results for RCx, ReCx and OCx separately.

Table 3. Data Collection Methodology

Objectives	Method	Population*	Target Sample Size	Achieved Sample Size	Data Source for Task
Square footage of commissioned building space	Online survey of professionals	85 firms	n/a	20 firms	Sample frame constructed from public data from certification bodies* and internet search
Market size (square footage of new and existing buildings)	Secondary sources	n/a	n/a	n/a	Dodge data provided by NEEA and 2014 CBSA data
Number of certified and uncertified commissioning professionals by state	Online survey of professionals	187 professionals	45 respondents	25 respondents	Number of certified professionals from public data from certification bodies* and internet search; number of uncertified providers obtained from survey

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

Online Survey

Cadmus used an online survey platform, designed and administered through Qualtrics, to collect square footage for commissioning activity. Appendix C contains the online survey instrument. Cadmus contacted all commissioning professionals of the commissioning firm population, targeting 45 responses.

To update the population of commissioning firms active in the Northwest, Cadmus used the list of certified commissioning professionals generated for the 2016 LTMT study, excluded professionals whose emails bounced back during the previous LTMT study, and updated the list with new information from internet research. The updated list is composed of commissioning professionals holding a commissioning certification from either the Building Commissioning Association (BCA), the AABC Commissioning Group (ACG), the American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE), the Association of Energy Engineers (AEE), or the National Environmental Balancing Bureau (NEBB). In addition, Cadmus also conducted a broad internet search of engineering firms in each of the four states to capture firms providing commissioning services that may not have certified personnel listed by the above professional organizations.

The updated list also included California-based engineering firms and professionals to investigate whether they serviced the Northwest in 2017. Three reported they had so Cadmus counted them in the

final population. Altogether, 25 commissioning professionals completed the survey, representing 20 firms (17 Northwest and three California-based firms).

Also, while all 27 responding professionals in 2016 (representing 25 firms) indicated interest in participating again, only 12 participated in this year's survey (along with seven new firms and one returning firm from two years ago). Of the 13 firms that dropped out in 2017, we found that the contact person at five of them had moved on to a new job. For the majority of the remaining eight firms that participated in 2016 and not 2017, Cadmus sent the survey invitation to at least two different contacts and made follow-up reminder calls to at least one contact.

Determination of Market Size

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

NEEA provided Cadmus new construction square footage from Dodge Data and Analytics (Dodge) for 2016 and 2017. Both years are necessary to arrive at the most accurate 2017 market size for new building commissioning because Cadmus lags the construction start data by nine months to account for the long duration between construction start and completion. For this year's study, the 2017 new building square footage estimate consists of 75% of the new construction starts' square footage from 2016, and 25% from 2017. Cadmus also removes the square footage of parking garages from this estimate because these structures typically do not undergo commissioning.

To determine the existing commercial building space in each state, Cadmus used NEEA's CBSA data from 2014. Last year, Cadmus updated the data to arrive at an estimate for the 2016 building stock by simply adding on 2015 new construction square footage; this year we followed the same methodology to arrive at a 2017 estimate for the existing building stock.⁴ Appendix B shows the new and existing building stock by state and by year.

Square Footage of Demolitions

NEEA requires estimates of demolished building space for the ACE Model. To calculate the square footage of demolished building space, Cadmus applied the 2013 LTMT study's established demolition rate of 0.63% to 2017's existing building square footage for each state. Cadmus reviewed other sources—including contacting state-level offices responsible for permit issuance—for an updated data source, but was not able to obtain a more up-to-date statewide or regional estimate of demolition rates.

⁴ Lagged by nine months.

Market Penetration

Cadmus determined commissioning market penetration by collecting commissioning firms' estimates of the area (in square feet) commissioned in 2017, by state and commissioning type.

Cadmus' market penetration methodology involved the following steps:

1. Collect commissioning square footage 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 square feet of commissioned space.
5. Calculate market penetration by state and commissioning type.

Table 4 contains the final estimated population of firms by state and commissioning type. In this case, "service population" means the number of firms that Cadmus estimates *serviced end users in that state*, for each specific commissioning type. We used these population estimates as a multiplier to generate the total square footage for the ACE model (see Key Findings).

