Codes and Standards for Carbon Neutral Buildings Initiative Year 3 Market Evaluation Report:

Baseline Estimates and Progress Toward Goals

Final Appendices

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Appendix A. Preliminary CEF Savings Estimates

In Year 3, the Market Evaluation Team calculated preliminary CEF savings estimates of the Codes and Standards for Carbon Neutral Buildings initiative associated with stretch code adoption and increased code compliance resulting from training.

Although the methodology for calculating these preliminary savings aligned with the methodology of Year 2 for the most part, the Team made these updates to the methodology:

- Leveraged Pacific Northwest National energy use intensities for building codes at the end-use level, rather than the whole-building level
- Used an adjusted method for estimating energy consumption assuming that elements of a building project that are not in compliance with current code are 100% compliant with the previous code version
- Updated code compliance estimates with results from the Year 3 Delphi Panel

Table 1 shows the estimated savings for 2020, 2021, and 2022 in terms of electric energy and demand, electric, demand, and fossil fuel savings. For 2022 training impacts, the Market Evaluation Team used the 2021 impacts. This is because the total 2022 building square footage, an important component of the savings calculation, was not yet available. The Team will update the 2022 estimates in Year 4, when complete 2022 data will be available. Similarly, the Team trued up 2021 estimates based on 2021 square footage data that became available in Year 3.

Table 1. Preliminary Savings Estimates

	Electric Savings (GWh)			**Demand Savings (MW)**			**Fossil Fuel Savings (Billion BTU)**		
	2020	**2021**	**2022**	**2020**	**2021**	**2022**	**2020**	**2021**	**2022**
Stretch Code Adoption	4.1	14.28	15.12	1.1	4.0	4.2	6.76	18.17	20.01
Training	49.01	42.00	42.00	13.8	11.2	11.2	71.45	83.56	83.56
Total	53.11	56.28	57.11	14.9	15.2	15.4	78.22	101.73	103.57

Because two sources provided funding for the initiative in 2020, the CEF and the T&MD, the Team estimated 2020 CEF savings based on the percentage of funding coming from the CEF. The revised 2020 estimate is shown in Table 2.

Table 2. Preliminary Savings Estimate – CEF Only

	Electric Savings (GWh)			Demand Savings (MW)			Fossil Fuel Savings (Billion BTU)		
	2020	**2021**	**2022**	**2020**	**2021**	**2022**	**2020**	**2021**	**2022**
Stretch Code Adoption	4.05	14.28	15.12	1.1	4.0	4.2	6.68	18.17	20.01
Training	48.39	42.00	42.00	13.6	11.2	11.2	70.55	83.56	83.56
Total	52.44	56.28	57.11	14.7	15.2	15.4	77.24	101.73	103.57

1.1. Stretch Code Adoption

To calculate the impacts of stretch code adoption, the Market Evaluation Team used the following variables: jurisdictions that have adopted NYStretch, the building square footage affected by NYStretch adoption, and the per-square-footage change in energy use intensity per square foot affected. Additionally, the Team applied an attribution factor estimating the percentage of energy savings from jurisdictions' stretch code adoption that should be attributed to the Codes and Standards for Carbon Neutral Buildings initiative. Table 3 provides the data inputs and sources for the stretch codes savings calculation.

Table 3. Data Inputs for Stretch Code Savings Calculation

Variable	Source/Notes
Affected Square Footage	Dodge data provided by NYSERDA: Assumed square footage is evenly distributed throughout the year and assumed compliance with the code was achieved upon adoption of the code Assumed 2022 construction is the same as the 2021 pace Adjusted county-level Dodge data to jurisdictions based on census information
Attribution Factor	Market Evaluation Team panel–based review of Year 3 Stretch Code jurisdiction interviews (for NYS and NYC separately)
Energy Use Intensity Change Per Square Footage	Pacific Northwest National Laboratory: Residential and Commercial Prototype Building Models: www.energycodes.gov/prototype-building-models NYSERDA 2020 NYStretch Energy Code Commercial Cost Effectiveness Analysis: July 2019 NYSERDA Energy Savings and Cost-Effectiveness Analysis of the 2020 NYStretch Energy Code Residential Provisions: July 2019

The Market Evaluation Team convened an internal panel of experts to estimate the attribution that the initiative should receive based on the initiative's work to develop and promote NYStretch. The internal panel made the following determinations following interviews with jurisdictions that had adopted stretch codes.

For NYC, the internal panel estimated that 75% of the savings realized from adopting the stretch code can be attributed to the initiative because NYC has climate priorities and a history of adopting stretch codes. However, NYSERDA provided critical assistance and support for NYC's adoption of its current stretch code.

For other jurisdictions, the internal panel estimated that 92% of stretch code savings are attributable to the initiative. Only one of the five jurisdictions outside NYC had adopted a stretch code prior to NYStretch-2020. This jurisdiction found NYSERDA's assistance important to its latest iteration of code important. The internal panel concluded that it would be unlikely for jurisdictions to develop and adopt stretch codes without NYSERDA's intervention.

Table 4 details the total impacts of the adoption of NYStretch. The Market Evaluation Team identified 31 jurisdictions that have adopted NYStretch across all three climate zones. Most significantly, NYC, which accounts for more than 92% of the affected square footage and energy savings of code adoption, adopted NYStretch in May of 2020.

Table 4. Local Impacts of New York Stretch Code Adoption

Jurisdiction or Climate Zone	Stretch Code Enhanced (1,000 sq ft)	Adoption Date	Attribution Factor	Electric Energy Savings (MWh)	Electric Demand Savings (MW)	Fossil Fuel Savings (Million BTU)
Statewide Total	28,842.7	N/A	76%	14,284	4.001	18,175
NYC	27,574.6	5/12/2020	75%	13,462	3.766	16,398
Climate Zone 4 - Total	858.8	N/A	92%	481	0.138	772
Hastings-on-Hudson, Village of	45.4	6/16/2020	92%	25	0.007	40
Dobbs Ferry, Village of	63.5	11/10/2020	92%	35	0.010	56
Bedford, Town of	90.4	2/2/2021	92%	50	0.014	80
New Rochelle, City of	316.7	4/20/2021	92%	176	0.050	279
Ossining, Town of	92.2	5/11/2021	92%	51	0.015	81
Mamaroneck, Town of	91.9	6/16/2021	92%	51	0.015	81
Cortlandt, Town of	109.2	7/20/2021	92%	61	0.017	96
North Salem, Town of	8.7	9/14/2021	92%	5	0.001	8
Irvington, Village of	10.5	9/20/2021	92%	6	0.002	9
East Hampton, Town of	11.4	11/18/2021	92%	8	0.002	17
New Castle, Town of	6.7	12/7/2021	92%	4	0.001	6
Southampton, Town of	12.3	12/14/2021	92%	9	0.003	19
Climate Zone 5 - Total	203.0	N/A	92%	172	0.048	479
Beacon, City of	94.8	4/20/2020	92%	75	0.021	202
Niskayuna, Town of	64.1	4/27/2021	92%	58	0.016	166
Lima, Village of	1.5	4/27/2021	92%	1	0.000	4
Athens, Village of	1.7	7/28/2021	92%	2	0.000	4
Philmont, Village of	2.0	8/9/2021	92%	2	0.001	5

Jurisdiction or Climate Zone	Stretch Code Enhanced (1,000 sq ft)	Adoption Date	Attribution Factor	Electric Energy Savings (MWh)	Electric Demand Savings (MW)	Fossil Fuel Savings (Million BTU)
Canandaigua, City of	24.4	9/2/2021	92%	22	0.006	63
Geneva, Town of	6.4	9/21/2021	92%	6	0.002	17
Tully, Village of	0.3	11/3/2021	92%	0	0.000	1
Orangetown, Town of	7.9	11/30/2021	92%	6	0.002	17
Pittsford, Village of	0.0	1/30/2022	92%	0	0.000	0
Climate Zone 6 - Total	206.2	N/A	92%	169	0.049	526
Montour Falls, Village of	14.0	2/18/2021	92%	13	0.004	45
Kingston, City of	69.0	4/6/2021	92%	66	0.019	223
Bethel, Town of	31.0	5/12/2021	92%	26	0.007	80
Dryden, Town of	63.7	5/20/2021	92%	42	0.012	108
Marbletown, Town of	12.7	6/1/2021	92%	12	0.004	41
Newfield, Town of	14.3	8/12/2021	92%	9	0.003	24
Humphrey, Town of	0.1	11/8/2021	92%	0	0.000	0
Esopus, Town of	1.4	12/16/2021	92%	1	0.000	5

1.2. Training Impacts

To calculate the impacts of trainings, the Market Evaluation Team used the following variables: the building square footage affected by trained code officials and building professionals, the percentage of increased compliance resulting from training activities, and the per-square-footage change in energy use intensity per square foot affected. Table 5 identifies the source for each of these variables.

Table 5. Data Sources for Training Impacts Validation

Variable	Source/Notes
Affected Square Footage	Market square footage according to Dodge data provided by NYSERDA: Square footage estimates reduced to account for above code new construction based on initial NYSERDA estimates of 15% for residential new construction and 30% for commercial new construction
Change in Compliance Due to Initiative	Massachusetts TXC47 Non-Residential Code Compliance Support Initiative Attribution and Net Savings Assessment, July 26, 2018, NMR Group and Cadmus
Energy Use Intensity Change Per Square Footage for Percentage of Change in Code Compliance	Pacific Northwest National Laboratory: Residential and Commercial Prototype Building Models: www.energycodes.gov/prototype-building-models

The Market Evaluation Team intended to base affected square footage on follow-up survey responses with training participants and then calculate an average impact to the population of trainees. However, the average square footage estimates applied to training participants would have yielded an impacted area that was greater than the total market. The high square footage estimate from training surveys was probably due to the code officials and building professionals working on the same projects

Table 6 shows the preliminary energy savings impacts from trainings for 2021 (square footage estimates for 2022 were not yet available when the analysis was conducted). The table shows the various building segments, market square footages, and final electric and fossil fuel savings. The final estimated 2021 energy savings is 41,995 MWh, the demand savings estimate is 11.2 MW, and the fossil fuel savings estimate is 83,557 MMBTU.

Table 6. Preliminary Energy Savings Impacts: Training

Segment	Market Square Footage (thousand sq-ft) [a]	Energy Savings (MWh/year)	Demand Savings (MW)	Fossil Fuel Savings (MMBTU/Year)
Statewide Total	77,697	41,995	11.2	83,557
Commercial New Construction	45,144	30,841	7.9	48,118
Commercial Major Alteration and Additions	5,639	4,292	1.0	7,488
Residential New Construction	26,672	6,780	2.2	27,759
Residential Major Alteration and Additions	242	82	0.0	192

[a] Dodge data provided by NYSERDA: Square footage estimates reduced to account for above code new construction based on initial NYSERDA estimates of 15% for residential new construction and 30% for commercial new construction

Appendix B. Code Compliance Additional Details

In early 2022, the Market Evaluation Team convened a Delphi Panel of 10 building energy codes and code compliance experts (panelists) working across NYS. The Delphi Panel process used the judgment of this group of experts to develop estimates and compile informed opinions on energy code compliance across the state. The *Appendix C: Evaluation Methodologies* section provides details on the Delphi Panel methodology.

Seven of the 10 Delphi panelists had expertise in both residential and commercial energy codes, as shown in Table 7. Two of the remaining three had only residential expertise; the final respondent had only commercial expertise.

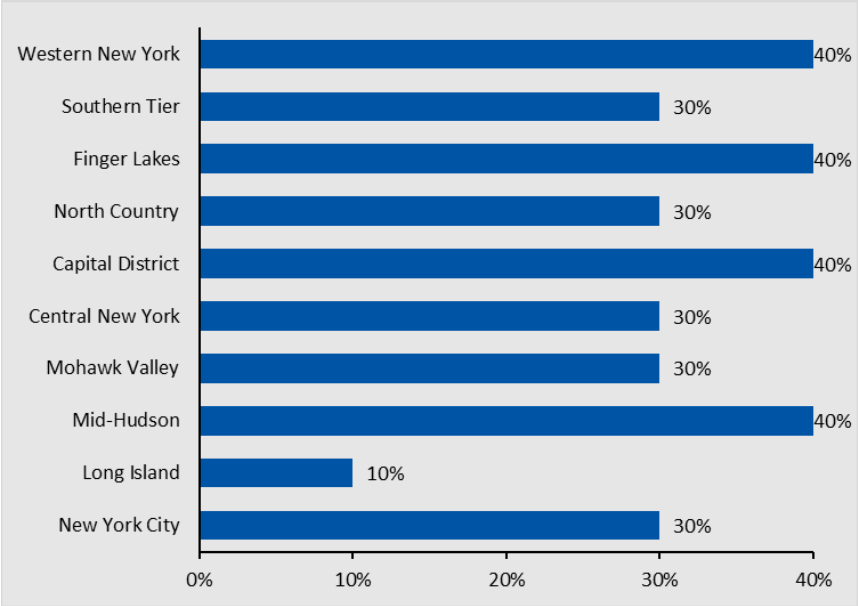
Table 7. Energy Code Expertise of Delphi Panel Participants

Category	Count
Commercial energy code expertise only	1
Residential energy code expertise only	2
Both commercial and residential energy code expertise	7

As shown in Figure 1, the Team worked to ensure that the Delphi Panel respondents represented a wide range of geographic regions of work experience, with three respondents reporting having significant work experience in multiple regions.

Figure 1 Delphi Panel Study Participants' Geographic Experience (n=10)

Source: Delphi Panel Question: Multiple responses allowed. "With which geographic region(s) do you have the most expertise?" June 2022.



The Team also interviewed seven individuals from three representative jurisdictions (an urban jurisdiction [NYC], a suburban jurisdiction, and a rural jurisdiction). Throughout the interviews, the Market Evaluation Team presented findings from the Delphi Panel and asked the individuals if the estimates were aligned with their experience.

The following sections detail the results of the Delphi Panel process and representative jurisdiction in-depth interviews.

1.3. Energy Code Compliance

The Market Evaluation Team asked Delphi Panel participants to estimate statewide compliance with the 2020 ECCCNYS, the energy code in effect during this evaluation year. The Delphi Panel provided estimates of the overall compliance rate, compliance rate by building system, and compliance rate by component for both new construction and for additions and alterations in the commercial and residential sectors. For this study, the *overall compliance rate* is the average percentage of requirements that are in compliance for the entire building. The *compliance rate* for building systems is the average percentage of requirements for a specific system that are in compliance.

1.3.1. Commercial Energy Code Compliance

The overall weighted panelist estimate of energy code compliance for commercial new construction in New York was 85%, and the overall estimate of compliance for alterations and additions was 84%. When asked if they agreed with the Delphi Panel's estimate of overall new construction compliance, the five jurisdiction representatives with experience in the commercial sector agreed with the Delphi Panel's assessment, and one representative from NYC disagreed (estimating 80% compliance).

As with the overall compliance estimates for commercial alterations and additions, five of the jurisdiction representatives agreed with the Delphi Panel's assessment, while one representative from NYC disagreed (estimating 80% compliance).

Table 8 shows that new construction commercial compliance estimates have increased by 11% from the baseline estimates established through the 2015 ERS Delphi Panel, and 2% over the Year 1 Delphi Panel study findings. The change was more notable in additions and alterations, where Year 3 Delphi Panel respondents estimated compliance to have increased by 14% over the Year 1 study.

Table 8. Commercial Compliance Rates by Code and Study Year

Building Type	New Construction			Additions and Alterations		
Study Year	2015	2020	2022	2015	2020	2022
ECCCNYS Version	2010	2016	2020	2010	2016	2020
Based on:	2009 IECC & ASHRAE 90.1-2007	2015 IECC & ASHRAE 90.1-2013	2018 IECC & ASHRAE 90.1-2016	2009 IECC & ASHRAE 90.1-2007	2015 IECC & ASHRAE 90.1-2013	2018 IECC & ASHRAE 90.1-2016
Date Code Adopted	December 2010	October 2016	May 2020	December 2010	October 2016	May 2020
Estimated Compliance	74%	83%	85%	59% to 68%[a]	70%	84%

[a] The 2015 ERS Delphi Panel did not provide an estimate for additions and alterations (referred to as renovations), but instead reported that panelists estimated renovation compliance to be 6%–15% worse than new construction compliance. Using this range, addition and alteration compliance increased by 2%–11% between the 2015 and 2020 studies.

When asked about the main challenges to achieving 100% commercial new construction compliance, respondents from representative jurisdictions commonly identified a lack of education, the complexity of the code, material costs, and a general resistance to change. One suburban architect also noted that for all project types, a key factor in achieving code compliance is the strictness of the building inspectors. They went on to say that particularly in smaller, rural communities, building firms may not have the same knowledge and experience as firms in urban communities and often are more reliant on code officials at the local level.

> *"They don't understand why they need to make changes, or pay the costs associated with those changes."*
>
> -Jurisdictional respondent

> *"It's always going to be challenging, working with an existing envelope – how do you bring a 100-year-old building up to code without destroying the character."*
>
> -Jurisdictional respondent

When asked about the main challenges to commercial additions and alterations compliance, respondents said they were the same challenges as for new construction. One respondent noted that those doing retrofits are often not the larger firms, exacerbating challenges around lack of education and pressure to comply. Three respondents noted that older buildings presented particular challenges, particularly around building envelope and finding ways to meet new standards with existing systems. They noted that customers were resistant to any change that affected the buildings "character" and didn't want to disturb the enclosure both because of cost as well as a resistance to insulating from the outside.

The Market Evaluation Team also asked the Delphi Panel to consider the effect of moving to a new version of the energy code on overall compliance with commercial new construction. Panelists estimated that compliance would decrease by 7% at the beginning of a new code cycle (estimates ranged from a 5% decrease to a 10% decrease).

Four of the seven jurisdiction experts with commercial code experience disagreed with this assessment, suggesting code compliance was more likely to drop 10% to 15%. Three respondents said that it was always very challenging for code officials and builders to become familiar with new code versions, and a code official said there was not a good way for builders and code officials to become familiar with a new code before it was adopted, resulting in initial

unfamiliarity with new code provisions and a reliance on building code officials catching issues as they arose, and educating builders over time.

Panelists also estimated the compliance rate for each major building system (the building envelope, mechanical systems, and electrical power and lighting systems). For both new construction and alterations and additions, panelists identified lighting and electrical systems as having the highest compliance (86% for both). Table 9 shows that the compliance estimates varied very little across the systems for both new construction and additions and alterations.

Table 9. Commercial Compliance Rate by System

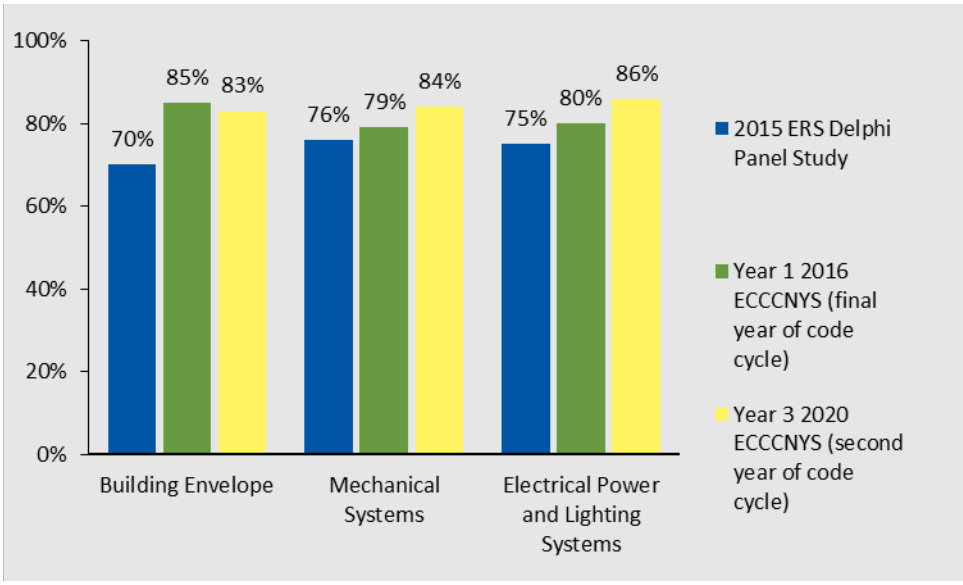
System	New Construction	Additions and Alterations
Building Envelope	83%	82%
Mechanical Systems	84%	83%
Electrical Power and Lighting Systems	86%	86%

Overall, the six jurisdiction respondents with commercial experience agreed with the new construction building system compliance estimates, and which building systems saw the highest and lowest compliance, with only two respondents disagreeing on at least one system estimate. One respondent (who owns a construction firm) said that he felt building envelope and electrical power and lighting systems should both be closer to 80%; the other respondent, an urban architect, also felt that the power and lighting systems estimate was too high, but otherwise agreed with the panel compliance estimates.

For commercial additions and alterations, more respondents disagreed with compliance estimates for systems, with three respondents agreeing with the Delphi Panel estimates, and three disagreeing. All three who disagreed felt that the envelope compliance estimate was too high (with jurisdiction respondent estimates ranging from 70% to 80%), with the suburban construction firm owner disagreeing with all three systems, thinking all should range between 70% and 75%. Respondents stated that for additions and alterations projects there was less scrutiny, and some confusion about when and where existing buildings needed to be upgraded. One respondent said code compliance for building envelopes was lower than study findings for additions and alterations, because “making the transition between old and new components is a challenge,” “there is so much confusion about when and where you have to install upgrades,” and “everything is a little harder, although not unachievable.”

Figure 2 provides a comparison of panel estimates of commercial new construction compliance rates by system for the current study, the Year 1 study, and the 2015 ERS Delphi Panel study. The current Delphi Panel study found an increase in new construction compliance in both mechanical systems and electrical power and lighting systems over the previous Delphi Panel studies, with a small decline in building envelope compliance over the Year 1 Delphi Panel findings.

Figure 2. Comparison of New Construction Commercial System Compliance Rates by Study Year



1.3.1.1. Commercial New Construction Component-Level Compliance

The Delphi panelists estimated the compliance rate for key building components affecting energy use, which the Market Evaluation Team identified in Year 1. Table 10 shows the average of the panelists' compliance rate estimates for each building component in new construction. Individual component compliance rate estimates may help NYSERDA and training implementers decide which topics to focus on with energy code training and other technical assistance.

Table 10. 2020 ECCCNYS Commercial New Construction Compliance Rate by Component

Component	Code Requirement	Compliance Estimate	
		Year 1	Year 3
Thermal bridging	Continuous insulation is in use for commercial projects to mitigate thermal bridging	66%	74%
Continuous air barrier installation	The air barrier is installed well with no gaps and all openings sealed continuously	70%	76%
Envelope insulation installation	Envelope insulation is installed per manufacturer requirements	67%	78%
Continuous air barrier	The air barrier meets the code requirements for materials, assembly, or testing	70%	78%
Demand controlled ventilation	Demand controlled ventilation is provided in all spaces greater than 500 square feet with an average load of 25 occupants per 1,000 square feet	69%	81%
Energy recovery ventilation	The energy recovery ventilation provided for fan systems exceeds values specified in the code; the exhaust air recovery efficiency is ≥50%	58%	84%
Mechanical commissioning	HVAC system is completed, including air and hydronic system balancing and functional performance testing; documentation and reporting requirements have been met	66%	84%
Daylighting controls	Daylit spaces have separate controls from general lighting controls or are automatically controlled with daylight sensors	80%	84%
Additional efficiency package options	Projects meet the additional efficiency requirements of Section C406	62%	84%
Envelope insulation	The building meets envelope insulation requirements	67%	85%
Vertical fenestration (windows and doors)	The vertical fenestration area is less than 30% of the gross above-grade wall area or up to 40% with automatic daylighting controls	71%	85%
Economizers	Economizers are provided where required, meet the design requirements for capacity, and have appropriate controls	85%	86%
Multiple HVAC systems	Multiple zone HVAC systems have supply air temperature reset controls and limit simultaneous heating and cooling to each zone	90%	87%
Equipment sizing	Equipment meets sizing requirements	80%	87%
Interior lighting controls	Manual and automatic lighting controls are installed and functioning properly	86%	88%
Lighting power density	Lighting power meets space-specific density requirements	91%	89%
Mechanical controls	Mechanical controls include a programmable thermostat that provides heating and cooling to each	92%	89%

Component	Code Requirement	Compliance Estimate	
		Year 1	Year 3
	zone, with capability for automatic setback and shutdown		
Exterior building lighting power	Exterior lighting does not exceed the exterior lighting power allowance	89%	89%
Distribution systems	Ductwork and piping meet the required insulation levels	85%	89%
Exterior lighting controls	Exterior lighting is controlled by either motion sensor or time clock	91%	89%
Fenestration (windows, skylights, and doors)	Windows and doors meet U-factor and solar heat gain coefficient requirements	88%	90%
Variable air volume systems	Variable air volume fan motors are ≥10 horsepower, are driven by variable speed drive, have a vane-axial fan with variable pitch blades, or have controls or devices to limit fan motor demand	88%	90%
Equipment efficiency	Installed equipment meets efficiency requirements	95%	93%

There were several notable changes between the two studies where Delphi panelists identified changes around code requirements compliance. The Year 1 Delphi Panel gave the lowest commercial new construction compliance scores to energy recovery ventilation (ERV) and additional efficiency package options; however, the Year 3 study saw a notable increase in reported compliance for both (from 58% and 62% respectively, to 84%). Two of the jurisdictional respondents specifically noted agreement with the panel results showing improved compliance with ERV requirements. However, they were not as sure if they had seen the same improvement with additional efficiency package options compliance as estimated by the Delphi Panel. Equipment efficiency remained at the highest level of compliance, likely because items in the state are already manufactured to required standards.

Specific code requirements with compliance rates below 80% include the thermal bridging, continuous air barrier installation quality, envelope insulation installation quality, and continuous air barrier—all building envelope requirements. Many panelists and interviewees noted that compliance is lowest for provisions that require expert installation or other expert knowledge and highest for products that can be purchased with code-required specifications.

1.3.1.2. Commercial Additions and Alterations Component-Level Compliance

The panelists also estimated the compliance rate for select building components for additions and alterations. Table 11 shows the average of the panelists' compliance rate estimates for each select building component.

Table 11. 2020 ECCCNYS Commercial Additions/Alterations Compliance Rate by Component

Component	Code Requirement	Compliance Estimate	
		Year 1	Year 3
Thermal bridging	Continuous insulation is in use for commercial projects to mitigate thermal bridging	49%	71%
Continuous air barrier installation	The air barrier is installed well with no gaps and all openings sealed continuously	57%	72%
Demand controlled ventilation	Demand controlled ventilation is provided in all spaces greater than 500 square feet with an average load of 25 occupants per 1,000 square feet	58%	73%
Energy recovery ventilation	The energy recovery ventilation provided for fan systems exceeds values specified in the code; the exhaust air recovery efficiency is ≥50%	62%	73%
Continuous air barrier	The air barrier meets the code requirements for materials, assembly, or testing	62%	74%
Envelope insulation installation quality	Envelope insulation is installed per manufacturer requirements	65%	74%
Additional efficiency package options	Projects meet the additional efficiency requirements of Section C406	33%	75%
Mechanical commissioning	HVAC system is completed, including air and hydronic system balancing and functional performance testing; documentation and reporting requirements have been met	53%	78%
Vertical fenestration (windows and doors)	The vertical fenestration area is less than 30% of the gross above-grade wall area or up to 40% with automatic daylighting controls	75%	79%
Daylighting controls	Daylit spaces have separate controls from general lighting controls or are automatically controlled with daylight sensors	63%	79%
Interior lighting controls	Manual and automatic lighting controls are installed and functioning properly	80%	80%
Economizers	Economizers are provided where required, meet the design requirements for capacity, and have appropriate controls	72%	81%
Multiple HVAC systems	Multiple zone HVAC systems have supply air temperature reset controls and limit simultaneous heating and cooling to each zone	78%	81%

Component	Code Requirement	Compliance Estimate	
		Year 1	Year 3
Exterior building lighting power	Exterior lighting does not exceed the exterior lighting power allowance	77%	81%
Variable air volume systems	Variable air volume fan motors are ≥10 horsepower, are driven by variable speed drive, have a vane-axial fan with variable pitch blades, or have controls or devices to limit fan motor demand	80%	81%
Exterior lighting controls	Exterior lighting is controlled by either motion sensor or time clock	84%	82%
Lighting power density	Lighting power meets space-specific density requirements	80%	82%
Envelope insulation	The building meets envelope insulation requirements	78%	83%
Equipment sizing	Equipment meets sizing requirements	64%	83%
Distribution systems	Ductwork and piping meet the required insulation levels	83%	84%
Mechanical controls	Mechanical controls include a programmable thermostat that provides heating and cooling to each zone, with capability for automatic setback and shutdown	79%	85%
Equipment efficiency	Installed equipment meets efficiency requirements	94%	86%
Fenestration (windows, skylights, and doors)	Windows and doors meet U-factor and solar heat gain coefficient requirements	79%	86%

There were several notable changes between the two studies where Delphi panelists identified changes around code requirements compliance for additions and alterations as well. The most significant change was the 42% compliance increase estimated for additional efficiency package options. Additionally, the other two lowest compliance requirements in Year 1, thermal bridging and mechanical commissioning, increased from 49% to 71% and 53% to 78% respectively in Year 3. One jurisdictional respondent said thermal bridging compliance was still low, but agreed that commissioning compliance had improved notably. Another jurisdictional respondent said he agreed with the panel results, seeing improvement for both these requirements over the past few years. Like new construction findings, this suggests that several key low-compliance components that were identified as particularly challenging in Year 1 saw improved compliance over time, bringing up overall compliance estimates.

New focus areas with compliance rates below 74% include thermal bridging and continuous air barrier installation quality (which also scored the lowest for new construction), as well as demand controlled and energy recovery ventilation. Many panelists and interviewees noted that

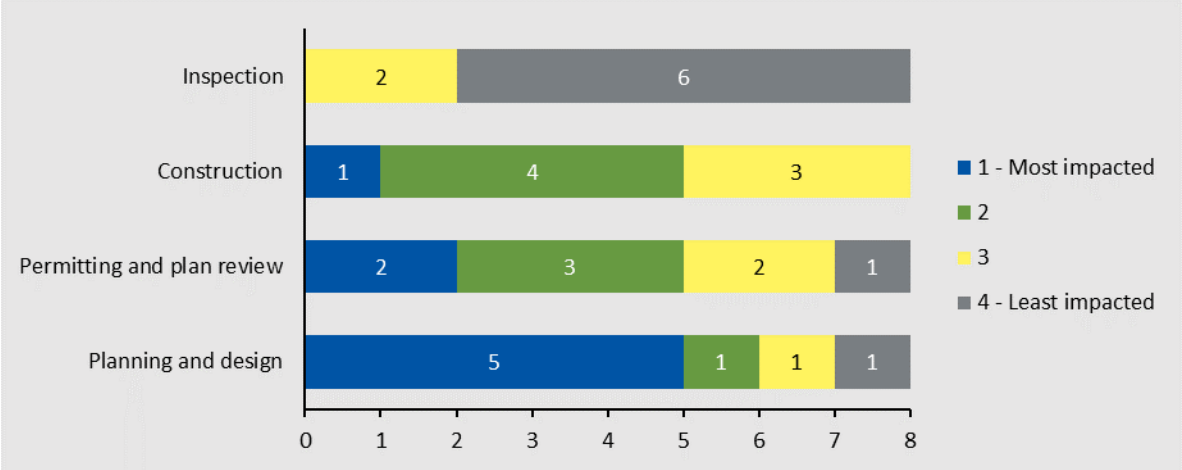
compliance is lowest for provisions that require significant changes to existing building structures, such as adding insulation to existing buildings.

1.3.1.3. Impact of Commercial Code Compliance Activities

In addition to estimating compliance with certain commercial energy code provisions, the Delphi panelists were also asked to rank the phase of a commercial new construction project at which energy compliance is most impacted. As shown in Figure 3, respondents were not in complete agreement, but most commonly cited the planning and design phase as having the greatest impact on compliance. One respondent noted that "you need to have it designed into the project first to even know what is needed to be done, and [account for] the added costs to the project." All eight Panelists with commercial experience ranked the inspection phase as having lower impact on compliance (a 3 or 4 on the 4-point scale).

Figure 3. Project Phase for Commercial New Construction Most Impacting Code Compliance (n=8)

Source: Delphi Panel Question: "At which phase of a commercial new construction project is energy code compliance most significantly impacted?" June 2022.



1.3.1.4. Overarching Commercial Findings

Panelists identified three key challenges the commercial building market must overcome when complying with the energy code:

- The complexity of the energy code
- The cost of implementing energy code requirements
- Lack of education for designers and installers

Panelists and jurisdiction interviewees identified which activities, practices or support would help increase compliance. Panelists said that more training, increased licensing requirements, and expanding the use of third parties for plan review and inspection oversight would help increase commercial compliance. One panelist also noted that standardizing envelope details for all exterior wall assembly types would help address confusion around how to work with different manufactured materials and create more consistent compliance with requirements.

1.3.2. Residential Energy Code Compliance

The panelists' overall weighted estimate of energy code compliance for single-family residential new construction in NYS was 85%, and their overall estimate of compliance for single-family alterations and additions was 81%. While two jurisdiction interviewees (of six with residential experience) agreed with these estimates, the remaining four disagreed about if the estimate was too high or too low. Two interview respondents again generally agreed with the compliance estimates for residential alterations and additions while the others all found it too high, all providing a compliance estimate of 75%.

As shown in Table 12, compliance estimates for the residential sector remained fairly consistent between the 2015 ERS study and the Year 1 study; however, both estimates for new construction compliance and additions and alterations compliance improved between the Year 1 and Year 3 Delphi Panel studies.

Table 12. Residential Compliance Rates by Code and Study Year

Building Type	New Construction			Additions and Alterations		
Study Year	2015	2020	2022	2015	2020	2022
ECCCNYS Version	2010	2016	2020	2010	2016	2020
Based on:	2009 IECC & ASHRAE 90.1-2007	2015 IECC & ASHRAE 90.1-2013	2018 IECC & ASHRAE 90.1-2016	2009 IECC & ASHRAE 90.1-2007	2015 IECC & ASHRAE 90.1-2013	2018 IECC & ASHRAE 90.1-2016
Date Code Implemented	December 2010	October 2016	May 2020	December 2010	October 2016	May 2020
Estimated Compliance	77%	77%	85%	62% to 71%[a]	71%	81%

[a] The 2015 ERS Delphi Panel did not provide an estimate for additions and alterations (referred to as renovations), but instead reported that panelists estimated renovation compliance to be 6%–15% worse than new construction compliance. Using this range, addition and alteration compliance increased by 0%–9% between the 2015 and 2020 studies.

Year 3 panelists estimated the current overall compliance rate for low-rise residential (low-rise multifamily) new construction as 82%, up from 73% in the Year 1 study, a 9% increase in compliance, which is similar to the compliance rate increase for the residential single-family new construction market (8%).

"If you've designed the building and if something is wrong, you may not be able to change it to get the correct thing because it takes so long to get materials."

-Jurisdictional respondent

When asked to consider the main challenges to achieving 100% residential new construction compliance, respondents identified education and training (particularly of contractors), and the cost and availability of materials and new technologies. One respondent noted that the increasing stringency of the energy code requires new, more technical building techniques, such as whole house air systems, that can be challenging to install. This tied in with other feedback on the challenges of getting builders up to speed, particularly small contractors who have fewer resources. Respondents also noted that the cost of many common building materials, like insulation, caulking, and sealants, had increased substantially over the past few years, increasing the cost of complying with energy code requirements. A respondent

who owns a construction firm noted that material costs issues were also sometimes exacerbated by lack of availability.

The respondents identified the same challenges facing residential additions and alterations as those affecting new construction and noted that, like new construction, these projects often involve smaller contracting firms that often are not as aware as larger firms of energy code requirements and the techniques needed to properly comply with them.

> *"The biggest one is communicating what code changes are and getting builders up to speed (they are not getting the education)."*
>
> -Jurisdictional respondent

The Market Evaluation Team asked the Delphi Panel to consider the effect of moving to a new version of the energy code on overall residential new construction code compliance. Panelists estimated that compliance would decrease by 7% at the beginning of a new code cycle (estimates ranged from a 5% decrease to a 10% decrease), but jurisdiction interviewees found this estimate to be too low, with several respondents suggesting that code compliance would more likely drop between 10% and 15%.

Panelists also estimated the compliance rate for each major building system (building envelope, mechanical systems, electrical power and lighting systems, and documentation). As shown in Table 13, panelists identified the electrical power and lighting system components as having the highest compliance for residential new construction and additions (92% for each) and documentation as having the lowest compliance (69% and 64% respectively).

Table 13. Residential Compliance Rate by System or Category

System or Category	New Construction	Additions and Alterations
Documentation	69%	64%
Building Envelope	84%	80%
Mechanical Systems	87%	84%
Electrical Power and Lighting Systems	92%	92%

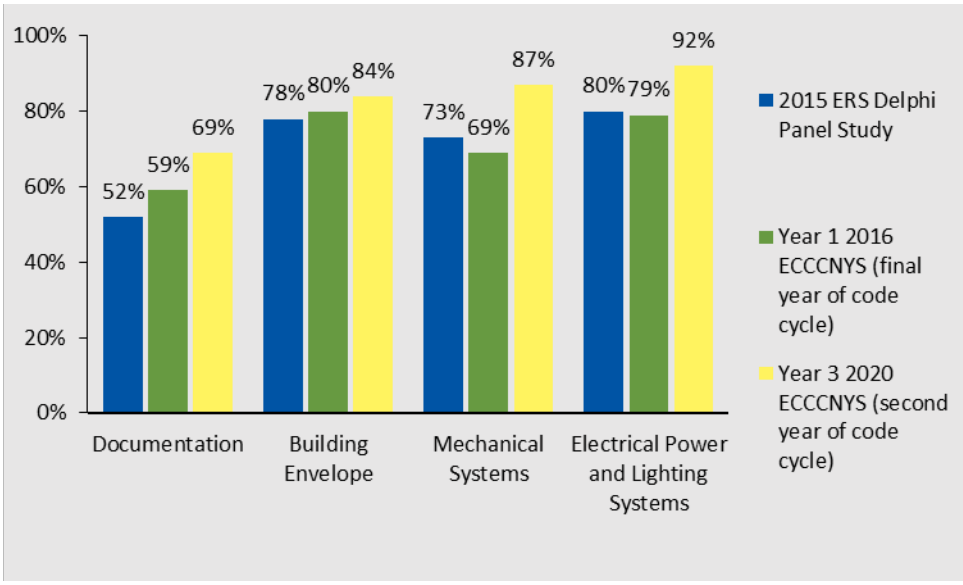
Jurisdictional respondent also considered the building system compliance estimates from the 2022 study for residential construction. Overall, the respondents agreed that lighting and power systems saw the highest compliance, noting that the bulbs and fixtures on the market tended to be very efficient and that those requirements tended to be easier to comply with than other building system requirements. However, several respondents disagreed with compliance estimates on

documentation (three of six), providing much lower numbers (40% to 50%); an additional respondent generally agreed with the panel's documentation estimate but acknowledged that compliance varied widely.

For residential additions and alterations, some respondent did not agree with compliance estimates. Two respondents felt that the mechanical systems estimate was high, saying that there just wasn't enough oversight on additions and alterations projects and that some mechanical systems projects in existing building could face technical issues. Two other respondents (both architects) said the envelope compliance estimate was too high, (also pointing to insufficient oversight), and the documentation estimate was also too high and should be closer to 50%.

Figure 4 provides a comparison of estimated residential new construction compliance rates by system over time. Compliance estimates increased for all four components between the Year 1 and Year 3 study but increased for mechanical and lighting systems only after having dropped in the Year 1 study. Overall, the Year 3 Delphi Panel estimated improved compliance levels compared with levels in both the 2015 and Year 1 study.

Figure 4. Comparison of Residential System Compliance Rates by Study Year



1.3.2.1. Residential New Construction Component-Level Compliance

As with commercial construction, the panelists estimated the compliance rate for key residential building components. Table 14 shows the average of the panelists' compliance rate estimates for each select building component in residential new construction.

