December 2022

2021 BC Energy Step Code Market Response Study

BC HOUSING
RESEARCH CENTRE

About this Report

The BC Energy Step Code is a provincial regulation that local governments may use to incentivize or require a level of energy-efficiency in new construction that goes above and beyond the requirements of the *BC Building Code*. It consists of a series of Steps, representing increasing levels of energy-efficiency performance. By gradually adopting one or more Steps of the standard, local governments can increase building performance requirements in their communities. The Province of British Columbia has set a goal that all new buildings must reach a net-zero energy ready level of efficiency by 2032. The BC Energy Step Code serves as the policy pathway to reach that goal.

At time of writing, the current 2018 *BC Building Code* has been updated to Revision 2 and was put into effect in December 2019. The standard is applicable to all new Part 9 residential construction province wide and details building envelope and equipment performance requirements for five Steps of the BC Energy Step Code.

The purpose of this ongoing research project is to better understand the BC Energy Step Code's impact on housing design and costs over time. Information collected will be used to better support industry stakeholders across B.C. in adapting to the BC Energy Step Code. This report marks the second phase of the BC Energy Step Code Market Response Study. It builds upon the first phase, which was published in 2020.

Credits and Acknowledgments

This report was funded by BC Housing, BC Hydro and the Province of BC and was prepared by BTY Group. BTY would also like to thank the local chapters of the BC Home Builders Association for distributing the survey to their members.

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1.0 Research Purpose and Methodology

1.1 Research Questions

The purpose of the BC Energy Step Code Market Response Monitoring Study ("the project") is to better understand how the BC Energy Step Code is impacting residential construction practices and costs over time and across British Columbia (B.C.). The initial research questions identified were:

- What is the number of homes built in B.C. to each Step of the BC Energy Step Code?
- To what extent is the BC Energy Step Code affecting residential construction costs in B.C.?
- How are construction costs for homes built under the BC Energy Step Code changing over time across different Steps, housing types, and regions?
- As relevant, what is causing construction costs to change for homes built under the BC Energy Step Code?
- How much is attributable to the BC Energy Step Code requirement compared to other regulatory or market factors?
- How is the BC Energy Step Code changing the way the industry builds homes?
- What are the challenges affecting construction cost under the BC Energy Step Code that require addressing?

In addition to the above research questions, there was a desire to understand which specific energy saving measures (ESMs) were being implemented as the BC Energy Step Code became more widely used (Table 1).

Table 1: **Covered Energy Saving Measures (ESMs)**

Building Envelope	Mechanical Systems
Better air tightness	HRVs/ERVs
Improved insulation	Heat pumps for heating/cooling
Reduced thermal bridging	High efficiency appliances
High performance windows and doors	Right-sizing mechanical systems
Improved building orientation	On-demand/tankless hot water heating
Optimizing window location	Better mechanical control systems
Simplified building form	Heat pumps for domestic hot water heating
Less window area	Individual unit metering
Sun-shading devices	Wastewater heat recovery

1.2 Methodology

Consistent with the first phase of the project, a monitoring survey (referred to here as "the survey") was completed on-line and responses were solicited through the local branches of the Home Builders Association (HBA). The survey was available on-line between November 15 and December 15, 2021. Builders who completed the survey in full were eligible for one Continuing Professional Development (CPD) point. In addition, or alternatively, builders were given access to BC Housing's webinar on the Integrated Design Process

(IDP) in compensation for their time. In total, 69 builders completed the survey to an acceptable level for inclusion in the analysis. Responses that were substantially incomplete, with only a few questions answered, were excluded from the analysis.

Based on the results of the first phase, an extensive review of the survey questions and energy saving measures (ESMs) was undertaken in consultation with stakeholders and the advisory committee. As the questions used in the first phase were refined, it is often not possible to directly compare the results between the two reports directly.

It is also important to acknowledge that, as with the previous monitoring survey, the methodology will bias the results. This is because builders who are members of HBAs are generally more engaged compared to the average builder population. For example, the 2021 Licensed Residential Builder Survey Summary Report[1] reported that 54% of builders had built to the BC Energy Step Code in the past year compared to 71% of respondents to the monitoring survey. These results indicate that the monitoring survey respondents on average have considerably more experience with the BC Energy Step Code compared to the general residential builder population. Readers should also be aware that while the results of the monitoring survey provide useful insights, they are not statistically significant and should be interpreted with appropriate caution.

1.3 Monitoring Survey Participant Profile

As previously noted, monitoring survey respondents were primarily drawn from the membership of local HBA chapters across B.C., who distributed the on-line survey link to their members. Other salient features of the respondents are:

- By region, 19% of respondents reported they worked in the Lower Mainland/Southern Coast, 61% on Vancouver Island, 28% in the Southern Interior and 10% in Northern B.C.[2] As such, Vancouver Island is over-represented, and the Lower Mainland/Southern Coast is under-represented in the responses. Approximately 7% of respondents reported that they worked in more than one region of B.C. In these instances, where a respondent worked in multiple regions, their responses have been included for each region.
- Nearly three-quarters (74%) of respondents reported building custom single-family homes and over one-third (35%) reported building single-family homes speculatively. Under one-fifth reported building multiplexes (16%), townhomes/row homes (12%), and low-rise wood-frame multi-family homes (12%). Around 1% reported building low-rise, multi-family concrete homes and none reported activity in the high-rise, multi-family sector. For the purposes of analysis by building type, the responses are combined into two categories: single-family (custom and speculative) and multi-family (multiplexes, townhomes/row homes, and low-rise wood-frame and low-rise concrete).
- By experience, 10% of builders reported they had 0-5 years of experience, 12% 5-10 years, 32% 10-20 years, 30% 20-30 years, and 16% builders 30+ years. While the monitoring survey data was analyzed by years of experience, the results were not found to be useful and as such the results are not presented in the report.
- Close to three-quarters of respondents reported that they built to the BC Energy Step Code in the past 12 months and provided information on the Steps they had experience with. Of these builders (49 responses), 4% only had experience with Step 1, 12% had experience up to Step 2, 35% up to Step 3, 22% up to Step 4 and 27% up to Step 5. Parts of the analysis in the report are primarily focused on Step 3, as by the end of 2022 it is expected that all residential buildings in B.C. will need to be 20% more energy efficient than the current *BC Building Code* (BCBC).

[1] BC Housing website - Licensed Residential Builder Survey: www.bchousing.org/research-centre/housing-data/new-homes-data.

[2] Approximately 7% of builders reported they worked in more than one region, and as a result the geographic regions add to over 100%.

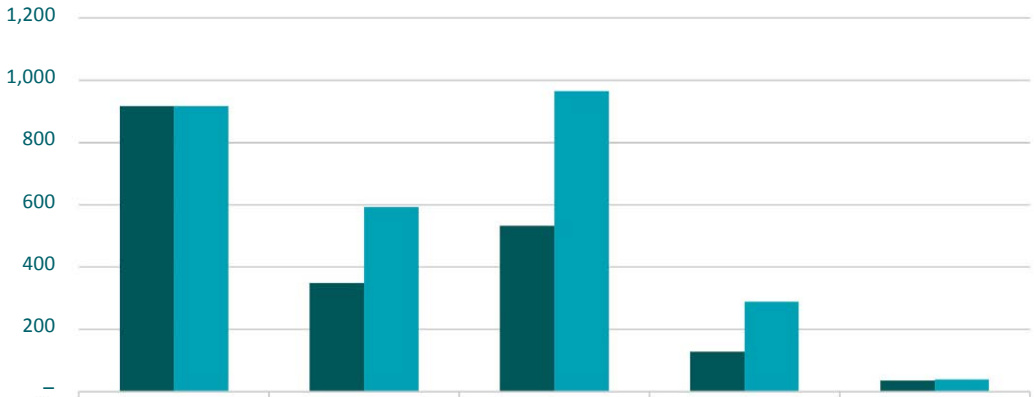
2.0 Research Results

2.1 Homes Built to the BC Energy Step Code

Using data obtained from Natural Resources Canada's (NRCan) EnerGuide Rating System (ERS) database[3], it is possible to do two things. Firstly, the number of homes built to the BC Energy Step Code can be identified. Secondly, it is possible to estimate the Step achieved. The data includes housing archetypes ranging from single detached to multi-family buildings of up to 3 stories. Therefore, the data excludes mid to high-rise buildings.