Table 4. 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	30	4	-	-
Montana	26	9	-	-
Oregon	43	21	9	13
Washington	55	30	13	13

Source: Cadmus analysis of 2017 survey data.

Adjustments

NEEA's commissioning initiative focused on the commercial building market. Although the survey focused on commercial building commissioning, respondents may have counted industrial and manufacturing (I&M) buildings in their reported commissioned square footage. To measure this trend, Cadmus included questions in the survey to inform the square footage of commissioned floor space that was from I&M buildings for each of the four types of commissioning and adjusted the final square footage to remove the square footage for these buildings.⁵

I&M buildings comprised 14% of Cx square footage, 29% of RCx square footage, 23% of ReCx square footage, and 7% of OCx square footage.

⁵ Questions E4, E7, E10, and E13 in Appendix C.

Extrapolation of Sample Data to Population

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

Equation 1. Extrapolation

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

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 4);

$n_{s,t}$ = Number of firms in the sample in state (s) and commissioning type (t) (Cadmus analysis of 2017 survey data);

$CxSqFt_{s,t}$ = Adjusted commissioning square feet reported by firm (f) for state (s) and commissioning type (t) (Cadmus analysis of 2017 survey data); and

$NCxSqFt_{s,t}$ = Total commissioning square feet for state (s) and commissioning type (t) (in Table 1 and Table 2).

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Appendix B. Historical Data

Table 5. Cx 2012–2017 Market Size, Activity, and Penetration Estimates

State	Year	New Building Market Size (sq. ft.)	Cx Activity (sq. ft.)	Market Penetration
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%
Idaho	2012	3,348,850	385,755	12%
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%
Montana	2012	995,300	576,183	58%
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%
Oregon	2012	6,498,525	2,918,564	45%
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%
Washington	2012	12,227,350	8,617,914	70%
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%
Total	2012	23,070,025	12,498,416	54%

Sources: Dodge; Cadmus 2014-2017; Cadmus analysis of 2017 data.

Table 6. RCx 2012–2017 Market Size, Activity, and Penetration Estimates

State	Year	Existing Building Market Size (sq. ft.)	RCx Activity (sq. ft.)	Market Penetration
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%
Idaho	2012	250,628,640	513,333	0.20%
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%
Montana	2012	73,726,888	621,000	0.84%
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%
Oregon	2012	698,772,815	9,682,095	1.39%
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%
Washington	2012	1,168,381,594	7,606,938	0.65%
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%
Total	2012	2,191,509,936	18,423,367	0.84%

Sources: Dodge; Cadmus 2014-2017; Cadmus analysis of 2017 data.

Table 7. ReCx 2012–2017 Market Size, Activity, and Penetration Estimates

State	Year	Existing Building Market Size (sq. ft.)	ReCx Activity (sq. ft.)	Market Penetration
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%
Idaho	2012	250,628,640	4,400	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%
Montana	2012	73,726,888	37,500	0.05%
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%
Oregon	2012	698,772,815	717,972	0.10%
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%
Washington	2012	1,168,381,594	2,050,000	0.18%
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%
Total	2012	2,191,509,936	2,809,872	0.13%

Sources: Dodge; Cadmus 2014-2017; Cadmus analysis of 2017 data.

Table 8. OCx 2012–2016 Market Size, Activity, and Penetration Estimates

State	Year	Existing Building Market Size (sq. ft.)	OCx Activity (sq. ft.)	Market Penetration
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%
Idaho	2012	250,628,640	-	0.00%
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%
Montana	2012	73,726,888	-	0.00%
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%
Oregon	2012	698,772,815	1,806,000	0.26%
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%
Washington	2012	1,168,381,594	2,171,400	0.19%
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%
Total	2012	2,191,509,936	3,977,400	0.18%

Sources: NEEA 2014 (CBSA); Cadmus 2014-2017.