Table 14. Residential Compliance Rate by Component – New Construction

Component	Code Requirement	Compliance Estimate	
		Year 1	Year 3
Documentation	Construction documents supply enough detail for code officials to assess compliance, including information about air sealing and duct sealing and mechanical system design	58%	72%
Recessed lighting	Recessed fixtures in the building envelope are IC-rated and sealed with a gasket or caulk to limit air leakage	64%	76%
Duct testing	Ducts located in unconditioned spaces are tested for air leakage; total duct leakage does not exceed 4 cfm per 100 square feet of conditioned floor area	62%	78%
Insulation installation	Envelope insulation is installed per manufacturer requirements and Table R402.4.1.1 of the ECCCNYS	69%	81%
Certificates in panel	Permanent certificates are posted on or in the electrical panel to document code compliance	63%	81%
Air barrier and insulation installation	Components of the thermal envelope are installed and inspected per Table R402.4.1.1 of the ECCCNYS and verified with a blower door test	67%	81%
Air sealing	Building thermal envelope is sealed to limit infiltration; all joints and penetrations are sealed, as well as windows, doors, and attic access	61%	81%
Air leakage	Air leakage rate does not exceed 3 ACH50	79%	82%
Distribution systems	Ductwork and piping are insulated and sealed	74%	85%
Tenant separation walls	The fire separations between dwelling units in two-family dwellings and townhouses are insulated to R-10 or greater and walls are air sealed	70%	85%
Equipment sizing	Heating and cooling equipment is sized per Manual J or similar requirements	65%	86%
Rooms containing fuel burning appliances	Appliance and combustion air opening is located outside the building thermal envelope or is enclosed in a room; combustion closets are insulated to levels not less than the basement wall R-value requirements in Table R402.1.2 of the ECCCNYS; closet is air sealed and door is fully gasketed	60%	86%
Inspection stickers	Builders leave window and door certification National Fenestration Rating Council stickers for inspection	78%	88%
Hot water pipe insulation	R-3 insulation on the hot water pipe is over 3/4-inch when applicable	80%	88%
Envelope insulation, general	The building meets or exceeds required envelope insulation levels (including for roof, above-grade wall, slab, foundation, and floor)	86%	90%
Duct insulation	Supply and return ducts in the attic are insulated a minimum of R-8 (where ≥3-inch diameter) and R-6 (where <3-inch diameter)	90%	91%
Vapor retarders	Vapor retarders are provided on interior side of frame walls (applicable to climate zones 5 and 6 only)	94%	91%

Component	Code Requirement	Compliance Estimate	
		Year 1	Year 3
Individual unit lighting metering	Individual dwelling units are separately metered	94%	92%
Programmable thermostats	Programmable thermostats are installed in each dwelling unit with capabilities for daily schedule control and automatic adjustment based on largest heating/cooling zone, and have a temperature range from 55°F to 85°F	96%	94%
Interior light fixtures	At least 75% of permanent fixtures have high-efficacy lamps	79%	95%
Windows and doors	Windows and doors meet U-factor requirements	94%	95%

There were several notable changes between the two most recent Delphi Panel studies for residential new construction. Most code requirements saw an increase in estimated compliance, with the largest increases reported for rooms containing fuel burning appliances (from 60% to 86%), equipment sizing (65% to 86%), and air sealing requirements (61% to 81%). One jurisdictional respondent agreed with the panel study, saying rooms with fuel burning appliances were seeing improvements in compliance, but did not think equipment sizing had improved so substantially. However, another jurisdictional respondent said that he believed equipment-sizing compliance was not overly challenging and likely was high. The Year 1 Delphi Panel gave the lowest residential new construction compliance score to documentation; while the Year 3 estimate for documentation increased by 14%, it continued to achieve the lowest compliance rating. Windows and doors remained at the high end for compliance, likely because this equipment is manufactured to required standards, making code requirements easy to comply with.

> *"Complete Energy Code documentation is rare."*
>
> -Delphi Panel Respondent

Areas that need focused attention to improve compliance rates (compliance below 80%) include documentation, recessed lighting, and duct testing.

1.3.2.2. Residential Additions and Alterations Component-Level Compliance

The panelists also estimated the compliance rate for select building components in residential additions and alterations. Table 15 shows the average of the panelists' compliance rate estimates for each select building component.

Table 15. Residential Compliance Rate by Component – Additions and Alterations

Component	Code Requirement	Compliance Estimate	
		Year 1	Year 3
Documentation	Projects supply enough detail on the construction documents for code officials to assess compliance, including details for air and duct sealing and mechanical system design	41%	65%
Recessed lighting	Recessed fixtures in the building envelope are IC-rated and sealed with a gasket or caulk to limit air leakage	58%	66%
Duct testing	Ducts located in unconditioned spaces are tested for air leakage; total duct leakage does not exceed 4 cfm per 100 square feet of conditioned floor area	61%	68%
Certificates in panel	Permanent certificates are posted on or in the electrical panel to document code compliance	25%	73%
Air sealing	Building thermal envelope is sealed to limit infiltration; all joints and penetrations are sealed, as well as windows, doors, and attic access	44%	74%
Air barrier and insulation installation	Components of the thermal envelope are installed and inspected per Table R402.4.1.1 of the ECCCNYS and verified with a blower door test	49%	74%
Equipment sizing	Heating and cooling equipment is sized per Manual J or similar requirements	58%	76%
Insulation installation	Envelope insulation is installed per manufacturer requirements and Table R402.4.1.1 of the ECCCNYS	66%	78%
Tenant separation walls	The fire separations between dwelling units in two-family dwellings and townhouses are insulated to R-10 or greater and walls are air sealed	55%	81%
Distribution systems	Ductwork and piping are insulated and sealed	71%	81%
Inspection stickers	Builders leave window and door certification National Fenestration Rating Council stickers for inspection	74%	81%
Air leakage rate	Air leakage rate does not exceed 3 ACH(50)	44%	81%
Envelope insulation, general	The building meets or exceeds required envelope insulation levels (including for roof, above-grade wall, slab, foundation, and floor)	79%	84%

Component	Code Requirement	Compliance Estimate	
		Year 1	Year 3
Rooms containing fuel burning appliances	Appliance and combustion air opening is located outside the building thermal envelope or is enclosed in a room; combustion closets are insulated to levels not less than the basement wall R-value requirements in Table R402.1.2 of the ECCCNYS; closet is air sealed and door is fully gasketed	44%	85%
Programmable thermostats	Programmable thermostats are installed in each dwelling unit with capabilities for daily schedule control and automatic adjustment based on largest heating/cooling zone, and have a temperature range from 55°F to 85°F	96%	85%
Hot water pipe insulation	R-3 insulation on the hot water pipe is over 3/4-inch when applicable	79%	86%
Duct insulation	Supply and return ducts in the attic are insulated a minimum of R-8 (where ≥3-inch diameter) and R-6 (where <3-inch diameter)	88%	87%
Vapor retarders	Vapor retarders are provided on interior side of frame walls (applicable to climate zones 5 and 6 only)	94%	88%
Windows and doors	Windows and doors meet U-factor requirements	93%	91%
Interior light fixtures	At least 75% of permanent fixtures have high-efficacy lamps	82%	92%
Individual unit lighting metering	Individual dwelling units are separately metered	91%	92%

There were several notable changes between the two most recent Delphi Panel studies for residential additions and alterations. Several code requirements saw a notable increase in estimated compliance, including certificates in panel (from 25% to 73%), rooms containing fuel burning appliances (44% to 85%), and air leakage rate (44% to 81%). The Year 1 Delphi Panel gave the lowest residential new construction compliance score to certificates being properly displayed to document compliance in electrical panels; while the Year 3 compliance estimate increased by 48%, it continues to show room for improvement. One jurisdictional respondent agreed about increased compliance with displaying certificates in panels, saying he knows they ask for the certificates, but he wasn't sure that they were consistently displayed in practice. Another said that he still did not consistently see certificates being properly displayed.

Requirements around light fixtures and metering received high compliance estimates, likely because of the increasing prevalence of these efficient technologies.

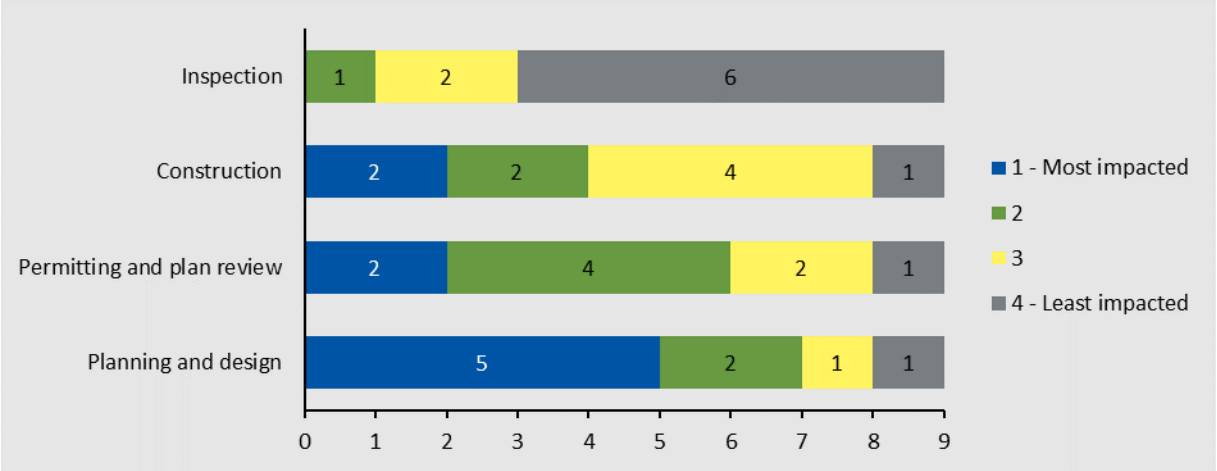
Areas that need focused attention to improve compliance rates (compliance below 70%) include documentation, recessed lighting, and duct testing – the same three lowest-rated components as residential new construction, suggesting that NYSERDA might consider focusing outreach and educational resources in these areas.

1.3.2.3. Impact of Residential Code Compliance Activities

The Delphi panelists were also asked to rank at which phase of a residential new construction project that energy compliance is most impacted. The nine respondents with residential code experience again most commonly found the planning and design phase to most impact overall project compliance, and for the inspection phase to have the least impact (see Figure 5). One respondent noted that "if it is not on the plans chances are it won't get done", and another noting "if/when the design is right, this [permitting and plan review] should be less significant." Many respondents noted they felt the same about residential new construction as they did for commercial projects in terms of what project phases ultimately most impacted code compliance.

Figure 5. Project Phase for Residential New Construction Most Impacting Code Compliance (n=9)

Source: Delphi Panel Question: "At which phase of a residential new construction project is energy code compliance most significantly impacted?" June 2022.



1.3.2.4. Overarching Residential Findings

Panelists with residential expertise identified several common challenges the residential building market must overcome when complying with energy codes.

- Costs of implementing energy code requirements
- Differing energy code interpretations by different jurisdictions/uneven enforcement across municipalities
- Difficulty sourcing materials
- The challenge of finding a qualified labor force (because of lack of education or resistance to change)
- The complexity of the energy code (also cited as a barrier in the commercial sector).

Panelists and jurisdiction interviewees identified which activities, practices, or support would help increase compliance. Panelists and members of representative jurisdictions said that, like with improving commercial compliance, more training was key to increasing compliance. Interviewees also suggested providing more rebates and tax incentives and implementing third-party enforcement more widely.

1.4. Initiative Progress

A key goal of the Codes and Standards for Carbon Neutral Buildings initiative is for energy code compliance to increase by five percent in NYS compared with a business-as-usual case. The current compliance estimate for commercial new construction is 85%, a small increase over the previous estimate of 83%, but a significant increase compared to the 2015 compliance estimate of 74%. The estimate for residential single-family new construction also significantly increased from 77% in 2015 to 85%, showing much improvement over the 2015 estimate. Importantly, the estimates reflect compliance during different state energy code cycles, and the Delphi Panel said that there is a drop in compliance when a new code is adopted.[1] Despite those fluctuations, estimated overall code compliance is improving over time.

[1] The Year 1 panel study was in the fourth year of the code cycle; the Year 3 panel study was in the second year of the code cycle.

Appendix C: Evaluation Methodologies

The Market Evaluation Team used a Delphi Panel to estimate code compliance, conducted interviews with experts in representative jurisdictions, interviewed officials in municipalities that had adopted stretch codes, conducted surveys with training participants, and conducted a preliminary savings analysis. This appendix provides methodologies for these research activities.

1.5. Delphi Panel Process

For the Delphi Panel process, the Team combined the opinions of a group of experts through an interactive, iterative process.

The Delphi method, first developed by the RAND Corporation in the 1950s, is widely used to develop informed opinions from a group of experts. Using this method, the implementer has experts anonymously reply to a survey or questionnaire, aggregates the results, and shares the group feedback with those experts, encouraging experts to consider the insight from other experts and refine their estimates. The implementer repeats this process with the goal of reducing the range of responses or, in some cases, reaching a consensus.

For this evaluation, the panelists completed three rounds of questionnaires to provide feedback and opinions based on their own experiences with the energy code in NYS building construction markets and as experts in their fields. First, the Market Evaluation Team asked panelists to review background material on the Codes and Standards for Carbon Neutral Buildings initiative, information on the adoption of the ECCCNYS and NYStretch, and information related to energy code compliance and enforcement in NYS. Once familiar with the study intent, panelists completed the first survey round, which included questions on energy code compliance and demographic information on respondents.

The Market Evaluation Team anonymized and aggregated the first-round estimates and rationales from panelists and returned them to the group for a second round of input. Panelists reviewed their own responses alongside the responses of their peers and adjusted or revised their answers based on the results, if desired. The Team repeated this process with a third and final survey round, providing experts with one additional opportunity to adjust their input or offer commentary.

The Delphi Panel comprised a diverse group of ten experts within the community of building code experts in New York. Table 16 shows the distribution of experts by occupation. Several

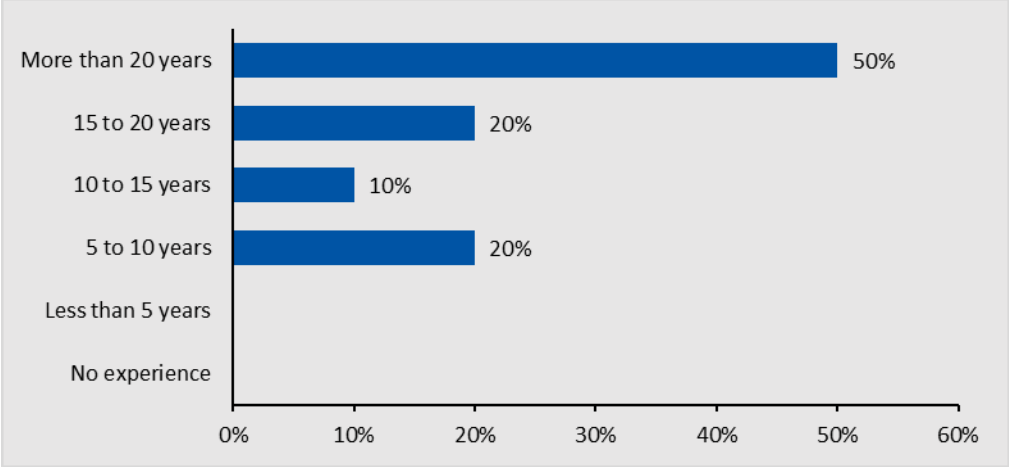
panelists selected more than one title for their current occupation noting that it can vary depending on the nature of the work or their role for a specific project. Most frequently, energy or code consultants also worked as third-party energy professionals or in architect or engineering positions.

Table 16. Delphi Panelists by Occupation

Delphi Panelist Occupation	Number of Experts Recruited
Energy or code consultant	5
Third party energy professional	3
Code official	3
Architect or engineer	2
Industry group	1
Other	3

Half the experts have been using or applying the energy code in NYS for over 20 years, and none of the participants had less than five years' experience (see Figure 6). All 10 economic regions defined by the New York State Department of Labor were represented.

Figure 6. Number of Years' Experience with the New York Energy Code (n=10)



Since panel participation was voluntary, one limitation of the Delphi Panel process is the possibility of self-selection bias. To mitigate self-selection bias from a predominance of one or a few respondent types, the Market Evaluation Team strategically recruited panelists to ensure that they represented a variety of occupations and regional expertise.

1.5.1. Energy Code Compliance Assessment Methodology

Delphi Panel survey panelists estimated the overall commercial and residential compliance rate, compliance rate by system or category, and compliance rate by component for both new construction and additions and alterations. In survey rounds two and three, panelists reviewed and responded to input from the group and recorded changes to their estimates, if applicable.

The Market Research Team calculated the overall compliance rate by weighting each panelists' individual system estimates by relative energy impact in accordance with the distribution of weighting used in the 2015 ERS Delphi Panel study. The energy impact weights were based on the Score + Store compliance tool developed by the U.S. Department of Energy with the Pacific Northwest National Laboratory, which assigned a weighted value to energy code provisions based on their energy impact, and modified by ERS based on research and experience. The Team reviewed the Score + Store tool, past and current compliance methodologies, and significant changes to the 2015 IECC, and concluded that the weights developed and used by ERS in the *Advanced Energy Codes Impact Evaluation Interim Report: First Delphi Process Results* report are still accurate. Table 17 shows the weight applied to each system for residential and commercial compliance rating.

Table 17. Distribution of Compliance Rating Weights by System

System	Commercial Weight	Residential Weight
Building Envelope	39%	62%
Mechanical Systems	39%	22%
Electrical Power and Lighting Systems	23%	11%
Documentation	-	5%

The Team used this weighted methodology for overall compliance to ensure consistency with the 2015 ERS Delphi Panel study. A comparison of these two studies could be used to claim savings attributable to NYSERDA's code compliance enhancement efforts. The Team also reported unweighted average responses from the Delphi Panel for determining compliance estimates by system and component.

1.6. Representative Jurisdiction In-Depth Interviews

The Market Evaluation Team combined the opinions from a group of experts, obtained through interactive, one-on-one, in-depth phone interviews. The Team asked respondents to provide

information parallel to that of the Delphi Panel based on their own experiences with the NYS energy code market and as experts in their respective fields.

To ensure geographical, socioeconomic, and building density diversity, the Team interviewed professionals who work with the energy code in an urban jurisdiction (NYC), a suburban jurisdiction, and a rural jurisdiction.

The Market Evaluation Team selected jurisdictions in Year 1 by conducting an analysis of new square footage in New York's urban, suburban, and rural counties since 2006. First, the Team mapped counties to a census-defined, core-based statistical area (CBSA) by urban, suburban, and rural categories. Then the Team assessed the new square footage over time for each CBSA. As expected, the CBSA that included NYC consistently had the highest new construction rates for the commercial and residential sectors. The Team filtered out the NYC CBSA to determine which suburban and rural counties consistently experienced the most new construction between 2006 and 2017 and used this list to select jurisdictions for participation.

The Market Evaluation Team created a potential sample list of experts for each of the three types of jurisdictions and set a target to interview three individuals in each jurisdiction. The Team developed the sample by researching local energy code experts and building professionals with experience in each jurisdiction, contacting building departments and design professional firms, and speaking with code officials and other experts for recommendations. To reduce self-selection bias in these interviews, the Team recruited respondents who represented a variety of occupations and regional expertise. The interviewees' occupations complemented the panelists' occupations well by providing greater representation of the construction industry. Table 18 shows respondent types from each region. Interviewees had, on average, 17 years of experience working with the NYS building codes.

Table 18. Jurisdictional Interview Respondent Types

Municipality Type	Code Officials	Construction Firms	Architecture Firms
Urban	1	0	1
Suburban	0	2	2
Rural	1	0	0

1.7. Stretch Code Jurisdiction Interviews

During July and August 2022, the Market Evaluation Team interviewed representatives from six of the 22 jurisdictions whose city councils had adopted NYStretch. The Team focused its outreach on the jurisdictions with the largest populations and aimed for geographic diversity by ensuring that no more than three jurisdictions were located in the same region of New York. The Market Evaluation Team interviewed staff from NYC, three jurisdictions located in the Hudson Valley, one jurisdiction located on Long Island, and one jurisdiction located in the Finger Lakes region. Other than NYC, each municipality had a population between 14,000 and 100,000. The Team targeted these interviews to jurisdiction staff who had experience with the NYStretch adoption process and key decision-makers involved in that adoption, as well as to staff who could speak to the impact that NYStretch adoption had on the new construction industry. Roles of the staff interviewed included code enforcement officials, planning officials, and a sustainability coordinator.

1.8. Training Participant Surveys

Starting in June 2020, the Market Evaluation Team sent surveys to webinar participants immediately after training sessions; participants received a survey invitation for every training session they attended, which allowed the Team to potentially gather feedback on multiple training topics for each attendee. Approximately six months after attending trainings, participants received a second survey. The Team sent the second, follow-up survey to unique individuals once.

The first round of surveys sent immediately after participation were primarily intended to gather feedback about the classes, such as the relevance of topics and overall participant satisfaction with the training.

The follow-up surveys, were designed to provide insight about how training participants applied the information from the trainings in their work and what changes they made after participating in trainings. Training survey results are key inputs into the final indirect savings evaluation, as they will be shared with an independent evaluation panel that will provide estimates of the degree to which initiative training activities have impacted overall code compliance in New York.

1.8.1. Survey Research Objectives

The immediate survey results provided below address three topics:

- Review of courses offered, number of respondents, and mean training score
- Geographic representation of jurisdictions of respondents
- Impacts of training on respondents' work in energy code implementation

The follow-up survey results provided information about several topics:

- Geographic representation of respondent jurisdictions
- Square footage of respondents' work since participating in trainings
- Impact of education on respondents' work in energy code implementation
- Dissemination of educational content beyond NYSERDA-sponsored events
- COVID-19 impacts on code compliance

1.9. Preliminary Savings Analysis

In Year 2, the Market Evaluation Team began conducting a preliminary calculation of the energy savings from the Codes and Standards for Carbon Neutral Buildings initiative under the CEF budget. The full preliminary savings calculation methodology aligns with the methods for the multi-year indirect impacts methodology.

1.9.1. Stretch Code Adoption

The Team first determined the building areas enhanced by a jurisdiction's adoption of NYStretch through Dodge data by the year of the permit. To calculate the areas affected by a jurisdiction's midyear adoption of NYStretch, the Team assumed construction was evenly distributed throughout the year. For example, if the code was adopted on June 30, the permitted areas were assumed to include half of the year's permitted construction.

To estimate the energy impacts of NYStretch, the Market Evaluation Team used the energy use intensities from the cost-effectiveness analysis of the commercial[2] and residential[3] codes. The

[2] NYSERDA 2020 NYStretch Energy Code Commercial Cost Effectiveness Analysis (July 2019)

[3] NYSERDA Energy Savings and Cost-Effectiveness Analysis of the 2020 NYStretch Energy Code Residential Provisions (July 2019)

Team analyzed the energy use intensities for residential and commercial buildings by climate zone (and for NYC due to a separate baseline code) for electricity and fossil fuels.

The Team estimated the energy savings for NYStretch to exclude energy savings from expected participation in other above-code programs, including ENERGY STAR and utility-sponsored programs. The Team also assumed that compliance with NYStretch was comparable to the 2020 statewide and NYC energy codes.

1.9.2. Increased Code Compliance Due to Training

To estimate the impacts of training, the Team first analyzed survey data to determine the average square footage affected by code officials and building professionals following training attendance. The Team then applied these per-trainee effects to the number of overall training participants and found that the total building square footage affected would have exceeded the total market square footage, as shown in the 2021 Dodge data. The likely reason for this discrepancy is double counting when multiple training participants, such as code officials, are working in the same building department. Accordingly, based on the significant number of trainees, the Team assumed that the initiative touched the entire New York market through its training initiative and applied training effects to the entire market as determined by Dodge data. The Team adjusted the Dodge data to account for homes that are built to higher standards than specified by the code.

Final evaluation will determine the percentage of compliance change that should be attributed to the Codes and Standards for Carbon Neutral Buildings initiative through an independent expert panel; this preliminary savings estimation relied on a benchmarked value from a code compliance study conducted in Massachusetts. [4] The study estimated that a similar program effected a 5% compliance increase in that state, which the Team applied to preliminary savings for this report. This percentage increase is a primary driver of the preliminary savings estimate. The independent expert panel, when presented with findings from the evaluation, may determine a different training impact on code compliance. As such, the preliminary savings estimates are highly sensitive to the determination of the independent panel.

[4] Massachusetts TXC47 Non-Residential Code Compliance Support Initiative Attribution and Net Savings Assessment: July 26, 2018: NMR and Cadmus

While an independent panel will base a final assessment on the percentage of code compliance increase that is attributable to the Codes and Standards for Carbon Neutral Buildings initiative, and the 5% benchmarked value presents a preliminary estimate, findings from the market evaluation survey research (which will be reviewed by the independent panel) indicate that the initiative is likely to increase code compliance across the state. The following findings from the Year 3 research indicate this directional trend:

- Trainings touch a significant number of code officials and building professionals from across the state
- Training participants indicate high satisfaction with training courses and relevance of training courses
- More than half of the training participants indicated that they have adjusted their work following the trainings
- Code officials and building professionals indicated that they believe code compliance has increased over the last year and that NYSERDA has played a role in this trend

To calculate the change in energy use intensities for each percentage of change in code compliance, the Team gathered the code energy use intensities from ASHRAE 90.1-2016 and ASHRAE 90.1-2013 for commercial building and the IECC 2015 and IECC 2018 for residential buildings in each of the three climate zones. The Team then calculated baseline energy use intensities (EUI) for each zone using the following equation:

$$\begin{aligned} Baseline\ EUI = (&ASHRAE\ 90.1-2016\ or\ IECC\ 2018\ EUI * Compliance\ Rate) \\ &+ (ASHRAE\ 90.1-2013\ or\ IECC\ EUI \\ &* (1 - Compliance\ Rate))/Compliance\ Rate \end{aligned}$$

To determine the EUI from one percentage increase of code compliance the team used the following equation;

$$\begin{aligned} &Increased\ Compliance\ EUI \\ &= (ASHRAE\ 90.1-2016\ or\ IECC\ 2018\ EUI * Compliance\ Rate) \\ &+ (ASHRAE\ 90.1-2013\ or\ IECC\ EUI \\ &* (1 - Compliance\ Rate))/(Compliance\ Rate + 1\%) \end{aligned}$$

The energy savings for one percentage point increase in compliance was calculated as the difference between the Baseline EUI and the Increased Compliance EUI. This formula is slightly adjusted from the Year 2 evaluation. The Year 3 method assumes that building elements that are not fully compliant with current code are fully compliant with the preceding code. In Year 3 the Team also adjusted the code compliance estimates based on Year 3 Delphi Panel results.

Table 19 shows the changes in EUI that each percentage change in code compliance achieves for each of the building sectors and climate zones. To calculate the preliminary savings estimates, the Market Evaluation Team multiplied these EUI by five percent points by the statewide building square footage from Dodge.

Table 19. Change in Energy Use Intensity per Percentage Change in Code Compliance

Building Type		Code Compliance	Climate Zone	Change in Energy Use Intensity per % change in compliance		
				kWh/sq ft	kW/sq ft	Million BTU/sq ft
Single Family	Addition and Alteration	81%	4A	0.04965	0.00002	0.00020
Single Family		81%	5A	0.05358	0.00002	0.00026
Single Family		81%	6A	0.05943	0.00002	0.00031
Multifamily Low Rise		81%	4A	0.06519	0.00002	0.00014
Multifamily Low Rise		81%	5A	0.06846	0.00002	0.00016
Multifamily Low Rise		81%	6A	0.07395	0.00002	0.00019
Multifamily Mid/High Rise		84%	4A	0.11962	0.00003	0.00015
Multifamily Mid/High Rise		84%	5A	0.11785	0.00003	0.00020
Multifamily Mid/High Rise		84%	6A	0.12355	0.00003	0.00026
Commercial		84%	4A	0.16369	0.00004	0.00024
Commercial		84%	5A	0.15493	0.00004	0.00031
Commercial		84%	6A	0.15966	0.00004	0.00041
Single Family	New Construction	85%	4A	0.04509	0.00002	0.00018
Single Family		85%	5A	0.04866	0.00002	0.00023
Single Family		85%	6A	0.05398	0.00002	0.00028
Multifamily Low Rise		85%	4A	0.05922	0.00002	0.00013
Multifamily Low Rise		85%	5A	0.06218	0.00002	0.00015
Multifamily Low Rise		85%	6A	0.06717	0.00002	0.00018
Multifamily Mid/High Rise		85%	4A	0.11677	0.00003	0.00014
Multifamily Mid/High Rise		85%	5A	0.11505	0.00003	0.00019
Multifamily Mid/High Rise		85%	6A	0.12061	0.00003	0.00025
Commercial		85%	4A	0.15974	0.00004	0.00023
Commercial		85%	5A	0.15118	0.00004	0.00030
Commercial		85%	6A	0.15580	0.00004	0.00040

Appendix D: Detailed Survey Results

2.1. Introduction

This section provides detailed results from the Market Evaluation Team's ongoing evaluation of the energy code training provided in a series of instructional sessions through NYSERDA's Code and Standards for Carbon Neutral Buildings initiative. This appendix provides analysis of data collected from the immediate and follow-up surveys (conducted approximately six months after trainees attended a session) and expands on the more condensed results of immediate surveys that are provided in the monthly summary memo.

The energy code training sessions are delivered to participants by the Urban Green Council (UGC), Newport Ventures, and Performance Systems Development (PSD). A third implementer, Karpman Consulting, has not yet provided registration information. Feedback on the training sessions is primarily captured through an immediate survey administered via email after each course. The immediate survey collects key information about training attendees and their experience with the training sessions. This quarterly memo summarizes results from the following immediate survey topics:

- Participant demographics and regions in which they work
- Participant knowledge of the Energy Conservation Construction Code of New York State (ECCCNYS) before and after attending the training
- Participant knowledge of the New York City Energy Conservation Code (NYCECC) before and after attending the training
- Participant knowledge of NYStretch before and after attending the training
- Participant satisfaction with key training aspects
- Participant perception of the usefulness of training topics and suggestions on areas of improvement

Follow-up surveys are more focused on actions taken by training attendees after the sessions, as well as general activities and knowledge of code compliance and code adoption. The memo summarizes results from the following follow-up survey topics:

- Work procedures that have changed due to participation in NYSERDA trainings
- Participant and jurisdiction energy code characteristics

- Information filled with code officials for different project types
- Perceived changes in code compliance over time, and the potential impact of NYSERDA webinars on that change
- Participants' perception of the value of webinars after six months

Table 20 provides the current immediate survey response rate for each implementer, as well as the overall response rate. A list of specific courses for which surveys were distributed is included at the conclusion of this Appendix. The data provided in this memo reflect the cumulative responses received from training participants to date (training sessions were delivered between March 2020 to August 2022).

Table 20. Immediate Survey Response Rate

Implementer	Surveys Sent	Responses Received	Response Rate
UGC	4,338	849	20%
Newport Ventures	1,210	165	14%
PSD	18,060	2,764	15%
Karpman Consulting	1,042	203	19%
Total	**24,650**	**3,981**	**16%**

The first round of follow-up surveys was distributed in March 2021 to those who participated in webinars in September 2020. Those who completed a follow-up survey in one month will not receive another invitation in a later month to ensure no double counting of experience and feedback. The responses shown in Table 21 are from participants who attended a webinar between September 2020 and February 2022.

Table 21. Follow-Up Survey Respondents through August 2021

Month Attended	Year Attended	Invites Sent	Responses [a]	Response Rate
September	2020	1,011	74	7%
October	2020	1,239	80	6%
November	2020	241	12	5%
December	2020	678	35	5%
January	2021	408	44	11%
February	2021	385	26	7%
March	2021	498	45	9%
April	2021	393	22	6%
May	2021	353	19	5%
June	2021	297	30	10%
July	2021	239	14	6%
August	2021	256	14	5%
September	2021	1,187	77	6%
October	2021	296	12	4%
November	2021	498	19	4%
December	2021	470	16	3%
January	2022	530	30	6%
February	2022	488	24	5%
Total		**9,467**	**593**	**6%**

[a] Responses include both partial and fully completed responses.

Of those who received a survey invite, 329 respondents completed the survey, with an additional 264 recorded as partial respondents (people who answered at least one question but did not complete the survey).

Table 22. Follow-Up Survey Response Rate

Attendance Month	Surveys Sent	Completed Surveys	Partially Completed Surveys	Response Rate
September 2020	1,011	31	43	7%
October 2020	1,239	40	40	6%
November 2020	241	7	5	5%
December 2020	678	24	11	5%
January 2021	408	21	23	11%
February 2021	385	12	14	7%
March 2021	498	23	22	9%
April 2021	393	11	11	6%
May 2021	353	10	9	5%
June 2021	297	26	4	10%
July 2021	239	9	5	6%
August 2021	256	11	3	5%
September 2021	1,187	34	43	6%
October 2021	296	7	5	4%
November 2021	498	14	5	4%
December 2021	470	8	8	3%
January 2022	530	22	8	6%
February 2022	488	19	5	5%
Total	**9,467**	**329**	**264**	**6%**

2.2. Courses Provided in 2020, 2021, and 2022

Between March 2020 and August 2022, four implementers (PSD Consulting, Urban Green Council, Karpman Consulting, and Newport Ventures) worked with NYSERDA to deliver energy code training webinars to code officials, builders, contractors, and others in the field. The implementers offered courses for the updated ECCCNYS, the NYCECC, and NYStretch-2020. Overall, 9,220 unique participants attended at least one webinar (3,118 in 2020, 3,990 in 2021, and 2,921 in 2022).[5]

Table 23 shows the training topics offered by each implementer, the number of survey invites sent, and the number of survey responses received. For the immediate survey, participants could receive multiple invites and provide feedback for multiple webinars, as each participant received

[5] This was determined using unique email addresses the implementers provided to the Market Evaluation Team from training attendee reports.

a survey link for each webinar they attended. The Market Evaluation Team sent invites out promptly after the webinar was conducted to obtain feedback as close as possible to the day of training attendance.

Table 23. Webinar Participants and Immediate Survey Respondents through Mid-August 2022

Implementer	Course Title	Invitations Sent	Survey Responses Received [a]	Response Rate
Karpman Consulting	110: Performance-Based Compliance with ASHRAE Standard 90.1 2016	758	148	20%
Karpman Consulting	210: Compliance Documentation for ASHRAE 90.1 Section 11 and Appendix G	112	17	15%
Karpman Consulting	213: Integrating Performance-Based Compliance into the Design Process	86	20	23%
Karpman Consulting	212: Review of the Modeling-based Submittals for ASHRAE 90.1 Section 11 and Appendix G	86	18	21%
Newport Ventures	2020 ECCCNYS for Residential Buildings: Overview	732	116	16%
Newport Ventures	2020 ECCCNYS and NYStretch Energy Code for Commercial Buildings	171	10	6%
Newport Ventures	2020 ECCCNYS for Commercial Buildings: Overview	204	24	12%
Newport Ventures	Clean Energy Communities Energy Code Enforcement	103	15	15%
PSD Consulting	A Process for Residential Energy Code Compliance and Enforcement / Part 2 Energy Code Inspections in 15 Minutes or Less	1421	242	17%
PSD Consulting	A Process for Energy Code Compliance and Enforcement / Energy Code Plan Reviews in 15 Minutes or Less	1439	314	22%
PSD Consulting	Air Sealing to 3 ACH50	1438	247	17%
PSD Consulting	Other IECC Envelope Requirements	1336	211	16%
PSD Consulting	Efficient Forced Air Distribution	1065	213	20%
PSD Consulting	Whole-house Mechanical Ventilation	1140	240	21%
PSD Consulting	Lighting Systems for Large Commercial Buildings	910	193	21%
PSD Consulting	Mechanical Systems for Large Commercial Buildings	929	195	21%

Implementer	Course Title	Invitations Sent	Survey Responses Received [a]	Response Rate
PSD Consulting	Prioritizing ECCCNYS Enforcement for Commercial Buildings (Pt 2)	1857	195	11%
PSD Consulting	Prioritizing ECCCNYS Enforcement for Commercial Buildings (Pt 1)	1938	219	11%
PSD Consulting	NYStretch Overview and Thermal Envelope Requirements Part 1	984	161	16%
PSD Consulting	NYStretch Mechanical, Plumbing, Lighting, and Electric Power Part 2	958	137	14%
PSD Consulting	NYStretch Energy Code for Commercial Buildings Part 1: Building Thermal Envelope, Mechanical Systems, Commissioning, and Additions and Alterations	791	77	10%
PSD Consulting	NYStretch Energy Code for Commercial Buildings Part 2: Electric Power and Lighting, Total Building Performance, Additional Efficiency Package Options, and Appendices	757	61	8%
PSD Consulting	NY Energy Codes for Simple Buildings- Part 1: Retail Building	209	22	11%
PSD Consulting	NY Energy Code for Simple Commercial Buildings- Part 2: Mixed-Use Apartment, Grocery, and Office Building	209	18	9%
PSD Consulting	Multifamily Air Sealing	57	9	16%
Urban Green Council	What's New in the 2020 NYC Energy Code	2470	276	11%
Urban Green Council	Crushing the Code New York City: Commercial	651	148	23%
Urban Green Council	Crushing the NYS Energy Code: Commercial	408	143	35%
Urban Green Council	What's New in the 2020 New York Energy Code	190	63	33%
Urban Green Council	Crushing the Code New York City: Residential	284	106	37%
Urban Green Council	Crushing the Code New York State: Residential	334	105	31%

[a] These responses include both fully and partially completed online surveys.

Immediate survey respondents were asked to rate a variety of aspects of the training they had just attended on a scale of 1 to 7, where 7 was the best possible score. As shown in Table 24, most trainings were rated highly by respondents for all elements, with “relevancy to work” generally rated slightly lower than “quality of information” from the webinar or “likelihood to recommend"

the trainings to others. None of the elements for any of the trainings got lower than a 5 average rating.

Table 24**. Webinar Scores by Training Topic through July 2021**

Implementer	Course Title	Quality of Information	Relevancy to Work	Likelihood to Recommend
Karpman Consulting	110: Performance-Based Compliance with ASHRAE Standard 90.1 2016	5.88	5.59	5.52
	210: Compliance Documentation for ASHRAE 90.1 Section 11 and Appendix G	6.43	5.93	6.46
	213: Integrating Performance-based Compliance into the Design Process	6.5	6.07	6.69
	212: Review of the Modeling-based Submittals for ASHRAE 90.1 Section 11 and Appendix G	6.59	6.06	6.75
Newport Ventures	2020 ECCCNYS for Residential Buildings: Overview	6.13	5.68	6.2
	2020 ECCCNYS and NYStretch Energy Code for Commercial Buildings	5.33	5	5.12
	2020 ECCCNYS for Commercial Buildings: Overview	6.29	6.41	6.19
	Clean Energy Communities Energy Code Enforcement	6	5.73	5.45
PSD Consulting	A Process for Residential Energy Code Compliance and Enforcement / Part 2 Energy Code Inspections in 15 Minutes or Less	6.5	6.01	6.28
	A Process for Energy Code Compliance and Enforcement / Energy Code Plan Reviews in 15 Minutes or Less	6.29	5.95	6.24
	Air Sealing to 3 ACH50	6.32	6.04	6.06
	Other IECC Envelope Requirements	6.39	5.93	6.29
	Efficient Forced Air Distribution	6.44	5.9	6.3
	Whole-house Mechanical Ventilation	6.45	5.92	6.3
	Lighting Systems for Large Commercial Buildings	6.28	5.65	6.15
	Mechanical Systems for Large Commercial Buildings	6.22	5.66	5.97
	Prioritizing ECCCNYS Enforcement for Commercial Buildings (Pt 2)	6.42	5.88	6.27
	Prioritizing ECCCNYS Enforcement for Commercial Buildings (Pt 1)	6.32	5.77	6.23
	NYStretch Overview and Thermal Envelope Requirements Part 1	6.27	5.77	6.19

Implementer	Course Title	Quality of Information	Relevancy to Work	Likelihood to Recommend
	NYStretch Mechanical, Plumbing, Lighting, and Electric Power Part 2	6.36	6.09	6.2
	NYStretch Energy Code for Commercial Buildings Part 1: Building Thermal Envelope, Mechanical Systems, Commissioning, and Additions and Alterations	6.41	5.65	6.14
	NYStretch Energy Code for Commercial Buildings Part 2: Electric Power and Lighting, Total Building Performance, Additional Efficiency Package Options, and Appendices	6.22	5.52	6.14
	NY Energy Codes for Simple Buildings- Part 1: Retail Building	6.21	5.61	6.37
	NY Energy Code for Simple Commercial Buildings- Part 2: Mixed-Use Apartment, Grocery, and Office Building	6.14	5.31	6.33
	Multifamily Air Sealing	6.5	6.29	6.14
Urban Green Council	What's New in the 2020 NYC Energy Code	6.33	6.24	6.48
	Crushing the Code New York City: Commercial	6.46	6.19	6.55
	Crushing the NYS Energy Code: Commercial	6.34	6.03	6.23
	What's New in the 2020 New York Energy Code	5.96	5.74	6.04
	Crushing the Code New York City: Residential	6.67	6.01	6.53
	Crushing the Code New York State: Residential	6.3	6.01	6.41

2.3. Immediate Survey Participant Characteristics

To understand who is participating in the sessions, the Market Evaluation Team asked respondents to identify if they were code officials or building professionals (which includes architects, engineers, contractors, etc.). As shown in Table 25, code officials represented a lower proportion of participants (47%).