The number of homes built to any Step of the BC Energy Step Code increased from 1,963 homes in 2020 to 2,804 homes in 2021 (Figure 1). The proportion of homes built to Step 3 or higher also increased from around a third (36%) to closer to a half (46%). Out of the five Steps, Step 3 saw the biggest change between 2020 and 2021, with 434 more homes built in 2021 compared to 2020

Figure 1: **Homes Built to the BC Energy Step Code in 2020 and 2021**



	Step 1	Step 2	Step 3	Step 4	Step 5
2020	916	350	532	128	37
2021	916	593	966	289	40

2.2 Implementation of the BC Energy Step Code

As of November 2021, 62 local governments were referencing the BC Energy Step Code. A further 25 were in the process of consulting with industry.[4] Of those local governments that had implemented the BC Energy Step Code, 42% were in the Lower Mainland/Southern Coastal region. This was followed by 32% in the Southern Interior and 24% on Vancouver Island. In Northern B.C. only the Regional District of Fraser-Fort George was referencing the BC Energy Step Code. However, several more local governments were listed as "in consultation".

It is anticipated that by the end of 2022, all residential buildings in B.C. will need to be 20% more efficient than the current BC Building Code. This is part of the ongoing implementation of the BC Energy Step Code.

[3] Data provided by NRCan on September 28, 2022 by email. Additional calculations were undertaken to identify the associated Step for each housing project. Archetypes range from single detached homes to buildings of up to 3 stories. Data for 2020 and 2021 only are provided.

[4] BC Energy Step Code website - Implementation Updates: energystepcode.ca/implementation_updates

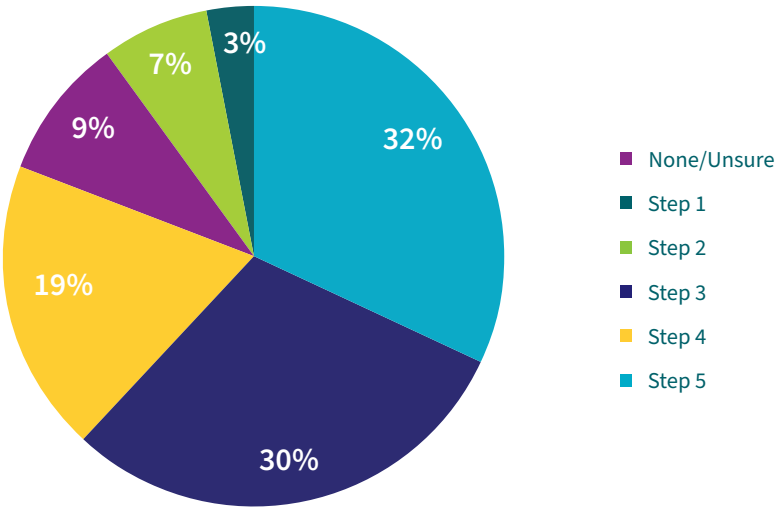
2.3 Builder Awareness, Training and Preparedness

According to BC Housing's 2021 Builder Survey, 92% of builders were aware of the BC Energy Step Code. This is up considerably from 52% in 2017. Just over half (52%) also reported having attended a training session on the BC Energy Step Code in the past year.[5]

When asked in the monitoring survey what was the highest Step they felt prepared for, 81% of respondents reported that they felt prepared for Step 3 or higher of the BC Energy Step Code. This was followed by 10% who felt they were ready for Step 1 or 2. Lastly,8% of respondents were either unsure or unprepared for any Step (Figure 2). Some observations by respondent demographic include:

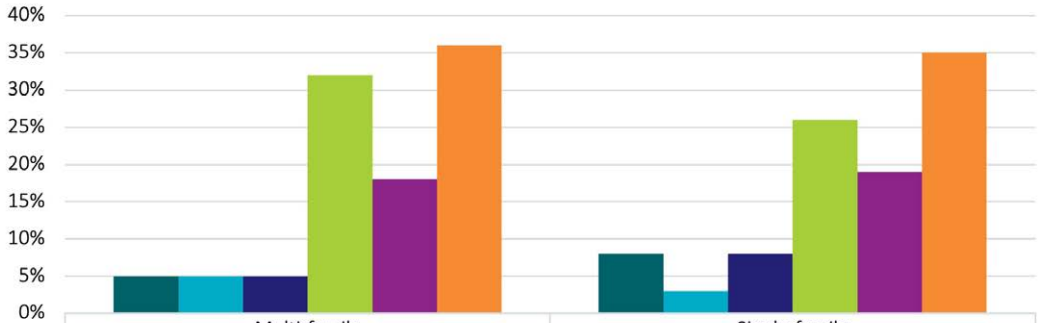
- By builder type, single-family builders (81%) and multi-family builders (86%) reported similar feelings of preparedness for Step 3 or higher (Figure 3). However, single-family speculative builders (75%) and multiplex builders (73%) were the least likely groups to feel prepared.
- Over three-quarters of builders working in the Southern Interior (79%) and Vancouver Island (79%) reported feeling prepared for Step 3 or higher. This was followed by builders working in the Lower Mainland/Southern Coast (69%) and Northern B.C. (43%) (Figure 4).

Figure 2: **Reported Preparedness by Highest Step**



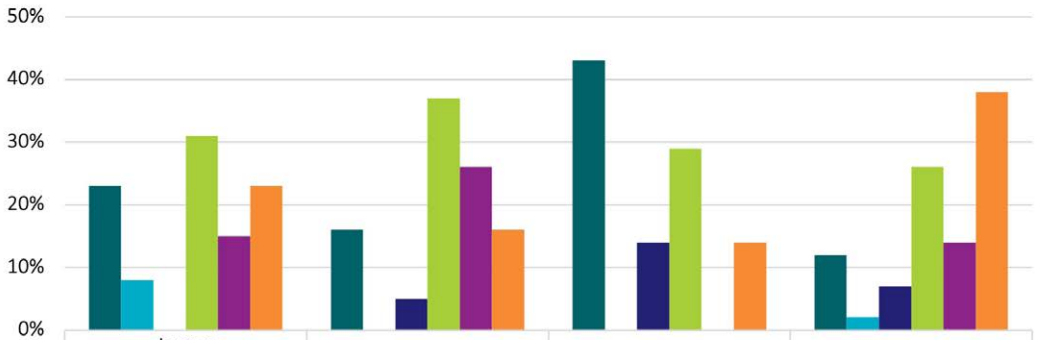
[5] BC Housing website – Licensed Residential Builder Survey: bchousing.org/research-centre/housing-data/new-homes-data

Figure 3: **Reported Preparedness by Highest Step and Builder Type**



	Multi-family	Single-family
None/Unsure	5%	8%
Step 1	5%	3%
Step 2	5%	8%
Step 3	32%	26%
Step 4	18%	19%
Step 5	36%	35%

Figure 4: **Reported Preparedness by Highest Step and Work Location**



	Lower Mainland/Southern Coast	Southern Interior	Northern B.C.	Vancouver Island
None/Unsure	23%	16%	43%	12%
Step 1	8%	0%	0%	2%
Step 2	0%	5%	14%	7%
Step 3	31%	37%	29%	26%
Step 4	15%	26%	0%	14%
Step 5	23%	16%	14%	38%

[6] BC Housing website - Licensed Residential Builder Survey: bchousing.org/research-centre/housing-data/new-homes-data [Invites Sent: 6,984 Surveys Completed: 1,220 Response Rate: 17.5%].

2.4 Building to BC Energy Step Code

Close to three-quarters of respondents (49 responses) reported that they had built to the BC Energy Step Code in the past 12 months and provided information on the Steps they had had experience with. Of these respondents, 4% only had experience with Step 1, 12% had experience up to Step 2, 35% up to Step 3, 22% up to Step 4 and 27% up to Step 5. As noted in the methodology section, these results likely reflect some of the bias in the monitoring survey. For example, in the 2021 Licensed Residential Builder Survey Summary Report,[6] approximately half of builders reported they were building to the BC Energy Step Code (54%). Of those, Step 3 was the most reported highest Step achieved at 51%, with close to a third reporting Step 1 (13%) or Step 2 (18%), and a smaller proportion either Step 4 (14%) or Step 5 (5%).

When monitoring survey respondents were asked about meeting their target Step for their last project (47 responses), 85% confirmed they met their target. This was followed by 11% reporting they were unsure and 4% reporting the target was not met. The two respondents that did not meet their target Step cited two separate reasons. One respondent indicated they failed to meet the airtightness requirements (Step 3). The other respondent reported reason was that they failed to meet the performance requirement of building equipment and systems (MEUI and ERS) (Step 5). For those who were unsure, reasons provided included not having completed the final testing and uncertainty over what the target was.

2.5 Energy Saving Measures and Construction Costs

This section focuses on the results from the monitoring survey on ESMs adoption and construction costs.