Appendix C. Survey Instrument

A. *Survey Invitation Email Message*

To: [EMAIL ADDRESS]

From: NEEA and Cadmus

Subject: Annual Paid Survey Opportunity - NEEA Commissioning Study

Dear [FIRST NAME]:

For the past five years, the non-profit Northwest Energy Efficiency Alliance (NEEA) has conducted an annual study on new building and existing building commissioning markets in the Northwest (Washington, Oregon, Idaho, and Montana) to track industry trends and market changes. 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.

The study aims to determine the total square footage of whole-building and energy-focused commissioned building space in the Northwest in the year 2017, and so we'll ask you to share your firm's square footage of commissioning projects, and a few other questions.

We know your time is valuable, so we are offering respondents a **\$150 Visa gift card** for completing a survey. This survey should take approximately 20 minutes. As always, individual results **always remain anonymous**.

Follow this link to the Survey: [SURVEY LINK]

Or copy and paste this URL into your internet browser: [SURVEY LINK]

To receive your gift card and participate in this study, please complete the survey by **December 22, 2017**.

NEEA greatly appreciates your participation. If you have any questions about the survey, please feel free to contact me. Thank you in advance!

Sincerely,

Hope Lobkowicz

Cadmus
720 SW Washington St.
Portland, OR 97205
503-467-7131

Follow the link to opt out of future emails:
\${!://OptOutLink?d=Click here to unsubscribe}

B. Survey Start Screen



[DISPLAY NEEA LOGO]

- B0. In 2017, did your firm provide commissioning services in the Northwest (Washington, Oregon, Idaho, or Montana)?
1. Yes [continue]
 2. No [terminate]
 3. Don't know [terminate]

[Termination message: "Only commissioning providers who have worked in the Northwest in 2017 are eligible for this study. Thank you for your interest. To learn more about NEEA, please visit www.neea.org"]

[SURVEY CONTINUES IF B0=1]

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 22, 2017** 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: The survey will ask you to gather the square footage of your whole-building, energy-focused commissioning or retro-commissioning projects completed in 2017 in the Northwest states of Washington, Oregon, Idaho, and Montana. The purpose of the research is to help NEEA understand more about the building commissioning industry and market trends. Your responses will remain confidential, we will aggregate them with others, and you will **not** be asked to report your clients' names or information.

[DISPLAY BEGIN SURVEY BUTTON]

C. Introduction

- C1. Name:
- Firm Name:
- Job Title:
- Phone Number:

- C2. 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. BCA (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

D. About Your Firm

For this study, the term “commissioning” is defined as **whole-building energy-focused commissioning** (as opposed to commission focusing exclusively 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).

- D1. 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
- D2. 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

D3. 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.

D4. Of this group, how many people hold individual professional commissioning certifications? Use your best guess.

D5. Does your firm hold any firm-level commissioning certifications?

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

[ASK IF D5=1]

D6. Which **firm-level** commissioning certifications does your firm hold? (Select all that apply)

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

E. *Project Square Footage*

In this section, we will ask you to enter square footage data for **whole-building energy-focused** commissioning projects your firm completed in 2017 for the Northwest states of Washington, Oregon, Idaho, and Montana. We are seeking data by state and by project 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 D1=1]

E1. Please enter the total square footage of **new building commissioning*** projects your firm completed in 2017 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.*

<input type="text"/>	Washington
<input type="text"/>	Oregon
<input type="text"/>	Idaho
<input type="text"/>	Montana

[ASK IF D1=1]

E2. If any of the square footage you just entered for **new building commissioning** was estimated, help us understand how much variance there may be from the actual square feet. Please estimate how accurate the value that you provided is. **[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	<input type="text"/>
Oregon	<input type="text"/>
Idaho	<input type="text"/>
Montana	<input type="text"/>

[ASK IF D1=1]

E3. About what percentage of the **new building commissioning** projects were major **renovations**?