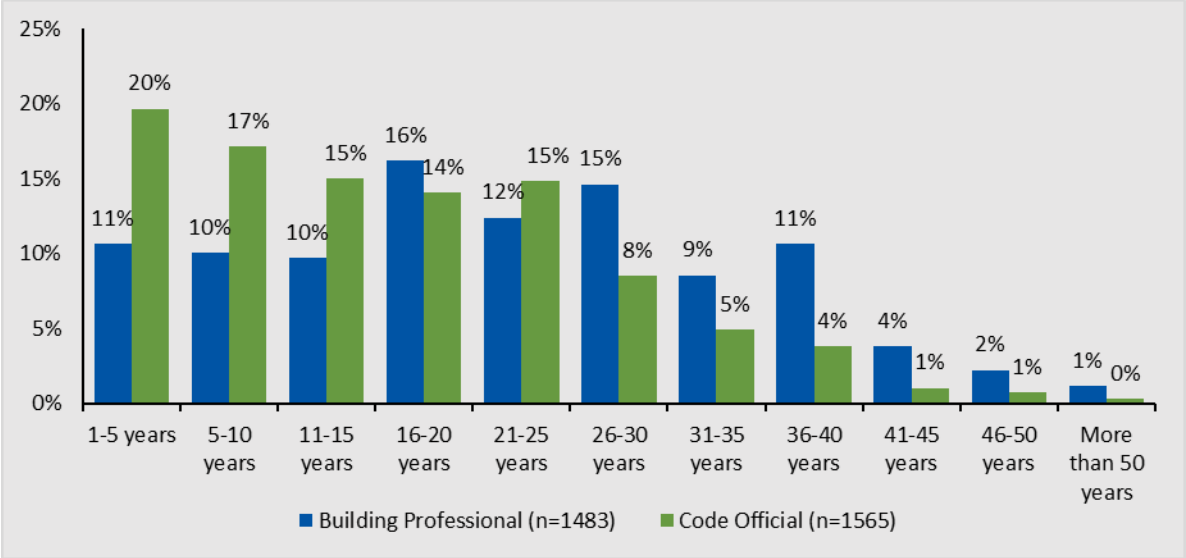
Table 25. Immediate Survey Occupation Type

Participant Type	Number of Participants	Percentage of Participants
Code Officials	1,886	47%
Building Professionals	2,098	53%
No Response Provided	0	0%
Total	3,982	100%

Participants' years of experience working in their position (or a similar position) ranged widely for both code officials and building professionals. As shown in Figure 7 code officials were more likely to have less than 21 years of experience in their job (66%) compared with building professionals (47%).

Figure 7. Years of Experience for Code Officials and Building Professionals

Source: Immediate Survey Question: "Years of experience in this (or similar) position."



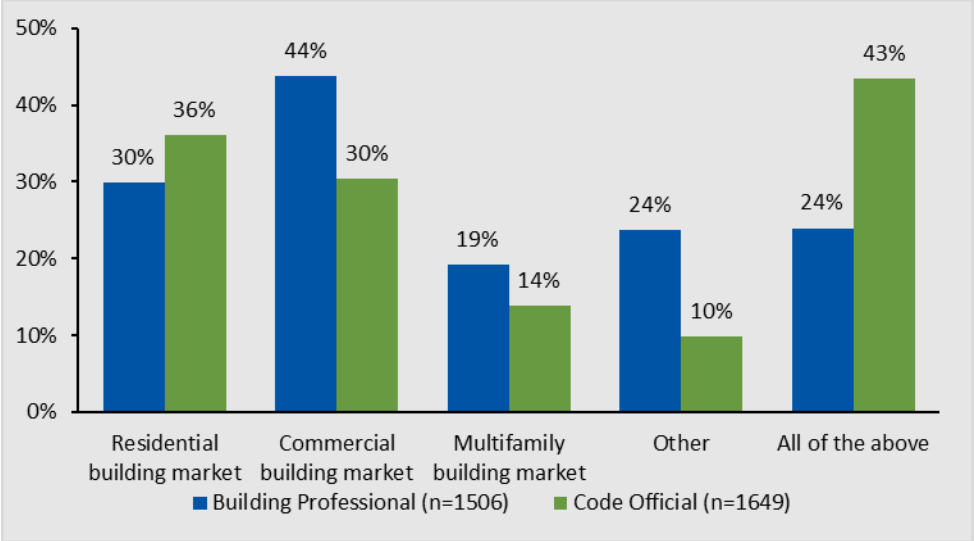
Overall, 35% of building professional respondents and 20% of code officials said they worked in a jurisdiction that has adopted NYStretch-2020. An additional 27% and 50%, respectively, said they do not work in a stretch code jurisdiction. The remaining respondents were not sure.

To get more insight into who is participating in the energy code training sessions, the Market Evaluation Team also collected information of the markets and types of work participants do

professionally. As shown in Figure 8, training is reaching participants in both residential and commercial markets, with 43% of code officials saying they work in all construction markets.

Figure 8. Market to Which Participants' Work Applies

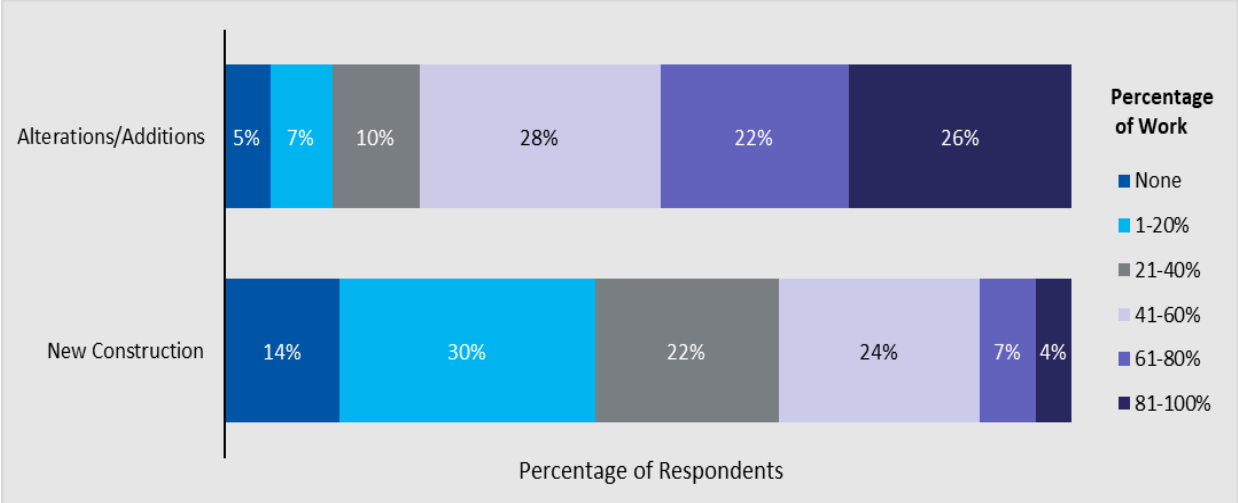
Source: Immediate Survey Question: "Please select the market to which your work applies."



Participants also reported on the percentage of their work that was new construction versus additions and alterations. As shown in Figure 9, 48% of respondents said that more than 60% of their work is in alterations and additions. Only 11% said that more than 60% of their work is new construction.

Figure 9. Breakdown of Participants' Time by Work Type (n=3,210)

Source: Immediate Survey Question: "About what percentage of your work is …?"

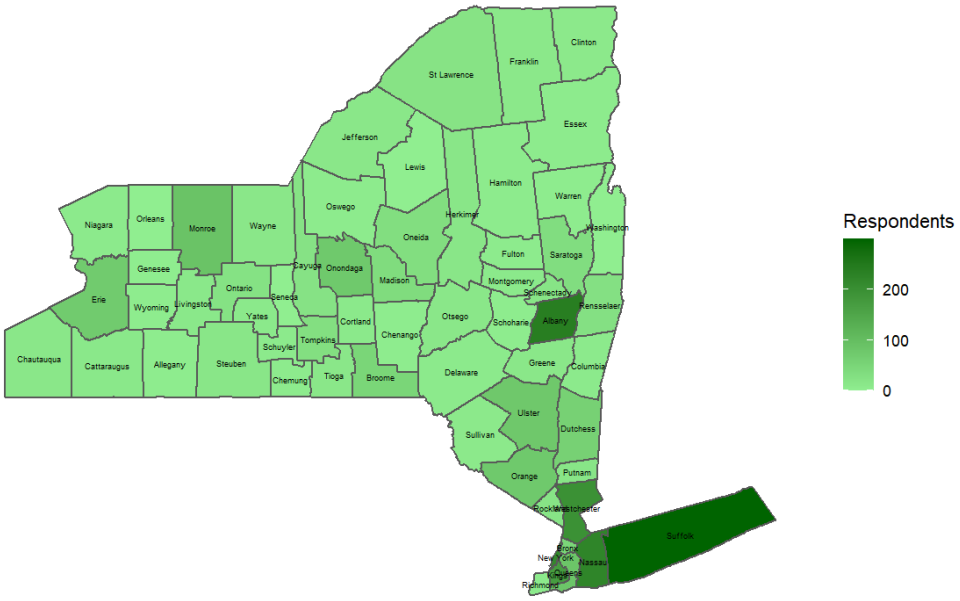


2.3.1.1. Geographical Representation

Immediate survey respondents were asked to list up to three jurisdictions in which they work, so the Market Evaluation Team could ensure that the webinars were reaching attendees across NYS. While the original intent was to collect the names of towns, a notable number of respondents specified counties or regions instead; because of this, the Team converted all responses to county-based entries and applied these to a state map.

As shown in Figure 10, 59 of 62 counties were represented (95% of all state counties) by immediate survey respondents. The counties with the highest representation were the five boroughs of New York (21% of respondents), Suffolk County (12%), and Albany County (9%). The average number of immediate survey respondents per county was 44.

Figure 10**. Immediate Survey Representation by County (n=2,589)**



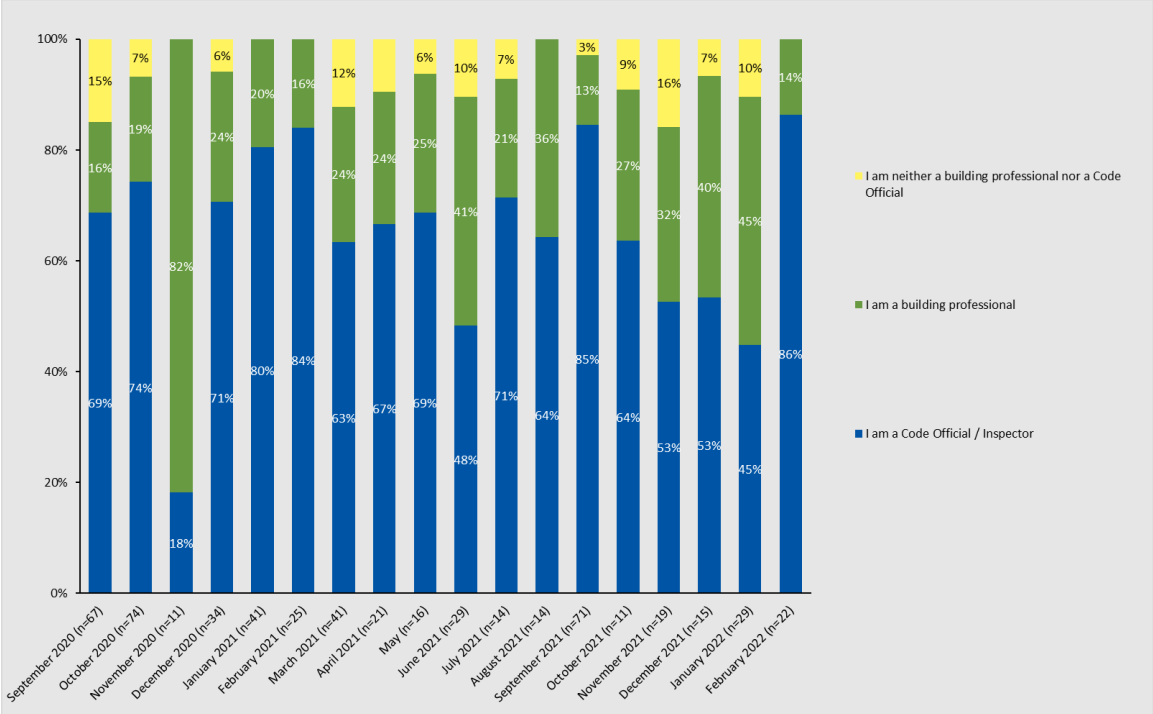
2.4. Follow-Up Survey Participant and Jurisdiction Characteristics

During the first six months of the follow-up survey data collection, 69% of respondents were code officials, with 24% building professionals (contractors, architects, etc.). This represents slightly different proportions of respondents by occupation type as from the immediate survey respondents, where code officials only represented 47% of respondents. As shown in Figure 11, with the exception of November 2020 training respondents, this is fairly consistent between months. Those who said they did not fall into the two main categories (code officials and building

professionals) self-reported a variety of positions including firefighters, planning board members, building maintenance staff, and health and safety professionals.

Figure 11. Survey Respondent Work Category (n=554)

Source: Follow-Up Survey Question: "Please select your area of work from the categories below."

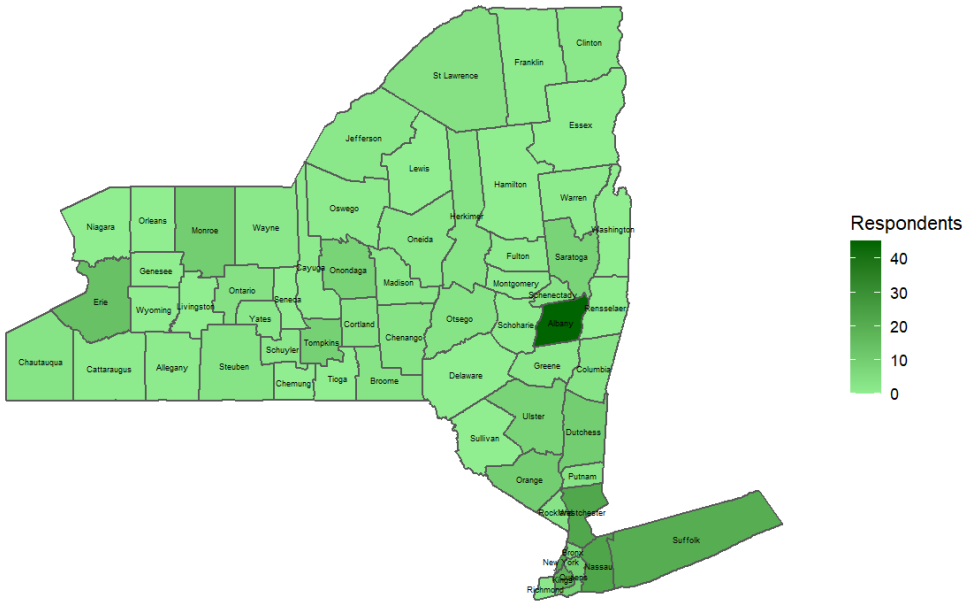


2.4.1.1. Geographical Representation

Follow-up survey respondents were asked to list up to three jurisdictions in which they work, so the Market Evaluation Team could ensure that the webinars are reaching attendees across NYS. While the original intent was to collect the names of towns, a notable number of respondents specified counties; because of this, the Team converted all responses to county-based entries and applied these to a state map.

As shown in Figure 12, 47 of 62 counties were represented (76% of all state counties) by follow-up survey respondents, with the lowest number of counties represented in the northwest portion of the state (which has a more rural population than that in the southeast, which had the most representation). The counties with the highest representation were the five boroughs of NYC (18% of respondents), Albany County (15%), and Nassau County (7%). The NYC counties and Albany County were also highly represented in the immediate surveys. Most counties were represented by only a few respondents (generally between one and four).

Figure 12. Follow-Up Survey Representation by County (n=310)

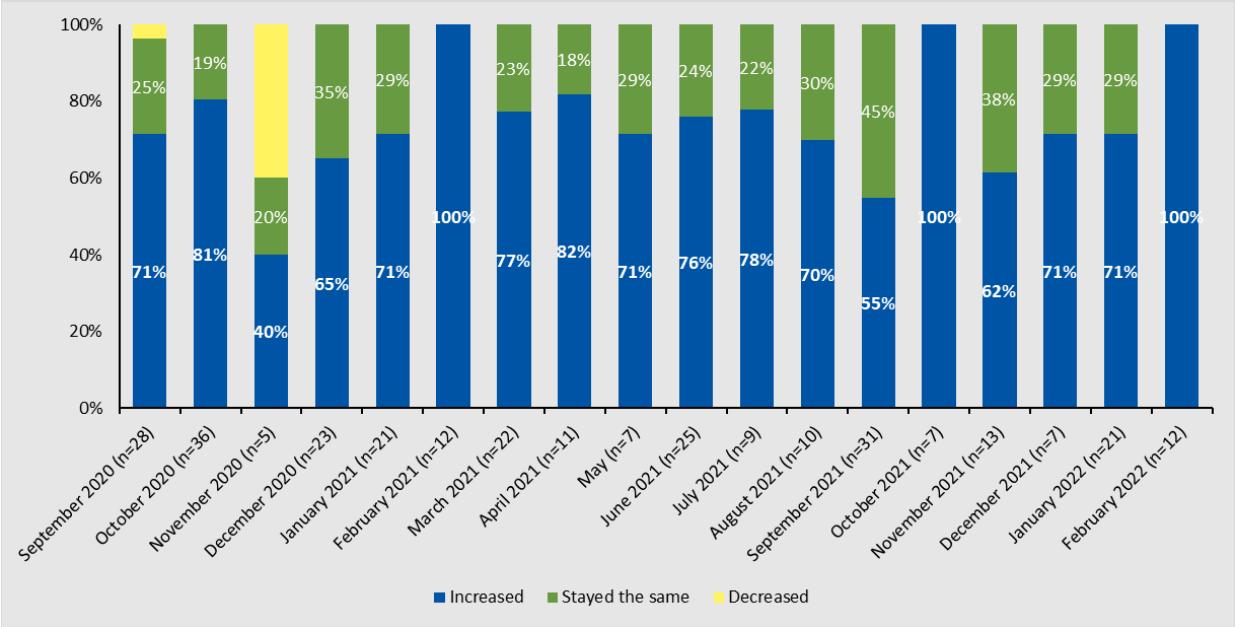


2.5. Trends (Follow-Up Survey)

Survey respondents were asked to consider the past 12 months and indicate if they felt that during that time compliance with the energy code in NYS had increased, decreased or stayed the same. Overall, 71% of all respondents said they felt that energy code compliance had increased over the past 12 months. As shown in Figure 13, the majority of respondents for each training month felt that energy code compliance had increased over the past 12 months, with a few months seeing 100% increases in compliance.

Figure 13. Change in Energy Code Compliance

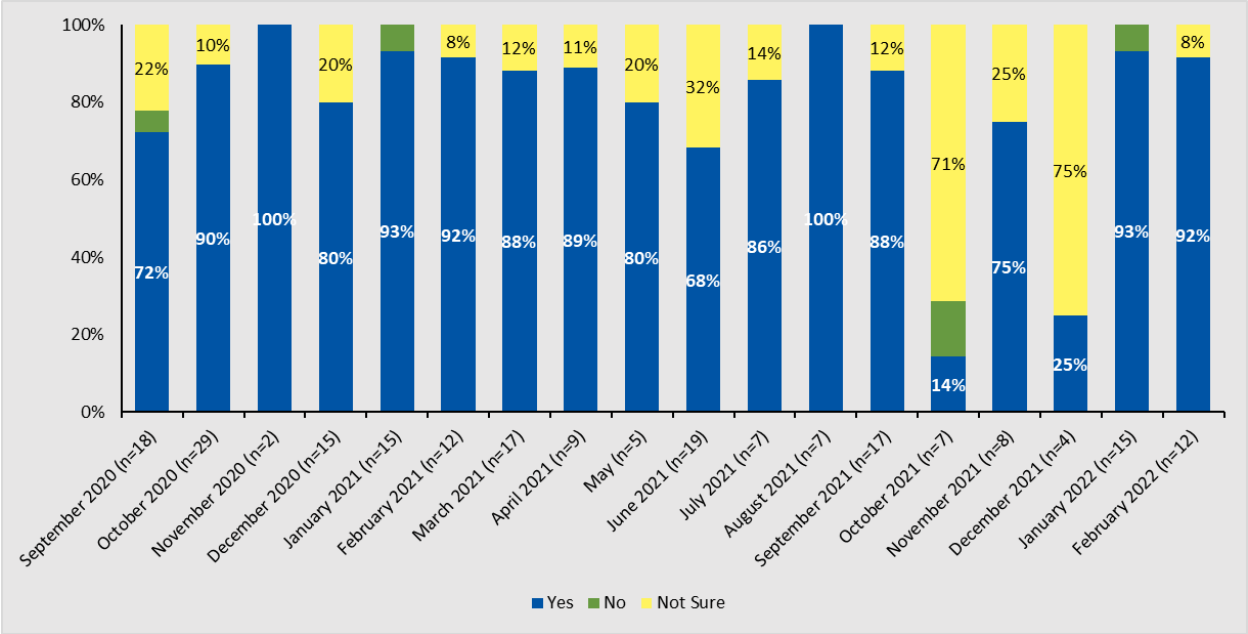
Source: Follow-Up Survey Question: "In the last year or so, do you think compliance with the energy code in New York State has increased, stayed the same, or decreased?"



Of those respondents who said that they had observed an increase in code compliance, 80% said that they thought the services provided by the NYSERDA technical support and training initiatives had played a role in this increase in compliance, with an additional 19% saying they were not sure. Figure 14 shows the breakdown by training month.

Figure 14. Whether NYSERDA-Sponsored Events Impact Compliance Improvements

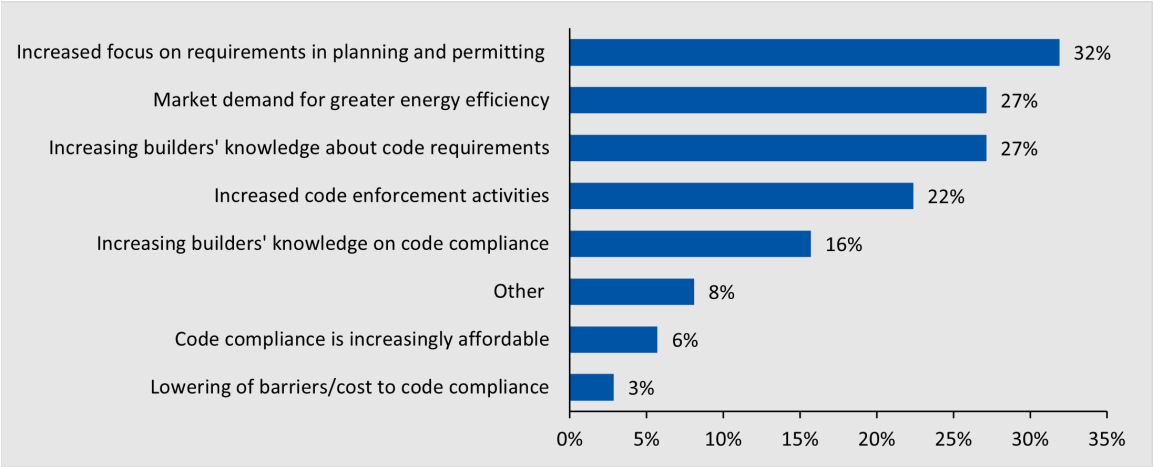
Source: Follow-Up Survey Question: "Do you think the services provided by the NYSERDA Initiative, including training and technical assistance, have played a role in this?"



Respondents who had reported an increase in energy code compliance were also asked to identify other factors that they thought contributed to the increased code compliance in NYS. As shown in Figure 15, respondents identified several factors, including increased focus on energy code in planning and permitting (32%), market demand for greater energy efficiency (27%), and increased builders' knowledge about code requirements (27%).

Figure 15. Other Factors Contributing to Increased Compliance (n=210)

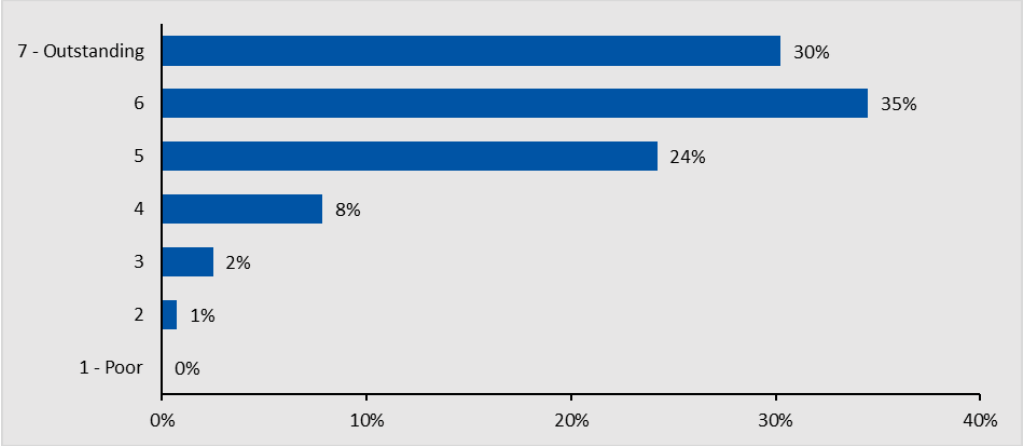
Source: Follow-Up Survey Question: "What factors do you think have contributed to the increase in code compliance other than the NYSERDA initiatives?"



Overall, taking everything into consideration, survey respondents rated the value of the webinars they attended as a 5.80 on a scale of 1 to 7 (with 1 being poor and 7 being outstanding) in helping attendees better understand and implement NYS energy code. As shown in Figure 16, the most common rating was a six, more than a third of respondents (35%) giving that score.

Figure 16. Overall Value of NYSERDA Training Initiative (n=281)

Source: Follow-Up Survey Question: "Taking everything into consideration, how would you rate the overall value of the webinar you attended?"



2.6. Square Footage Calculation

The Team asked follow-up survey respondents to estimate the number of projects and the square footage of projects completed since participating in the webinars. Although most respondents work only in certain sectors (such as residential construction and alterations), overall, 212 respondents provided usable information. The number of respondents for each project and respondent types are included in the tables below.

Overall, 131 of the 382 code officials who completed the survey provided a response for at least one building category. As shown in Table 26, most code officials reported working on residential alternations and additions following the trainings. This category includes multifamily buildings with five or fewer dwelling units that were on average the smallest in terms of square footage. The largest projects code officials reported working on were multifamily new construction projects.

The Market Evaluation Team calculated the total square footage that code officials worked on after the trainings as the product of the percentage of code officials who worked on a building category, the median of projects on which each building professional worked, the average square footage per project (based on the median of average project square footage reported by code

officials), and the number of code officials trained in 2021[6]. The total square footage affected by code officials based on this calculation is greater than the 2021 new construction and additions and alterations data reported by Dodge Data and Analytics (Dodge), which NYSERDA provided to the Market Evaluation Team. The difference is especially significant for additions and alterations.

Table 26. Projects in the Six Months After Attending Training (Code Officials)

Category	n	% Code Providing a Response	Median Number of Projects	Average Square Footage per Project	Code Officials Trained in 2021	Square footage affected by Training Participants
Commercial New Construction	30	41%	2	45,000	1,863	68,891,055
Commercial Additions and Alterations	38	52%	4	30,000		114,802,138
Residential New Construction	28	38%	2	10,000		16,112,581
Residential Alterations and Additions	37	51%	3	6,000		19,162,462
Multifamily New Construction	9	12%	5	55,000		71,211,853
Multifamily Alterations and Additions	4	5%	6	50,000		34,526,959

Overall, 73 of the 133 building professionals who completed the survey provided a response for at least one building category. As shown in Table 27, building professionals worked mostly on commercial new construction and alteration and additions projects, which together accounted for more affected square footage than residential and multifamily projects. As with code officials, total square footage reported by building officials exceeds the building square footage reported by Dodge, particularly for alterations and additions.

[6] 3,963 unique persons attended trainings in 2021. According to the immediate surveys, 47% of those training attendees were code officials.

Table 27. Projects in the Six Months since Attending Training (Building Professionals)

Category	n	% Code Providing a Response	Median Number of Projects	Average Square Footage per Project	Building Professionals Trained in 2021	Square footage affected by Training Participants
Commercial New Construction	30	41%	2	45,000	2,100[7]	77,685,658
Commercial Additions and Alterations	38	52%	4	30,000		114,802,138
Residential New Construction	28	38%	2	10,000		16,112,581
Residential Alterations and Additions	37	51%	3	6,000		19,162,462
Multifamily New Construction	9	12%	5	55,000		71,211,853
Multifamily Alterations and Additions	4	5%	6	50,000		34,526,959

The square footage analysis is based on a larger number of responses than were in the previous evaluation report. The total square footage reportedly affected by the follow-up survey respondents exceeds the 2021 square footage reported by Dodge. This difference may result from multiple respondents in the same building department or firm working on the same building or from inaccurate data from Dodge.

2.7. COVID-19 Impacts

The Market Evaluation Team asked follow-up survey respondents to consider whether the COVID-19 pandemic had impacted commercial and residential building code compliance and enforcement activities. Respondents considered this for the sectors where they previously indicated having work experience.

Commercial Energy Code

Follow-up survey respondents who reported completing projects on commercial properties were asked to note how, if at all, the COVID-19 pandemic had affected energy code compliance and

[7] 3,963 unique persons attended trainings in 2021. According to the immediate surveys, 53% of those training attendees were building professionals.

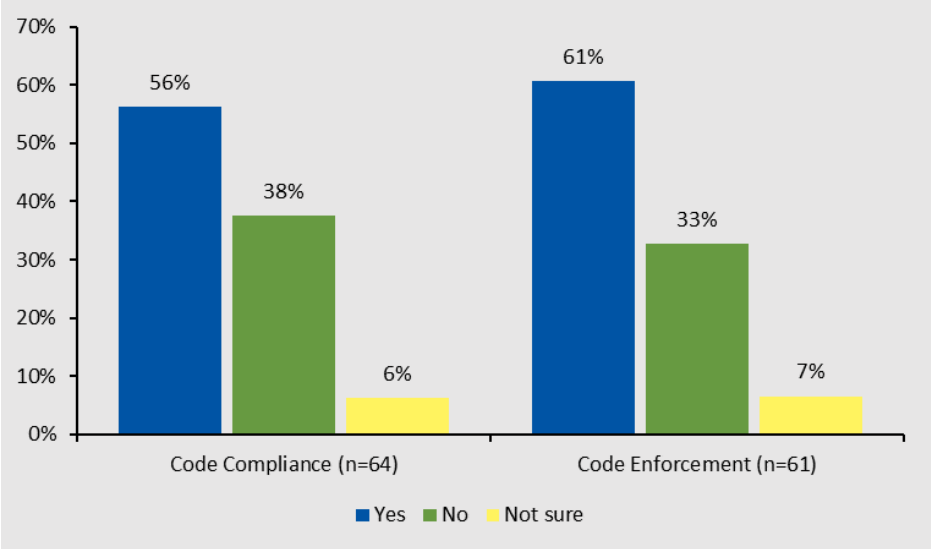
enforcement. As shown in Figure 17, more than half of respondents observed impacts on commercial energy code compliance (56%), and energy code enforcement activities (61%).

Compliance impacts noted by respondents included increased difficulty in sourcing compliant building materials, difficulty finding staff willing to conduct site visits or work on site, fewer or less-detailed inspections (which allowed noncompliant contractors to get away with more noncompliance), slowed project timelines due to permitting delays and longer review times, and a shift to virtual inspections for some communities.

Positive compliance impacts were noted by two respondents, who noted an increased availability of online educational opportunities that they saw as a positive impact on compliance resulting from organizations like NYSERDA responding to the COVID-19 pandemic.

Figure 17. COVID-19 Impacts on Commercial Energy Code

Source: Follow-Up Survey Question: "How has the COVID-19 pandemic impacted commercial code compliance and enforcement?" August 2022.



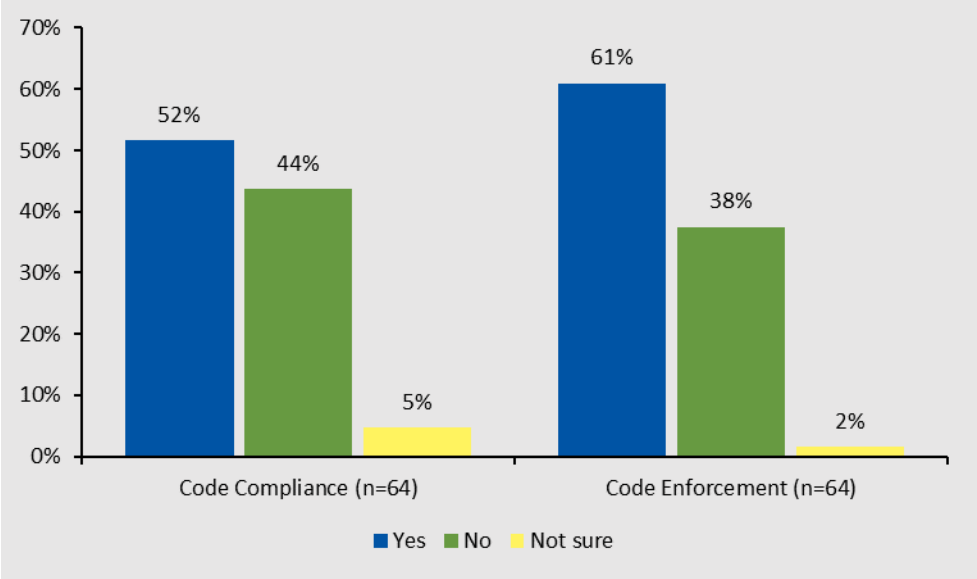
Residential Energy Code

Follow-up survey respondents who reported completing projects on residential properties were also asked to note how, if at all, the COVID-19 pandemic had affected energy code compliance and enforcement. As shown in Figure 18, more than half of respondents said they had observed impacts on residential energy code compliance (52%) and energy code enforcement activities (61%).

The compliance impacts noted by respondents focused on slowed down timelines (due to both lack of available building materials and slowed enforcement activities). Regarding enforcement challenges, respondents noted fewer building code officials available to complete required inspection activities, code officials that did not want to conduct on-site inspections due to safety concerns and filing approval timelines that were slowed down noticeably. For building materials, ten respondents all identified a lack of (or prohibitively high cost for) building materials as a notable impact resulting from the pandemic.

Figure 18. COVID-19 Impacts on Residential Energy Code

Source: Follow-Up Survey Question: "How has the COVID-19 pandemic impacted residential code compliance and enforcement?" August 2022.



2.8. Understanding of the ECCCNYS, NYCECC, and NYStretch (Immediate Survey)

To assess the impact of the training on attendees' understanding of the ECCCNYS, NYCECC, and NYStretch, the Market Evaluation Team asked immediate survey respondents to estimate their level of understanding of the energy code before and immediately following the event on a 7-point scale (where 1 is no understanding and 7 is expert understanding).

Figure 19 illustrates the change in attendees' level of understanding of the ECCCNYS. The Team asked only individuals attending ECCCNYS-specific training to estimate their level of understanding of the ECCCNYS before and after the training. Overall, 16% of respondents ranked themselves as having an understanding of 6 or 7 on the 7-point scale prior to attending the

training. When asked how they ranked themselves after the training, the scores improved such that 50% of respondents ranked themselves a 6 or 7. This resulted in an increase from a mean score of 4.3 to a mean score of 5.3.

Figure 19. Understanding of the ECCCNYS (n=2,420)

Source: Immediate Survey Questions: "Prior to attending the training on [Course Title], what was your level of understanding of the Energy Conservation Code of New York State?" and "After attending the training on [Course Title], what is your level of understanding of the Energy Conservation Code of New York State?"

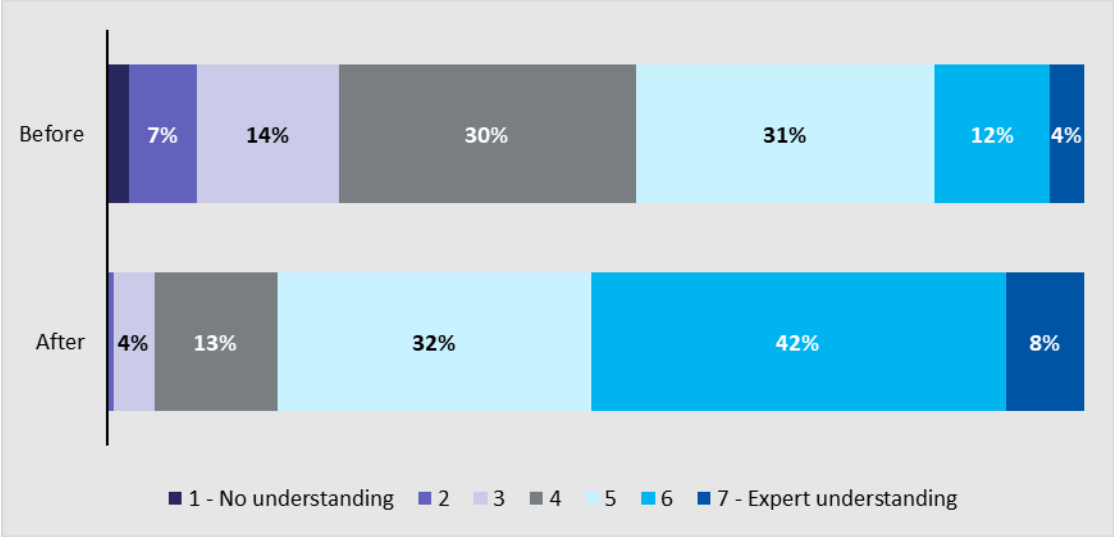


Figure 20 shows the change in attendees' level of understanding of the NYCECC. The Team asked individuals attending NYC-specific training to estimate their level of understanding of the NYCECC before and after the training events. Eleven percent of the respondents ranked themselves as having an understanding of 6 or 7 on the 7-point scale prior to attending the training. When asked how they ranked themselves after the training, the scores improved such that 35% of respondents ranked themselves as having an understanding of 6 or 7. This resulted in an increase from a mean score of 3.4 to a mean score of 4.5.

Figure 20. Understanding of the NYCECC (n=1,849)

Source: Immediate Survey Questions: "Prior to attending the training on [Course Title], what was your level of understanding of the New York City Energy Conservation Code?" and "After attending the training on [Course Title], what is your level of understanding of the New York City Energy Conservation Code?"

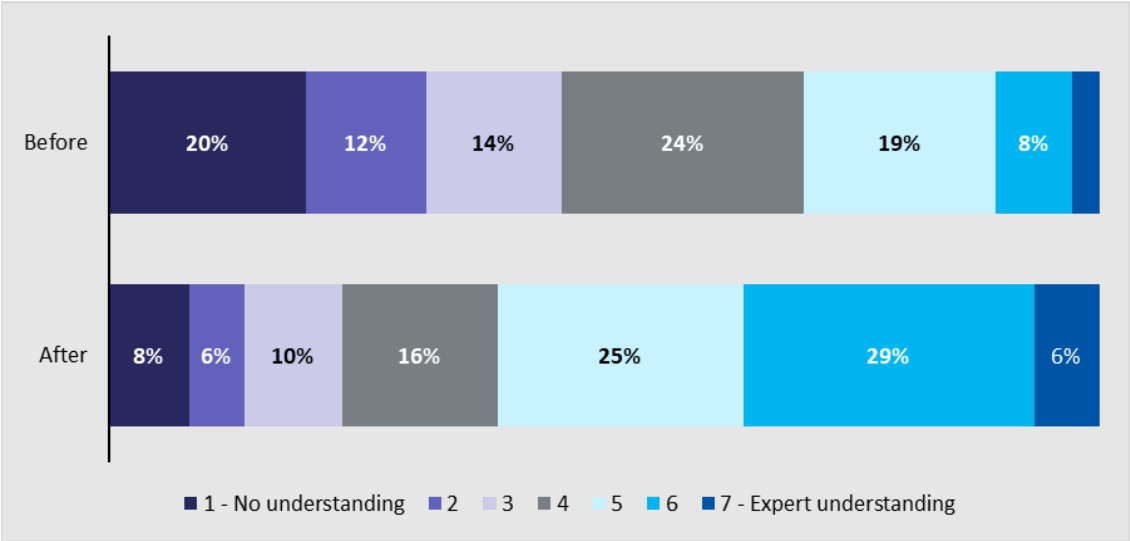
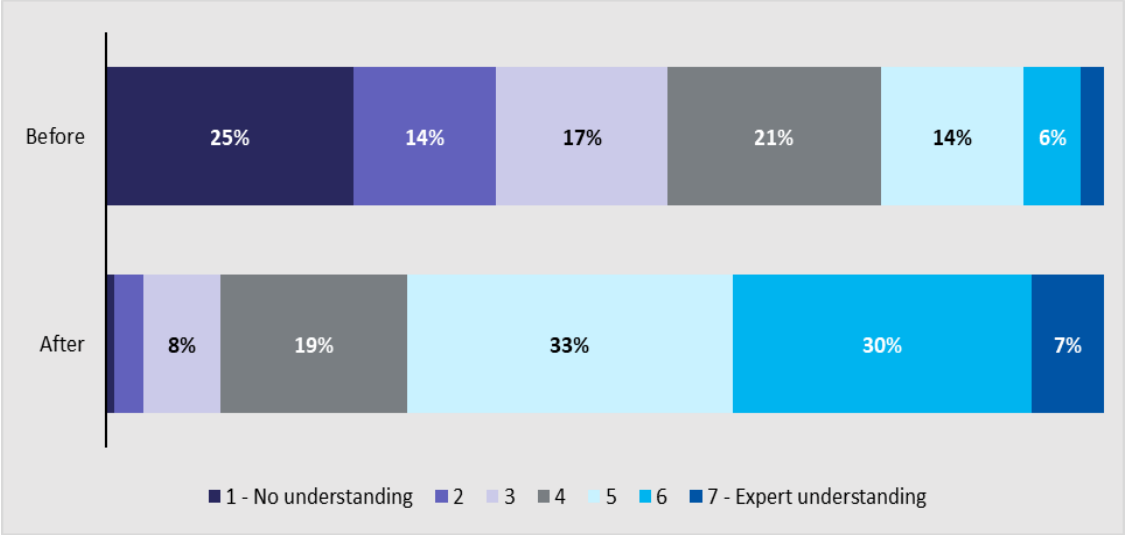


Figure 21 shows the change in attendees' level of understanding of NYStretch. The Team asked only individuals attending a training session covering NYStretch topics to provide their level of understanding of the stretch energy code before and after the training events. Only 8% of respondents ranked themselves as having a level of understanding of 6 or 7 prior to attending the training. The level of understanding increased to 37% rating themselves a 6 or 7 after the training. Overall, mean scores increased from 3.1 prior to the training to 4.9 after attending the training.