2.5.1 Building Envelope Energy Saving Measures (ESMs)

Among the 62 respondents who identified ESMs, the most common building envelope ESMs used were (Figure 5): better air tightness (90%), improved insulation (72%), reduced thermal bridging (64%), and use of high-performance windows and doors (61%). The lesser used ESMs were generally lower cost in nature. They included: optimizing window location (25%), simplified building form (24%), less window area (18%), and use of sun-shading devices (18%).

Overall, builders who reported achieving Step 3 or higher were more likely to report using all of the listed ESMs compared to those at Step 2 or below. Builders at Step 3 and above were considerably more likely to report using better air tightness, improved insulation and less window area compared to builders at Step 2 or below (Figure 6).

By region, there was substantial variation in some of the ESMs being reported (Figure 7). While it cannot be confirmed with certainty why these regional variations occur, it is possible to speculate that it is driven by a combination of factors. These include differences in climate conditions, supply chain considerations, access to industry education and training, and the regional "cultural" preferences of both builders and homebuyers:

- Respondents working in the Lower Mainland/Southern Coast were comparatively less likely to use high performance windows and doors (38%) and less window area (8%).
- Respondents working on Vancouver Island were relatively more likely to report using simplified building form (29%) and less window area (21%) compared to the other regions.
- Respondents working in the Southern Interior were comparatively more likely to report improved insulation (84%), improved building orientation (32%), and optimized window location (25%).
- Respondents working in Northern B.C. were most likely to report better air tightness (100%), reduced thermal bridging (86%), higher performance windows and doors (71%), but less likely to improve building orientation (14%), optimize window location (0%), or use simplified building form (0%).

Reported ESMs were generally consistent between single-family and multi-family builders, with the exception that multi-family builders were relatively more likely to report use of sun shading devices (27%) and less window area (23%). In contrast, single-detached builders were more likely to report reduced thermal bridging (58%) and optimized window location (21%).

When asked about the motivation behind the selected ESMs, over half of respondents indicated they were driven by the best energy savings for the cost premium (60%) and the best energy savings (52%) (Figure 8).

Figure 5: **Reported Use of Building Envelope ESMs**

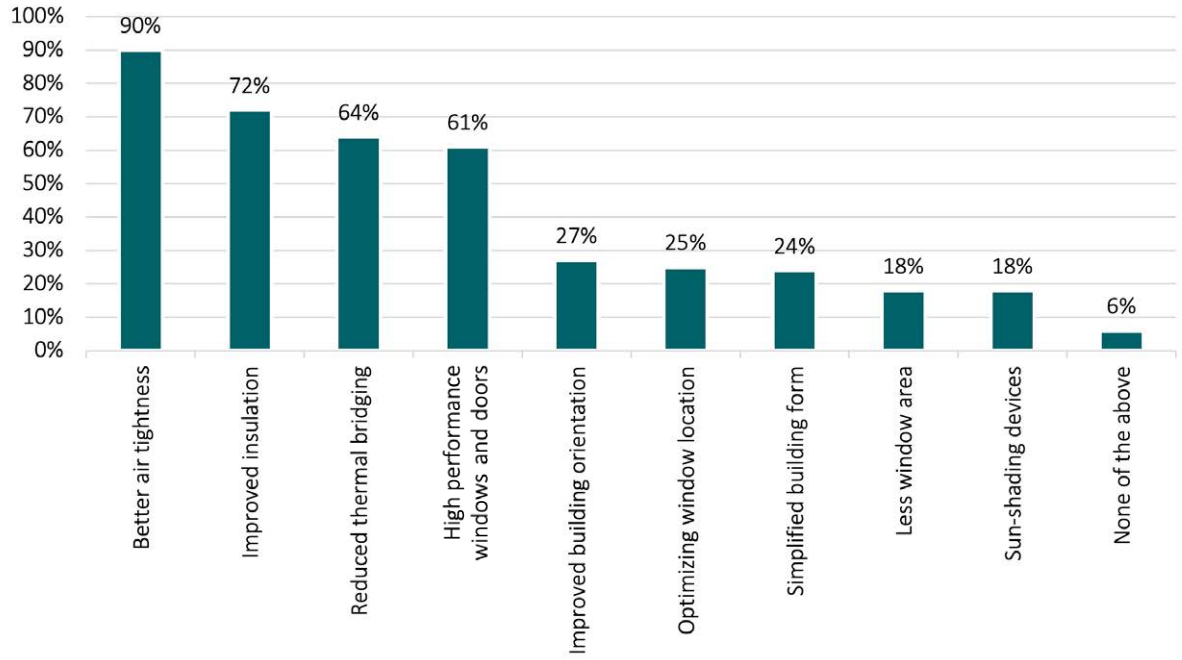
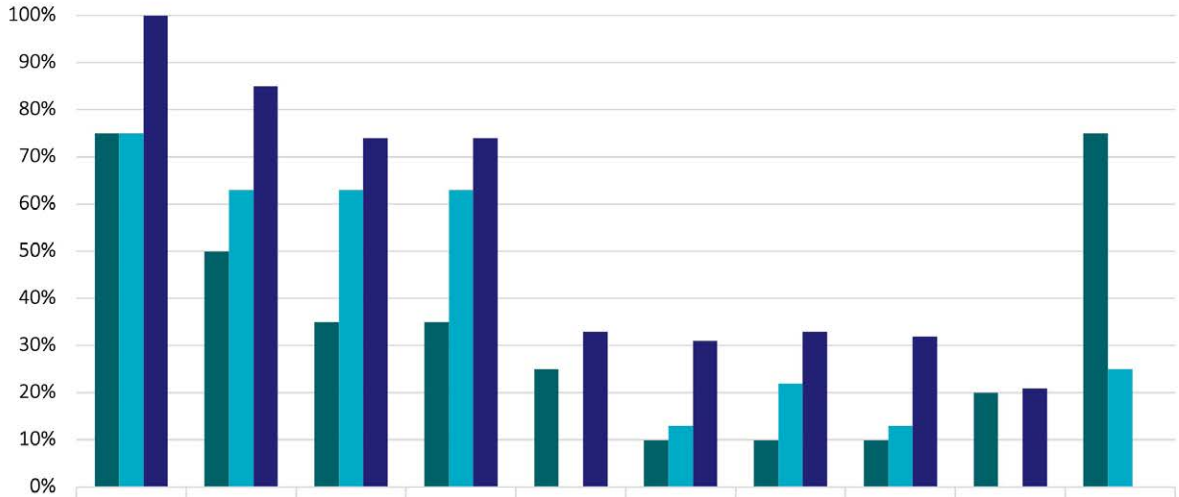
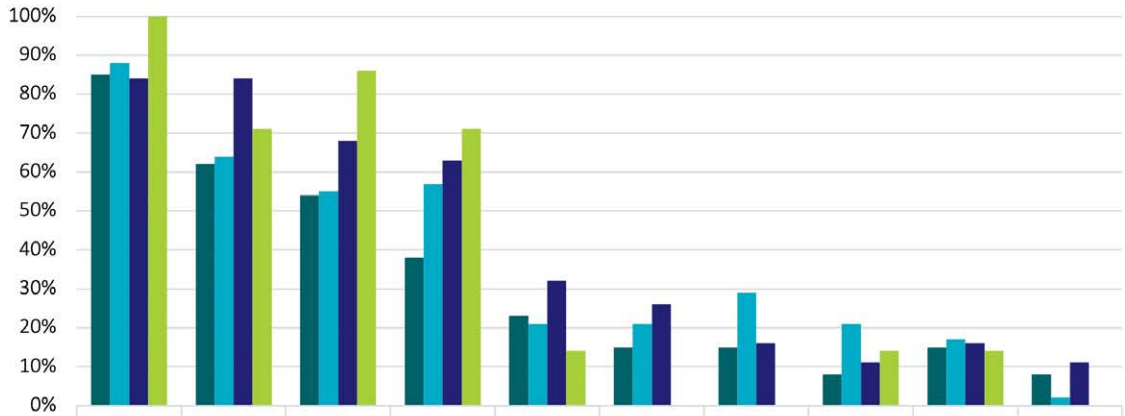