Washington	<input type="text"/>
Oregon	<input type="text"/>
Idaho	<input type="text"/>
Montana	<input type="text"/>

[ASK IF D1=1]

E4. About what percentage of the total square footage of **new building** space your firm commissioned in 2017 was **industrial or manufacturing facilities**, if any? Please consider square footage for industrial or manufacturing **building** commissioning, not industrial or manufacturing **equipment** commissioning. **[DROP DOWN SELECTION MENU WITH RESPONSE CHOICES: 0-100%, in 5% increments, plus DK]**

<input type="text"/>

[ASK IF D1=2]

- E5. Please enter the total square footage of **retro-commissioning** projects your firm completed in 2017 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.*

<input type="text"/>	Washington
<input type="text"/>	Oregon
<input type="text"/>	Idaho
<input type="text"/>	Montana

[ASK IF D1=2]

- E6. If any of the square footage you just entered for **retro-commissioning** was estimated, help us understand how much variance there may be from the actual square feet. Please estimate how accurate the value that you provided is. [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	<input type="text"/>
Oregon	<input type="text"/>
Idaho	<input type="text"/>
Montana	<input type="text"/>

[ASK IF D1=2]

- E7. About what percentage of the total square footage of **retro-commissioned** space your firm completed in 2017 were **industrial or manufacturing facilities**, if any? Please only consider square footage for industrial or manufacturing **building** retro-commissioning, not industrial or manufacturing **equipment** retro-commissioning. [DROP DOWN SELECTION MENU WITH RESPONSE CHOICES: 0-100%, in 5% increments, plus DK]

[ASK IF D1=3]

- E8. Please enter the total square footage for **re-commissioning** projects your firm completed in 2017 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.*

<input type="text"/>	Washington
<input type="text"/>	Oregon
<input type="text"/>	Idaho
<input type="text"/>	Montana

[ASK IF D1=3]

E9. If any of the square footage you just entered for **re-commissioning** was estimated, help us understand how much variance there may be from the actual square feet. Please estimate how accurate the value that you provided is. [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	<input type="text"/>
Oregon	<input type="text"/>
Idaho	<input type="text"/>
Montana	<input type="text"/>

[ASK IF D1=3]

E10. About what percentage of the [TOTAL FROM E8] sq. ft. of **re-commissioned** space your firm commissioned in 2017 was **industrial or manufacturing facilities**, if any? Please only consider square footage for industrial or manufacturing **building** re-commissioning, not industrial or manufacturing **equipment** re-commissioning. [DROP DOWN SELECTION MENU WITH RESPONSE

CHOICES: 0-100%, in 5% increments, plus DK]

[ASK IF D1=4]

E11. Please enter the total square footage for **ongoing/continuous commissioning** projects your firm completed in 2017 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.*

<input type="text"/>	Washington
<input type="text"/>	Oregon
<input type="text"/>	Idaho
<input type="text"/>	Montana

[ASK IF D1=4]

E12. If any of the square footage you just entered for **ongoing/continuous commissioning** was estimated, help us understand how much variance there may be from the actual square feet. Please estimate how accurate the value that you provided is. [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	<input type="text"/>
Oregon	<input type="text"/>
Idaho	<input type="text"/>
Montana	<input type="text"/>

[ASK IF D1=4]

E13. About what percentage of the square footage of **ongoing commissioned** space your firm completed in 2017 was in **industrial or manufacturing facilities**, if any? Please only consider square footage for industrial or manufacturing **building** ongoing commissioning, not industrial or manufacturing **equipment** ongoing commissioning. [DROP DOWN SELECTION MENU WITH RESPONSE CHOICES: 0-

100%, in 5% increments, plus DK]

[SKIP TO F1]

F. *Market Drivers and Barriers*

[ASK IF INPUT FOR ID > 0 IN E1, E5, E8 OR E11]

- F1. What do you think is the most important driver of **new building commissioning** in Idaho? [OPEN END]

[ASK IF F1 IS ASKED]

- F2. Using a scale from 1 to 5 where 1 means “extremely significant” and 5 means “not at all significant,” please rate the level of significance of the following barriers to **new building commissioning** in Idaho. [RANDOMIZE ORDER] [DROP DOWN SELECTION MENU WITH RESPONSE CHOICES: 1-5, plus DK]
- A. Building owners/developers are not requesting it
 - B. Cost savings are difficult to estimate
 - C. Building codes and regulations have not required it in the past
 - D. There are not enough qualified providers in the region

[ASK IF F1 IS ASKED]

- F3. Are there any other barriers to **new building commissioning** in Idaho? These other barriers can be minor or major. Please be sure to specify.
- 1. Yes, please specify
 - 2. No
 - 98. Don't know

[ASK IF F3=1]

- F4. Using a scale from 1 to 5 where 1 means “extremely significant” and 5 means “not at all significant,” please rate the level of significance this other barrier has to **new building commissioning** in Idaho.