Figure 21. Understanding of NYStretch (n=610)

Source: Immediate Survey Questions: "Prior to attending the training on [Course Title], what was your level of understanding of the NYStretch Energy Code - 2020 on a scale from 1 to 7" and "After attending the training on [Course Title], what is your level of understanding of the NYStretch Energy Code - 2020 on a scale from 1 to 7"

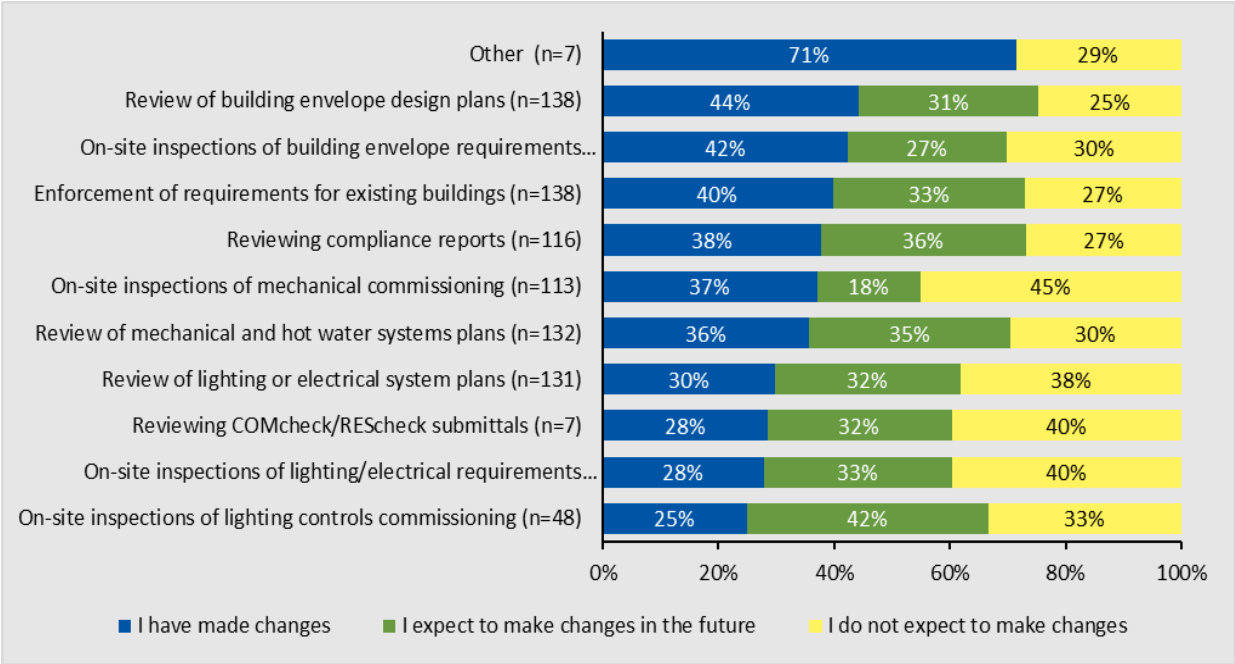


2.9. Participant Changes to Work Procedures (Follow-Up Survey)

Code officials were asked to identify what (if any) procedures of their work had changed as a result of attending the training webinars. As shown in Figure 22, code officials said that they had made changes to the way they review building envelope design plans (44%) and to their on-site inspections of building envelope requirements (42%). However, a similar percentage of code officials also said they were unlikely to make changes around on-site inspections of mechanical commissioning requirements (45%). Additionally, code officials said that they were unlikely to make changes when reviewing COMcheck or RES check submittals (40%) or on-site inspections of lighting/electrical requirements (40%).

Figure 22. Work Procedures Changed from Lessons Learned at NYSERDA Webinars (Code Officials)

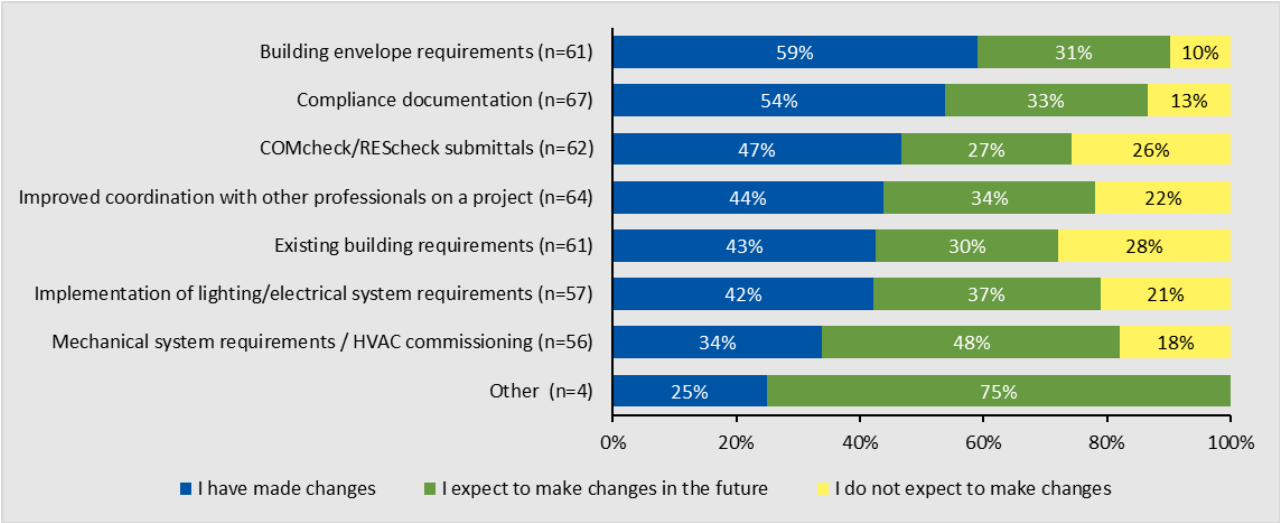
Source: Immediate Survey Question: "For each topic listed below, please identify if the procedures of your work have changed or will change as a result of what you learned at the webinars you attended."



Building professionals were also asked to consider if their work procedures had changed as a result of what they learned at NYSERDA-sponsored webinars. As shown in Figure 23, building professionals most often reported that they had made changes to their work around meeting building envelope requirements (59%), compliance documentation (54%), and COMcheck and REScheck submittals (47%). However, an additional 28% of building professionals indicted they were unlikely to make change to their work around existing building requirements.

Figure 23. Work Procedures Changed from Lessons Learned at NYSERDA Webinars (Building Professionals)

Source: Immediate Survey Question: "For each topic listed below, please identify if the procedures of your work have changed or will change as a result of what you learned at the webinars you attended."

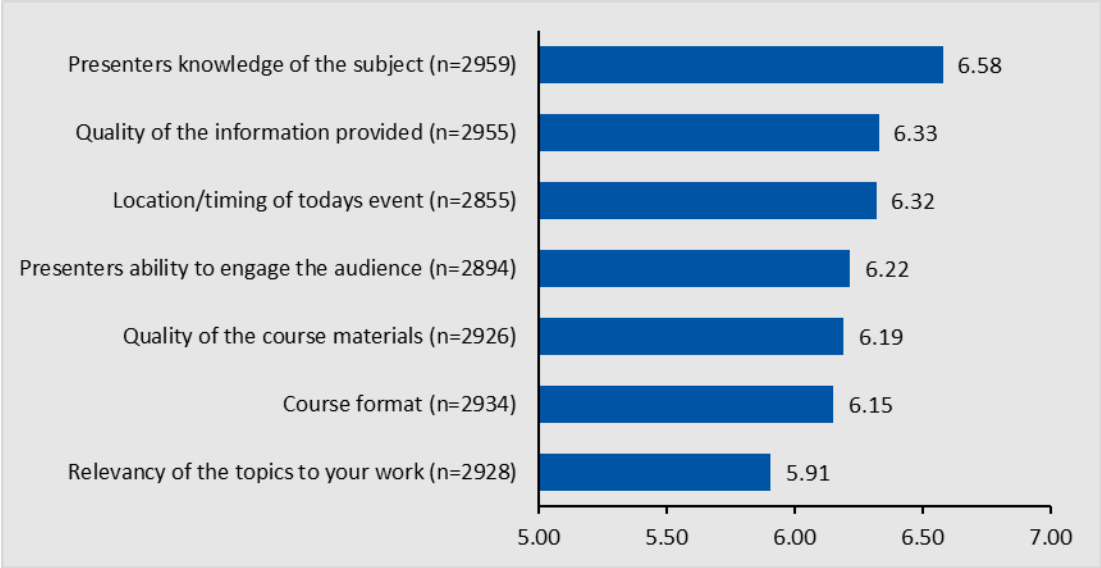


2.10. Satisfaction with Training Elements (Immediate Survey)

The Market Evaluation Team asked respondents to rate their satisfaction with key aspects of the training on a 7-point scale, where 1 is not at all satisfied and 7 is very satisfied. Figure 24 shows that attendees are generally satisfied with all aspects of the training. The mean rating for all but one training element is higher than 6 on the 7-point scale. Figure 24 also shows that respondents were most satisfied with how knowledgeable the presenters were on the subject matter, followed by satisfaction with the quality of the information provided and the convenient timing of the webinars.

Figure 24. Respondent Mean Satisfaction Rating for Key Training Elements

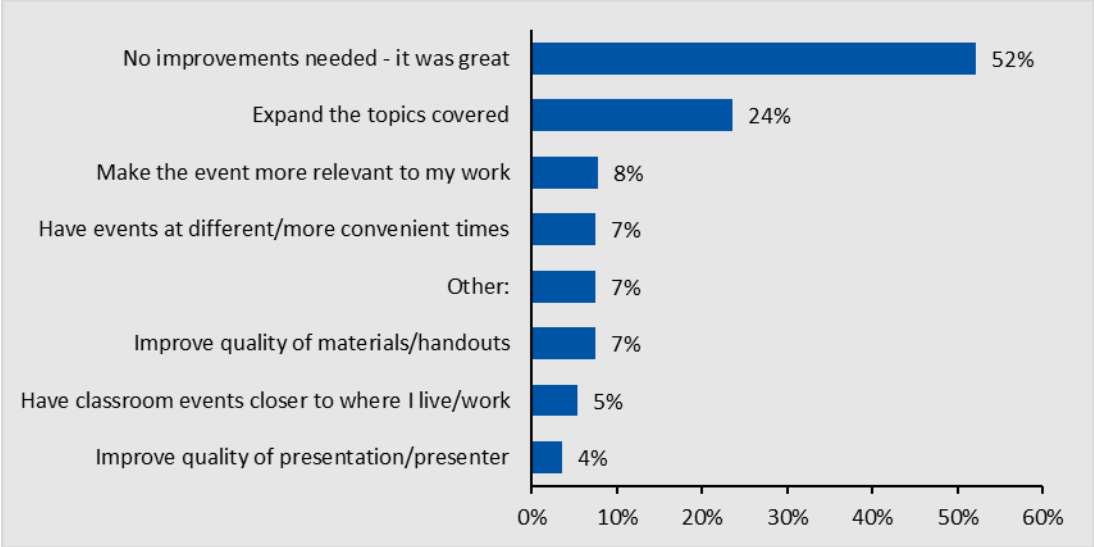
Source: Immediate Survey Question: "Please rate your satisfaction with: … on a scale of 1 – Not satisfied at all, to 7 – Very satisfied."



When asked what could improve the training events, 52% of respondents said the training was great and no improvements were needed. Figure 25 shows the most common suggestions for improvements.

Figure 25. Respondent Suggests for Course Improvement (n=2,507)

Source: Immediate Survey Question: "How can we improve the [Course Title] training or similar events in the future?"



Recent verbatim responses provided by respondents included the following:

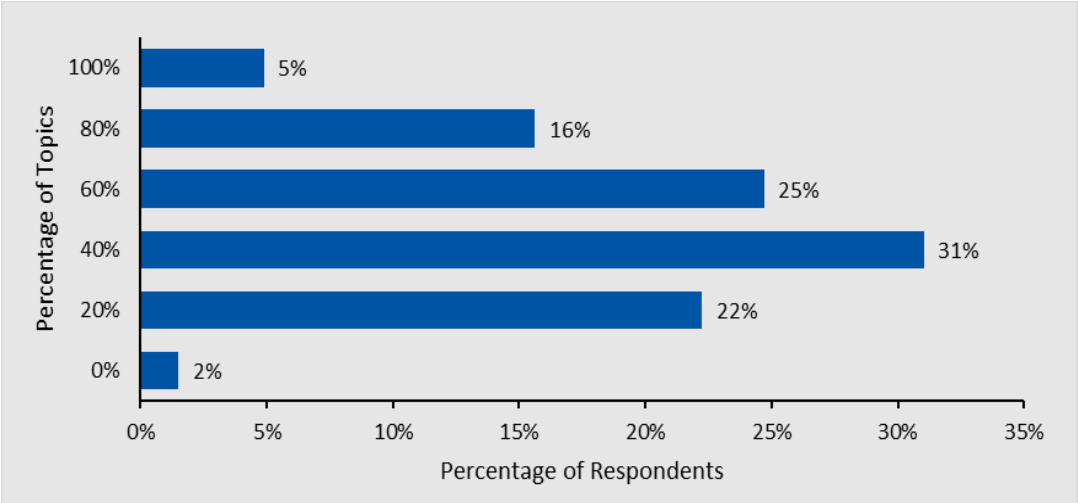
- "Have evening and weekend training courses so we don't need to lose work during weekday work hours, if possible."
- "Either slow it down or make it longer - it moved just a little too fast. Also, make the slide deck available to the attendees."
- "I felt the lecture format was not that engaging - most of the information could have been learned more quickly by just reading the slides. And I also felt a presenter who was a practitioner would have been more productive - I was hoping to learn from someone who was expert in the practical realities of how the code is implemented and enforced on projects, but this course was more at a theoretical level."

2.11. Relevance and Usefulness of Training Topics (Immediate Survey)

The Market Evaluation Team asked respondents to identify the percentage of topics covered in the training sessions that covered new information. As shown in Figure 26, few respondents said that either all or none of the topics covered were new information. Nearly a third of respondents (31%) said that approximately 40% of the topics covered was new information.

Figure 26. New Information as a Percentage of Topics Covered (n=2,926)

Source: Immediate Survey Question: "What percent of the topics covered in the training session today was new information for you?"



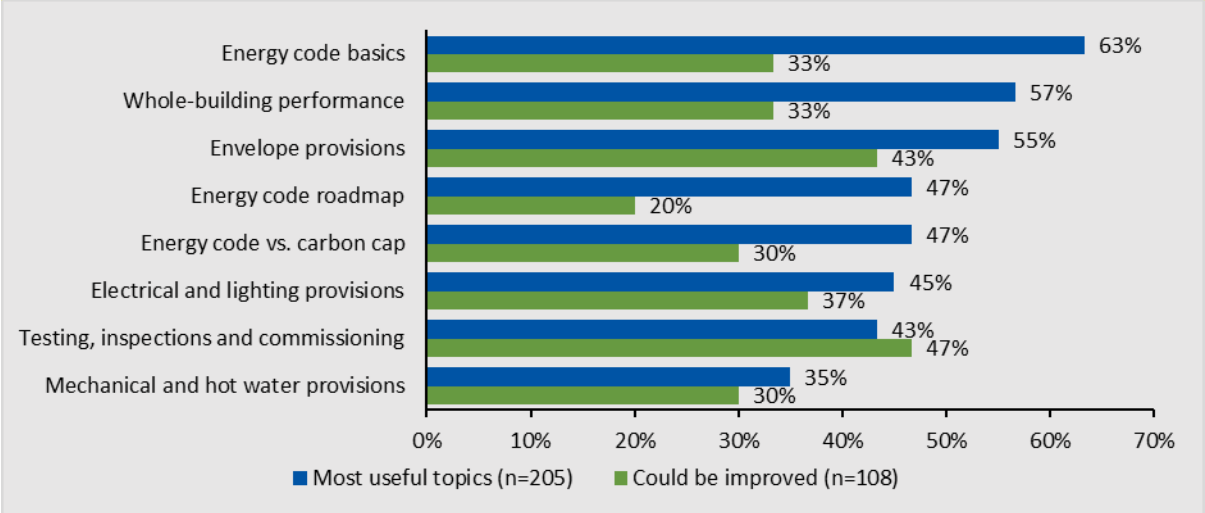
The most useful topics and the topics identified as needing improved content for each course are presented in the following sections.

2.12. What's New in the 2020 NYC Energy Code: Commercial (UGC)

Figure 27 shows the topics respondents who took the "What's New in the 2020 NYC Energy Code" training found most useful and those they suggested could be improved. The topic respondents found most useful was energy code basics (63%). When asked which topic could be improved, 47% said testing, inspections, and commissioning.

Figure 27. Feedback on Topics Covered (What's New in the 2020 NYC Energy Code: Commercial)

Source: Immediate Survey Questions: "What were the most useful topics of the training for you?" and "Are there any topics from today's training that could be improved?" Multiple responses allowed.

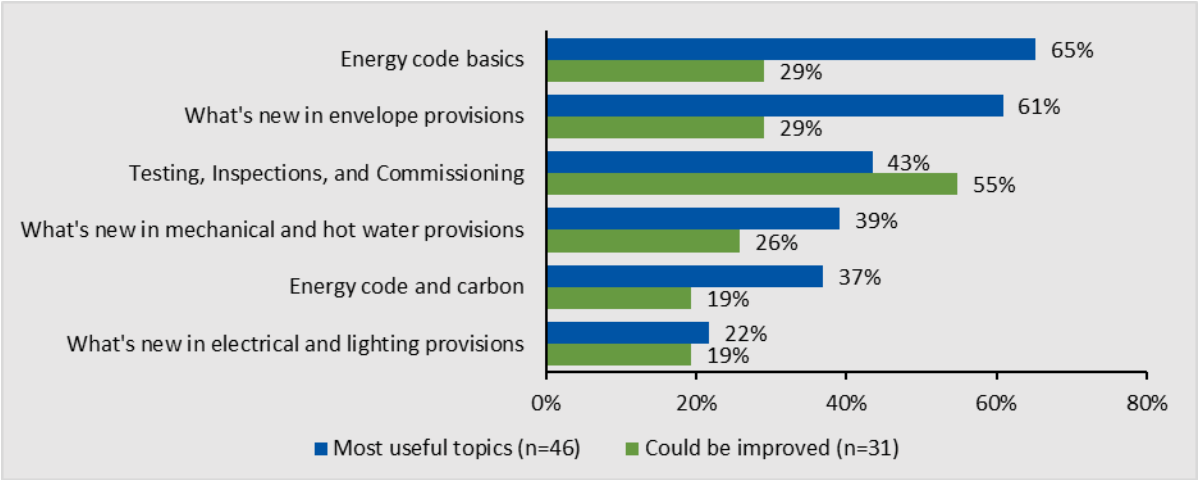


2.13. What's New in the 2020 New York Energy Code: Commercial (UGC)

Figure 28 shows the topics respondents who took the "What's New in the 2020 New York Energy Code" training found most useful and those they suggested could be improved. The topic respondents found most useful was energy code basics (65%). When asked which topic could be improved, 55% said testing, inspections, and commissioning.

Figure 28. Feedback on Topics Covered (What's New in the 2020 New York Energy Code: Commercial)

Source: Immediate Survey Questions: "What were the most useful topics of the training for you?" and "Are there any topics from today's training that could be improved?" Multiple responses allowed.

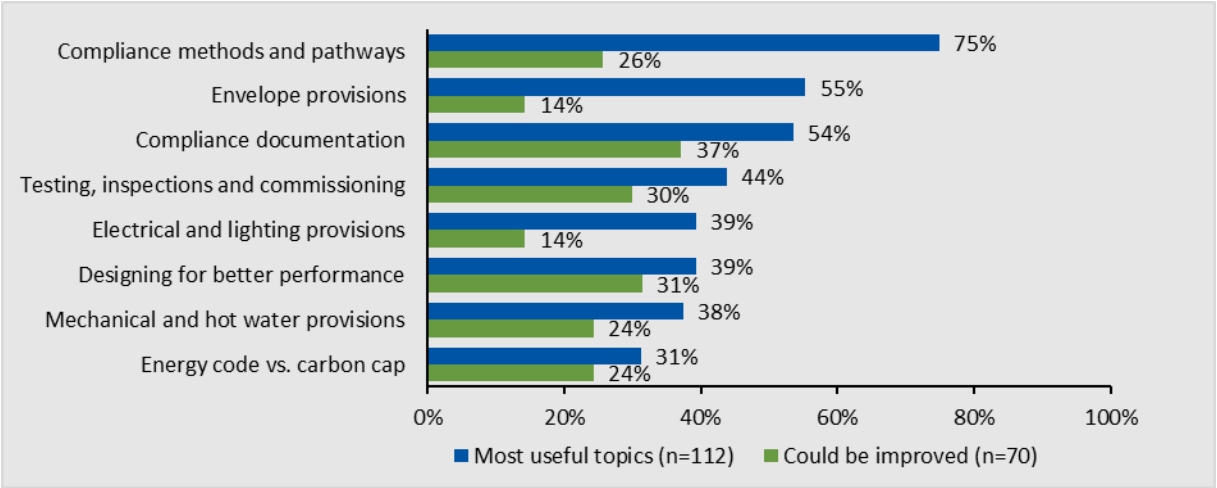


2.14. Crushing the NYC Energy Code: Commercial (UGC)

Figure 29 shows the topics respondents who took the "Crushing the NYC Energy Code: Commercial" training found most useful and those they suggested could be improved. The topic respondents found most useful was compliance methods and pathways (75%). When asked which topic could be improved, 37% of respondents said compliance documentation.

Figure 29. Feedback on Topics Covered (Crushing the NYC Energy Code: Commercial)

Source: Immediate Survey Questions: "What were the most useful topics of the training for you?" and "Are there any topics from today's training that could be improved?" Multiple responses allowed.

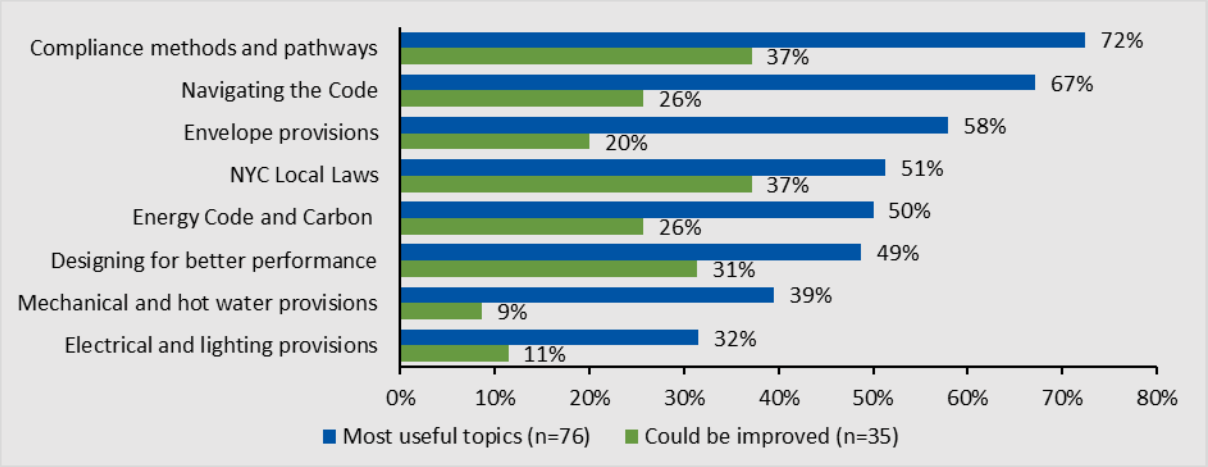


2.15. Crushing the NYC Energy Code: Residential (UGC)

Figure 30 shows the topics respondents who took the "Crushing the NYC Energy Code: Residential" training found most useful and those they suggested could be improved. The topic respondents found most useful was compliance methods and pathways (72%). The topic that respondents most commonly said could be improved are also compliance methods and pathways and NYC Local Laws (37%).

Figure 30. Feedback on Topics Covered (Crushing the NYC Energy Code: Residential)

Source: Immediate Survey Questions: "What were the most useful topics of the training for you?" and "Are there any topics from today's training that could be improved?" Multiple responses allowed.

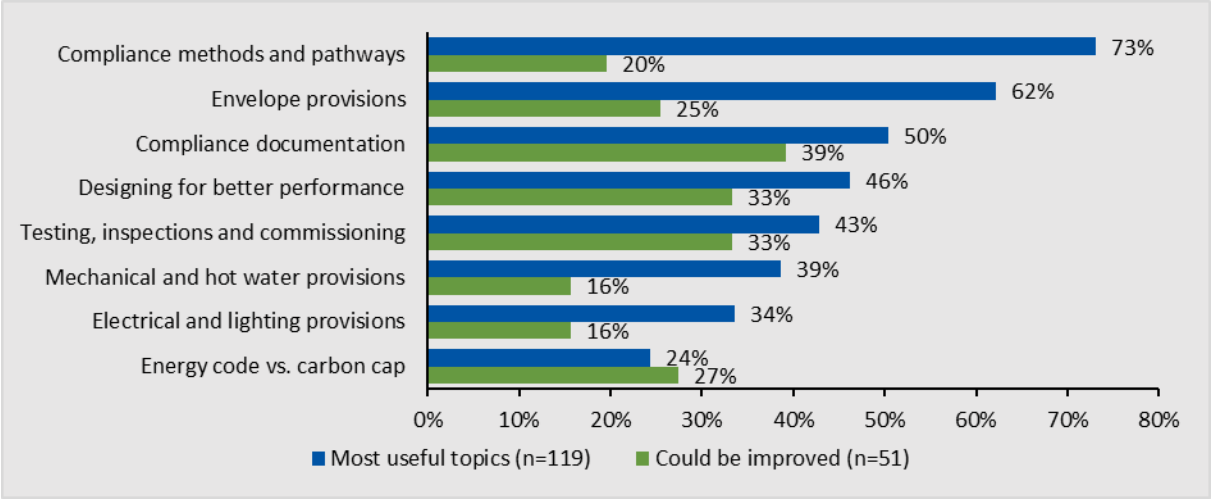


2.16. Crushing the NYS Energy Code: Commercial (UGC)

Figure 31 shows the topics respondents who took the "Crushing the NYS Energy Code: Commercial" training found most useful and those they suggested could be improved. Respondents said the most useful topic was compliance methods and pathways (73%). When asked which topics could be improved, respondents said designing for better performance (39%).

Figure 31. Feedback on Topics Covered (Crushing the NYS Energy Code: Commercial)

Source: Immediate Survey Questions: "What were the most useful topics of the training for you?" and "Are there any topics from today's training that could be improved?" Multiple responses allowed.

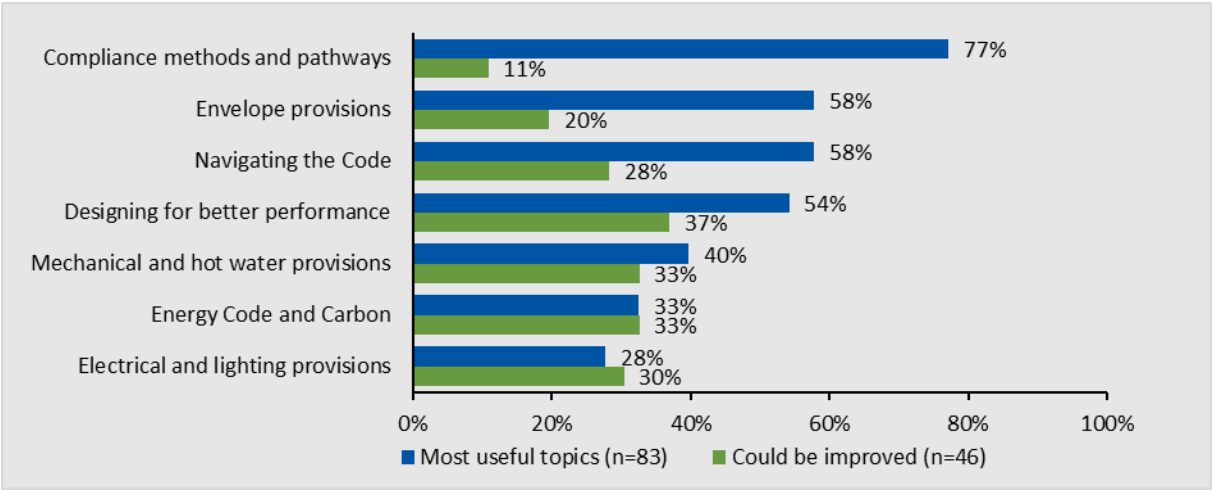


2.17. Crushing the NYS Energy Code: Residential (UGC)

Figure 32 shows the topics respondents who took the "Crushing the NYS Energy Code: Residential" training found most useful and those they suggested could be improved. Respondents said the most useful topic is compliance methods and pathways (77%). When asked which topics could be improved, respondents said designing for better performance (37%).

Figure 32. Feedback on Topics Covered (Crushing the NYS Energy Code: Residential)

Source: Immediate Survey Questions: "What were the most useful topics of the training for you?" and "Are there any topics from today's training that could be improved?" Multiple responses allowed.

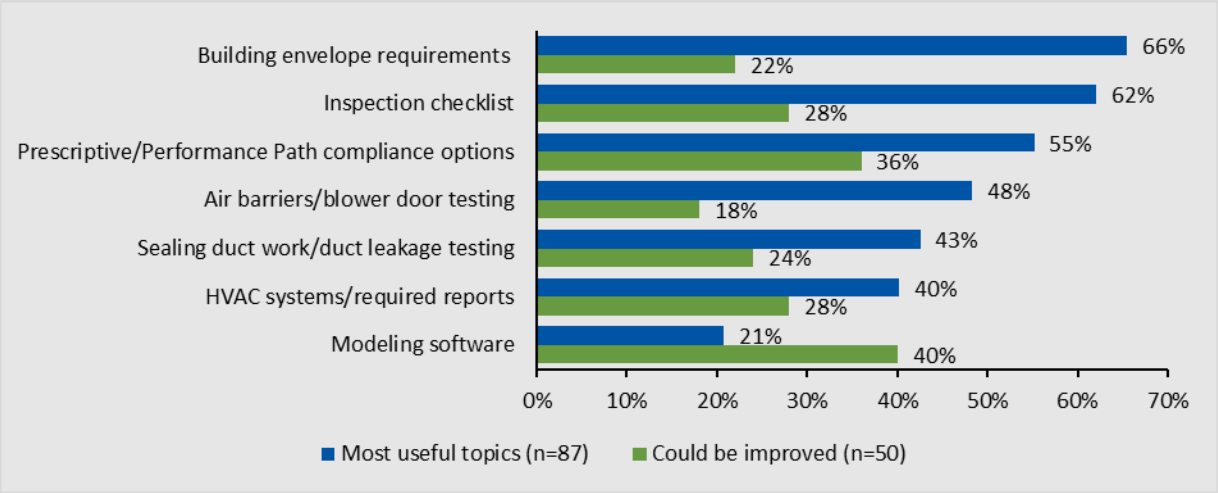


2.18. 2020 ECCCNYS for Residential Buildings: Overview (Newport Ventures)

Figure 33 shows the topics respondents who took the "2020 ECCCNYS for Residential Buildings: Overview" training found most useful and those they suggested could be improved. Respondents said the most useful topic was the building envelope requirements (66%). When asked which topics could be improved, respondents identified modeling software (40%).

Figure 33. Feedback on Topics Covered (2020 ECCCNYS for Residential Buildings: Overview)

Source: Immediate Survey Questions: "What were the most useful topics of the training for you?" and "Are there any topics from today's training that could be improved?" Multiple responses allowed.

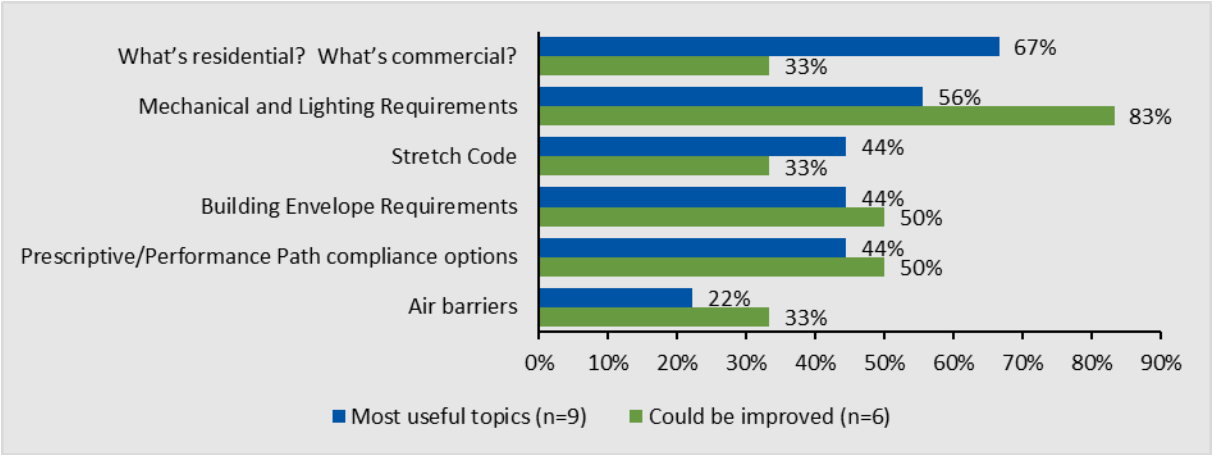


2.19. 2020 ECCCNYS and NYStretch Energy Code for Commercial Buildings (Newport Ventures)

Figure 34 shows the topics respondents who took the "2020 ECCCNYS and NYStretch Energy Code for Commercial Buildings" training found most useful and those they suggested could be improved. Respondents said the most useful topic was "What's residential? What's Commercial" (67%). When asked which topics could be improved, respondents identified mechanical and lighting requirements (83%).

Figure 34. Feedback on Topics Covered (2020 ECCCNYS for Residential Buildings: Overview)

Source: Immediate Survey Questions: "What were the most useful topics of the training for you?" and "Are there any topics from today's training that could be improved?" Multiple responses allowed.

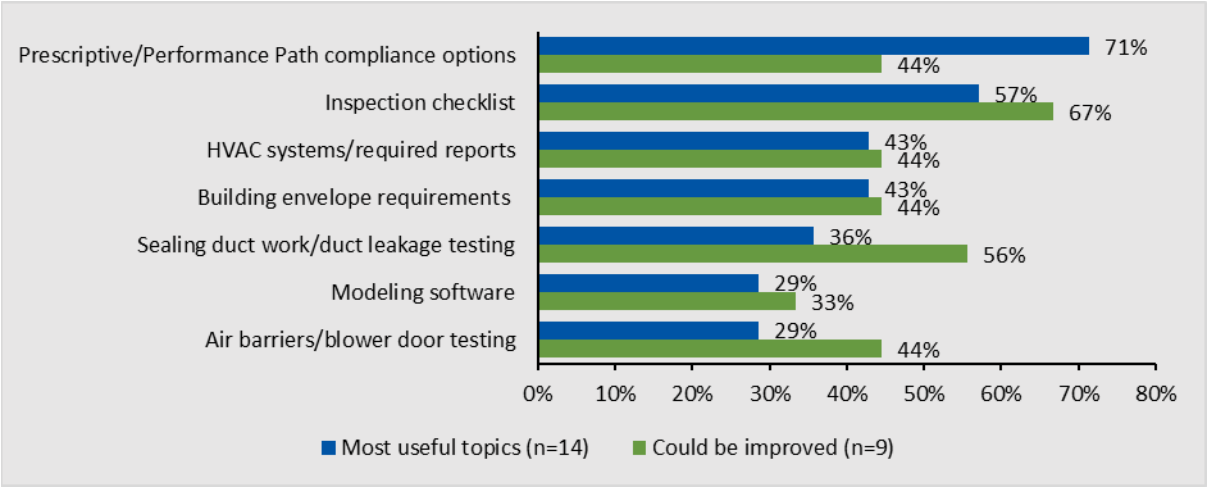


2.20. 2020 ECCCNYS for Commercial Buildings: Overview (Newport Ventures)

Figure 35 shows the topics respondents who took the "2020 ECCCNYS for Commercial Buildings: Overview" training found most useful and those they suggested could be improved. Respondents said the most useful topic was prescriptive/performance path compliance options (71%). When asked which topics could be improved, respondents identified inspection checklist (67%).

Figure 35. Feedback on Topics Covered (2020 ECCCNYS for Commercial Buildings: Overview)

Source: Immediate Survey Questions: "What were the most useful topics of the training for you?" and "Are there any topics from today's training that could be improved?" Multiple responses allowed.

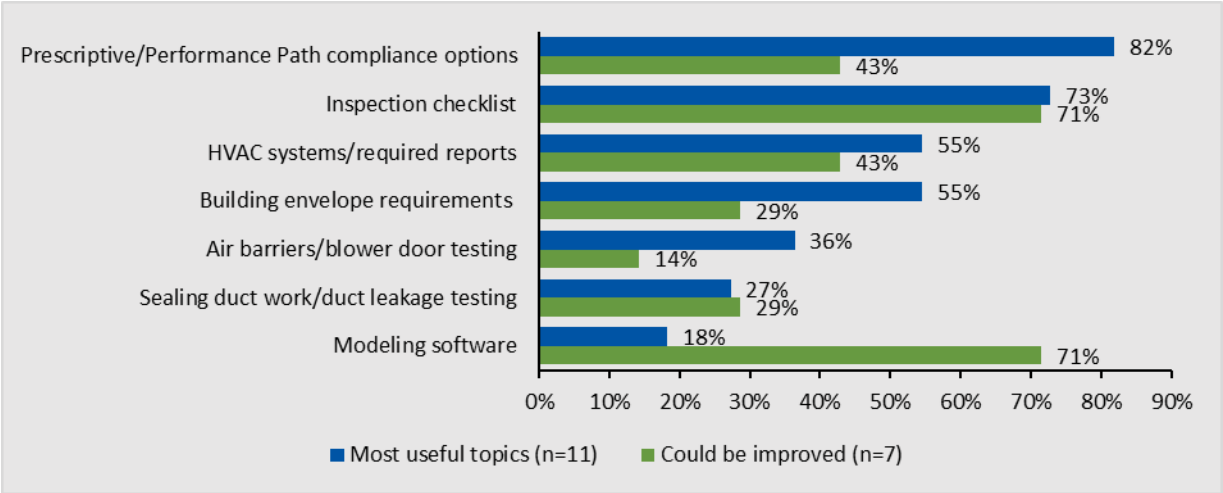


2.21. Clean Energy Communities Energy Code Enforcement (Newport Ventures)

Figure 36 shows the topics respondents who took the "Clean Energy Communities Energy Code Enforcement" training found most useful and those they suggested could be improved. Respondents said the most useful topic was prescriptive/performance path compliance options (82%). When asked which topics could be improved, respondents identified modeling software (71%).