Figure 6: **Reported Use of Building Envelope ESMs by Highest Step Achieved**



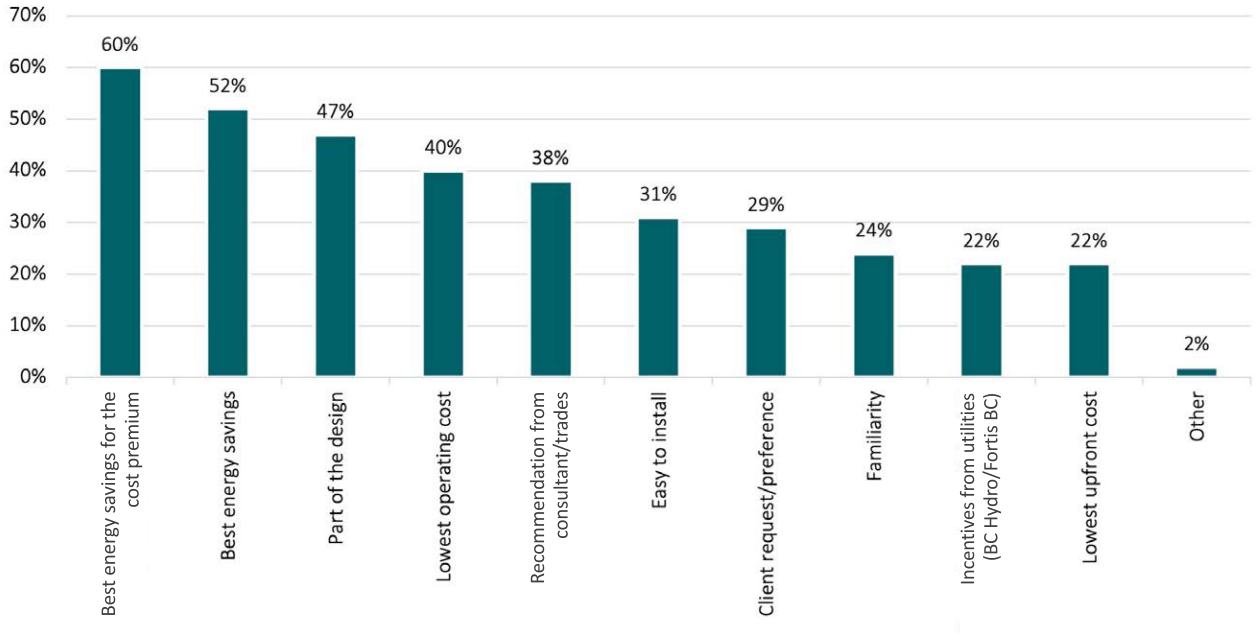
	Better air tightness	Improved insulation	Reduced thermal bridging	High performance windows and doors	Improved building orientation	Optimizing window location	Simplified building form	Less window area	Sun-shading devices	None of the above
No Step	75%	50%	35%	35%	25%	10%	10%	10%	20%	75%
Step 1 and 2	75%	63%	63%	63%	0%	13%	22%	13%	0%	25%
Step 3 and Higher	100%	85%	74%	74%	33%	31%	33%	32%	21%	0%

Figure 7: **Reported Use of Building Envelope ESMs by Work Location**



	Better air tightness	Improved insulation	Reduced thermal bridging	High performance windows and doors	Improved building orientation	Optimizing window location	Simplified building form	Less window area	Sun-shading devices	None of the above
Lower Mainland/Southern Coast	85%	62%	54%	38%	23%	15%	15%	8%	15%	8%
Vancouver Island	88%	64%	55%	57%	21%	21%	29%	21%	17%	2%
Southern Interior	84%	84%	68%	63%	32%	26%	16%	11%	16%	11%
Northern B.C.	100%	71%	86%	71%	14%	0%	0%	14%	14%	0%

Figure 8: **Reported Motivation for Selected Building Envelope ESMs**



* Other refers to responses that were not feasible due to increased cost, lack of necessary skilled labour to implement, local government requirements, or necessary products/materials not available.

2.5.2 Mechanical System Energy Saving Measures (ESMs)

Among the 64 respondents who identified mechanical system ESMs used, the most reported ESMs were HRVs/ERVs (73%) and heat pumps for heating/cooling (72%). Right-sizing the mechanical systems was reported by around half of respondents (52%) (Figure 9).

Except for high efficiency appliances, builders who reported achieving Step 3 or higher were more likely to report using all the listed ESMs compared to those at Step 2 or below (Figure 10). The largest difference between the two groups was for right-sizing the mechanical system (25% for Steps 1 and 2 compared to 69% for Steps 3 and higher). This variation by Step in use of right-sizing the mechanical systems is consistent with the reduced need for heating capacity in higher Step homes.

By region, there was substantial variation in some of the ESMs reported (Figure 11). As with the building envelope ESMs, it is possible to speculate that differences across regions is driven by a combination of factors. These differences include climate conditions, supply chain considerations, access to industry education and training, and the regional "cultural" preferences of both builders and homebuyers:

- Respondents working on Vancouver Island were relatively more likely to report using heat pumps for heating/cooling (76%) and right-sizing the mechanical system (55%) compared to other regions.
- Respondents working in the Lower Mainland/Southern Coast were comparatively more likely to report using high efficiency appliances (69%) and on-demand/tankless hot water heating (54%). However, they were less likely to report right-sizing the mechanical system (31%) or use of HRVs/ERVs (62%).
- Respondents working in the Southern Interior were comparatively more likely to report using individual unit metering (21%). However, they were less likely to report using on-demand/tankless hot water heating (37%) or heat pumps for hot water heating (5%).
- Respondents working in Northern B.C. were most likely to report not using any of the ESMs (14%). They were least likely to report using heat pumps for heating/cooling (43%) and using better mechanical control systems (14%). However, they were most likely to report using HRVs/ERVs (86%). This is consistent with its colder winter conditions and greater benefit of recouping heat from vented air.

Single-family builders were generally more likely to report using a given ESM compared to multi-family builders. The one exception to this was use of high efficiency appliances, with 68% of multi-family builders reporting their use.

When asked about the motivation behind the selected ESMs, over 40% of the 64 respondents who identified mechanical system ESMs indicated they were driven by recommendations from consultants/trades (44%), best energy savings for the cost premium (42%), and client request/preference (42%) (Figure 12).