- F5. Using a scale from 1 to 5 where 1 means “extremely important” and 5 means “not at all important,” please rate the level of importance you believe the following factors have on the overall market for **existing building commissioning** in the Northwest. [RANDOMIZE ORDER] [DROP DOWN SELECTION

MENU WITH RESPONSE CHOICES: 1-5, plus DK]

- A. LEED
- B. Utility programs/incentives
- C. Trade associations (such as BCA, ACG, ASHRAE) that publish guidelines, offer education, and legitimize the practice through professional certifications
- D. Public policies/procurement policies/government buildings
- E. Overall awareness of the benefits of retro-commissioning or recommissioning among building owners/decision-makers

- F6. Are there any other drivers of **existing building commissioning** in the Northwest? These other drivers can be minor or major. Please be sure to specify.
- 1. Yes, please specify
 - 2. No
 - 98. Don't know

[ASK IF F6=1]

- F7. Using a scale from 1 to 5 where 1 means "extremely important" and 5 means "not at all important," please rate the level of importance this other driver has on your firm's **existing building commissioning** business.

- F8. In your observation of the **retro-commissioning*** market in the Northwest, did the total retro-commissioning square footage in the Northwest increase, decrease, or remain the same in the past two years?
- 1. Increase
 - 2. Decrease
 - 3. Remain the same
 - 4. Other: specify
 - 98. Don't know

*Retro-commissioning is the commissioning of existing buildings that have not previously been commissioned.

- F9. Using a scale from 1 to 5 where 1 means "extremely significant" and 5 means "not at all significant," please rate the level of significance of the following barriers to **retro-commissioning** in

the Northwest. [RANDOMIZE ORDER] [DROP DOWN SELECTION MENU WITH RESPONSE CHOICES: 1-5, plus DK]

- A. Building owners are not requesting it
- B. Qualified providers are not proposing or recommending it
- C. Qualified providers or firms are more focused on new buildings due to the demand
- D. Qualified providers or firms are more focused on new buildings due to profitability or existing business models
- E. Costs of retro-commissioning are too high for building owners
- F. Cost savings are difficult to estimate
- G. There are not enough qualified providers in the region

F10. Are there any other barriers to **retro-commissioning** in the Northwest? These other barriers can be minor or major. Please be sure to specify.

- 1. Yes, please specify
- 2. No
- 98. Don't know

[ASK IF F10=1]

F11. Using a scale from 1 to 5 where 1 means "extremely significant" and 5 means "not at all significant," please rate the level of significance this other barrier has to **retro-commissioning** in the Northwest.

[ASK IF F8=2 AND IF INPUT FOR MT > 0 E1, E5, E8, OR E11]

F12. Other than what you mentioned previously, do you think there are any reasons for the decline in **retro-commissioning** in Montana, specifically? [OPEN END]

[ASK IF F8=2 AND IF INPUT FOR ID > 0 E1, E5, E8, OR E11]

F13. Other than what you mentioned previously, do you think there are any reasons for the decline in **retro-commissioning** in Idaho, specifically? **[OPEN END]**

[SKIP TO G1]

G. Thank You!

G1. Please provide your mailing address to receive the \$150 Visa gift card.

Name	<input type="text"/>
Street Address	<input type="text"/>
City	<input type="text"/>
State	<input type="text"/>
Zip Code	<input type="text"/>

G2. Are you interested in being contacted for future annual research on this topic? Participants are eligible for a \$150 gift card for each year of data they provide.

<input type="checkbox"/>	Yes
<input type="checkbox"/>	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