Figure 36. Feedback on Topics Covered (2020 ECCCNYS for Residential Buildings: Overview)

Source: Immediate Survey Questions: "What were the most useful topics of the training for you?" and "Are there any topics from today's training that could be improved?" Multiple responses allowed.

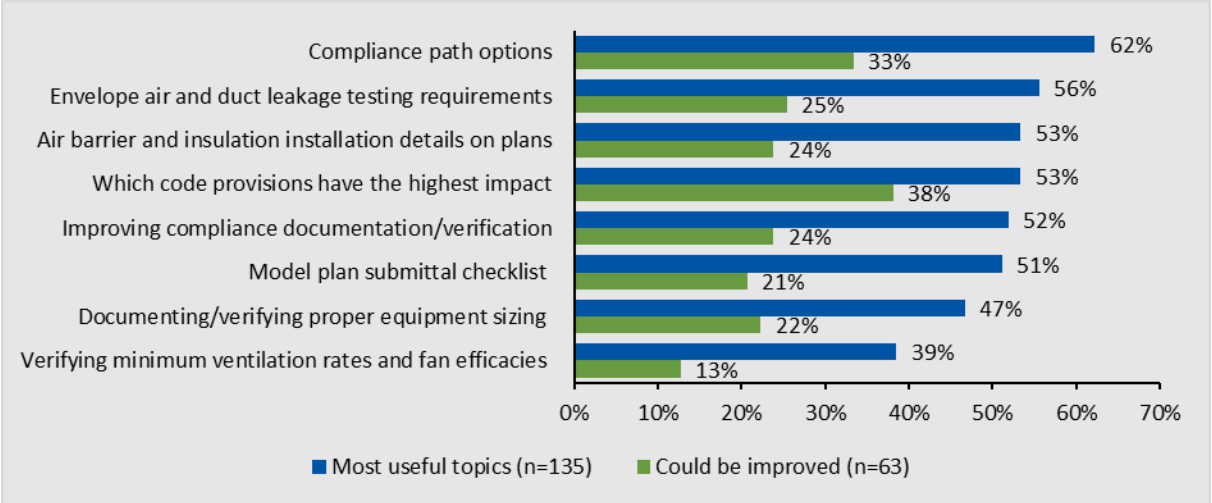


2.22. R1.1 Energy Code Plan Reviews (PSD)

Figure 37 shows the topics respondents who took the "Energy Code Plan Reviews" training found most useful and those they suggested could be improved. Respondents said the most useful topic was the information on compliance path options (62%). More than a third (38% and 33% respectively) of respondents suggested improving topics on which code provisions have the highest impact and compliance path options.

Figure 37. Feedback on Topics Covered (R1.1 Energy Code Plan Reviews)

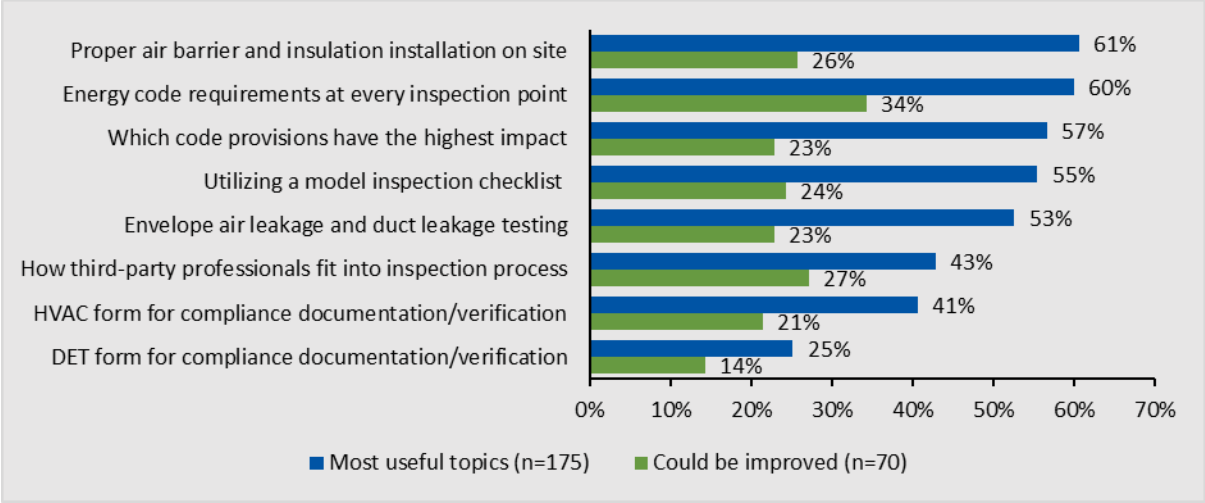
Source: Immediate Survey Questions: "What were the most useful topics of the training for you?" and "Are there any topics from today's training that could be improved?" Multiple responses allowed.



2.23. R1.2 Energy Code Inspections in 15 Minutes or Less (PSD)

Figure 38 shows the topics respondents who took the "Energy Code Inspections in 15 Minutes or Less" training found most useful and those they suggested could be improved. The most useful topics were proper air barrier and insulation installation on site (61%) and energy code requirements at every inspection point (60%). When asked which topics could be improved, 34% of respondents identified the energy code requirements at every inspection point topic.

Figure 38. Feedback on Topics Covered (R1.2 Energy Code Inspections in 15 Minutes or Less)

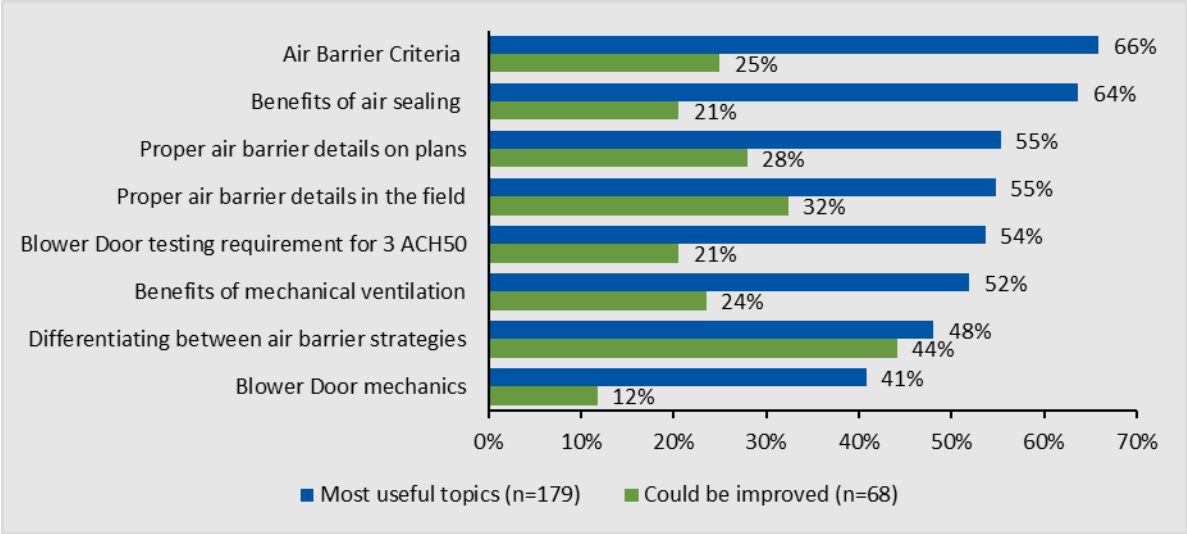


2.24. R2.1 Air Sealing to 3 ACH50 (PSD)

Figure 39 shows the topics respondents who took the "Air Sealing to 3 ACH50" training found most useful and those they suggested could be improved. The most useful topics were air barrier criteria (66%), and benefits of air sealing (6%4 each). The topic that could be improved most was differentiating between air barrier strategies (44%).

Figure 39. Feedback on Topics Covered (R2.1 Air Sealing to 3 ACH50)

Source: Immediate Survey Questions: "What were the most useful topics of the training for you?" and "Are there any topics from today's training that could be improved?" Multiple responses allowed.

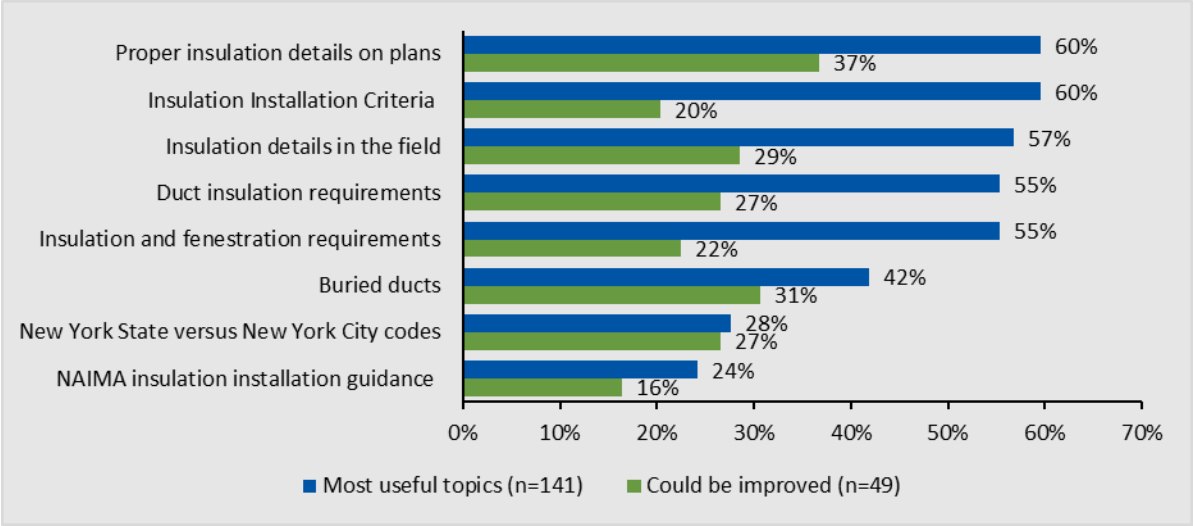


2.25. R2.2 Other IECC Envelope Requirements (PSD)

Figure 40 shows the topics respondents who took the "Other IECC Envelope Requirements" training found most useful and those they suggested could be improved. The most useful topics were insulation details in the field and insulation installation criteria (both 60%). When considering what could be improved, respondents most commonly identified proper insulation details on plans (37%).

Figure 40. Feedback on Topics Covered (R2.2 Other IECC Envelope Requirements)

Source: Immediate Survey Questions: "What were the most useful topics of the training for you?" and "Are there any topics from today's training that could be improved?" Multiple responses allowed.

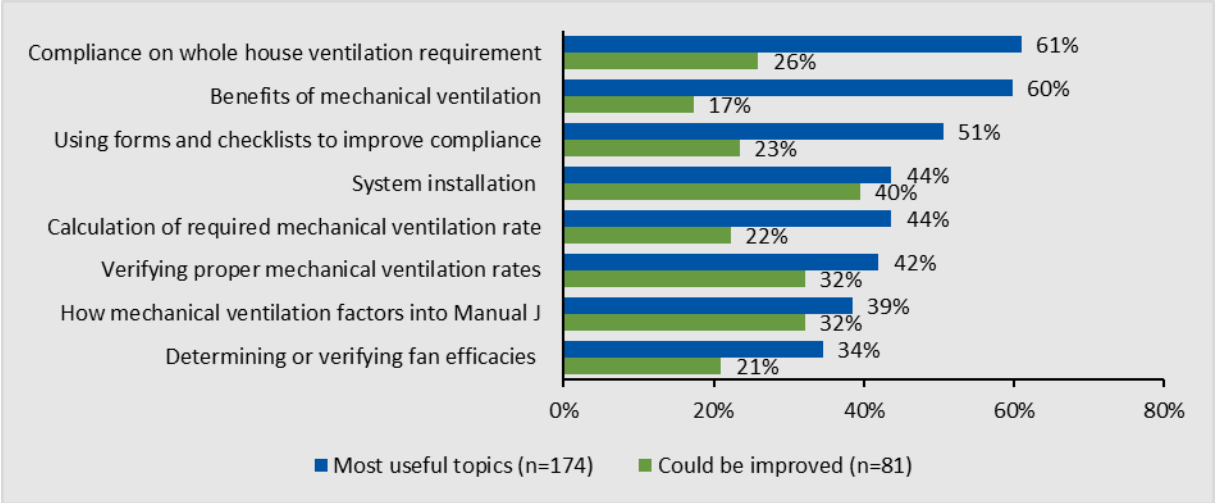


2.26. R3.1 Whole-house Mechanical Ventilation (PSD)

Figure 41 shows the topics respondents who took the "Whole-house Mechanical Ventilation" training found most useful and those they suggested could be improved. The most useful topic was compliance on whole-house ventilation requirements (61%). When asked what topics could be improved, 40% of respondents identified system installation.

Figure 41. Feedback on Topics Covered (R3.1 Whole-house Mechanical Ventilation)

Source: Immediate Survey Questions: "What were the most useful topics of the training for you?" and "Are there any topics from today's training that could be improved?" Multiple responses allowed.

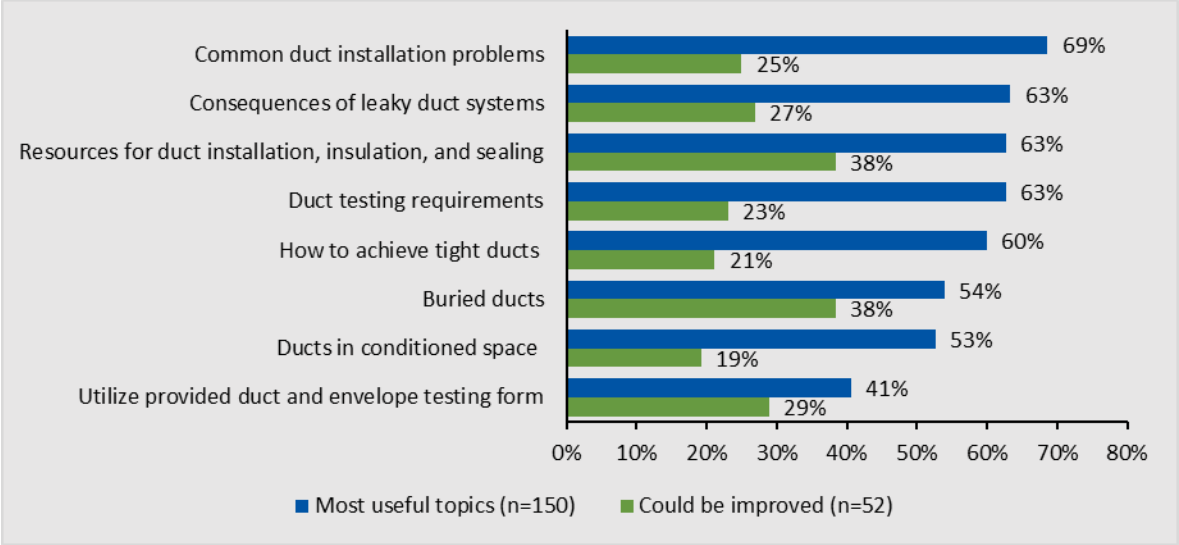


2.27. R3.2 Efficient Forced Air Distribution (PSD)

Figure 42 shows the topics respondents who took the "Efficient Forced Air Distribution" training found most useful and those they suggested could be improved. The most useful topic was common duct installation problems (69%). When asked which topis could be improved, respondents most commonly identified buried ducts and resources for duct installation, insulation, and sealing (both 38%).

Figure 42. Feedback on Topics Covered (R3.2 Efficient Forced Air Distribution)

Source: Immediate Survey Questions: "What were the most useful topics of the training for you?" and "Are there any topics from today's training that could be improved?" Multiple responses allowed.

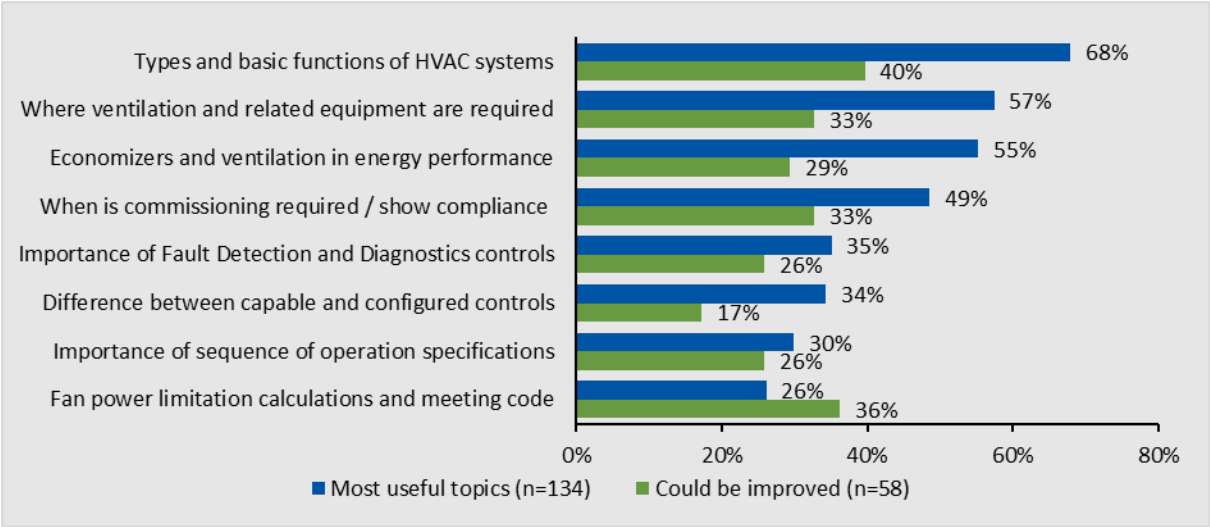


2.28. C1.1 Mechanical Systems for Large Commercial Buildings (PSD)

Figure 43 shows the topics respondents who took the "Mechanical Systems for Large Commercial Buildings" training found most useful and those they suggested could be improved. The most useful topic was the information on types and basic functions of HVAC systems (68%). Respondents found the same topic (40%) to need the most improvement.

Figure 43. Feedback on Topics Covered (C1.1 Mechanical Systems for Large Commercial Buildings)

Source: Immediate Survey Questions: "What were the most useful topics of the training for you?" and "Are there any topics from today's training that could be improved?" Multiple responses allowed.

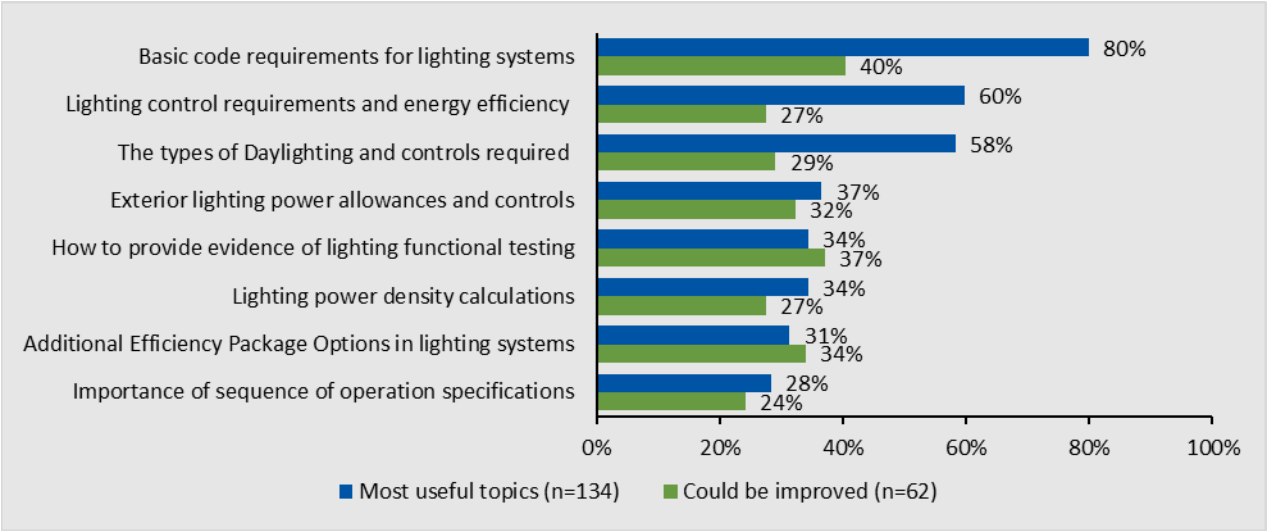


2.29. C1.2 Lighting Systems for Large Commercial Buildings (PSD)

Figure 44 shows the topics respondents who took the "Lighting Systems for Large Commercial Buildings" training found most useful and those they suggested could be improved. The most useful topic was information on basic code requirements for lighting systems (80%). Respondents suggested that the same topic could use improvement (40%).

Figure 44. Feedback on Topics Covered (C1.2 Lighting Systems for Large Commercial Buildings)

Source: Immediate Survey Questions: "What were the most useful topics of the training for you?" and "Are there any topics from today's training that could be improved?" Multiple responses allowed.

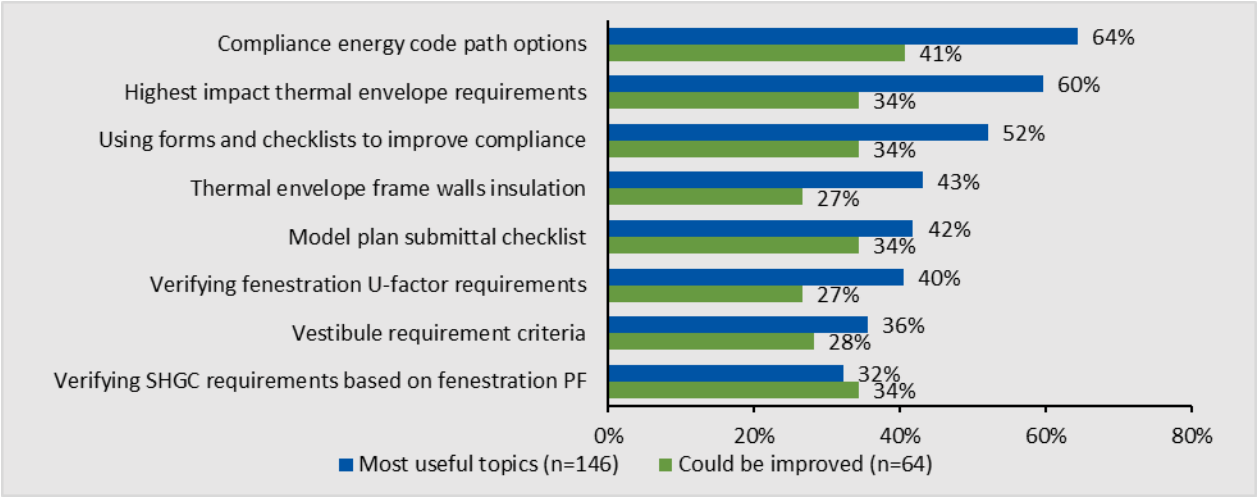


2.30. C2.1 Prioritizing ECCCNYS Enforcement for Commercial Buildings (Pt 1) (PSD)

Figure 45 shows the topics respondents who took the "Prioritizing ECCCNYS Enforcement for Commercial Buildings (Pt 1)" training found most useful and those they suggested could be improved. The most useful topic was compliance energy code path options (64%). Respondents also suggested that the same topic could use the most improvement (41%).

Figure 45. Feedback on Topics Covered (C2.1 Prioritizing ECCCNYS Enforcement for Commercial Buildings)

Source: Immediate Survey Questions: "What were the most useful topics of the training for you?" and "Are there any topics from today's training that could be improved?" Multiple responses allowed.

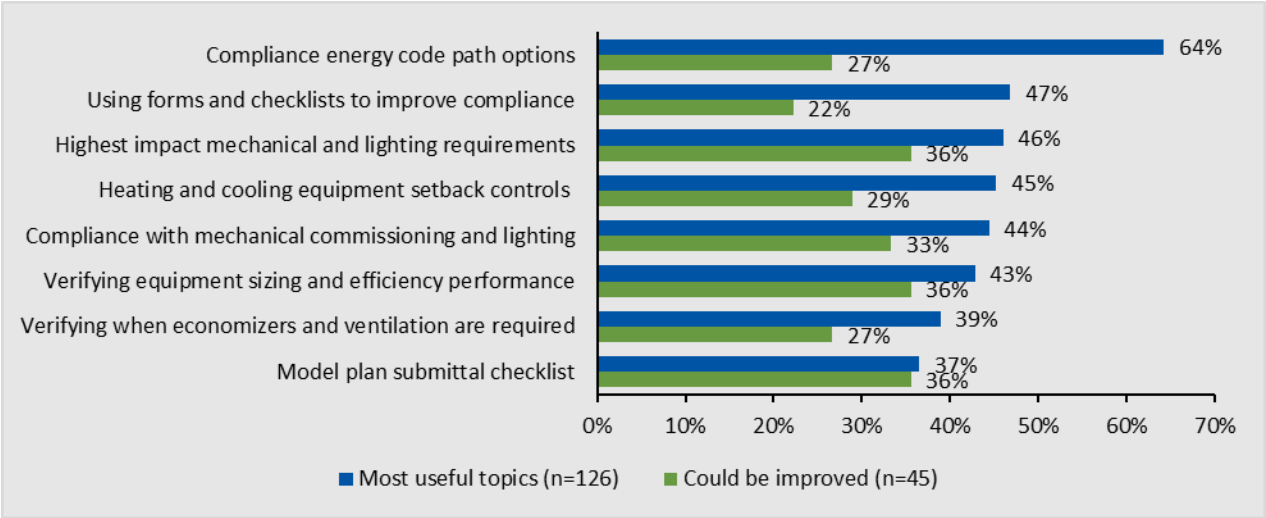


2.31. C2.2 Prioritizing ECCCNYS Enforcement for Commercial Buildings (Pt 2) (PSD)

Figure 46 shows the topics respondents who took the "Prioritizing ECCCNYS Enforcement for Commercial Buildings (Pt 2)" training found most useful and those they suggested could be improved. The most useful topic was compliance energy code path options (64%). Respondents suggested the highest impact mechanical and lighting requirements, verifying equipment sizing and efficiency performance, and model plan submittal checklist topics could use improvement (36%).

Figure 46. Feedback on Topics Covered (C2.2 Prioritizing ECCCNYS Enforcement for Commercial Buildings)

Source: Immediate Survey Questions: "What were the most useful topics of the training for you?" and "Are there any topics from today's training that could be improved?" Multiple responses allowed.

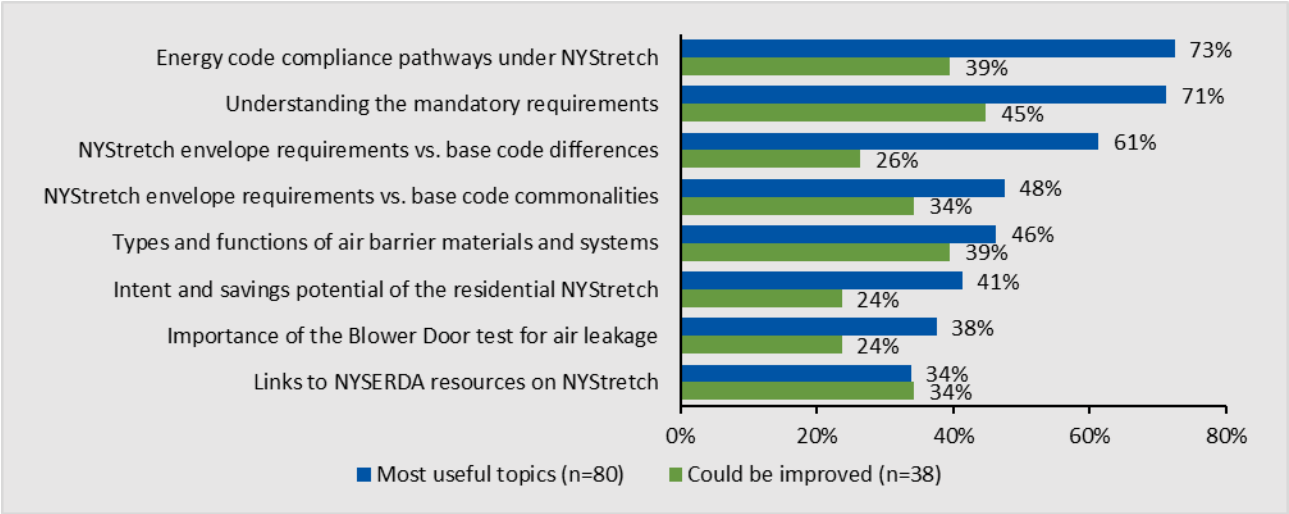


2.32. S2.1 NYStretch Overview and Thermal Envelope Requirements Part 1 (PSD)

Figure 47 shows the topics respondents who took the "NYStretch Overview and Thermal Envelope Requirements Part 1" training found most useful and those they suggested could be improved. The most useful topic was understanding energy code pathways under NYStretch (73%). Respondents suggested the understanding the mandatory requirements topic could use improvement (45%).

Figure 47. Feedback on Topics Covered (S2.1 NYStretch Overview and Thermal Envelope Requirements)

Source: Immediate Survey Questions: "What were the most useful topics of the training for you?" and "Are there any topics from today's training that could be improved?" Multiple responses allowed.

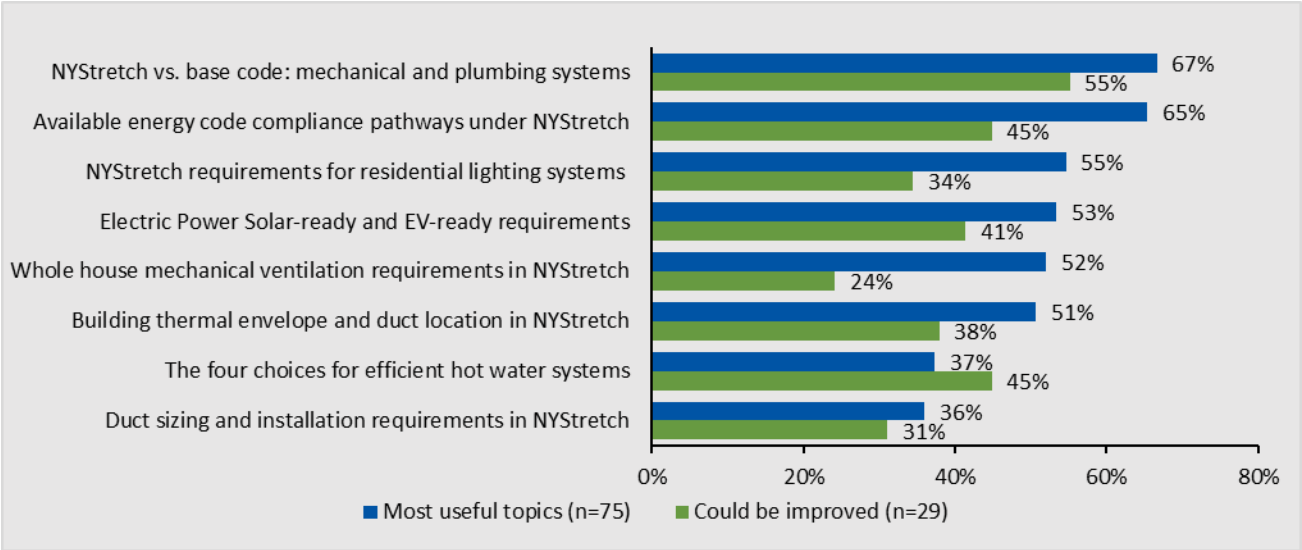


2.33. S2.2 NYStretch Mechanical, Plumbing, Lighting, and Electric Power Part 2 (PSD)

Figure 48 shows the topics respondents who took the "NYStretch Mechanical, Plumbing, Lighting, and Electric Power Part 2" training found most useful and those they suggested could be improved. The most useful topic was comparing the mechanical and pluming systems information from NYStretch and the base code (67%). Respondents also suggested that the same topic could use the most improvements (55%).

Figure 48. Feedback on Topics Covered (S2.2 NYStretch Mechanical, Plumbing, Lighting, and Electric Power)

Source: Immediate Survey Questions: "What were the most useful topics of the training for you?" and "Are there any topics from today's training that could be improved?" Multiple responses allowed.

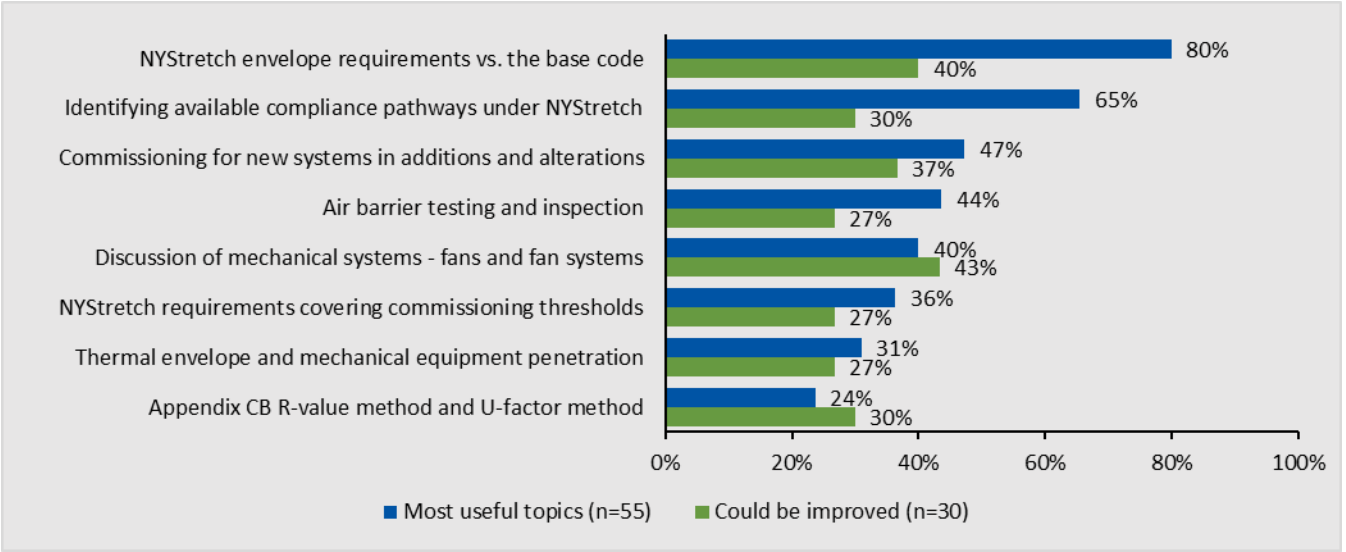


2.34. S3.1 NYStretch Energy Code for Commercial Buildings Part 1: Building Thermal Envelope, Mechanical Systems, Commissioning, and Additions and Alterations (PSD)

Figure 49 shows the topics respondents who took the "NYStretch Energy Code for Commercial Buildings Part 1: Building Thermal Envelope, Mechanical Systems, Commissioning, and Additions and Alterations" training found most useful and those they suggested could be improved. The most useful topic was comparing NYStretch envelopment requirements to the base code (80%). Respondents suggested that the discussion of mechanical systems (specifically fans and fan systems) could use the most improvement (43%).

Figure 49. Feedback on Topics Covered (S3.1 NYStretch Energy Code for Commercial Buildings Part 1)

Source: Immediate Survey Questions: "What were the most useful topics of the training for you?" and "Are there any topics from today's training that could be improved?" Multiple responses allowed.

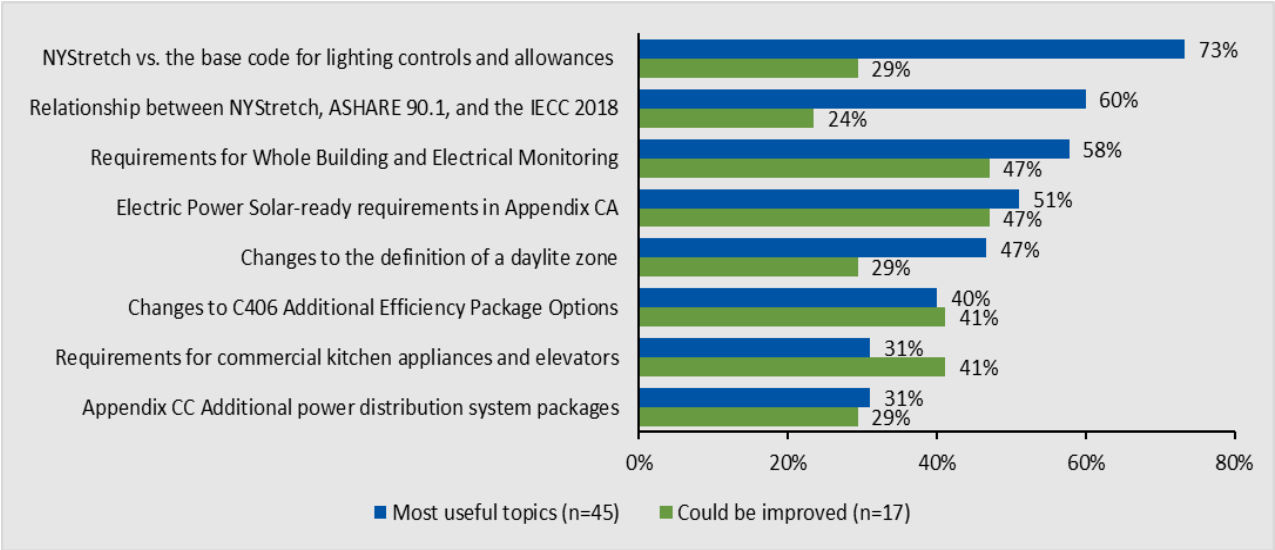


2.35. S3.2 NYStretch Energy Code for Commercial Buildings Part 2: Electric Power and Lighting, Total Building Performance, Additional Efficiency Package Options, and Appendices (PSD)

Figure 50 shows the topics respondents who took the "NYStretch Energy Code for Commercial Buildings Part 2: Electric Power and Lighting, Total Building Performance, Additional Efficiency Package Options, and Appendices" training found most useful and those they suggested could be improved. The most useful topic was comparing NYStretch and the base code for lighting controls and allowances (73%). Respondents suggested that requirements for whole-building and electrical monitoring, and electric power solar-ready requirements in Appendix CA could use the most improvements (47%).

Figure 50. Feedback on Topics Covered (S3.2 NYStretch Energy Code for Commercial Buildings Part 2)

Source: Immediate Survey Questions: "What were the most useful topics of the training for you?" and "Are there any topics from today's training that could be improved?" Multiple responses allowed.

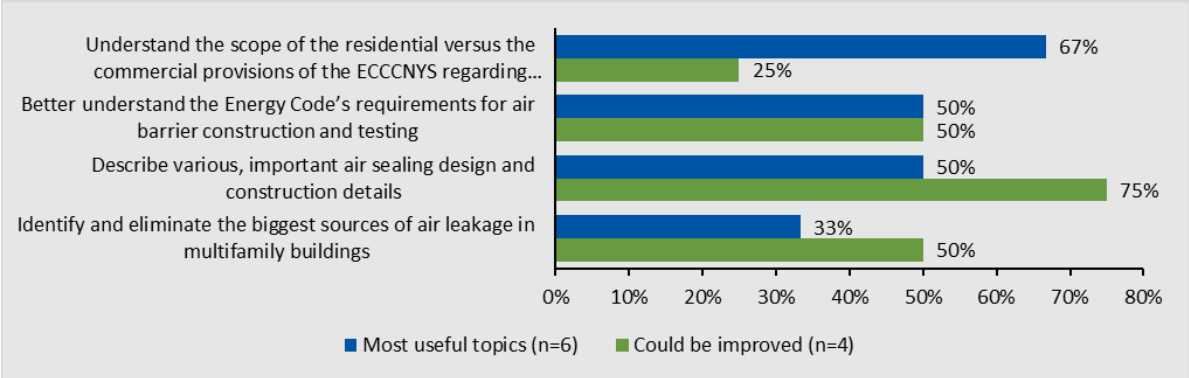


2.36. M1.1 Multifamily Air Sealing (PSD)

Figure 51 shows the topics respondents who took the "Multifamily Air Sealing" training found most useful and those they suggested could be improved. The most useful topic was understanding the scope of the residential versus the commercial provisions of the ECCCNYS regarding multifamily buildings (67%). Respondents suggested that describing various, important air sealing design and construction details could use the most improvements (75%).

Figure 51. Feedback on Topics Covered (M1.1 Multifamily Air Sealing)

Source: Immediate Survey Questions: "What were the most useful topics of the training for you?" and "Are there any topics from today's training that could be improved?" Multiple responses allowed.