Figure 9: **Reported Use of Mechanical System ESMs**

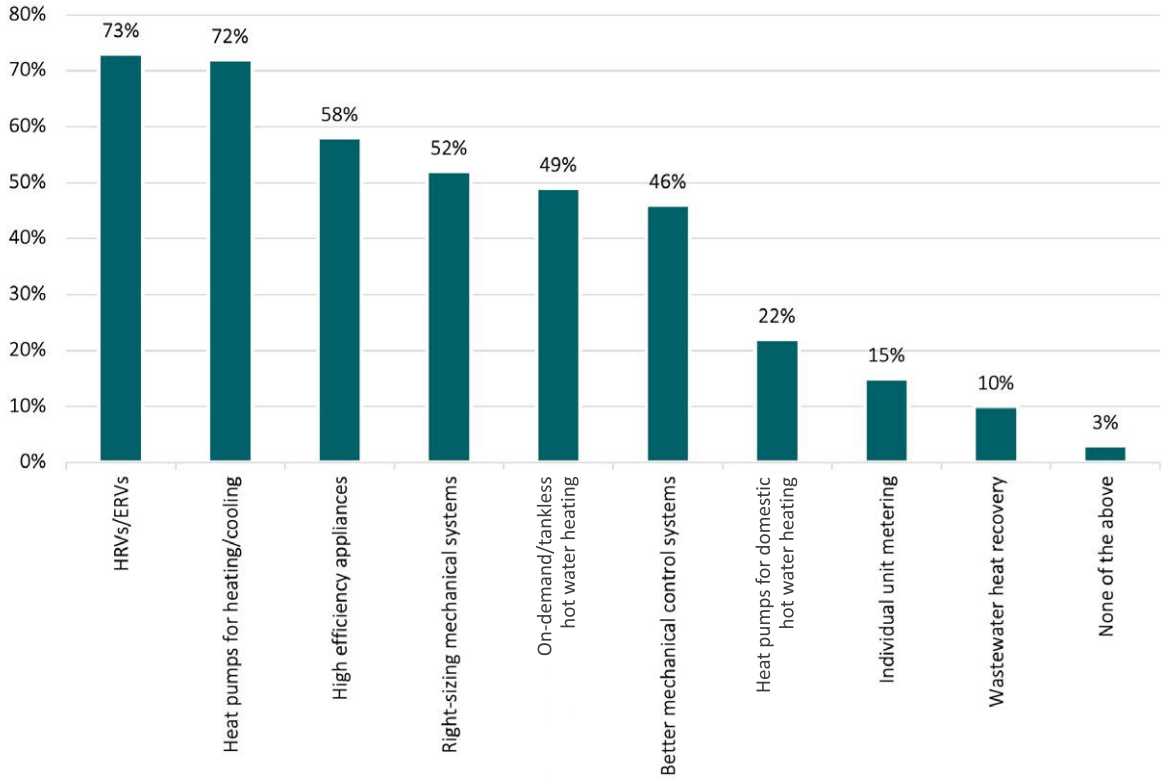
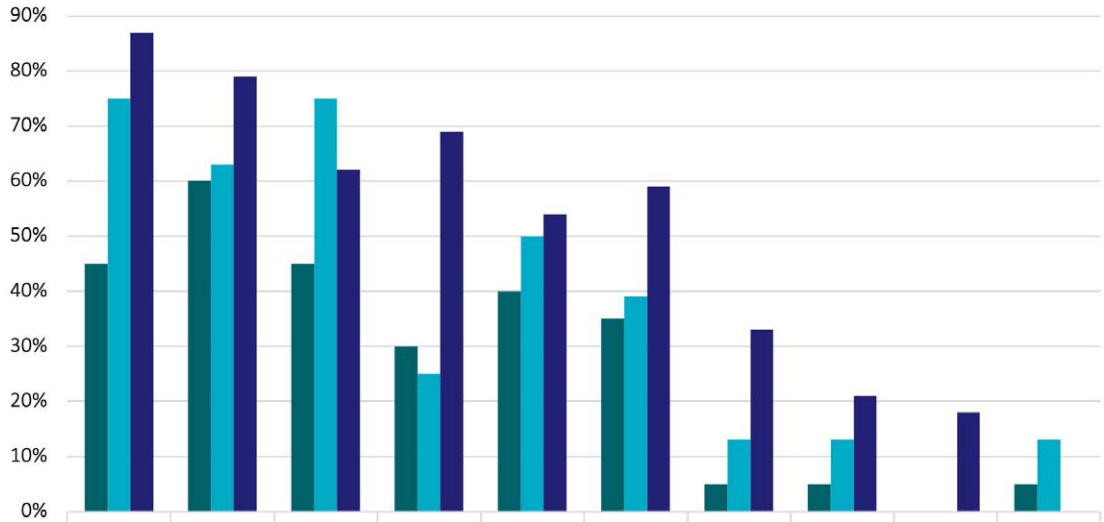
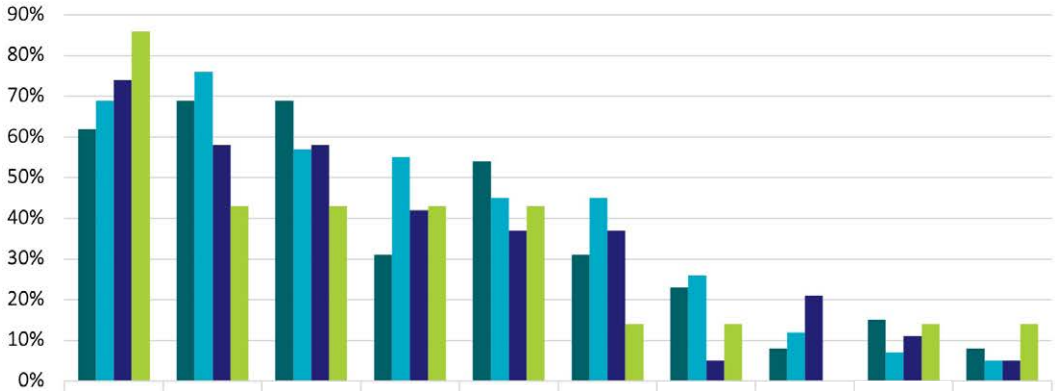


Figure 10: **Reported Use of Mechanical System ESMs by Highest Step Achieved**



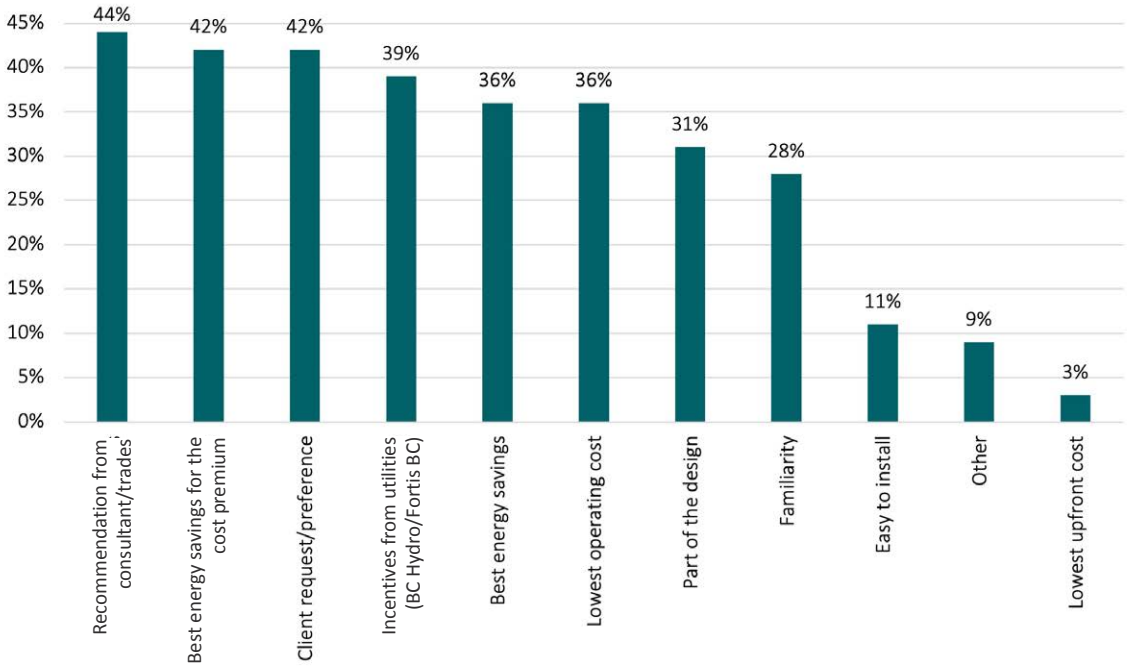
	HRVs/ ERVs	Heat pumps for heating/ cooling	High efficiency applicances	Right-sizing mechanical systems	On-demand tankless hot water heating	Better mechanical control systems	Heat pumps for domestic heating	Individual unit Metering	Waste-water heat recovery	None of the above
No Step	45%	60%	45%	30%	40%	35%	5%	5%	0%	5%
Step 1 and 2	75%	63%	75%	25%	50%	39%	13%	13%	0%	13%
Step 3 and Higher	87%	79%	62%	69%	54%	59%	33%	21%	18%	0%

Figure 11: **Reported Use of Mechanical System ESMs by Work Location**



	HRVs/ ERVs	Heat pumps for heating/ cooling	High efficiency applicances	Right-sizing mechanical systems	On-demand tankless hot water heating	Better mechanical control systems	Heat pumps for domestic heating	Individual unit metering	Waste-water heat recovery	None of the above
Lower Mainland/Southern Coast	62%	69%	69%	31%	54%	31%	23%	8%	15%	8%
Vancouver Island	69%	76%	57%	55%	45%	45%	26%	12%	7%	5%
Southern Interior	74%	58%	58%	42%	37%	37%	5%	21%	11%	5%
Northern B.C.	86%	43%	43%	43%	43%	14%	14%	0%	14%	14%

Figure 12: **Reported Motivation for Selected Mechanical System ESMs**



* "Other" refers to responses that were not feasible due to increased cost, lack of necessary skilled labour to implement, local government requirements, or necessary products/materials not available.

2.5.3 Integrated Design Process

Of the 67 respondents, a third (34%) reported that they had used an integrated design process (IDP) in the last year while close to two-thirds (61%) reported they had not. The remaining 4% of respondents were unsure (Figure 13).[7] The likelihood of using IDP generally correlated with higher Steps achieved. For instance, half (49%) of builders achieving Step 3 or higher reported using IDP compared to a quarter (25%) at Steps 1 or 2 (Figure 14). Use of IDP was largely consistent across regions and building type at around a third. The only exception was Northern B.C., where IDP was reported as being used by 14% of respondents.

Although use of IDP generally correlated both with higher ESM use and higher achieved Steps, IDP use appeared to have greatest influence on use of a few specific ESMs. For building envelope related ESMs, builders using IDP were similarly likely to report using better air tightness (96%) and improved insulation (87%) as builders achieving Step 3 or higher. However, builders using IDP were relatively more likely to report using reduced thermal bridging (87%), simplified building form (48%), improved building orientation (39%), optimizing window location (39%), and sun-shading devices (30%) (Figure 15). For mechanical system ESMs, builders using IDP were more likely to report using high-efficiency appliances (74%) and heat pumps for hot water heating (48%) compared to builders achieving Step 3 or higher (Figure 16).