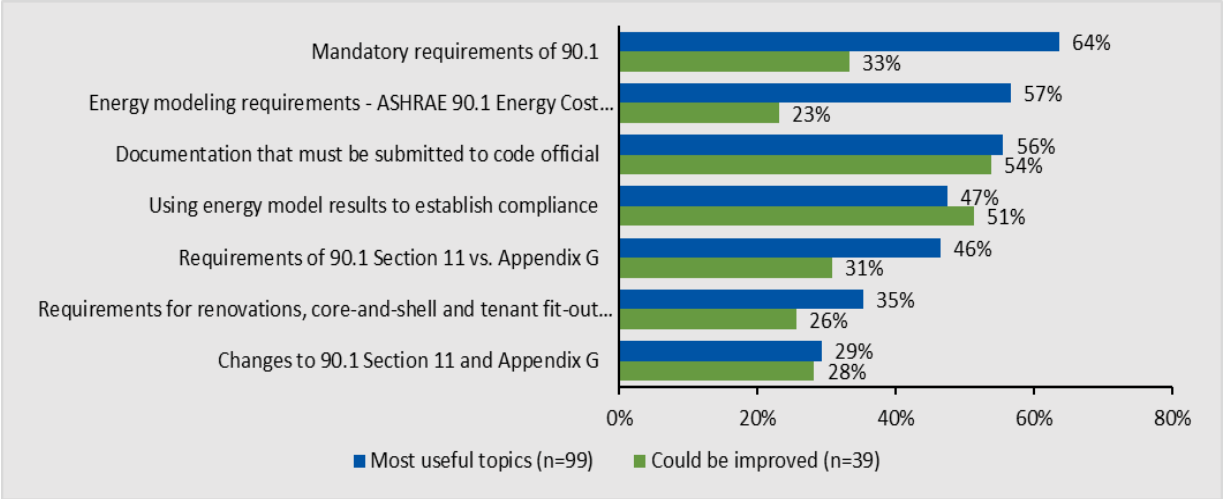


2.37. 110: Performance-Based Compliance with ASHRAE Standard 90.1 2016 (Karpman)

Figure 52 shows the topics respondents who took the "110: Performance-Based Compliance with ASHRAE Standard 90.1 2016" training found most useful and those they suggested could be improved. The most useful topic was mandatory requirements of 90.1 (64%). Respondents suggested that the training covering documentation that must be submitted to code officialcs could use the most improvements (54%).

Figure 52. Feedback on Topics Covered (110: Performance-Based Compliance with ASHRAE Standard 90.1 2016)

Source: Immediate Survey Questions: "What were the most useful topics of the training for you?" and "Are there any topics from today's training that could be improved?" Multiple responses allowed.

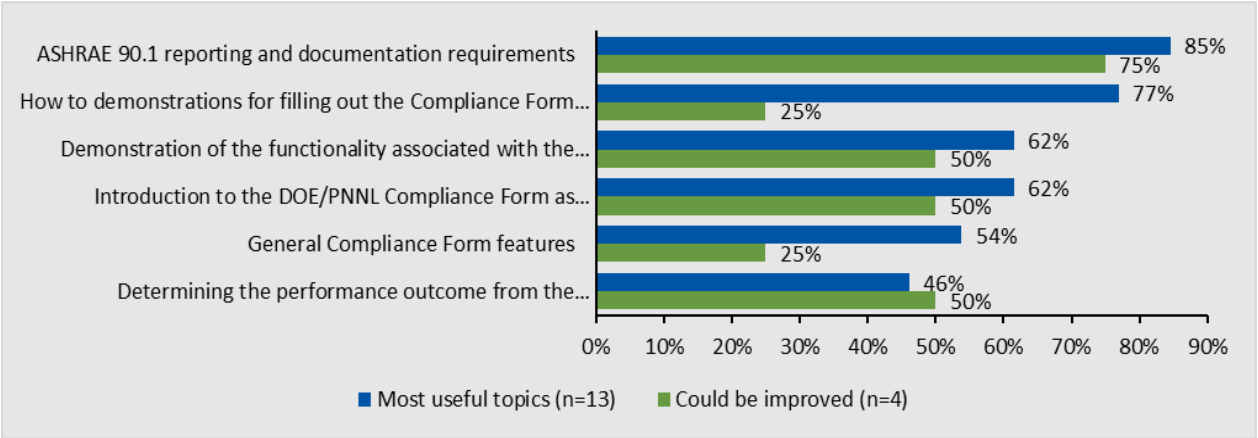


2.38. 210: Compliance Documentation for ASHRAE 90.1 Section 11 and Appendix G (Karpman)

Figure 53 shows the topics respondents who took the "210: Compliance Documentation for ASHRAE 90.1 Section 11 and Appendix G" training found most useful and those they suggested could be improved. The most useful topic was ASHRAE 90.1 reporting and documentation requirements (85%). Respondents suggested that the same topic could use the most improvements (75%).

Figure 53. Feedback on Topics Covered (210: Compliance Documentation for ASHRAE 90.1 Section 11 and Appendix G)

Source: Immediate Survey Questions: "What were the most useful topics of the training for you?" and "Are there any topics from today's training that could be improved?" Multiple responses allowed.

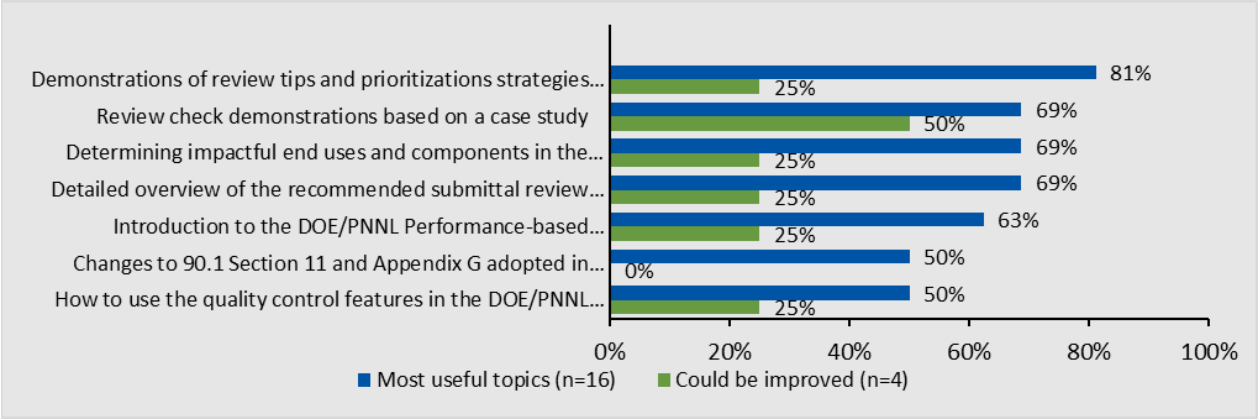


2.39. 212: Review of the Modeling-based Submittals for ASHRAE 90.1 Section 11 and Appendix G (Karpman)

Figure 54 shows the topics respondents who took the "212: Review of the Modeling-based Submittals for ASHRAE 90.1 Section 11 and Appendix G" training found most useful and those they suggested could be improved. The most useful topic was demonstrations of review tips and prioritizations strategies from the Review Manual (81%). Respondents suggested that the course to review check demonstrations based on a case study could use the most improvements (50%).

Figure 54. Feedback on Topics Covered (212: Review of the Modeling-based Submittals for ASHRAE 90.1 Section 11 and Appendix G)

Source: Immediate Survey Questions: "What were the most useful topics of the training for you?" and "Are there any topics from today's training that could be improved?" Multiple responses allowed.

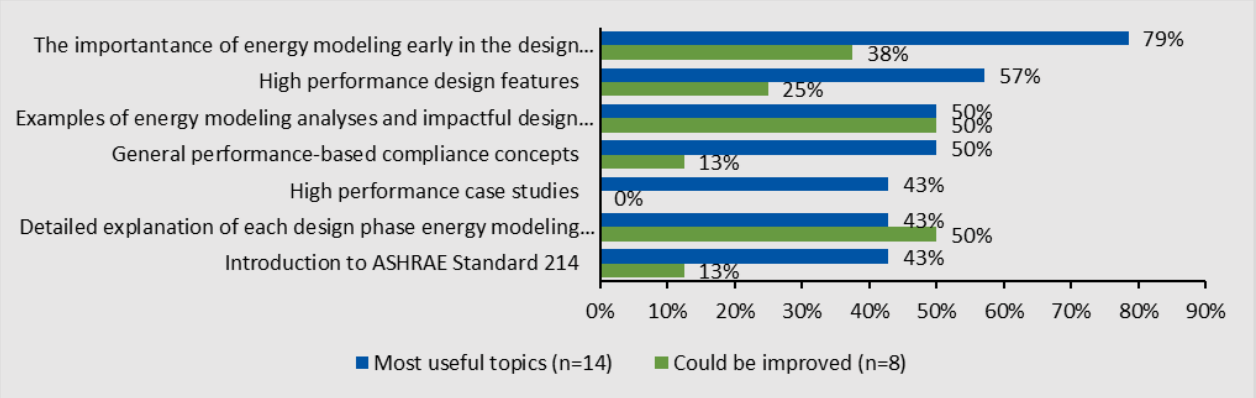


2.40. 213: Integrating Performance-based Compliance into the Design Process (Karpman)

Figure 55 shows the topics respondents who took the "213: Integrating Performance-based Compliance into the Design Process" training found most useful and those they suggested could be improved. The most useful topic was the importance of energy modeling early in the design process for performance-based compliance (79%). Respondents suggested that the examples of energy modeling analyses and impactful design features with code compliance alerts identifying design features that could impact code compliance, and detailed explanation of each design phase energy modeling cycle per ASHRAE Standard 214 topics could use the most improvements (50%).

Figure 55. Feedback on Topics Covered (213: Integrating Performance-based Compliance into the Design Process)

Source: Immediate Survey Questions: "What were the most useful topics of the training for you?" and "Are there any topics from today's training that could be improved?" Multiple responses allowed.



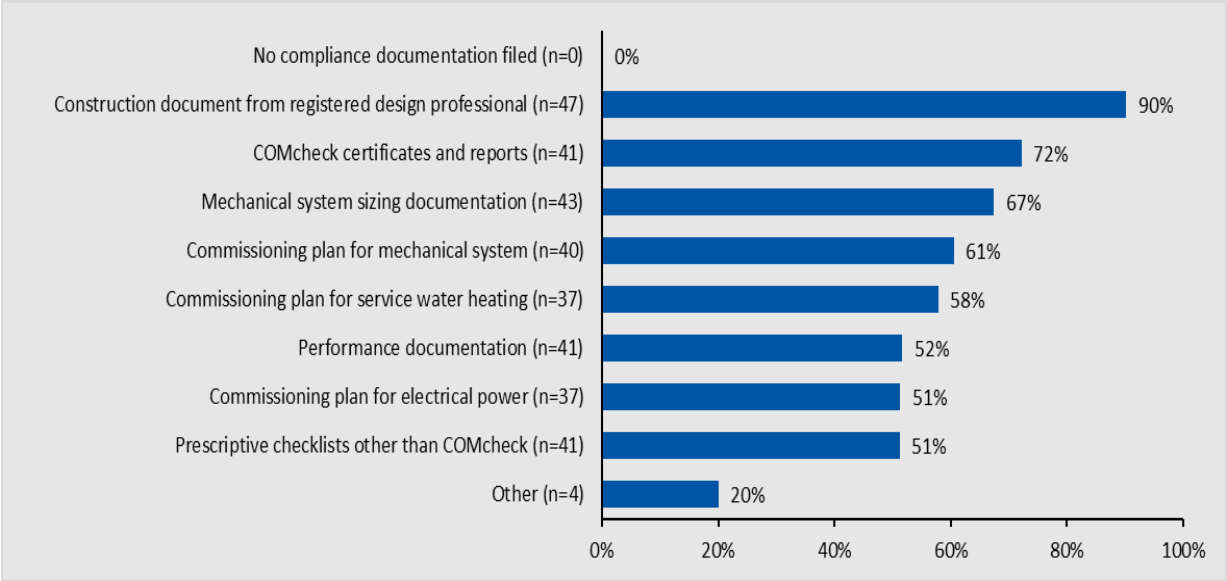
2.41. Documentation Filed with Building Departments (Follow-Up Survey)

In order to investigate the types of information filed at building departments, code officials were asked about a range of documents associated with commercial and residential new construction and renovation work. For each project type, code officials were asked about a series of document types that might be included for a project and asked to estimate the percentage of projects that included that type of compliance documentation.

As shown in Figure 56, for commercial new construction projects, no code official reported projects for which no compliance documents were filed. The documents respondents indicated were most consistently filed included construction documents prepared by a registered design professional (90% of projects) and COMcheck documents (72% of projects).

Figure 56. Documents Filed for Commercial New Construction Projects

Source: Follow-Up Survey Question: "Approximately what percentage of new construction projects submit the following:"

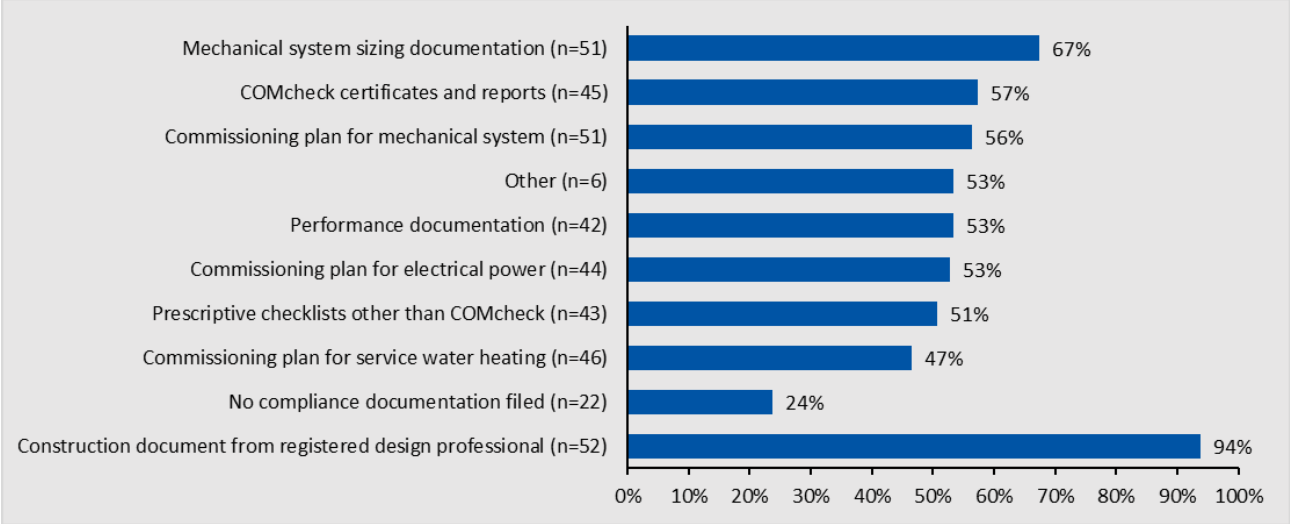


For commercial addition and alteration projects, code officials also reported that they consistently saw construction documents prepared by a registered design professional; however, 22 code officials noted that they on a few occasions they did not see any compliance documents filed.[8]

[8] This discrepancy between 94% seeing construction documents and 24% seeing no documentation is likely due to respondents not filling out percentages for all document types (the response "n" is provided for each document type for which code officials provided a response).

Figure 57. Documentation Filed for Commercial Addition or Alteration Projects

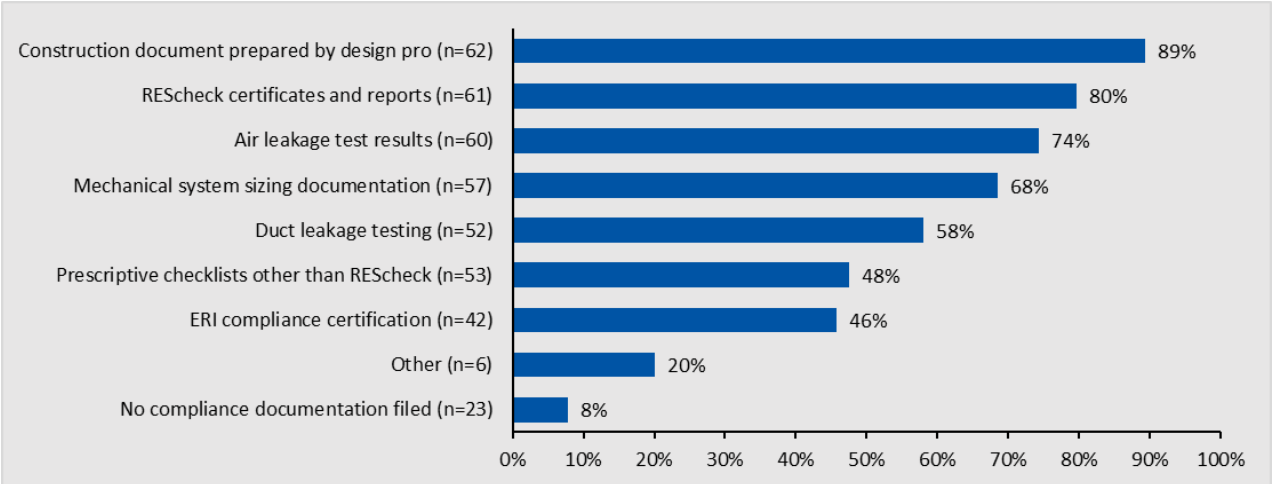
Source: Follow-Up Survey Question: "Thinking of documents relevant to the projects you have reviewed, approximately what percentage of projects submit the following:"



As with commercial new construction, code officials stated that the most commonly filed document for residential new construction projects were construction documents prepared by a registered design professional, with an average of 89% of projects providing this documentation. Overall, 23 respondents said that projects received, "No compliance documentation."

Figure 58. Documents Filed for Residential New Construction Projects

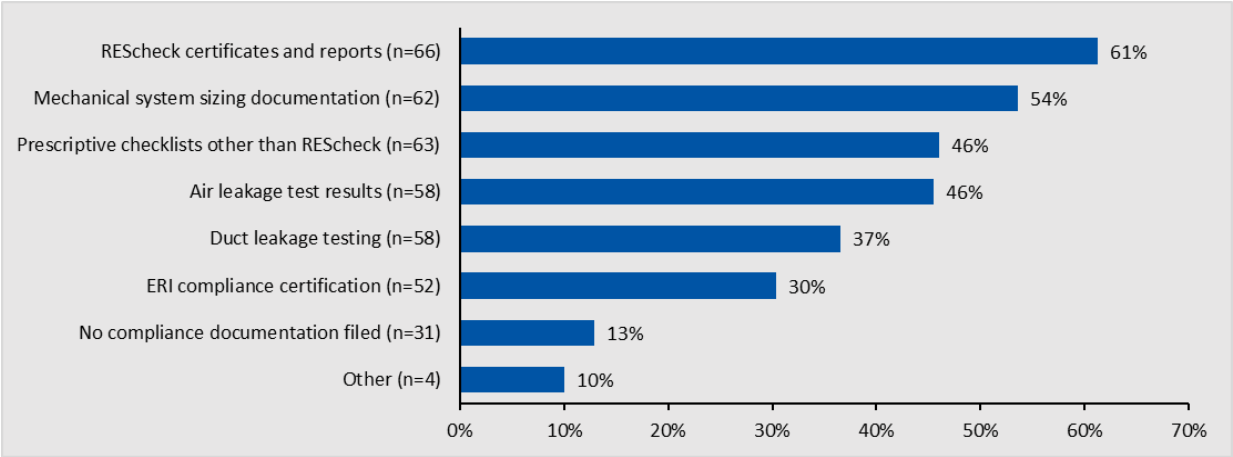
Source: Follow-Up Survey Question: "Approximately what percentage of new construction projects submit the following:"



As shown in Figure 59, REScheck certificates and reports are the most commonly filed document for residential alteration and addition projects (at 61% of projects). For these projects, code officials estimated that 13% of projects filed no compliance documentation at all.

Figure 59. Documentation Filed for Residential Addition or Alteration Projects

Source: Follow-Up Survey Question: "Thinking of documents relevant to the projects you have reviewed, approximately what percentage of projects submit the following:"



2.42. Courses

Table 28 lists the courses offered to date.

Table 28. Training Courses

Course Title	Implementer	Training Type	Date
2020 ECCCNYS for Residential Buildings: Overview	Newport Ventures	Webinar	3/31/2020
2020 ECCCNYS for Residential Buildings: Overview	Newport Ventures	Webinar	4/2/2020
2020 ECCCNYS for Residential Buildings: Overview	Newport Ventures	Webinar	4/7/2020
2020 ECCCNYS for Residential Buildings: Overview	Newport Ventures	Webinar	4/9/2020
2020 ECCCNYS for Residential Buildings: Overview	Newport Ventures	Webinar	4/14/2020
2020 ECCCNYS for Residential Buildings: Overview	Newport Ventures	Webinar	4/16/2020
2020 ECCCNYS for Residential Buildings: Overview	Newport Ventures	Webinar	4/21/2020
2020 ECCCNYS for Residential Buildings: Overview	Newport Ventures	Webinar	4/23/2020
2020 ECCCNYS for Residential Buildings: Overview	Newport Ventures	Webinar	4/28/2020

Course Title	Implementer	Training Type	Date
2020 ECCCNYS for Residential Buildings: Overview	Newport Ventures	Webinar	4/30/2020
2020 ECCCNYS for Residential Buildings: Overview	Newport Ventures	Webinar	5/5/2020
2020 ECCCNYS for Residential Buildings: Overview	Newport Ventures	Webinar	5/14/2020
2020 ECCCNYS for Residential Buildings: Overview	Newport Ventures	Webinar	6/10/2020
Other IECC Envelope Requirements	PSD Consulting	Webinar	6/16/2020
Other IECC Envelope Requirements	PSD Consulting	Webinar	6/22/2020
Other IECC Envelope Requirements	PSD Consulting	Webinar	6/23/2020
Other IECC Envelope Requirements	PSD Consulting	Webinar	6/30/2020
Whole-house Mechanical Ventilation	PSD Consulting	Webinar	8/19/2020
Other IECC Envelope Requirements	PSD Consulting	Webinar	8/20/2020
2020 ECCCNYS for Residential Buildings: Overview	Newport Ventures	Webinar	8/24/2020
2020 ECCCNYS for Residential Buildings: Overview	Newport Ventures	Webinar	8/26/2020
Whole-house Mechanical Ventilation	PSD Consulting	Webinar	9/2/2020
Other IECC Envelope Requirements	PSD Consulting	Webinar	9/3/2020
Whole-house Mechanical Ventilation	PSD Consulting	Webinar	9/16/2020
2020 ECCCNYS for Residential Buildings: Overview	Newport Ventures	Webinar	9/17/2020
Other IECC Envelope Requirements	PSD Consulting	Webinar	9/17/2020
Crushing the NYS Energy Code: Residential	Urban Green Council	Webinar	9/29/2020
2020 ECCCNYS for Residential Buildings: Overview	Newport Ventures	Webinar	9/30/2020
Other IECC Envelope Requirements	PSD Consulting	Webinar	10/1/2020
Crushing the NYS Energy Code: Residential	Urban Green Council	Webinar	10/7/2020
Other IECC Envelope Requirements	PSD Consulting	Webinar	10/14/2020
Other IECC Envelope Requirements	PSD Consulting	Webinar	10/15/2020

Course Title	Implementer	Training Type	Date
Whole-house Mechanical Ventilation	PSD Consulting	Webinar	10/16/2020
Crushing the NYS Energy Code: Residential	Urban Green Council	Webinar	10/27/2020
Whole-house Mechanical Ventilation	PSD Consulting	Webinar	10/28/2020
Whole-house Mechanical Ventilation	PSD Consulting	Webinar	10/29/2020
Crushing the NYC Energy Code: Residential	Urban Green Council	Webinar	11/6/2020
Crushing the NYS Energy Code: Residential	Urban Green Council	Webinar	11/12/2020
Other IECC Envelope Requirements	PSD Consulting	Webinar	11/12/2020
2020 ECCCNYS for Residential Buildings: Overview	Newport Ventures	Webinar	11/24/2020
Whole-house Mechanical Ventilation	PSD Consulting	Webinar	12/2/2020
Other IECC Envelope Requirements	PSD Consulting	Webinar	12/3/2020
Crushing the NYS Energy Code: Residential	Urban Green Council	Webinar	12/9/2020
Whole-house Mechanical Ventilation	PSD Consulting	Webinar	12/10/2020
Crushing the NYC Energy Code: Residential	Urban Green Council	Webinar	12/15/2020
Other IECC Envelope Requirements	PSD Consulting	Webinar	12/17/2020
Whole-house Mechanical Ventilation	PSD Consulting	Webinar	12/23/2020
A Process for Residential Energy Code Compliance and Enforcement/Energy Code Plan Reviews	PSD Consulting	Webinar	1/12/2021
A Process for Residential Energy Code Compliance and Enforcement / Part 2 Energy Code Inspections in 15 Minutes or Less	PSD Consulting	Webinar	1/12/2021
Other IECC Envelope Requirements	PSD Consulting	Webinar	1/13/2021
Whole-house Mechanical Ventilation	PSD Consulting	Webinar	1/14/2021
Other IECC Envelope Requirements	PSD Consulting	Webinar	1/27/2021
Crushing the NYS Energy Code (Residential)	Urban Green Council	Webinar	1/21/2021
Crushing the NYS Energy Code (Residential)	Urban Green Council	Webinar	1/28/2021
Whole-house Mechanical Ventilation	PSD Consulting	Webinar	1/28/2021

Course Title	Implementer	Training Type	Date
2020 ECCCNYS for Residential Buildings: Overview	Newport Ventures	Webinar	1/26/2021
Other IECC Envelope Requirements	PSD Consulting	Webinar	2/10/2021
Whole-house Mechanical Ventilation	PSD Consulting	Webinar	2/11/2021
Crushing the NYC Energy Code (Residential)	Urban Green Council	Webinar	2/19/2021
Crushing the NYC Energy Code (Residential)	Urban Green Council	Webinar	3/10/2021
Crushing the NYS Energy Code (Residential)	Urban Green Council	Webinar	3/18/2021 - 3/19/2021
A Process for Residential Energy Code Compliance and Enforcement/Energy Code Plan Reviews in 15 Minutes or Less	PSD Consulting	Webinar	3/23/2021
A Process for Residential Energy Code Compliance and Enforcement / Part 2 Energy Code Inspections in 15 Minutes or Less	PSD Consulting	Webinar	3/23/2021
Other IECC Envelope Requirements	PSD Consulting	Webinar	3/24/2021
Whole-house Mechanical Ventilation	PSD Consulting	Webinar	3/25/2021
Other IECC Envelope Requirements	PSD Consulting	Webinar	4/1/2021
Other IECC Envelope Requirements	PSD Consulting	Webinar	4/7/2021
Whole-house Mechanical Ventilation	PSD Consulting	Webinar	4/8/2021
Crushing the NYC Energy Code: Residential	Urban Green Council	Webinar	4/13-4/14/2021
A Process for Residential Energy Code Compliance and Enforcement / Part 2 Energy Code Inspections in 15 Minutes or Less	PSD Consulting	Webinar	4/20/2021
Other IECC Envelope Requirements	PSD Consulting	Webinar	4/21/2021
Whole-house Mechanical Ventilation	PSD Consulting	Webinar	4/22/2021
Crushing the NYC Energy Code (Residential)	Urban Green Council	Webinar	5/6/2021
A Process for Residential Energy Code Compliance and Enforcement / Part 2 Energy Code Inspections in 15 Minutes or Less	PSD Consulting	Webinar	5/4/2021
Other IECC Envelope Requirements	PSD Consulting	Webinar	5/5/2021
Whole-house Mechanical Ventilation	PSD Consulting	Webinar	5/6/2021
Crushing the Code New York State: Residential	Urban Green Council	Webinar	5/14/2021

Course Title	Implementer	Training Type	Date
A Process for Residential Energy Code Compliance and Enforcement / Part 2 Energy Code Inspections in 15 Minutes or Less	PSD Consulting	Webinar	5/18/2021
Other IECC Envelope Requirements	PSD Consulting	Webinar	5/19/2021
Whole-house Mechanical Ventilation	PSD Consulting	Webinar	5/20/2021
A Process for Residential Energy Code Compliance and Enforcement/Energy Code Plan Reviews in 15 Minutes or Less	PSD Consulting	Webinar	6/1/2021
A Process for Residential Energy Code Compliance and Enforcement / Part 2 Energy Code Inspections in 15 Minutes or Less	PSD Consulting	Webinar	6/1/2021
Other IECC Envelope Requirements	PSD Consulting	Webinar	6/2/2021
Whole-house Mechanical Ventilation	PSD Consulting	Webinar	6/3/2021
Crushing the Code New York State: Residential	Urban Green Council	Webinar	6/3/2021
Crushing the NYC Energy Code (Residential)	Urban Green Council	Webinar	6/16/2021
A Process for Residential Energy Code Compliance and Enforcement / Part 2 Energy Code Inspections in 15 Minutes or Less	PSD Consulting	Webinar	6/15/2021
Other IECC Envelope Requirements	PSD Consulting	Webinar	6/16/2021
Whole-house Mechanical Ventilation	PSD Consulting	Webinar	6/17/2021
A Process for Residential Energy Code Compliance and Enforcement/Energy Code Plan Reviews in 15 Minutes or Less	PSD Consulting	Webinar	6/29/2021
A Process for Residential Energy Code Compliance and Enforcement / Part 2 Energy Code Inspections in 15 Minutes or Less	PSD Consulting	Webinar	6/29/2021
Other IECC Envelope Requirements	PSD Consulting	Webinar	6/30/2021
Whole-house Mechanical Ventilation	PSD Consulting	Webinar	7/1/2021
Other IECC Envelope Requirements	PSD Consulting	Webinar	7/15/2021
Whole-house Mechanical Ventilation	PSD Consulting	Webinar	7/20/2021
Crushing the NYC Energy Code (Residential)	Urban Green Council	Webinar	7/21/2021
Crushing the Code New York State: Residential	Urban Green Council	Webinar	7/28/2021
Other IECC Envelope Requirements	PSD Consulting	Webinar	8/3/2021

Course Title	Implementer	Training Type	Date
Whole-house Mechanical Ventilation	PSD Consulting	Webinar	8/4/2021
Other IECC Envelope Requirements	PSD Consulting	Webinar	8/18/2021
Whole-house Mechanical Ventilation	PSD Consulting	Webinar	8/19/2021
Crushing the NYC Energy Code: Residential	Urban Green Council	Webinar	8/19/2021
Crushing the NYS Energy Code (Residential)	Urban Green Council	Webinar	8/31/2021
Other IECC Envelope Requirements	PSD Consulting	Webinar	9/2/2021
Whole-house Mechanical Ventilation	PSD Consulting	Webinar	9/7/2021
Other IECC Envelope Requirements	PSD Consulting	Webinar	9/21/2021
Whole-house Mechanical Ventilation	PSD Consulting	Webinar	9/22/2021
Crushing the NYS Energy Code (Residential)	Urban Green Council	Webinar	9/30/2021
Other IECC Envelope Requirements	PSD Consulting	Webinar	10/14/2021
Whole-house Mechanical Ventilation	PSD Consulting	Webinar	10/22/2021
Crushing the NYC Energy Code: Residential	Urban Green Council	Webinar	10/21/2021
Crushing the NYS Energy Code (Residential)	Urban Green Council	Webinar	10/22/2021
Other IECC Envelope Requirements	PSD Consulting	Webinar	11/2/2021
Whole-house Mechanical Ventilation	PSD Consulting	Webinar	11/3/2021
Crushing the NYS Energy Code (Residential)	Urban Green Council	Webinar	11/16/2021
Other IECC Envelope Requirements	PSD Consulting	Webinar	11/18/2021
Whole-house Mechanical Ventilation	PSD Consulting	Webinar	11/23/2021
Crushing the NYC Energy Code: Residential	Urban Green Council	Webinar	12/14/2021
Crushing the NYS Energy Code (Residential)	Urban Green Council	Webinar	12/16/2021
Other IECC Envelope Requirements	PSD Consulting	Webinar	12/8/2021
Whole-house Mechanical Ventilation	PSD Consulting	Webinar	12/9/2021

Course Title	Implementer	Training Type	Date
Other IECC Envelope Requirements	PSD Consulting	Webinar	12/28/2021
Whole-house Mechanical Ventilation	PSD Consulting	Webinar	12/29/2021
NYStretch Energy Code for Commercial Buildings Part 1: Building Thermal Envelope, Mechanical Systems, Commissioning, and Additions and Alterations	PSD Consulting	Webinar	1/4/2022
NYStretch Energy Code for Commercial Buildings Part 2: Electric Power and Lighting, Total Building Performance, Additional Efficiency Package Options, and Appendices	PSD Consulting	Webinar	1/4/2022
Prioritizing ECCCNYS Enforcement for Commercial Buildings (Pt 1)	PSD Consulting	Webinar	1/5/2022
Prioritizing ECCCNYS Enforcement for Commercial Buildings (Pt 2)	PSD Consulting	Webinar	1/5/2022
NYStretch Overview and Thermal Envelope Requirements Part 1	PSD Consulting	Webinar	1/6/2022
NYStretch Mechanical, Plumbing, Lighting, and Electric Power Part 2	PSD Consulting	Webinar	1/6/2022
Crushing the NYS Energy Code: Commercial	Urban Green Council	Webinar	1/11/2022
A Process for Energy Code Compliance and Enforcement / Energy Code Plan Reviews in 15 Minutes or Less	PSD Consulting	Webinar	1/11/2022
A Process for Energy Code Compliance and Enforcement / Energy Code Inspections in 15 Minutes or Less	PSD Consulting	Webinar	1/11/2022
Air Sealing to 3 ACH50	PSD Consulting	Webinar	1/12/2022
Other IECC Envelope Requirements	PSD Consulting	Webinar	1/12/2022
Whole-house Mechanical Ventilation	PSD Consulting	Webinar	1/13/2022
Efficient Forced Air Distribution	PSD Consulting	Webinar	1/13/2022
What's New in the 2020 NYC Energy Code	Urban Green Council	Webinar	1/18/2022
Crushing the NYC Energy Code (Commericial)	Urban Green Council	Webinar	1/19/2022
ECCCNYS for Large Commercial Buildings (Pt 1): Mechanical Systems	PSD Consulting	Webinar	1/18/2022
ECCCNYS for Large Commercial Buildings (Pt 2): Lighting Systems	PSD Consulting	Webinar	1/18/2022
NYStretch Energy Code for Commercial Buildings Part 1: Building Thermal Envelope, Mechanical Systems, Commissioning, and Additions and Alterations	PSD Consulting	Webinar	1/19/2022

Course Title	Implementer	Training Type	Date
NYStretch Energy Code for Commercial Buildings Part 2: Electric Power and Lighting, Total Building Performance, Additional Efficiency Package Options, and Appendices	PSD Consulting	Webinar	1/19/2022
Prioritizing ECCCNYS Enforcement for Commercial Buildings (Pt 1)	PSD Consulting	Webinar	1/20/2022
Prioritizing ECCCNYS Enforcement for Commercial Buildings (Pt 2)	PSD Consulting	Webinar	1/20/2022
Crushing the NYC Energy Code: Residential	Urban Green Council	Webinar	1/25/2022
Crushing the NYS Energy Code (Residential)	Urban Green Council	Webinar	1/27/2022
What's New in the 2020 NYC Energy Code	Urban Green Council	Webinar	1/27/2022
NYStretch Overview and Thermal Envelope Requirements Part 1	PSD Consulting	Webinar	1/25/2022
NYStretch Mechanical, Plumbing, Lighting, and Electric Power Part 2	PSD Consulting	Webinar	1/25/2022
A Process for Energy Code Compliance and Enforcement / Energy Code Plan Reviews in 15 Minutes or Less	PSD Consulting	Webinar	1/26/2022
A Process for Energy Code Compliance and Enforcement / Energy Code Inspections in 15 Minutes or Less	PSD Consulting	Webinar	1/26/2022
Prioritizing ECCCNYS Enforcement for Commercial Buildings (Pt 1)	PSD Consulting	Webinar	1/27/2022
Prioritizing ECCCNYS Enforcement for Commercial Buildings (Pt 2)	PSD Consulting	Webinar	1/27/2022
Crushing the NYS Energy Code: Commercial	Urban Green Council	Webinar	2/3/2022
Air Sealing to 3 ACH50	PSD Consulting	Webinar	2/1/2022
Other IECC Envelope Requirements	PSD Consulting	Webinar	2/1/2022
Whole-house Mechanical Ventilation	PSD Consulting	Webinar	2/2/2022
Efficient Forced Air Distribution	PSD Consulting	Webinar	2/2/2022
ECCCNYS for Large Commercial Buildings (Pt 1): Mechanical Systems	PSD Consulting	Webinar	2/3/2022
ECCCNYS for Large Commercial Buildings (Pt 2): Lighting Systems	PSD Consulting	Webinar	2/3/2022
NYStretch Energy Code for Commercial Buildings Part 1: Building Thermal Envelope, Mechanical Systems, Commissioning, and Additions and Alterations	PSD Consulting	Webinar	2/8/2022
NYStretch Energy Code for Commercial Buildings Part 2: Electric Power and Lighting,	PSD Consulting	Webinar	2/8/2022

Course Title	Implementer	Training Type	Date
Total Building Performance, Additional Efficiency Package Options, and Appendices			
Prioritizing ECCCNYS Enforcement for Commercial Buildings (Pt 1)	PSD Consulting	Webinar	2/9/2022
Prioritizing ECCCNYS Enforcement for Commercial Buildings (Pt 2)	PSD Consulting	Webinar	2/9/2022
NYStretch Overview and Thermal Envelope Requirements Part 1	PSD Consulting	Webinar	2/10/2022
NYStretch Mechanical, Plumbing, Lighting, and Electric Power Part 2	PSD Consulting	Webinar	2/10/2022
Crushing the NYC Energy Code (Commericial)	Urban Green Council	Webinar	2/10/2022
Crushing the NYC Energy Code: Residential	Urban Green Council	Webinar	2/15/2022
A Process for Energy Code Compliance and Enforcement / Energy Code Plan Reviews in 15 Minutes or Less	PSD Consulting	Webinar	2/15/2022
A Process for Energy Code Compliance and Enforcement / Energy Code Inspections in 15 Minutes or Less	PSD Consulting	Webinar	2/15/2022
Air Sealing to 3 ACH50	PSD Consulting	Webinar	2/16/2022
Other IECC Envelope Requirements	PSD Consulting	Webinar	2/16/2022
Whole-house Mechanical Ventilation	PSD Consulting	Webinar	2/17/2022
Efficient Forced Air Distribution	PSD Consulting	Webinar	2/17/2022
ECCCNYS for Large Commercial Buildings (Pt 1): Mechanical Systems	PSD Consulting	Webinar	2/22/2022
ECCCNYS for Large Commercial Buildings (Pt 2): Lighting Systems	PSD Consulting	Webinar	2/22/2022
NYStretch Energy Code for Commercial Buildings Part 1: Building Thermal Envelope, Mechanical Systems, Commissioning, and Additions and Alterations	PSD Consulting	Webinar	2/23/2022
NYStretch Energy Code for Commercial Buildings Part 2: Electric Power and Lighting, Total Building Performance, Additional Efficiency Package Options, and Appendices	PSD Consulting	Webinar	2/23/2022
NYStretch Overview and Thermal Envelope Requirements Part 1	PSD Consulting	Webinar	2/24/2022
NYStretch Mechanical, Plumbing, Lighting, and Electric Power Part 2	PSD Consulting	Webinar	2/24/2022
Crushing the NYS Energy Code (Residential)	Urban Green Council	Webinar	2/23/2022
Crushing the NYC Energy Code (Commericial)	Urban Green Council	Webinar	3/1/2022

Course Title	Implementer	Training Type	Date
Prioritizing ECCCNYS Enforcement for Commercial Buildings (Pt 1)	PSD Consulting	Webinar	3/1/2022
Prioritizing ECCCNYS Enforcement for Commercial Buildings (Pt 2)	PSD Consulting	Webinar	3/1/2022
NYStretch Overview and Thermal Envelope Requirements Part 1	PSD Consulting	Webinar	3/2/2022
NYStretch Mechanical, Plumbing, Lighting, and Electric Power Part 2	PSD Consulting	Webinar	3/2/2022
A Process for Energy Code Compliance and Enforcement / Energy Code Plan Reviews in 15 Minutes or Less	PSD Consulting	Webinar	3/3/2022
A Process for Energy Code Compliance and Enforcement / Energy Code Inspections in 15 Minutes or Less	PSD Consulting	Webinar	3/3/2022
ECCCNYS for Large Commercial Buildings (Pt 1): Mechanical Systems	PSD Consulting	Webinar	3/8/2022
ECCCNYS for Large Commercial Buildings (Pt 2): Lighting Systems	PSD Consulting	Webinar	3/8/2022
Air Sealing to 3 ACH50	PSD Consulting	Webinar	3/9/2022
Other IECC Envelope Requirements	PSD Consulting	Webinar	3/9/2022
Whole-house Mechanical Ventilation	PSD Consulting	Webinar	3/10/2022
Efficient Forced Air Distribution	PSD Consulting	Webinar	3/10/2022
Crushing the NYS Energy Code: Commercial	Urban Green Council	Webinar	3/10/2022
Crushing the NYC Energy Code: Residential	Urban Green Council	Webinar	3/15/2022
What's New in the 2020 NYC Energy Code	Urban Green Council	Webinar	3/16/2022
110: Performance-Based Compliance with ASHRAE Standard 90.1 2016	Karpman Consulting	Webinar	3/1/2022
110: Performance-Based Compliance with ASHRAE Standard 90.1 2016	Karpman Consulting	Webinar	3/7/2022
ECCCNYS for Large Commercial Buildings (Pt 1): Mechanical Systems	PSD Consulting	Webinar	3/15/2022
ECCCNYS for Large Commercial Buildings (Pt 2): Lighting Systems	PSD Consulting	Webinar	3/15/2022
What's New in the 2020 NYC Energy Code	Urban Green Council	Webinar	3/16/2022
NYStretch Energy Code for Commercial Buildings Part 2: Electric Power and Lighting, Total Building Performance, Additional Efficiency Package Options, and Appendices	PSD Consulting	Webinar	3/16/2022
Prioritizing ECCCNYS Enforcement for Commercial Buildings (Pt 1)	PSD Consulting	Webinar	3/17/2022