Figure 13: **Reported IDP Use in the Past Year**

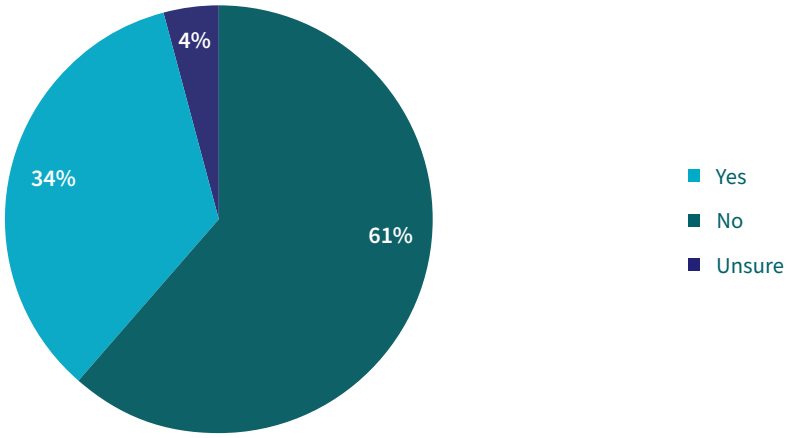
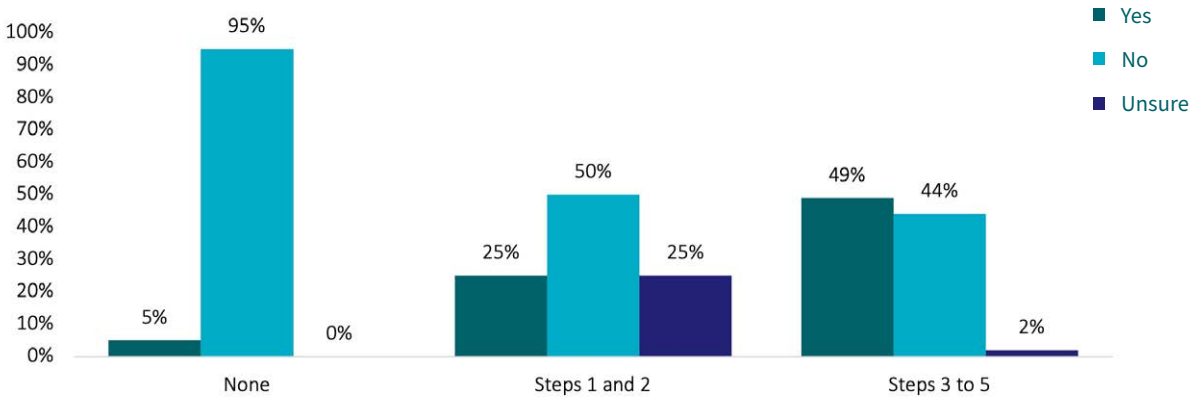
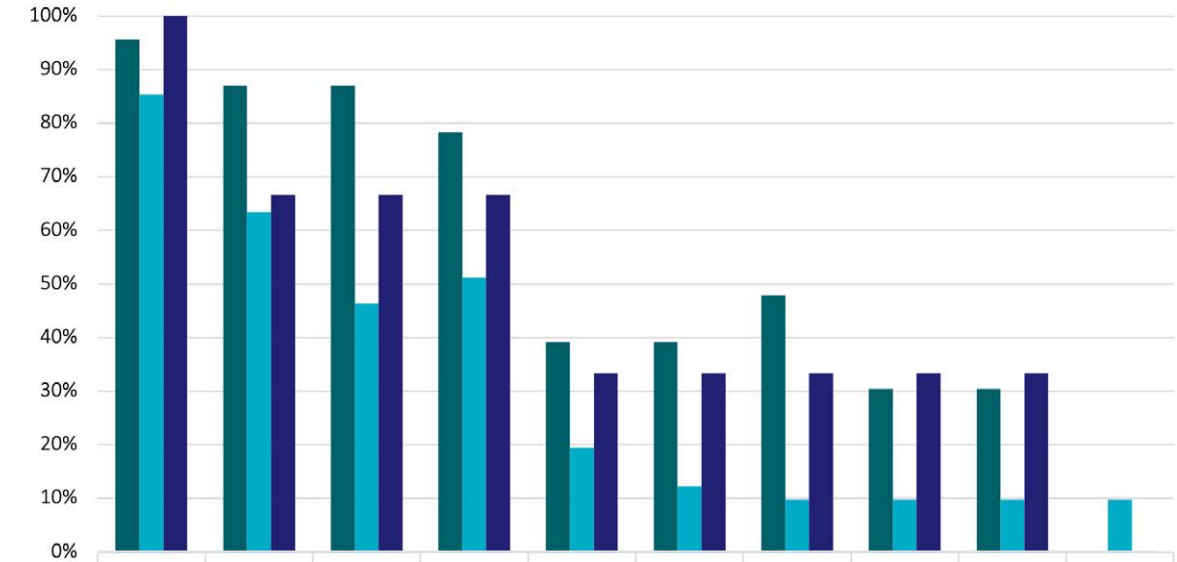


Figure 14: **Reported IDP Use in the Past Year by Highest Step Achieved**



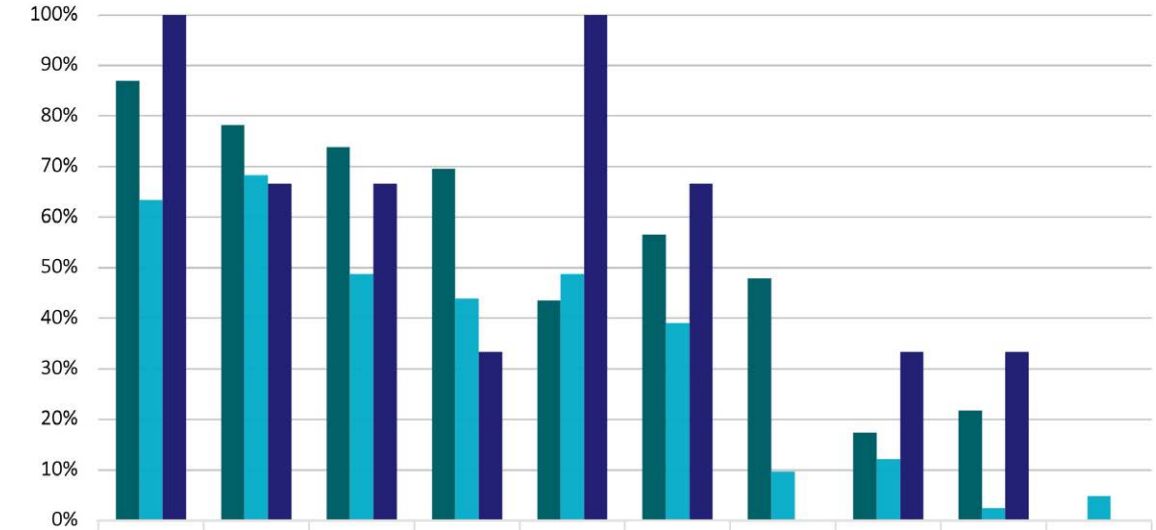
[7] Integrated Design Process (IDP) is a collaborative design approach that is intended to optimize performance, cost, occupant comfort and resilience of a residential building. It involves engaging the builder and their team of designers, mechanical contractor, and energy advisor at the conceptual design stage. The goal IDP is to ensure all objectives of are met. More information on IDP can be found here.

Figure 15: **Reported IDP Use in the Past Year by Building Envelope ESM**



	Better air tightness	Improved insulation	Reduced thermal bridging	High performance windows and doors	Improved building orientation	Optimizing window location	Simplified building form	Less window area	Sun-shading devices	None of the above
Yes	96%	87%	87%	78%	39%	39%	48%	30%	30%	0%
No	85%	63%	46%	51%	20%	12%	10%	10%	10%	10%
Unsure	100%	67%	67%	67%	33%	33%	33%	33%	33%	0%

Figure 16: **Reported IDP Use in the Past Year by Mechanical System ESM**



	HRVs/ERVs	Heat pumps for heating/ cooling	High efficiency appliances	Right-sizing mechanical systems	On-demand tankless hot water heating	Better mechanical control systems	Heat pumps for domestic hot water heating	Individual unit metering	Waste-water heat recovery	None of the above
Yes	87%	78%	74%	70%	43%	57%	48%	17%	22%	0%
No	63%	68%	49%	44%	49%	39%	10%	12%	2%	5%
Unsure	100%	67%	67%	33%	100%	67%	0%	33%	33%	0%

2.5.4 Energy Source Selection

Builders achieving either Step 4 of Step 5 were asked if building to the higher Steps had affected their decision making with respect to:

- Space heating and/or domestic hot water heating
- Electrical or gas home appliances

For space heating and/or domestic hot water heating, approximately half (47%) of the 32 respondents indicated they were more likely to use electrical. Meanwhile, one quarter (25%) reported they were more likely to use gas. The remaining 28% indicated their choice between electrical or gas had not been influenced by building to the higher Steps.

For home appliances, results were similar. Over half (53%) of respondents reported they were more likely to use electrical. Whereas around a quarter reported they were more likely to use gas (22%) or that their decision-making was not influenced (25%).

These results may be the outcome of a combination of different utility incentives, Local Government requirements, and shifting construction considerations at Steps 4 and 5. However, this cannot be confirmed with certainty.

2.5.5 Construction Costs

COST DRIVER OVERVIEW

Many factors inform construction costs. This includes (but is not limited to) the cost of materials, labour costs and cost of land. In turn, these costs can be influenced by both economy-wide factors (such as trade disputes, labour supply and availability of natural resources) as well as project-specific details (such as location, design and contractor/supplier-relationships).

In recent years, construction costs in B.C. have been adversely impacted by demand and supply shocks created by the COVID-19 pandemic and the Russian invasion of Ukraine. While high inflation has occurred globally, specific products experiencing price volatility provincially include lumber, plywood, fuel/petroleum, cement, and heating and cooling equipment.[8] It is also important to note that overall cost increases are being driven by materials as well as labour costs. Readers should however be aware that, while macro-economic influences are important, each project and each builder will have their own set of costs. This makes tracking the specific impact of the BC Energy Step Code on construction costs at an industry-wide level a unique challenge.

When asked how their construction costs had changed overall in the past 12 months[9] , all but one of the 69 respondents indicated costs had increased. The one respondent who did not indicate an increase instead reported costs had remained the same. When asked to identify the three most important drivers of cost increases, cost of lumber and wood products was the most cited at 88%. This was followed by the cost of skilled trades at 68% and cost of windows and doors at 51% (Figure 17).

Of the 11 potential cost increase drivers provided, the BC Energy Step Code was in 8th place at 21%. Of the five Steps, Step 3 was the most cited Step specifically (13%). It is assumed this result reflects the fact that more Local Governments are encouraging or requiring Part 9 home builders to achieve Step 3. This is because the respondent group most likely to select the BC Energy Step Code as a cost driver were builders achieving Step 3 as their highest Step (41%). Except for this observation, there was no discernible trend on drivers of cost by highest achieved Step (Figure 18).

[8] BTY Group – Construction Pricing Brief June 2022.

[9] Between November 1, 2020 and October 31, 2021.

Across regions, the top three identified cost drivers were consistent. However, builders working in the Lower Mainland/Southern Coast were generally more likely to select a given driver with a few exceptions. By building type, the top three identified cost drivers also remained consistent (Figure 19). Multi-family builders were more generally more likely to select a given cost driver relative to single-family builders (including the BC Energy Step Code at 32%). The exceptions to this were the cost of insulation/membranes/vapour barriers and cost of electrical equipment (HVAC and DHW) (Figure 20).

Figure 17: **Top 3 Most Important Factors Driving Cost Increases**

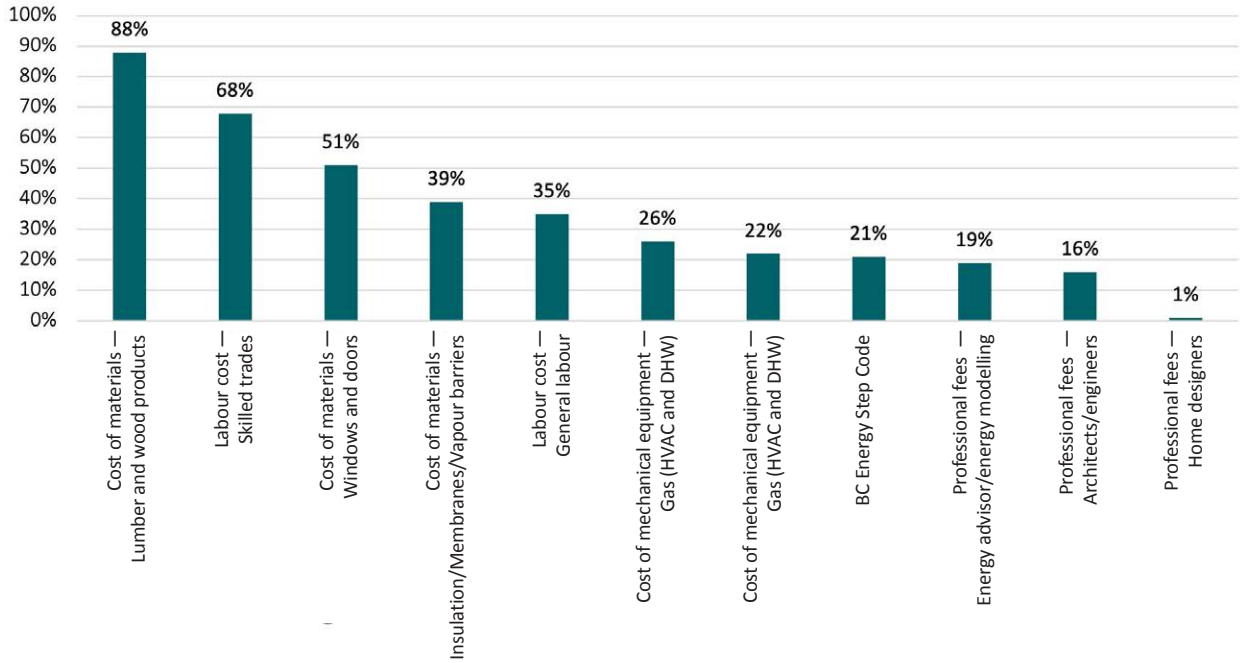
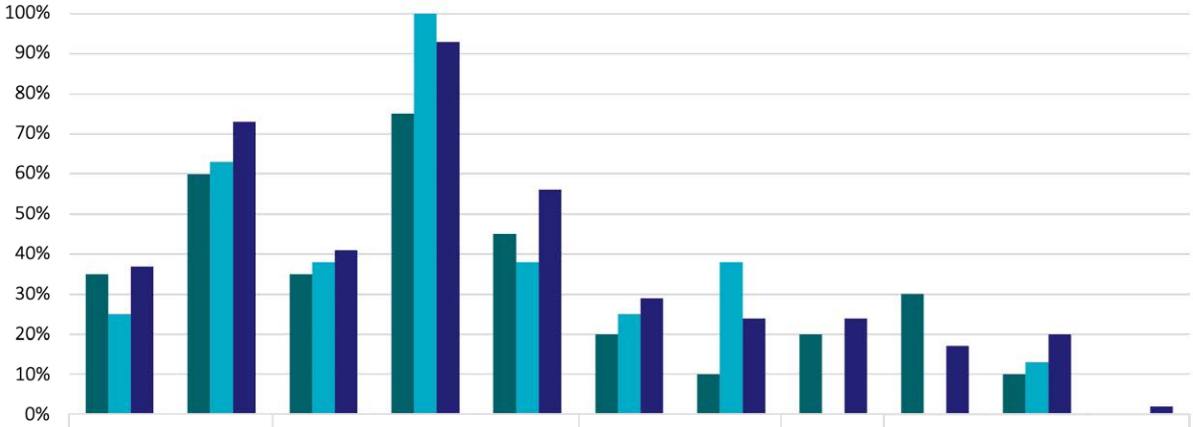
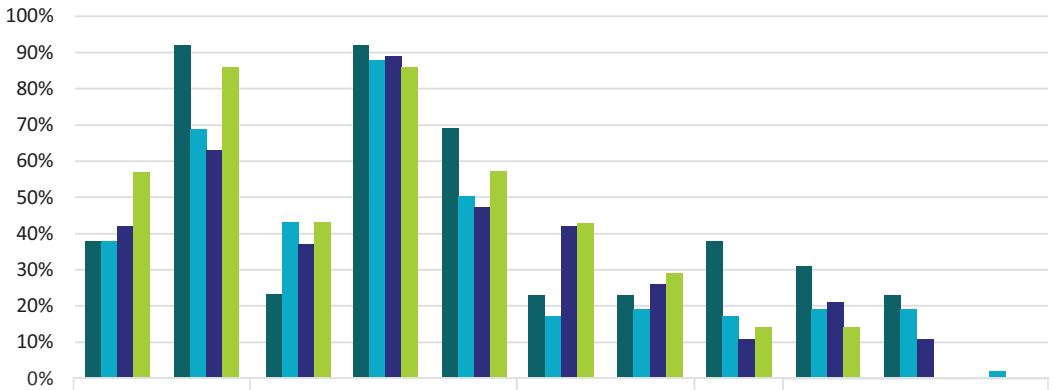