Course Title	Implementer	Training Type	Date
Prioritizing ECCCNYS Enforcement for Commercial Buildings (Pt 2)	PSD Consulting	Webinar	3/17/2022
210: Compliance Documentation for ASHRAE 90.1 Section 11 and Appendix G	Karpman Consulting	Webinar	3/15/2022
What's New in the 2020 NYC Energy Code	Urban Green Council	Webinar	3/21/2022
NYStretch Overview and Thermal Envelope Requirements Part 1	PSD Consulting	Webinar	3/22/2022
NYStretch Mechanical, Plumbing, Lighting, and Electric Power Part 2	PSD Consulting	Webinar	3/22/2022
A Process for Energy Code Compliance and Enforcement / Energy Code Plan Reviews in 15 Minutes or Less	PSD Consulting	Webinar	3/23/2022
A Process for Energy Code Compliance and Enforcement / Energy Code Inspections in 15 Minutes or Less	PSD Consulting	Webinar	3/23/2022
NY Energy Codes for Simple Buildings- Part 1: Retail Building	PSD Consulting	Webinar	3/24/2022
NY Energy Code for Simple Commercial Buildings- Part 2: Mixed-Use Apartment, Grocery, and Office Building	PSD Consulting	Webinar	3/24/2022
Crushing the NYS Energy Code (Residential)	Urban Green Council	Webinar	3/23/2022
What's New in the 2020 NYC Energy Code	Urban Green Council	Webinar	3/29/2022
212: Review of the Modeling-based Submittals for ASHRAE 90.1 Section 11 and Appendix G	Karpman Consulting	Webinar	3/29/2022
213: Integrating Performance-based Compliance into the Design Process	Karpman Consulting	Webinar	4/5/2022
Crushing the NYS Energy Code: Commercial	Urban Green Council	Webinar	4/5/2022
What's New in the 2020 NYC Energy Code	Urban Green Council	Webinar	4/7/2022
NYStretch Energy Code for Commercial Buildings Part 1: Building Thermal Envelope, Mechanical Systems, Commissioning, and Additions and Alterations	PSD Consulting	Webinar	4/5/2022
NYStretch Energy Code for Commercial Buildings Part 2: Electric Power and Lighting, Total Building Performance, Additional Efficiency Package Options, and Appendices	PSD Consulting	Webinar	4/5/2022
Prioritizing ECCCNYS Enforcement for Commercial Buildings (Pt 1)	PSD Consulting	Webinar	4/6/2022
Prioritizing ECCCNYS Enforcement for Commercial Buildings (Pt 2)	PSD Consulting	Webinar	4/6/2022
NYStretch Overview and Thermal Envelope Requirements Part 1	PSD Consulting	Webinar	4/7/2022
NYStretch Mechanical, Plumbing, Lighting, and Electric Power Part 2	PSD Consulting	Webinar	4/7/2022

Course Title	Implementer	Training Type	Date
Crushing the NYC Energy Code: Residential	Urban Green Council	Webinar	4/12/2022
A Process for Energy Code Compliance and Enforcement / Energy Code Plan Reviews in 15 Minutes or Less	PSD Consulting	Webinar	4/12/2022
A Process for Energy Code Compliance and Enforcement / Energy Code Inspections in 15 Minutes or Less	PSD Consulting	Webinar	4/12/2022
NY Energy Codes for Simple Buildings- Part 1: Retail Building	PSD Consulting	Webinar	4/13/2022
NY Energy Code for Simple Commercial Buildings- Part 2: Mixed-Use Apartment, Grocery, and Office Building	PSD Consulting	Webinar	4/13/2022
Air Sealing to 3 ACH50	PSD Consulting	Webinar	4/14/2022
Other IECC Envelope Requirements	PSD Consulting	Webinar	4/14/2022
What's New in the 2020 NYC Energy Code	Urban Green Council	Webinar	4/20/2022
Crushing the NYC Energy Code: Commercial	Urban Green Council	Webinar	4/21/2022
Whole-house Mechanical Ventilation	PSD Consulting	Webinar	4/19/2022
Efficient Forced Air Distribution	PSD Consulting	Webinar	4/19/2022
ECCCNYS for Large Commercial Buildings (Pt 1): Mechanical Systems	PSD Consulting	Webinar	4/20/2022
ECCCNYS for Large Commercial Buildings (Pt 2): Lighting Systems	PSD Consulting	Webinar	4/20/2022
NYStretch Energy Code for Commercial Buildings Part 1: Building Thermal Envelope, Mechanical Systems, Commissioning, and Additions and Alterations	PSD Consulting	Webinar	4/21/2022
NYStretch Energy Code for Commercial Buildings Part 2: Electric Power and Lighting, Total Building Performance, Additional Efficiency Package Options, and Appendices	PSD Consulting	Webinar	4/21/2022
Prioritizing ECCCNYS Enforcement for Commercial Buildings (Pt 1)	PSD Consulting	Webinar	4/26/2022
Prioritizing ECCCNYS Enforcement for Commercial Buildings (Pt 2)	PSD Consulting	Webinar	4/26/2022
NYStretch Overview and Thermal Envelope Requirements Part 1	PSD Consulting	Webinar	4/27/2022
NYStretch Mechanical, Plumbing, Lighting, and Electric Power Part 2	PSD Consulting	Webinar	4/27/2022
A Process for Energy Code Compliance and Enforcement / Energy Code Plan Reviews in 15 Minutes or Less	PSD Consulting	Webinar	4/28/2022

Course Title	Implementer	Training Type	Date
A Process for Energy Code Compliance and Enforcement / Energy Code Inspections in 15 Minutes or Less	PSD Consulting	Webinar	4/28/2022
Crushing the NYS Energy Code (Residential)	Urban Green Council	Webinar	4/28/2022
Crushing the NYC Energy Code (Residential)	Urban Green Council	In-Person	5/3/2022
Air Sealing to 3 ACH50	PSD Consulting	Webinar	5/4/2022
Other IECC Envelope Requirements	PSD Consulting	Webinar	5/4/2022
Whole-house Mechanical Ventilation	PSD Consulting	Webinar	5/5/2022
Efficient Forced Air Distribution	PSD Consulting	Webinar	5/5/2022
What's New in the 2020 NYC Energy Code	Urban Green Council	Webinar	5/10/2022
Crushing the NYS Energy Code: Commercial	Urban Green Council	Webinar	5/11/2022
110: Performance-Based Compliance with ASHRAE Standard 90.1 2016	Karpman Consulting	Webinar	5/3/2022
ECCCNYS for Large Commercial Buildings (Pt 1): Mechanical Systems	PSD Consulting	Webinar	5/10/2022
ECCCNYS for Large Commercial Buildings (Pt 2): Lighting Systems	PSD Consulting	Webinar	5/10/2022
NYStretch Energy Code for Commercial Buildings Part 1: Building Thermal Envelope, Mechanical Systems, Commissioning, and Additions and Alterations	PSD Consulting	Webinar	5/11/2022
NYStretch Energy Code for Commercial Buildings Part 2: Electric Power and Lighting, Total Building Performance, Additional Efficiency Package Options, and Appendices	PSD Consulting	Webinar	5/11/2022
Crushing the NYS Energy Code (Residential)	Urban Green Council	Webinar	5/19/2022
A Process for Energy Code Compliance and Enforcement / Energy Code Plan Reviews in 15 Minutes or Less	PSD Consulting	Webinar	5/17/2022
A Process for Energy Code Compliance and Enforcement / Energy Code Inspections in 15 Minutes or Less	PSD Consulting	Webinar	5/17/2022
NY Energy Codes for Simple Buildings- Part 1: Retail Building	PSD Consulting	Webinar	5/18/2022
NY Energy Code for Simple Commercial Buildings- Part 2: Mixed-Use Apartment, Grocery, and Office Building	PSD Consulting	Webinar	5/18/2022
Clean Energy Communities Energy Code Enforcement	Newport Ventures	In-Person	3/2/2022

Course Title	Implementer	Training Type	Date
Clean Energy Communities Energy Code Enforcement	Newport Ventures	In-Person	3/3/2022
Clean Energy Communities Energy Code Enforcement	Newport Ventures	In-Person	3/15/2022
Clean Energy Communities Energy Code Enforcement	Newport Ventures	In-Person	3/22/2022
Clean Energy Communities Energy Code Enforcement	Newport Ventures	In-Person	3/23/2022
Clean Energy Communities Energy Code Enforcement	Newport Ventures	In-Person	3/29/2022
2020 ECCCNYS for Residential Buildings: Overview	Newport Ventures	Webinar	3/15/2022
2020 ECCCNYS for Residential Buildings: Overview	Newport Ventures	Webinar	3/24/2022
ECCCNYS for Large Commercial Buildings (Pt 1): Mechanical Systems	PSD Consulting	Webinar	5/24/2022
ECCCNYS for Large Commercial Buildings (Pt 2): Lighting Systems	PSD Consulting	Webinar	5/24/2022
NYStretch Energy Code for Commercial Buildings Part 1: Building Thermal Envelope, Mechanical Systems, Commissioning, and Additions and Alterations	PSD Consulting	Webinar	5/25/2022
NYStretch Energy Code for Commercial Buildings Part 2: Electric Power and Lighting, Total Building Performance, Additional Efficiency Package Options, and Appendices	PSD Consulting	Webinar	5/25/2022
Crushing the NYC Energy Code: Commercial	Urban Green Council	Webinar	5/25/2022
Prioritizing ECCCNYS Enforcement for Commercial Buildings (Pt 1)	PSD Consulting	Webinar	5/26/2022
Prioritizing ECCCNYS Enforcement for Commercial Buildings (Pt 2)	PSD Consulting	Webinar	5/26/2022
What's New in the 2020 NYC Energy Code	Urban Green Council	Webinar	5/31/2022
Crushing the NYC Energy Code (Residential)	Urban Green Council	Webinar	6/1/2022
NYStretch Overview and Thermal Envelope Requirements Part 1	PSD Consulting	Webinar	5/31/2022
NYStretch Mechanical, Plumbing, Lighting, and Electric Power Part 2	PSD Consulting	Webinar	5/31/2022
A Process for Energy Code Compliance and Enforcement / Energy Code Plan Reviews in 15 Minutes or Less	PSD Consulting	Webinar	6/2/2022
A Process for Energy Code Compliance and Enforcement / Energy Code Inspections in 15 Minutes or Less	PSD Consulting	Webinar	6/2/2022
NY Energy Codes for Simple Buildings- Part 1: Retail Building	PSD Consulting	Webinar	6/7/2022

Course Title	Implementer	Training Type	Date
NY Energy Code for Simple Commercial Buildings- Part 2:Mixed-Use Apartment, Grocery, and Office Building	PSD Consulting	Webinar	6/7/2022
Air Sealing to 3 ACH50	PSD Consulting	Webinar	6/8/2022
Other IECC Envelope Requirements	PSD Consulting	Webinar	6/8/2022
NYStretch Energy Code for Commercial Buildings Part 1: Building Thermal Envelope, Mechanical Systems, Commissioning, and Additions and Alterations	PSD Consulting	Webinar	6/9/2022
NYStretch Energy Code for Commercial Buildings Part 2: Electric Power and Lighting, Total Building Performance, Additional Efficiency Package Options, and Appendices	PSD Consulting	Webinar	6/9/2022
Crushing the NYS Energy Code (Residential)	Urban Green Council	Webinar	6/8/2022
What's New in the 2020 NYC Energy Code	Urban Green Council	Webinar	6/9/2022
Whole-house Mechanical Ventilation	PSD Consulting	Webinar	6/16/2022
Efficient Forced Air Distribution	PSD Consulting	Webinar	6/16/2022
110: Performance-Based Compliance with ASHRAE Standard 90.1 2016	Karpman Consulting	Webinar	6/14/2022
What's New in the 2020 NYC Energy Code	Urban Green Council	Webinar	6/21/2022
210: Compliance Documentation for ASHRAE 90.1 Section 11 and Appendix G	Karpman Consulting	Webinar	6/21/2022
NYStretch Overview and Thermal Envelope Requirements Part 1	PSD Consulting	Webinar	6/21/2022
NYStretch Mechanical, Plumbing, Lighting, and Electric Power Part 2	PSD Consulting	Webinar	6/21/2022
A Process for Energy Code Compliance and Enforcement / Energy Code Plan Reviews in 15 Minutes or Less	PSD Consulting	Webinar	6/22/2022
A Process for Energy Code Compliance and Enforcement / Energy Code Inspections in 15 Minutes or Less	PSD Consulting	Webinar	6/22/2022
Crushing the NYC Energy Code: Commercial	Urban Green Council	Webinar	6/23/2022
NY Energy Codes for Simple Buildings- Part 1: Retail Building	PSD Consulting	Webinar	6/23/2022
NY Energy Code for Simple Commercial Buildings- Part 2:Mixed-Use Apartment, Grocery, and Office Building	PSD Consulting	Webinar	6/23/2022
Crushing the NYS Energy Code: Commercial	Urban Green Council	Webinar	6/28/2022

Course Title	Implementer	Training Type	Date
Air Sealing to 3 ACH50	PSD Consulting	Webinar	6/28/2022
Other IECC Envelope Requirements	PSD Consulting	Webinar	6/28/2022
NYStretch Energy Code for Commercial Buildings Part 1: Building Thermal Envelope, Mechanical Systems, Commissioning, and Additions and Alterations	PSD Consulting	Webinar	6/29/2022
NYStretch Energy Code for Commercial Buildings Part 2: Electric Power and Lighting, Total Building Performance, Additional Efficiency Package Options, and Appendices	PSD Consulting	Webinar	6/29/2022
Multifamily Air Sealing	PSD Consulting	Webinar	6/30/2022
Multifamily Thermal Bridging	PSD Consulting	Webinar	6/30/2022
Whole-house Mechanical Ventilation	PSD Consulting	Webinar	7/5/2022
Efficient Forced Air Distribution	PSD Consulting	Webinar	7/5/2022
NYStretch Overview and Thermal Envelope Requirements Part 1	PSD Consulting	Webinar	7/7/2022
NYStretch Mechanical, Plumbing, Lighting, and Electric Power Part 2	PSD Consulting	Webinar	7/7/2022
Crushing the NYC Energy Code (Residential)	Urban Green Council	Webinar	7/14/2022
Crushing the NYS Energy Code (Residential)	Urban Green Council	Webinar	7/14/2022
NY Energy Codes for Simple Buildings- Part 1: Retail Building	PSD Consulting	Webinar	7/12/2022
NY Energy Code for Simple Commercial Buildings- Part 2: Mixed-Use Apartment, Grocery, and Office Building	PSD Consulting	Webinar	7/12/2022
Multifamily Air Sealing	PSD Consulting	Webinar	7/14/2022
Multifamily Thermal Bridging	PSD Consulting	Webinar	7/14/2022
212: Review of the Modeling-based Submittals for ASHRAE 90.1 Section 11 and Appendix G	Karpman Consulting	Webinar	7/12/2022-7/15/2022
Crushing the NYC Energy Code: Commercial	Urban Green Council	Webinar	7/19/2022
213: Integrating Performance-based Compliance into the Design Process	Karpman Consulting	Webinar	7/19/2022
What's New in the 2020 NYC Energy Code	Urban Green Council	Webinar	7/21/2022
NYStretch Energy Code for Commercial Buildings Part 1: Building Thermal Envelope,	PSD Consulting	Webinar	7/19/2022

Course Title	Implementer	Training Type	Date
Mechanical Systems, Commissioning, and Additions and Alterations			
NYStretch Energy Code for Commercial Buildings Part 2: Electric Power and Lighting, Total Building Performance, Additional Efficiency Package Options, and Appendices	PSD Consulting	Webinar	7/19/2022
A Process for Energy Code Compliance and Enforcement / Energy Code Plan Reviews in 15 Minutes or Less	PSD Consulting	Webinar	7/21/2022
A Process for Energy Code Compliance and Enforcement / Energy Code Inspections in 15 Minutes or Less	PSD Consulting	Webinar	7/21/2022
What's New in the 2020 NYC Energy Code	Urban Green Council	Webinar	7/26/2022
Crushing the NYS Energy Code: Commercial	Urban Green Council	Webinar	7/28/2022
Crushing the NYC Energy Code (Residential)	Urban Green Council	Webinar	8/3/2022
Crushing the NYS Energy Code (Residential)	Urban Green Council	Webinar	8/10/2022
What's New in the 2020 NYC Energy Code	Urban Green Council	Webinar	8/11/2022
110: Performance-Based Compliance with ASHRAE Standard 90.1 2016	Karpman Consulting	Webinar	8/8/2022
ECCCNYS for Large Commercial Buildings (Pt 1): Mechanical Systems	PSD Consulting	Webinar	8/2/2022
ECCCNYS for Large Commercial Buildings (Pt 2): Lighting Systems	PSD Consulting	Webinar	8/2/2022
Multifamily Air Sealing	PSD Consulting	Webinar	8/4/2022
Multifamily Thermal Bridging	PSD Consulting	Webinar	8/4/2022
NYStretch Overview and Thermal Envelope Requirements Part 1	PSD Consulting	Webinar	8/9/2022
NYStretch Mechanical, Plumbing, Lighting, and Electric Power Part 2	PSD Consulting	Webinar	8/9/2022
A Process for Energy Code Compliance and Enforcement / Energy Code Plan Reviews in 15 Minutes or Less	PSD Consulting	Webinar	8/11/2022
A Process for Energy Code Compliance and Enforcement / Energy Code Inspections in 15 Minutes or Less	PSD Consulting	Webinar	8/11/2022
210: Compliance Documentation for ASHRAE 90.1 Section 11 and Appendix G	Karpman Consulting	Webinar	8/16/2022
Crushing the NYC Energy Code (Commericial)	Urban Green Council	Webinar	8/17/2022
What's New in the 2020 NYC Energy Code	Urban Green Council	Webinar	8/18/2022

Course Title	Implementer	Training Type	Date
NYStretch Energy Code for Commercial Buildings Part 1: Building Thermal Envelope, Mechanical Systems, Commissioning, and Additions and Alterations	PSD Consulting	Webinar	8/16/2022
NYStretch Energy Code for Commercial Buildings Part 2: Electric Power and Lighting, Total Building Performance, Additional Efficiency Package Options, and Appendices	PSD Consulting	Webinar	8/16/2022
NY Energy Codes for Simple Buildings- Part 1: Retail Building	PSD Consulting	Webinar	8/18/2022
NY Energy Code for Simple Commercial Buildings- Part 2: Mixed-Use Apartment, Grocery, and Office Building	PSD Consulting	Webinar	8/18/2022

Appendix E: NYSERDA TMD Savings Memo

Memorandum

To:	Patricia Gonzales and Chris Sgroi; NYSERDA
From:	Mike Kaar, Allen Lee, and Jeremy Eckstein; Cadmus
Subject:	Savings Attributed to NYSERDA Advanced Energy Codes and Standards
Program Date:	July 9, 2021

Introduction

In 2020 Cadmus reviewed the methodology NYSERDA applied to estimate the impacts of its Advanced Energy Codes and Standards program (delivered under the Technology and Market Development program [T&MD]) for 2012 through 2018. As part of this review Cadmus provided recommendations for potential improvements to the savings estimation data sources and methodologies. In 2021, based on the findings of our review, NYSERDA amended Cadmus' Code to Zero evaluation scope of work to include an update to the NYSERDA savings estimation methodology.

This memo presents the results of Cadmus' update to NYSERDA's Advanced Energy Codes and Standards program savings estimation, providing results for 2015 through 2020. We employed methods and applied data sources based on the comments and recommendations we had provided to NYSERDA in November 2020. Cadmus made three adjustments to NYSERDA's original savings methodology, which changed the original savings estimates:

- Adjusted program-influence compliance calculations to reflect the simplified approach recommended in the November 2020 memo.
- Updated code compliance rates, as well as program effects on compliance, using benchmarks from national code compliance evaluations.
- Updated the T&MD program savings model with actual new construction and alteration data.

Analysis

This section gives a comparison of the analysis method NYSERDA used in the original calculation workbook with the method Cadmus used in the new calculation workbook, along with the data sources we used. We conducted a detailed review of NYSERDA's original savings estimates, provided in the November 2020 memo.

Original NYSERDA Calculation Methodology

In the original methodology, NYSERDA estimated the overall program energy impacts by combining building square footage and residential dwelling unit estimates, energy use intensities (EUI) for various code versions, and code compliance rates.

Commercial

For the commercial sector, NYSERDA followed several steps in its original savings estimate methodology:

- Estimated a baseline facility EUI for buildings that adhere to code (assuming ASHRAE Standard 90.1-2004).
- Adjusted EUI upward by 20% to account for assumed noncompliance.
- Calculated savings under three codes (New York State equivalents of the 2009, 2012, and 2015 International Energy Conservation Code [IECC]) by applying a percentage energy use saving relative to the baseline average EUI and subtracting this value from the baseline adjusted for noncompliance.
- Converted kilowatt-hour savings to watts per square foot per year assuming 4,580 operating hours per year.
- Estimated program savings by assuming that the program increases a compliance rate associated with each new code version. Assumed two compliance rates for each code, each year: business-as-usual and enhanced (attributable to the effects of the program).
- Applied the same method to renovations, assuming two things: (1) renovations constitute an additional 50% of the floor area of new construction and (2) the EUI is 5% more for renovations than for new construction. Both the assumed business-as-usual and enhanced compliance rates for renovations are less than those for new construction; however, the result in all cases is that the difference between the two rates is larger for renovations.
- Calculated program energy savings by multiplying the estimated savings per square foot by the estimated floor area (from 2007 Dodge data). The 2007 Dodge data had been discounted by 20% to account for the recession, then escalated by 1% per year for all years analyzed. Further reduced the estimates by 30% each year to account for buildings participating in the New Construction program (to avoid double-counting of savings). Assumed that renovations comprise an additional 50% of the total new construction floor area (with no deduction for program participation).
- Calculated the savings in kilowatt-hours for electricity and in therms (or Btus) for natural gas. Calculated peak demand reduction (in megawatts) from kilowatt-hour savings by assuming 4,580 operating hours. Equally applied all the factors used in the analysis (such as floor area and compliance rates) to the kilowatt-hour, therm, and megawatt savings.

Residential

NYSERDA's methodology to determine savings for the residential sector was very similar to its methodology for the commercial sector—relying on an estimated compliance rate for savings relative to a fixed base case—by following several steps:

- Normalized savings per building unit for multiple residential codes in New York State (no source was identified for the savings estimates).
  - Calculated savings for codes starting with the 2009 IECC (the 2010 New York State code) based on the percentage change in efficiency. Per a workbook note, based the savings for the 2009 IECC on the ENERGY STAR Homes program for three regions: Upstate, Downstate, and Lower Hudson. A workbook note indicates a 15% change in efficiency for

the 2009 IECC and for the 2012 IECC and a 20% change for the 2015 IECC.

  - Calculated savings for codes after the 2009 IECC by adding the percentage of the preceding code's savings to the current code's savings.

- Applied a similar approach to that outlined in the *Commercial* sector methodology described above to estimate the effect of compliance rates on the residential savings.
- Calculated total savings for new housing units by multiplying the new construction population (quantity of new housing starts) by (1) the savings per unit and by (2) the difference in the compliance rates. Estimated the unit savings using the weighted-savings estimates for the three New York State regions (noted above) and weighted by 60% for one to four dwelling units and by 40% for low-rise multifamily buildings. Applied the weighted savings to a separate estimate of the number of units built each year, subtracting out ENERGY STAR houses, then multiplied by the estimated increase in compliance due to the program. Based the number of units on census data (a workbook note indicates that the estimate and forecast may be low because of the recession).
- Repeated the above calculation for residential projects in which less than 50% of systems or subsystems were affected by the code. (Cadmus assumed this indicates retrofit projects that are covered by the code, but this was not clearly stated in the methodology or noted in the workbook.) Assumed a quantity of units of one-fourth that of new construction projects. For the rest of the analysis, followed the same steps as outlined in the *Commercial* sector methodology described above.
- Calculated electric demand reduction from the estimated kilowatt-hour saving by dividing by 6,000 assumed operating hours per year (equivalent to about 16 hours per day). As with commercial buildings, the residential savings calculations for peak and natural gas consumption apply the same factors as those for calculating kilowatt-hour savings.

Revised Cadmus Methodology (Commercial and Residential)

Following a review of the original NYSERDA method for calculating savings for the Advanced Energy Codes and Standards program, Cadmus made several adjustments to that methodology:

- Estimated facility EUI for buildings that adhere to code (code EUI) (ASHRAE 90.1 for the commercial sector and IECC for the residential sector) for all code years covered in analysis (2015 through 2020).
- Calculated an average building EUI (electric and natural gas) for the state by applying weightings by building type and climate zone (code EUI). The source documents (Pacific Northwest National Laboratory [PNNL] cost-effectiveness studies for ASHRAE 90.1 and IECC, detailed in the *Data Sources* section below) contained both the energy use and the weighting by climate zone.
- Applied specific code EUIs to building square footage based on code adoption dates.
- Estimated the typical level of statewide code compliance from previous studies (see the *Data Sources* section for details of the studies we referenced).
- Estimated increases in code compliance that are attributable to the NYSERDA program as documented in previous studies. Only attributed savings for years 2015 and beyond (as 2015 was the first program year).

- Calculated the baseline EUI by dividing the code EUI by the estimated code compliance, then subtracting the level of improvement attributable to the Advanced Energy Codes and Standards program.
- Calculated EUI with the NYSERDA Advanced Energy Codes and Standards program by adding back the level of improvement attributable to the program (NYSERDA enhanced EUI).
- Estimated the EUI savings attributable to the program as the difference between the NYSERDA enhanced EUI and the baseline EUI.
- Multiplied EUI savings by the floor area for the construction sector being evaluated to calculate both the electric and natural gas usage savings.
    - To calculate the total floor area for the new construction commercial sector, we excluded the floor area attributed to the commercial New Construction program (30%).
    - To calculate the total floor area for the new construction residential sector, we excluded the floor area attributed to the ENERGY STAR Homes program (15%).
- Calculated electric demand reduction by diving the usage savings by the yearly operating hours for the sector being evaluated.

Key Differences between Original and Revised Approach

Cadmus' revised methodology had several key differences from NYSERDA's original methodology:

- Cadmus used EUIs that were calculated for each code year (instead of projecting EUIs from the original year and applying a percentage improvement for subsequent years). EUI's were sourced from PNNL documents listed in Data Sources.
- Cadmus applied floor areas based on Dodge data for the residential sector (as opposed to using housing starts from census data combined with average floor area).
- Cadmus used actual construction floor area data (as opposed to estimating the impact due to recession and estimating the remodel floor area).
- Cadmus used the same code-based EUI methodology for the residential and commercial analyses (instead of using the savings per unit).
- Cadmus applied compliance rates estimated by previous code compliance studies (sources for NYSERDA estimates were not documented).
- Cadmus used estimates of compliance rate improvements from studies on similar training programs (sources for NYSERDA estimates were not documented).
- Cadmus applied the same compliance rate improvements to new construction and to alterations.

Data Sources

Table 1 through Table 4 provide source details for the data Cadmus used in our revised analysis for each construction sector. For the commercial sector, we sourced the EUIs from a PNNL document; for the residential sector, we calculated the EUIs based on the information given in that PNNL document (such as fuel cost and model house floor area). Cadmus was unable to find sources for some inputs:

- ***Percentage floor area for ENERGY STAR Homes*** (residential sector). We estimated this at 15% per the original NYSERDA analysis.
- ***Percentage floor area for the commercial New Construction program*** (commercial sector). We estimated this at 30% per the original NYSERDA analysis.
- ***NYSERDA T&MD program improvement rate*** (residential sector). This is the % code compliance improvement attributable to the T&MD program. We used the same improvement rate as that in the commercial sector analysis.

Table 1. Key Data Inputs: Commercial New Construction

Input	Source
Hours of Operation	*New York Technical Reference Manual* version 8 (NY TRM v8), facility operating hours from commercial lighting measure (pg. 624) weighted by Dodge new construction commercial data
EUI (90.1-2007 and 90.1-2010)	Cost Effectiveness of ASHRAE Standard 90.1-2010 for the State of New York; PNNL-22999
EUI (90.1-2013 and 90.1-2016)	Cost Effectiveness of ASHRAE Standard 90.1-2016 for the State of New York; PNNL-30330
Weighting for Building Type and Climate Zone	Cost Effectiveness of ASHRAE Standard 90.1-2016 for the State of New York; PNNL-30330
Code Compliance Rates	*Code to Zero Initiative Market Evaluation Report: Baseline Estimates and Progress toward Goals*, NYSERDA Contract # 104542; June 2020
Percentage of Floor Area (for NYSERDA Commercial New Construction program	Original NYSERDA Analysis; SBC4 Energy code savings calc-creationbypjr-revised 1-30-2012.xls
NYSERDA T&MD Program Improvement Rate	*Massachusetts TXC47 Non-Residential Code Compliance Support Initiative Attribution and Net Savings Assessment*, July 26, 2018
Building Floor Area	Dodge *Historical Starts Dashboard* for commercial new construction projects from 2012 to 2020

Table 2. Key Data Inputs: Commercial Major Alteration

Input	Source
Hours of Operation	NY TRM v8, facility operating hours from commercial lighting measure (pg. 624) weighted by Dodge new construction commercial data
EUI (90.1-2007 and 90.1-2010)	Cost-Effectiveness of ASHRAE Standard 90.1-2010 for the State of New York; PNNL-22999
EUI (90.1-2013 and 90.1-2016)	Cost Effectiveness of ASHRAE Standard 90.1-2016 for the State of New York; PNNL-30330
Weighting for Building Type and Climate Zone	Cost Effectiveness of ASHRAE Standard 90.1-2016 for the State of New York; PNNL-30330
Code Compliance Rates	*Code to Zero Initiative Market Evaluation Report: Baseline Estimates and Progress toward Goals*, NYSERDA Contract # 104542; June 2020
NYSERDA T&MD Program Improvement Rate	*Massachusetts TXC47 Non-Residential Code Compliance Support Initiative Attribution and Net Savings Assessment*, July 26, 2018
Building Floor Area	Dodge *Historical Starts Dashboard* for commercial major addition, and commercial addition and alteration from 2012 to 2020

Table 3. Key Data Inputs: Residential New Construction

Input	Source
Hours of Operation	Original NYSERDA Analysis; SBC4 Energy code savings calc-creationbypjr-revised 1-30-2012.xls
EUI (IECC-2009)	Cost Effectiveness Analysis of the Residential Provisions of the 2015 IECC for New York; PNNL-23940 Rev-2; 2015 IECC: Energy Savings Analysis; PNNL-23977
EUI (IECC-2015 and IECC-2018)	Cost-Effectiveness Analysis of the Residential Provisions of the 2018 IECC for New York; PNNL; National Cost-Effectiveness of the Residential Provisions of the 2018 IECC; PNNL-28515
Weighting for Building Type and Climate Zone	Cost-Effectiveness Analysis of the Residential Provisions of the 2015 IECC for New York; PNNL-23940 Rev-2; Cost-Effectiveness Analysis of the Residential Provisions of the 2018 IECC; PNNL
Code Compliance Rates	*Code to Zero Initiative Market Evaluation Report: Baseline Estimates and Progress toward Goals*, NYSERDA Contract # 104542; June 2020
Percentage of Floor Area (for ENERGY STAR Homes)	Original NYSERDA Analysis; SBC4 Energy code savings calc-creationbypjr-revised 1-30-2012.xls
NYSERDA T&MD Program Improvement Rate	*Massachusetts TXC47 Non-Residential Code Compliance Support Initiative Attribution and Net Savings Assessment*, July 26, 2018
Building Floor Area	Dodge *Historical Starts Dashboard* for residential new construction from 2012 to 2020

Table 4. Key Data Inputs: Residential Major Alteration

Input	Source
Hours of Operation	NY TRM v8, operating hours from residential heat recovery ventilator measure (pg. 180)
EUI (IECC-2009)	Cost-Effectiveness Analysis of the Residential Provisions of the 2015 IECC for New York; PNNL-23940 Rev-2; 2015 IECC: Energy Savings Analysis; PNNL-23977
EUI (IECC-2015 and IECC-2018)	Cost-Effectiveness Analysis of the Residential Provisions of the 2018 IECC for New York; PNNL; National Cost-Effectiveness of the Residential Provisions of the 2018 IECC; PNNL-28515
Weighting for Building Type and Climate Zone	Cost-Effectiveness Analysis of the Residential Provisions of the 2015 IECC for New York; PNNL-23940 Rev-2; Cost-Effectiveness Analysis of the Residential Provisions of the 2018 IECC for New York; PNNL
Code Compliance Rates	*Code to Zero Initiative Market Evaluation Report: Baseline Estimates and Progress toward Goals*, NYSERDA Contract # 104542; June 2020
NYSERDA T&MD Program Improvement Rate	*Massachusetts TXC47 Non-Residential Code Compliance Support Initiative Attribution and Net Savings Assessment*, July 26, 2018
Building Floor Area	Dodge *Historical Starts Dashboard* for residential major addition, and residential addition and alteration from 2012 to 2020

Results (New Analysis)

Table 5 through Table 9 provide the estimated savings attributed to the Advanced Energy Codes and Standards program for the different market segments.

Table 5. Advanced Energy Codes and Standards Program Savings – Total

Savings - Total	2015	2016	2017	2018	2019	2020
Electric						
Usage Savings (GWh)	116.88	78.88	88.35	84.19	89.00	56.64
Demand Reduction (MW)	33.229	22.517	25.005	23.764	25.345	15.744
Natural Gas						
Savings (Billion Btu)	135.40	106.56	103.51	100.13	100.69	78.97

Table 6. Advanced Energy Codes and Standards Program Savings – Commercial New Construction

Savings - Commercial (New Construction)	2015	2016	2017	2018	2019	2020
Electric						
Usage Savings (GWh)	90.86	60.39	63.19	61.73	68.69	40.92
Demand Reduction (MW)	26.948	17.910	18.741	18.308	20.370	12.137
Natural Gas						
Savings (Billion Btu)	74.07	52.17	54.33	53.07	59.05	39.80

Table 7. Advanced Energy Codes and Standards Program Savings – Commercial Major Alteration

Savings - Commercial (Major Alterations)	2015	2016	2017	2018	2019	2020
Electric						
Usage Savings (GWh)	14.97	11.74	15.94	13.18	12.23	7.60
Demand Reduction (MW)	4.440	3.481	4.728	3.909	3.627	2.255
Natural Gas						
Savings (Billion Btu)	12.20	10.14	13.71	11.33	10.51	7.39

Table 8. Advanced Energy Codes and Standards Program Savings – Residential New Construction

Savings - Residential (New Construction)	2015	2016	2017	2018	2019	2020
Electric						
Usage Savings (GWh)	10.94	6.69	9.11	9.16	8.00	8.05
Demand Reduction (MW)	1.824	1.115	1.518	1.527	1.333	1.342
Natural Gas						
Savings (Billion Btu)	48.66	43.80	35.04	35.26	30.79	31.53

Table 9. Advanced Energy Codes and Standards Program Savings – Residential Major Alteration

Savings - Residential (Major Alterations)	2015	2016	2017	2018	2019	2020
Electric						
Usage Savings (GWh)	0.11	0.07	0.11	0.12	0.09	0.06
Demand Reduction (MW)	0.018	0.012	0.019	0.020	0.015	0.010
Natural Gas						
Savings (Billion Btu)	0.47	0.45	0.43	0.47	0.34	0.24

For some funding for the Advanced Energy Codes and Standards Program was provided from the Technology and Market Development Program and from the Clean Energy Fund. Because the proportion of budget allocations differed by year, NYSERDA adjusted the savings estimates provided above according to relative budget fund. After adjusting for budget allocation, the Advanced Energy Codes and

Standards program savings under the Technology and Market Development Program are shown in Table 10.

Table 10. Advanced Energy Codes and Standards Program Savings – Adjusted for Budget

Savings - Total	2015	2016	2017	2018	2019	2020
Electric						
Usage Savings (GWh)	116.88	78.88	88.01	62.60	27.21	0.71
Demand Reduction (MW)	33.2	22.5	24.9	17.7	7.8	0.2
Natural Gas						
Savings (Billion Btu)	135.4	106.6	103.1	74.5	30.8	1.0
Percent Attributable to the Technology and Market Development Program Based on Budget						
%	100%	100%	100%	74%	31%	1%

Comparison

The estimated program savings for electricity provided by the revised analysis are on the same order of magnitude with the estimates generated by the original NYSERDA analysis. In contrast, the estimates for natural gas savings are significantly lower than those produced by the original analysis. Several differences between the two-analyses resulted in the savings changes:

- In the revised analysis, Cadmus did not count savings for years prior to 2015 (the initial year for the Advanced Energy Codes and Standards program). Additionally, the original analysis did not provide results for years 2018 through 2020.
- In the revised analysis, Cadmus used the actual floor area for the major alteration categories (sourced from the Dodge data) of approximately 10% of the new construction floor area (per year). The original analysis used a 50% estimate.
- In the revised analysis, Cadmus based compliance rates on typical empirical estimates. The original analysis estimated much smaller business-as-usual code compliance rates (without providing citations).
- In the revised analysis, Cadmus based savings on how the compliance rate affects estimated consumption under each code. The original analysis estimated savings for each code based on the energy use, adjusted for non-compliance, under a baseline code prior to the period analyzed.
- The largest change between the two analyses was in the estimate of natural gas savings due to the program. The discrepancy resulted primarily due to different savings per square foot estimates. The original analysis resulted in a much larger savings per square foot value than the revised analysis. For example, for 2015 commercial new construction savings the original analysis estimated 7.6 kBtu per square foot, whereas the updated analysis estimated 1.15 kBtu per square foot. For 2015 commercial major alterations the original per square foot savings estimate was 8.76 kBtu, whereas the updated savings estimate was 1.58 kBtu per square foot.

Table 11 through Table 13 show a comparison of the total calculated savings from the original NYSERDA methodology to the total savings from the revised calculation.

Table 11. Comparison of Savings – Gigawatt-Hours

Savings - Total GWh	2012	2013	2014	2015	2016	2017	2018	2019	2020	Total
Original NYSERDA Workbook (GWh)	48.33	48.99	59.38	99.65	101.15	119.37	0.00	0.00	0.00	476.86
New Analysis (GWh)	0.00	0.00	0.00	116.88	78.88	88.35	84.19	89.00	56.64	513.95
Difference (GWh)	**-48.33**	**-48.99**	**-59.38**	**17.23**	**-22.26**	**-31.01**	**84.19**	**89.00**	**56.64**	**37.09**
Percentage of Original Estimate	**0%**	**0%**	**0%**	**117%**	**78%**	**74%**				**108%**

Table 12. Comparison of Savings – Megawatts

Savings - Total MW	2012	2013	2014	2015	2016	2017	2018	2019	2020	Total
Original NYSERDA Workbook (MW)	10.077	10.208	12.377	20.456	20.744	24.484	0.000	0.000	0.000	98.35
New Analysis (MW)	0.000	0.000	0.000	33.229	22.517	25.005	23.764	25.345	15.744	145.60
Difference (MW)	**-10.077**	**-10.208**	**-12.377**	**12.773**	**1.773**	**0.521**	**23.764**	**25.345**	**15.744**	47.26
Percentage of Original Estimate	**0%**	**0%**	**0%**	**162%**	**109%**	**102%**				**148%**

Table 13. Comparison of Savings – Billion Btu (Natural Gas)

Savings - Total (Billion Btu)	2012	2013	2014	2015	2016	2017	2018	2019	2020	Total
Original NYSERDA Workbook (Billion Btu)	292.57	299.48	361.08	723.98	742.16	874.34	0.00	0.00	0.00	3,293.61
New Analysis (Billion Btu)	0.00	0.00	0.00	135.40	106.56	103.51	100.13	100.69	78.97	625.27
Difference (Billion Btu)	**-292.57**	**-299.48**	**-361.08**	**-588.57**	**-635.60**	**-770.83**	**100.13**	**100.69**	**78.97**	**-2,668.34**
Percentage of Original Estimate	**0%**	**0%**	**0%**	**19%**	**14%**	**12%**				**19%**

Appendix F: CEF Methodology

Memorandum

To: Patricia Gonzales, PhD; NYSERDA

From: Allen Lee, PhD, Karen Horkitz, and Jeremy Eckstein; Cadmus

Subject: Proposed Methodology for Analyzing Indirect Energy Impacts of the Code to Zero Initiative

Date: June 19, 2020

Introduction

This memo proposes a methodology for analyzing the indirect energy impacts of the Code to Zero Initiative. The objective of this memo is to solicit feedback from NYSERDA and provide the basis for finalizing the methodology.

As noted in NYSERDA's *Code-to-Zero Evaluation Plan*, assessing the indirect impacts of the Initiative is linked to hypotheses testing. NYSERDA developed a set of testable hypotheses in the *Theory of Change for the Initiative* and Cadmus will work with NYSERDA to ensure that indicators and data collection processes are aligned to support the analysis. Although the actual analysis of indirect impacts will not occur for several years, it is important to design the methodology now to ensure that appropriate data are collected during the years prior to the analysis. Some of the activities included in this proposed plan are not reflected in the current evaluation plan: such activities are identified in the sections below. Cadmus will make adjustments to the evaluation plan where necessary, based on the final methodology agreed upon-.

Indirect impacts are market effects that are expected to accrue over the longer term from follow-on market activity that results from the activities NYSERDA undertakes in this Initiative. The Initiative activities are intended to influence the behavior of various stakeholder groups through ongoing training, demonstrations, and technical support. NYSERDA designed this Initiative to produce indirect impacts, as most of the energy impacts will result from market activities and changes that occur in the market over time in response to NYSERDA's market interventions.

Indirect Impacts Framework

This section discusses the basic framework required to estimate indirect savings from the Initiative.

Logic Model

NYSERDA developed a logic model to characterize the structure of the Code to Zero Initiative and to provide the basis for evaluating its impacts.[1] This logic model presents market barriers, Initiative activities (and resources), target audiences, outputs, near-term outcomes, and mid- and long-term outcomes. Cadmus extracted key portions of the logic model to guide our development and explanation of its proposed analysis methodology.

Table 1 lists the five major activities in the Initiative, along with their outputs and anticipated outcomes. The table also presents indicators that can be used to monitor the performance and progress of the Initiative. As described in the *Code-to-Zero Evaluation Plan*:

"[P]rogram activity/output indicators represent measurable, quantifiable direct results of activities undertaken in the Initiative. Outputs are a key way of regularly tracking progress, especially in the early stages of an Initiative, before broader market changes are measurable. Outcome indicators can encompass near-term through longer-term changes in market conditions expected to result from the activities/outputs of an intervention."

Indicators are clear, verifiable metrics of how well the Initiative is achieving its goals, with outcomes ranging from accomplishing planned activities to driving fundamental market changes. For each activity, the table presents multiple indicators that can be used to track the progress of various components of the logic model. The outcome indicators will be assessed relative to a baseline value, which will be established through the initial steps of the evaluation, with progress measured periodically throughout the evaluation.

[1] The logic model appears in Appendix A of the *Clean Energy Fund Investment Plan: Codes Chapter,* dated April 19, 2019. https://www.nyserda.ny.gov/-/media/Files/About/Clean-Energy-Fund/CEF-Codes-Chapter.pdf

Table 1. Key Elements of Code to Zero Initiative Logic Model

Initiative Activity	Outputs	Near-Term Outcomes (1-3 Years)	Longer-Term Outcomes (More than 3 Years)	Indicators
Support for code compliance and enforcement	Audience-specific training delivered (13,250 trained in total); general support services to jurisdictions that pay into the System Benefits Charge	Improved code process effectiveness	Code compliance increases throughout New York State (NYS)	Number trained; compliance increases by 10%
Code enactment support of ECCCNYS and stretch code (NY Stretch 2020)	Five entities receive support services from NYSERDA • New York Department of State receives support to enact ECCCNYS • Jurisdictions receive technical support to enact stretch codes	Supported entities implement the Energy Conservation Construction Code of New York State (ECCCNYS) or enact stretch codes	Jurisdictions enact the stretch code and enact ECCNYS	Number of supported entities enacting ECCCNYS; number of jurisdictions enacting the stretch code
Pilots: Stretch to Zero	Three pilots with positive findings; findings disseminated	Pilots are scaled to additional communities, further demonstrating positive findings	Jurisdictions adopt the stretch code; stretch code concept is integrated into ECCCNYS by NYS Department of State	Number of pilots supported (3); 10 non-pilot jurisdictions adopt stretch code
Pilots: alternative code enforcement structure	Three pilots with positive findings; findings disseminated	Pilots are scaled to additional communities, further demonstrating positive findings	Jurisdictions with alternative enforcement structures demonstrate improved enforcement of the energy code	Number of pilots supported (3); 8 non- pilot jurisdictions adopt alternative enforcement structures

Initiative Activity	Outputs	Near-Term Outcomes (1-3 Years)	Longer-Term Outcomes (More than 3 Years)	Indicators
Code development and advancement	Integration of stretch code concepts into ECCCNYS and national model code	Technologies and strategies considered in ECCCNYS and model code	Concepts integrated into ECCCNYS; model code adopted that addresses all aspects of a building's energy use and energy production	Number of supported code changes adopted including stretch code requirements

Overview of Savings Potential

Each Initiative activity could produce indirect energy savings, but the timing and mechanisms will vary. It is important to understand the outputs and outcomes from each activity and how they could produce energy savings.

The codes compliance and enforcement training activity is likely to produce the largest energy savings in the near term. This is because the training can be started and can reach large numbers of code officials and building professionals relatively quickly. Prior studies have demonstrated that immediately after such training, participants say that they plan to make changes in their code enforcement and compliance, and follow-up surveys have confirmed that the training led to behavior changes that improved enforcement and compliance.[2]

However, any energy savings resulting from greater compliance will be constrained by the current rate of noncompliance and the amount that compliance can be improved. To illustrate, if the latest energy code is intended to reduce the amount of building energy consumption by 10% compared to the prior code and compliance is at a level where buildings are achieving 90% of the expected savings, the maximum increase in savings from training would be 1% (10% of 10%) of the consumption under the prior code. This increase in savings would apply to the buildings associated with training attendees who were influenced by the training and possibly to buildings associated with other code officials or building professionals who were influenced by the trainees.

Although Initiative activities other than training will likely take longer to produce energy savings, some have the potential to generate larger savings. For example, the stretch code pilots are intended to encourage nonparticipant jurisdictions to adopt stretch codes, and ultimately to lead to the adoption of some of the stretch code components into the state energy code. If the stretch code produced 10% savings relative to the base code, then all buildings in jurisdictions that adopt the stretch code would generate savings a full 10% above the base code (if they fully comply). Any stretch code components adopted in the next base state code will generate savings in all new buildings across the state. The combined savings from these effects could be much larger than the savings from increasing the compliance rate alone, but the magnitude of savings will depend on how many and which jurisdictions adopt the stretch code and which of those components are adopted in the base code.

[2] NMR Group and Cadmus. March 10, 2020. *Massachusetts Codes and Standards Compliance and Support Initiative Residential and Commercial Immediate and Follow-up Surveys – All 2019 Reports.* MA19X04-B-CCSISVY.

Steps in Determining Program-Induced Indirect Savings

The overall process of determining program-induced indirect savings for each Initiative activity entails several steps:

1. The evaluator refines and explains the logic model for how each activity leads to indirect impacts and savings and identifies the key parameters that will be used to estimate the impact of each Initiative activity.
2. The evaluator uses the logic model to identify the outputs, outcomes, and indicators associated with each activity.
3. The evaluator works with the Initiative team to identify sources of information for each indicator that will be tracked during the course of the Initiative. Likely sources include Initiative data, results from pilot projects, Delphi panel results, representative jurisdiction interviews, training participant surveys, and secondary sources.
4. The evaluator compiles the information from all relevant sources and the annual indicator data.
5. The evaluator creates a panel of independent code experts to assess the market impacts of specific Initiative activities, based on a careful and systematic review of the evidence, and to determine the program-induced effects. The independent panel will include a mix of experts, not just from New York State but also from other parts of the country, who understand relationships between program activities and influence on compliance.
6. For Initiative activities they assess, the independent panel members review the compiled information and estimate the parameters required to calculate the indirect energy impacts of the Initiative for each activity (as specified in the component-specific sections of this document).
7. For all Initiative components, the evaluator estimates values for all parameters required to calculate the indirect energy impacts that are not estimated by the independent panel (as described in the component-specific sections of this document).
8. The evaluator uses the estimated parameter values for specific activities to calculate the estimated indirect energy impacts.
9. The evaluator makes any adjustments required to avoid double-counting impacts.

NYSERDA provided the following guidance for developing a savings estimation methodology:

"The program staff would like to explore adopting a savings methodology approach that may already be out in the field in use, but if there is not one that fits the NYSERDA program, then modifications to the current approach may be advisable. The current approach is a very detailed

bottom-up approach with a lot of inputs and uncertainty. The staff would like to limit their inputs, have greater certainty in the selected inputs, and would prefer a more top-down methodology."

Cadmus took this guidance into account when developing these proposed methodologies and has relied on approaches already used to the extent possible. The different activities in the Initiative, however, are very diverse, as are their mechanisms for affecting outcomes in the market. Therefore, we have tailored the methodology to fit the nature of each activity.

Training Impacts

This section presents Cadmus' proposed approach to evaluate indirect savings resulting from the Initiative's code compliance and enforcement training activities.

The basic algorithm for calculating indirect savings due to training is shown in Equation 1, where each variable in the equation is specific to buildings that are affected directly and indirectly by the training.

Equation 1. Training Indirect Savings Calculation

$$Indirect\ Savings_{Training}$$
$$= Compliance\ Rate\ Increase_{Training}$$
$$\times Energy\ Savings\ Per\ Unit\ Compliance\ Rate\ Increase_{Training}$$
$$\times New\ Buildings/SQFT\ Affected_{Training}$$

While this algorithm looks relatively straightforward, there are complexities. For example, the compliance rate must be expressed and measured in a way that reflects the effect of code compliance on energy savings. To produce reasonably accurate estimates of energy impacts, it may be necessary to disaggregate compliance by building components or by systems to account for building type and size. The affected buildings include those that trained code officials inspect for compliance and those that trained building professionals design or build. Table 2 summarizes the input variables used in Equation 1, their data sources, and the timing of when Cadmus will compile those inputs. Each variable is discussed in further detail below the table.

Table 2. Training Effects Input Variable Sources and Timing

Outcome Variable	Input Variables	Sources	Details	Timing
Compliance rate increase from training	Training effects on compliance rates	Independent panel estimate based on expertise and multiple sources; prior study findings; program tracking data; training surveys; jurisdiction in-depth interviews (IDIs); code compliance (as estimated by Delphi panel)	Independent panel reviews inputs from all sources; use experience and professional judgment to develop consensus estimates for change in compliance rate for residential and commercial buildings, new construction, and alterations resulting from training	2024 (collecting sources to inform panel estimate over multiple years)
Energy savings per unit change in compliance rate	Energy use compared to compliance rate	Cadmus review of prior studies; building simulations (note that these results will also apply to the savings analysis of alternative enforcement effects)	Literature review of compliance rate versus energy use; building simulations (if needed); level of disaggregation determined and normalized by floor area	2024
Buildings affected by training	Building market characteristics	Dodge data; Construction Monitor data; construction market data; U.S. Census Bureau details	Census residential permits; other sources combined to cover commercial building market; building type and floor area compiled; profile of new construction and alterations developed	2024 (analysis for all years)
	Buildings/SQFT directly affected by trainees	Follow-up surveys	Number of buildings and floor area quantified by building type inspected or designed by trainees (accounting for possible overlap of code official and building professional counts)	Annual

Logic Model Components

The training targets code officials who are engaged in enforcing the code and building professionals who follow the code requirements by designing and constructing buildings. These trained participants are the output of the training activity, and the training output metric is the number of persons trained, possibly by profession.

The anticipated outcome is an increased level of compliance with the code. In the near term, the outcome is improved code process effectiveness, which captures both changes in the perceptions that building professionals have about the importance of the code (and their efforts to comply with the code) and in the effectiveness of the enforcement process to ensure compliance. In the longer term, specific compliance level targets can be established. For this Initiative, NYSERDA set a statewide target of 10% compliance rate increase.

The indicators for the training activity include the number of people who take the training (an output) and the compliance level percentage (an outcome). As stated above, the compliance level must be measured in a way that can be used to estimate the effects of code compliance on energy consumption.

Estimate of Compliance Rate Increase

Cadmus will convene an independent panel of national code experts to estimate the average change in compliance in buildings associated with training participants. The independent panel will base their estimates on experience and professional judgment, combined with data compiled by Cadmus.

We will ask the independent panel to estimate the change in compliance in buildings affected by training participants in terms of specific code requirements, system-level compliance, and whole-building compliance—the same categories that were estimated by the Delphi panel. For commercial buildings, the panel will indicate whether the estimated change in compliance rates varies by building type and, for both commercial and residential buildings, whether the change in compliance rates varies by jurisdiction type. The panel will provide separate estimates for new construction and for additions and alterations.

Cadmus will collect and compile data from the sources listed in Table 3 to inform the independent code expert panel that assesses the increase in code compliance resulting from the training. We will present this information to panel members in a well-organized, clearly written document.

Table 3. Compliance Rate Increase Estimate Inputs, Sources, and Timing

Input	Source	Details	Timing
Other program findings	Literature review by Cadmus	Review prior studies for training effects	2021
Number of trainees	Program tracking data	Obtain all information on training attendees	Annual
Training effects on intentions	Immediate surveys	Surveys document what trainees learned and how they plan to use the information	Ongoing

Input	Source	Details	Timing
Training effects on actions	Follow-up surveys	Surveys document specifics about what and how trainees have changed code compliance behavior based on training and with whom and what they have shared from training	Ongoing
Jurisdiction perceptions	Jurisdiction IDIs	Assess compliance rate by building type and system, the role of training and other activities in enhancing compliance, and areas for training to target	Annual
Compliance rate estimates and influences	Delphi panel	Current code compliance levels by building type, system, and key requirement (including with code change in May 2020)	2021, 2023

Literature Review and Initiative Data

Cadmus will research and document the study findings of how training programs have affected code compliance. We will also obtain training attendance data from NYSERDA and will organize these data by date, region, profession, and subject matter in a transparent and easy-to-process format.

Delphi Panel Information

The primary source of information for the independent code expert panel will be findings that Cadmus compiles from the Delphi expert panel. The Delphi panel's estimates of compliance rates are key inputs. The compliance rate is the percentage of code requirements that are complied with. The Delphi panel estimated compliance for individual code requirements (such as lighting power density), for major systems (such as mechanical systems), and for whole buildings for both new construction and alterations and additions.

The first Delphi panel process occurred from late 2019 to early 2020 and provided baseline compliance estimates for the 2016 ECCCNYS, which became effective in October 2016. The evaluation plan will require updating those Delphi panel estimates in 2021 and 2023. Given the code change in 2020, it will be important to use the 2021 Delphi panel estimates to establish baseline compliance rates for the new code. Furthermore, the subsequent Delphi panel estimates will be important evidence to establish estimates of the effect of training on compliance.

In addition to quantitative compliance estimates, the Delphi panel provides qualitative information that will support the independent code expert panel's estimates and provide added context. For example, the Delphi panel provides insights on challenges the market faces in complying with the energy code then describes how compliance challenges vary by building type and location. This descriptive information will be useful to the independent panel in judging the effect of the training on compliance.

Training Participant Information

Cadmus will extract and summarize information from the immediate surveys and follow-up surveys of training participants. The immediate survey will be administered during each training class and the follow-up surveys will be administered about six months after the training. We will design the surveys to gather details about what the participants learned and how they might use this information in their work as code official or building professional.

The data from these surveys will inform the independent panel about the influence of the training on participant behavior and will help panelists understand how the training affected enforcement of and compliance with the code. The immediate survey data will provide information about participants' intentions. The follow-up survey data will provide information about actions taken by the participants, how the training affected their behavior, and how they shared information and influenced the behavior of other professionals who might also affect code compliance.

Jurisdictional In-Depth Interview Data

Cadmus has interviewed representatives from three jurisdictions across NYS and documented the views and experiences of code officials and building professionals from diverse jurisdictions. The evaluation plan includes interviewing staff from these same jurisdictions year over year. These interviews provide information that can be compared to findings by the Delphi panel and may highlight unique perspectives or conditions that reflect jurisdictional differences, which are important to capture.

To assess the effects of training, the most useful information from the interviews is about challenges to code compliance, ways to enhance enforcement, the role of training, and any support other than training that would increase code compliance. Cadmus will summarize and share the relevant interview findings with the independent panel for their consideration.

Estimate of Buildings Affected and Unit Energy Savings

Indirect savings are an estimate of the savings resulting from changes in the compliance rate multiplied by an appropriate measure of the buildings/SQFT affected. Table 3 above identified the data sources required to estimate these values.

Building/SQFT Affected by Training

Cadmus will compile estimates of the building floor area or number of units constructed and the amount of alterations and additions that occur each year. We will use the training participant follow-up surveys to estimate the quantity of buildings affected by the training. We will design an appropriate method to accurately allocate the buildings/SQFT affected to building type, given the available data.

Unit Energy Savings

We will use existing information on the effect of different compliance rates on energy consumption, starting with prior studies for NYS. If necessary, we will supplement the available information by modeling building energy consumption with various assumptions about code compliance.

Indirect Savings Calculation

Cadmus will calculate the indirect energy savings from the training activities using Equation 1 (above) by multiplying the estimated compliance rate increase by the energy savings and buildings/SQFT affected. We will perform these calculations at the most disaggregated level possible as well as at an aggregated level.

Code Enactment Support Impacts

NYSERDA's Code to Zero Initiative includes two activities that will indirectly influence jurisdictions to adopt stretch codes:

1. General code enactment support. NYSERDA provides services (such as technical support and modeling) to jurisdictions with constrained resources and expertise. This activity can generate two type of indirect impacts: the first results when those jurisdictions receiving support go on to adopt a stretch code and the second results when those jurisdictions influence other jurisdictions to also adopt a stretch code. Additionally, NYSERDA provides support to the New York Department of State to enact the ECCCNYS.

2. Stretch code pilots. Through its stretch code pilots, NYSERDA supports a limited number of jurisdictions to adopt a stretch code. This activity can generate indirect benefits if those pilots also influence other jurisdictions (that NYSERDA did not directly assist) to adopt a stretch code.

Although these two initiative activities are distinct, supporting the enactment of NYStrech-2020 (general code enactment) and Stretch to Zero (pilots), we recommend assessing their indirect benefits using the same basic methodology. To accomplish this, we will analyze the indirect savings from stretch codes adopted outside the code enactment support and pilots and will assess how much influence the code support had on adoption and the influence of the stretch code pilots.

This section presents the proposed steps to analyze indirect savings from code enactment support, including stretch code pilots.

The basic method for assessing indirect energy savings is presented in Equation 2.

Equation 2. Code Enactment Support and Stretch Code Pilots Indirect Savings Calculation

$$Indirect\ Savings_{Stretch\ Code\ Adoption} = \sum(Potential\ Energy\ Savings\ Per\ Building\ / SQFT_{Stretch\ code,i} \times Compliance\ Rate_{Stretch\ code,i} \times New\ Building\ /SQFT\ Affected_{Stretch\ code,i} \times Attribution_i)$$

This equation assumes that the indirect result of the Initiative to provide code enactment support and implementing stretch code pilots is that some jurisdictions are indirectly influenced to adopt a stretch code. These jurisdictions could have been supported by the Initiative or could have been indirectly influenced by other jurisdictions or by NYSERDA's support. The equation sums the savings across all jurisdictions that were indirectly influenced to adopt a stretch code because of support provided by NYSERDA and adjusts these savings by compliance rate and by an attribution factor that captures how much influence the Initiative had on the jurisdiction's ability to adopt the code. Table 4 summarizes the inputs and sources required to calculate savings in Equation 2.

Table 4. Code Enactment Support Input Variable Sources and Timing

Outcome Variable	Input Variables	Source	Details	Timing
Potential stretch code savings per building	Savings from stretch code compared to base code	Energy modeling analysis by NYSERDA	Savings per residential building and per square foot for different commercial building types	2024

Outcome Variable	Input Variables	Source	Details	Timing
Stretch code compliance rate	Code compliance rate relative to base code compliance rate	Delphi panel informed by prior studies and Cadmus' inputs	Compile information from other studies, Cadmus' experience, and Delphi panel	2024
New buildings affected	Quantities of residential and commercial buildings in affected jurisdictions	Jurisdiction building permit data, Dodge data, Construction Monitor data, construction market data, and U.S. Census Bureau data	Request building construction data from affected jurisdictions (and supplement as needed with other sources)	2024
Attribution (stretch codes adopted as a result of NYSERDA activities)	Percentage of stretch code savings attributable to NYSERDA code enactment support and pilots	Independent panel estimate based on expertise and multiple sources: literature review. Delphi panel results, stretch code expert IDIs, adopting jurisdiction IDIs, and pilot participant interviews	Independent panel review inputs from all sources based on experience and professional judgment (with consensus estimates for percentage of stretch code savings attributable to NYSERDA code enactment support and pilots by adopting jurisdiction)	2024 (sources informing panel estimate collected over multiple years)

Logic Model Components

Key logic model components for NYSERDA's code enactment support and stretch code pilot activities are described below.

Code Enactment Support

The logic underlying code enactment support (such as with technical details and modeling services) is that providing this support to resource- or expertise-constrained jurisdictions will indirectly enable those jurisdictions to adopt a stretch code or to encourage other jurisdictions to adopt a stretch code.

The output of this code enactment support activity is jurisdictions that enact the NYStretch-2020 stretch code.

The anticipated outcome is that the Initiative's support services will enable jurisdictions, including those that did receive and those that did not receive NYSERDA support, to enact the same stretch code.

The core indicators for this program activity include the number of jurisdictions supported by the Initiative, the number of these jurisdictions that later adopt a stretch code, and the number of other jurisdictions that enact a stretch code and were influenced by this activity.

Stretch Code Pilots

The logic underlying the Initiative activity of having stretch code pilots is that the jurisdictions that offer and adopt such stretch code pilots would influence other jurisdictions to adopt similar codes, particularly if the pilots demonstrate energy and environmental benefits and the code is cost-effective and easy to implement.

The output delivered by the stretch code pilots activity is pilot jurisdictions that adopt the Stretch to Zero stretch code. The Initiative targets the recruitment of three pilot jurisdictions to adopt a stretch code and produce positive results that are broadly disseminated to other jurisdictions.

The anticipated outcome is that the Initiative's pilots will influence about 10 non-pilot jurisdictions to adopt the same stretch code.

The core indicators for this program activity are the number of pilot jurisdictions recruited to adopt a stretch code and the number of non-pilot jurisdictions that adopt a stretch code. Another indicator is the number of jurisdictions aware of the findings from the pilots and the degree to which the pilot results influenced each jurisdiction to adopt a stretch code.

Estimating Program-Induced Effects

Cadmus will convene an independent panel of national code experts to estimate how much the support provided by NYSERDA impacted jurisdictions' ability to adopt a stretch code and how much the pilots and information provided by NYSERDA influenced jurisdictions in their decision to adopt a stretch code. The estimates from these experts will provide the attribution factor in Equation 2, and will be based on experience and professional judgment, combined with data compiled by Cadmus.

We propose to estimate program-induced effects and indirect savings for each adopting jurisdiction (unless a very large number of those jurisdictions are supported by the Initiative and ultimately adopt a stretch code, in which case we will categorize jurisdictions (by size, urban versus rural, and other categories) and will develop estimates for each category.

Cadmus will collect and compile data from the sources listed in Table 5 to inform the independent panel. We will summarize this information in a structured format and present it to the independent panel so they can estimate the attribution of stretch code adoption to the pilots.

Table 5. Code Enactment Support and Stretch Code Pilots Attribution

Input Variables	Source	Details	Timing
Influence of Initiative on stretch code adoption	Literature review; Delphi panel results; interviews of stretch code experts	Provide findings about influences on stretch code adoption	2021, 2023
Perceptions about stretch codes in NYS	Jurisdictions IDIs	Compile information for input to independent panel attribution assessment	Annual
Influence of NYSERDA jurisdiction support on stretch code adoption	IDIs with jurisdictions supported by NYSERDA	Identify and interview jurisdictions; independent panel estimates attribution based on interview data	2022, 2024
Influence of jurisdictions that adopt stretch code on other jurisdictions	IDIs with jurisdictions adopting stretch code influenced by other stretch code jurisdictions	Identify and interview jurisdictions; independent panel estimates attribution based on interview data	2022, 2024

Literature Review and Initiative Data

Our literature review of secondary sources will include case studies of advanced technologies that were incorporated in national model energy codes and stretch codes. We also will review NYStretch Energy Code–2020 and future iterations of NYStretch. We will supplement and combine details from the literature review with responses from targeted interviews of four experts who are knowledgeable about stretch codes.

Delphi Panel Information

One task performed by the first Delphi panel was developing a forecast of the percentage of jurisdictions that will adopt a stretch code each year through 2030 absent any involvement by NYSERDA to encourage adoption. The Delphi panel also provided observations about factors affecting stretch code adoption and barriers to adoption and presented their comparison of adopting the One-Cycle stretch code versus the Stretch to Zero code.

We will update the first Delphi panel findings with those from subsequent cycles, then we will combine and summarize this information for a presentation to the independent panel.

Jurisdictional In-Depth Interview Data

In the in-depth interviews, we will ask respondents about the status of and projections for stretch code adoption, and about the adoption rates projected by the Delphi panel, to gather any insights based on their experience.

We will compile and summarize the data collected from the interviews each year to identify any trends and effects of the Initiative and will organize this information for a presentation to the independent panel.

Adopting Jurisdiction Interviews

Cadmus will design an interview instrument and will interview a sample of jurisdictions (or a census if the number of adopting jurisdictions is small) that adopt a stretch code. We will obtain information on what influenced them to adopt.

We also will interview representatives from non-pilot/ non-supported jurisdictions that adopted stretch codes during or after the pilot to determine code characteristics, awareness of the NYSERDA activities, and influence of NYSERDA activities on the design and adoption of the codes. These non-supported jurisdiction interviews will provide data needed to differentiate between the effect of the two Initiative activities (code enactment support and stretch code pilots).

Cadmus will summarize the findings from these interviews and from any other data provided by the jurisdictions in a format to present to the independent panel.

Estimate of Buildings/SQFT Affected, Unit Energy Savings, and Compliance Rate

Estimating the indirect savings from adopting a stretch code requires estimating the compliance rate for the stretch code, savings from the stretch code, and an appropriate measure of the buildings/ SQFT affected. We will estimate compliance with the stretch code based on estimates from the Delphi panel, prior studies, and Cadmus' experience and will estimate savings and the number of affected buildings using jurisdiction building construction data.

Indirect Savings Calculation

Cadmus will calculate the indirect energy savings from the adoption of stretch codes using Equation 2. We will conduct this analysis either by individual jurisdiction or by jurisdiction category and will sum the results.

Alternative Code Enforcement Structure Impacts

This section presents the proposed steps to analyze indirect savings resulting from adoption of alternative code enforcement structures by non-pilot jurisdictions. The basic algorithm for calculating indirect savings resulting from non-pilot adoption of alternative code enforcement approaches is presented in Equation 3.

Equation 3. Alternative Enforcement Structure Indirect Savings Calculation

$$Indirect\ Savings_{Alt\ enforcement}$$

$$= \sum(Attribution_i \times Compliance\ Rate\ Increase_{Alt\ enforcement,i}$$

$$\times Energy\ Savings\ Per\ Unit\ Compliance\ Rate\ Increase_{Alt\ enforcement,i}$$

$$\times New\ Buildings\ Affected_{Alt\ enforcement,i}\ )$$

This equation assumes that adoption of an alternative enforcement structure can increase code compliance above what it would have been under the standard enforcement process. Greater compliance in turn leads to energy savings. The equation sums the energy savings across all jurisdictions that adopt an alternative structure in response to the findings from the three pilot jurisdictions. The savings are adjusted by an attribution factor to capture how much influence the pilots had on each jurisdiction's decision to adopt an alternative structure. Table 6 summarizes the inputs needed to estimate the indirect energy savings due to non-pilot jurisdictions adopting alternative code enforcement structures.

Table 6. Alternative Code Enforcement Input Variable Sources and Timing

Outcome Variable	Input Variables	Source	Details	Timing
Alternative enforcement structure adopted as a result of NYSERDA activities	Percent of alternative enforcement structure adoption attributable to NYSERDA pilots	Independent panel estimate, based on expertise and multiple sources: literature review, Delphi panel, pilot jurisdiction IDIs, IDIs with other jurisdictions adopting alternative enforcement structures	Independent panel reviews inputs from all sources; based on experience and professional judgment develop consensus estimate of influence of pilots on other jurisdictions adopting alternative enforcement structures	2024; Delphi panel 2021 and 2023
Compliance rate increase	Compliance rate increase	same as above	same as above	2024; Delphi panel 2021 and 2023

Outcome Variable	Input Variables	Source	Details	Timing
Energy savings per unit change in compliance rate	Energy use compared to compliance rate	Cadmus review of prior studies; building simulations. Results will apply to training effects savings analysis too.	Review literature for compliance rate vs. energy use; perform building simulations if needed; determine level of disaggregation; normalize by floor area	2024
Buildings affected	Quantities of residential and commercial buildings in affected jurisdictions	Jurisdiction building permit data, Dodge data, Construction Monitor, Construction Market Data, US census	Request building construction data from affected jurisdictions; supplement as needed with other sources	2024

Logic Model Components

The logic underlying this Initiative component is that pilots adopting alternative enforcement structures would influence some other jurisdictions to adopt similar structures. If the pilots demonstrate benefits (such as greater compliance), the benefits outweigh any added costs or burdens, and if NYSERDA promulgates the findings effectively, the expectation is that other jurisdictions would want to take advantage of alternative enforcement structures and would adopt them.

The outputs delivered by the alternative code enforcement activity are pilot jurisdictions that adopt an alternative code enforcement approach. The initiative aims to conduct pilots with three jurisdictions, producing positive results that are disseminated broadly to other jurisdictions.

The anticipated outcome is that several non-pilot jurisdictions adopt alternative enforcement structures. The Initiative projects that eight jurisdictions will be influenced to adopt alternative structures and will produce positive results that include improved code compliance.

The core indicators for this Initiative component include the number of pilot jurisdictions recruited and the number of non-pilot jurisdictions that adopt an alternative enforcement structure. Another indicator is the number of jurisdictions aware of the findings from the pilot and the degree to which the results of the pilot influenced each jurisdiction to adopt an alternative structure.

Estimation of Attribution and Compliance Rate Increase

The independent panel will provide two types of information to inform Cadmus' assessment of the indirect savings from adoption of alternative enforcement structures. First, we will ask the panel to estimate how much the pilots and information provided by NYSERDA influenced jurisdictions' decision to adopt an alternative structure. This will provide the attribution factor in Equation 3, above.

Second, the panel will estimate the average change in compliance in buildings because of the change in enforcement structure. This is the second term in Equation 3. This process will follow a procedure similar to that described earlier for effects of training on code compliance.

We propose to analyze each adopting jurisdiction unless a very large number adopt an alternative structure. If the latter, we will categorize jurisdictions and develop estimates for each category.

We will compile and summarize data from multiple sources about the alternative compliance structures implemented through the Initiative in a structured format for presentation to the independent panel to provide the basis for the panel to estimate attribution and increases in code compliance rates.

Literature Review and Initiative Data

Cadmus will review and summarize findings from prior studies of alternative enforcement structures, including the structure design, components, advantages, and disadvantages, if available.

Delphi Panel Information

We will summarize information from the Delphi panel about alternative code enforcement structures. The first Delphi panel survey (late 2019 to early 2020) obtained estimates of the share of jurisdictions that currently implement alternative enforcement structures and observations about the potential benefits of such structures and likely jurisdiction concerns.

We will request similar information from subsequent Delphi panels every other year. We will expand the survey to solicit feedback on how the structures being adopted affect code compliance. We will compile and summarize the Delphi panel findings for presentation to the independent code expert panel.

Jurisdictional In-Depth Interview Data

Cadmus will review information from the interviews conducted with professionals in the three jurisdictions selected for in-depth interviews and document perceptions about alternative enforcement structures, awareness of jurisdictions that have adopted them, and experience with alternative structures.

We will compile and summarize data collected from the interviews each year, identify any trends and effects of the Initiative, and organize the information for presentation to the independent panel.

Adopting Jurisdiction Interviews

Cadmus will interview participants in the jurisdictions that adopted alternative enforcement structures during the pilot. We also will interview representatives from non-pilot jurisdictions that adopted such structures during or after the pilot to determine characteristics of the enforcement structures, awareness of the pilots, and influence of the pilots on the design and adoption of the enforcement structures. Interviews will be conducted with up to 10 jurisdictions.

We will summarize the findings from these interviews and any other data provided by the jurisdictions in a format for presentation to the independent panel. Data compiled by NYSERDA related to alternative enforcement structures may also be shared with the independent panel in addition to or in lieu of jurisdiction interviews.

Estimation of Other Equation Parameters

As in estimating training impacts, estimating the indirect savings from alternative enforcement structures requires multiplying the changes in compliance rate by an appropriate measure of the quantity of buildings affected and an estimate of the savings resulting from the change in compliance rate. We will follow a similar procedure to the one described above for the indirect savings from training.

This analysis for the enforcement structure changes will be simpler than for the training impacts. We will assume that all buildings in the jurisdictions are affected and that the effects are not dependent on specific code officials.

Indirect Savings Calculation

Cadmus will calculate the indirect energy savings from the adoption of alternative enforcement structures using Equation 3. We will conduct the analysis at either the individual jurisdiction level or by jurisdiction category and sum the results. We will multiply the attribution factor times the estimated compliance rate increase times the energy savings and the number of buildings affected.

State and National Code Development Impacts

This section presents the proposed steps to analyze savings resulting from indirect influences of the Initiative on national model code and on NYS energy code development and adoption. The basic

algorithm for calculating indirect savings from the influence of the Initiative on code development and adoption is shown in Equation 4.

Equation 4. Code Development and Adoption Indirect Savings Calculation

$$Indirect\ Savings_{Code\ D\ and\ A} = Savings_{Adoption,NYS} + Savings_{Development,NYS} + Savings_{Development,Model\ codes}$$

Where:

$Indirect\ Savings_{Code\ D\ and\ A}$ = Indirect savings from influence on code development (D) and adoption (A)

$Savings_{Adoption,NYS}$ = Indirect savings from influence on the timing of adoption of the ECCCNYS

$Savings_{Development,NYS}$ = Indirect savings from influence on the stringency of the ECCCNYS

$Savings_{Development,Model\ codes}$ = Indirect savings from influence on the stringency of residential and commercial model codes

This equation breaks the indirect savings into those from effects on the ECCCNYS and on the national model codes. For the NYS code, the equation accounts for the time that the Initiative advances code adoption as well as the added stringency of the code. For the national model codes, we assume they continue to follow their normal cycle, but the Initiative could have an effect on the final stringency. The stringency of the model codes affects savings in NYS by setting the threshold for stringency that the state might increase through amendments. Table 7 summarizes the inputs required to estimate the indirect energy savings from the Initiative's influence on code adoption timing and stringency.

Table 7. Code Development Impact Input Variable Sources and Timing

Outcome Variable	Input Variables	Source	Details	Timing
Savings from accelerating NYS code adoption	Months ECCCNYS adoption accelerated as result of NYSERDA Code-to-Zero Initiative activities	Independent panel, based on expertise and information from literature review, Delphi panel, interviews with code adoption professionals	Independent panel will provide consensus estimate of influence of code adoption acceleration	2024; Delphi panel 2021 and 2023
	Quantities of residential and commercial buildings constructed during time adoption was accelerated	Jurisdiction building permit data, Dodge data, Construction Monitor,	Request statewide building construction data; supplement as needed with other sources	2024

Outcome Variable	Input Variables	Source	Details	Timing
		Construction Market Data, US census		
	Savings from NYS code	Analyses conducted to support adoption; building energy simulations as needed	Compile ECCCNYS savings estimates; perform building energy simulations to fill gaps as needed	2024
Savings from increased NYS code stringency	Code requirements resulting from the influence of the Initiative	Independent panel, based on expertise and information from literature review, Delphi panel, interviews with code adoption professionals	Independent panel will provide consensus estimate of requirements influenced and extent of influence	2024
	Energy savings from increased ECCCNYS stringency	Analyses conducted to support adoption; building energy simulations as needed	Compile ECCCNYS savings estimates; perform building energy simulations to fill gaps as needed	2024
	Quantities of residential and commercial buildings constructed during time adoption was accelerated	Jurisdiction building permit data, Dodge data, Construction Monitor, Construction Market Data, US census	Request statewide building construction data; supplement as needed with other sources	2024
Savings from increased model code stringency	Code requirements resulting from the influence of the Initiative	Independent panel, based on expertise and information from literature review, interviews with code adoption professionals	Independent panel will provide consensus estimate of requirements influenced and extent of influence	2024
	Energy savings from increased model code stringency	Analyses conducted to support adoption; building energy simulations as needed; ICC and ASHRAE documentation	Compile model code savings estimates (ICC and ASHRAE); perform building energy simulations to fill gaps as needed	2024

Logic Model Components

The program theory underlying this Initiative component is that Initiative impacts, such as the influence on stretch code adoption, could have a second order effect on when codes are adopted in NYS, on their stringency, and on the stringency of national model codes. These impacts differ from the other impacts discussed here because there is no Initiative activity that directly targets state or national code adoption. That is, these impacts would be anticipated to result from other outputs or outcomes associated with the

Initiative. The logic model for the Code to Zero Initiative highlights this by showing these impacts as mid- to long-term outcomes.

In NYS, adoption of stretch codes could make it more likely that some of the required measures could be incorporated in the next state code. The Initiative might also help accelerate when NYS adopts its next code. At the national level, Initiative outcomes, such as stretch code adoption, could influence what measures are included in the next model codes by demonstrating their feasibility and cost-effectiveness.

Because there are no Initiative activities directed at the state code or national model codes, these impacts do not follow the logic model structure that presents activities and outputs. All activities and outputs that influence the state and national model codes are embedded in the other Initiative activities discussed previously.

The anticipated outcomes are the changes to the state and model codes described above. The core indicators include the requirements adopted in new state and model codes and the timing of NYS code updates.

Estimate of NYSERDA Influence: Acceleration and Stringency

The independent panel will be asked to identify how the Initiative affected state and model code development, including what requirements resulted from the influence of the Initiative and how the timing of state adoption was affected.

We will rely on information from the sources used to assess the other indirect savings. To credibly assess how the Initiative influenced code development and timing, we also recommend conducting interviews with NYS and model code developers. If available, Cadmus will review and summarize NYSERDA's own tracking of code advocacy efforts for the panel.

Estimate of Savings from ECCCNYS Acceleration and Increased Stringency and from National Model Code Stringency

To estimate code energy savings, we will compile data from other sources, such as studies conducted to support adoption of the ECCCNYS and development of the model codes. As necessary, we will perform building energy simulations to provide energy savings estimates for code requirements if information from other sources is inadequate.

Cadmus will use the information provided by the independent panel to estimate the additional energy savings resulting from the Initiative's influence. This will require using the estimates of the number of

new buildings constructed to calculate savings from the other effects as well as the energy impacts of the specific code requirements.

Indirect Savings Calculation

We will combine all data and calculate additional indirect savings that could be attributed to the state and model code requirements and timing effects of the Initiative. Given that these effects are secondary, we anticipate this analysis to be more of a qualitative assessment than a detailed quantitative analysis.

Eliminate Double-Counted Savings

There is the possibility that some Initiative activities will contribute to the same outcomes and impacts as other activities. Cadmus will start with the existing Initiative logic model and refine it as needed to identify paths through which different activities could produce similar outcomes. As described earlier, we anticipate overlap in the effects of the support provided to resource-constrained jurisdictions and the stretch code pilots, so our review of potential double-counting will include an assessment of the interactions and potential overlap of these Initiative activities.

We will use the revised logic model to guide development of the interview instruments and focus our data collection to distinguish among the effects of different Initiative activities.

We will carry this process into the independent panel assessments by stressing that the panel should consider indirect impacts that are linked primarily to a single Initiative activity. We will also ask the panel to identify any impacts that could be attributable to multiple Initiative activities and provide estimates of the extent of any overlapping influences.

We will be responsible for using this information to make any necessary adjustments to the impact assessments to minimize double counting.