Figure 18: **Top 3 Most Important Factors Driving Cost Increases by Highest Achieved Step**



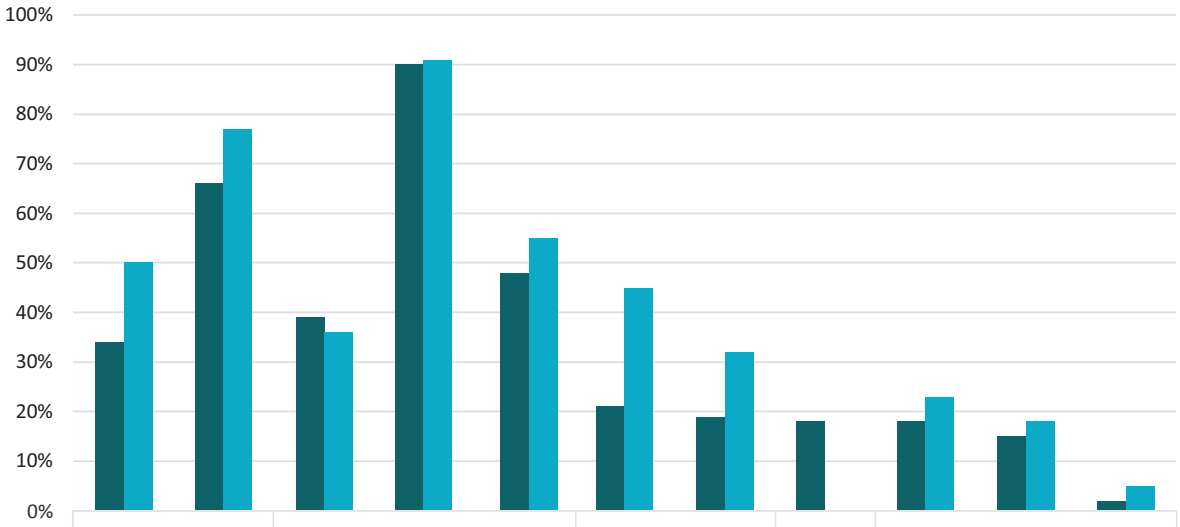
	Labour cost		Cost of materials			Cost of mechanical equipment		BC Energy Step Code overall	Professional fees		
	General labour	Skilled trades	Insulation/ membranes/ vapour barriers	Lumber and wood products	Windows and doors	Gas (HVAC and DHW)	Electrical (HVAC and DHW)		Energy advisor/ energy modelling	Architects/ engineers	Home designers
None	35%	60%	35%	75%	45%	20%	10%	20%	30%	10%	0%
Steps 1 and 2	25%	63%	38%	100%	38%	25%	38%	0%	0%	13%	0%
Steps 3 and 5	37%	73%	41%	93%	56%	29%	24%	24%	17%	20%	2%

Figure 19: **Top 3 Most Important Factors Driving Cost Increases by Work Location**



	Labour cost		Cost of materials			Cost of mechanical equipment		BC Energy Step Code overall	Professional fees		
	General labour	Skilled trades	Insulation/ membranes/ vapour barriers	Lumber and wood products	Windows and doors	Gas (HVAC and DHW)	Electrical (HVAC and DHW)		Energy advisor/ energy modelling	Architects/ engineers	Home designers
Lower Mainland/Sunshine Coast	38%	92%	23%	92%	69%	23%	23%	38%	31%	23%	0%
Vancouver Island	38%	69%	43%	88%	50%	17%	19%	17%	19%	19%	2%
Southern Interior	42%	63%	37%	89%	47%	42%	26%	11%	21%	11%	0%
Northern B.C.	57%	86%	43%	86%	57%	43%	29%	14%	14%	0%	0%

Figure 20: **Top 3 Most Important Factors Driving Cost Increases by Builder Type**



	Labour cost		Cost of materials			Cost of mechanical equipment		BC Energy Step Code	Professional fees		
	General labour	Skilled trades	Insulation/ membranes/ vapour barriers	Lumber and wood products	Windows and doors	Gas (HVAC and DHW)	Electrical (HVAC and DHW)		Energy advisor/ energy modelling	Architects/ engineers	Home designers
Single Family	34%	66%	39%	90%	48%	21%	19%	18%	18%	15%	2%
Multi Family	50%	77%	36%	91%	55%	45%	32%	0%	23%	18%	5%

CONSTRUCTION COST CHANGES BY STEP

Respondents with experience building to the BC Energy Step Code (45 responses) were asked to estimate how this had impacted their construction and design costs compared to base BCBC (Figure 21). Across all Steps, responses roughly broke down into:

- One third (36%) reporting cost changes of between 0% and 3%.
- One quarter (27%) reporting cost changes of between 3% to 5%.
- One third (36%) reporting cost changes of 6% or higher.

When responses were examined by the highest Step achieved, the likelihood of reporting cost increases of 6% or higher appeared to correlate with higher Steps, such that:

- Half (50%) of Step 5 builders reported cost increases of 6% or more.
- Around 40% of Step 3 and 4 builders reported cost increases of 6% or more.
- One third (33%) of Step 2 builders reported cost increases of 6% or more.

Similarly, the likelihood of reporting a smaller increase of 3% or less showed the reverse trend:

- Three quarters (71%) of Step 1 builders reported cost increases of 3% or less.
- Half (47%) of Step 2 builders reported cost increases of 3% or less.
- A quarter to a third (27% to 30%) of Step 3 to 5 builders reported cost increases of 3% or less.

Focusing on reported cost changes at Step 3[10], respondent groups that appeared more likely to report the highest cost increases of 6% or more included:

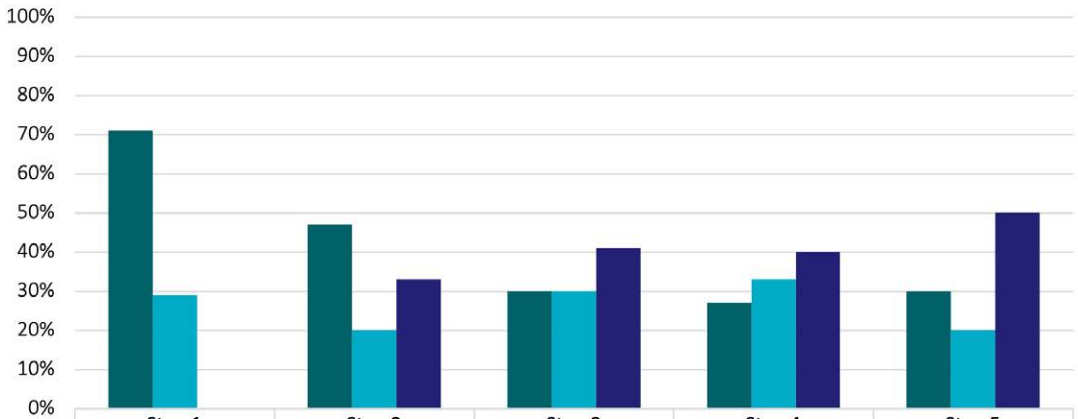
- 60% of builders working in the Lower Mainland/Southern Coast
- 60% of builders with 10 years or less experience
- 60% of builders with 30+ years experience

While use of IDP did not appear to heavily influence cost increase reporting at Step 3, the reasons behind ESM selection did. When respondents were asked to select all the potential reasons for adopting reported building envelope ESMs (Figure 22), those who selected “client request/preference” (86%) were most likely to report a cost increase of 6% or more. In contrast, respondents who chose ‘lowest upfront cost’ (17%) or “incentives from utilities” (17%) were much less likely to report the same.

When moving to the mechanical ESM motivators (Figure 23), respondents who selected “part of the design” (83%) and “client request/preference” (70%) were most likely to report a cost increase of 6% or more. In contrast, those who selected “lowest upfront cost” (0%), “easy to install” (0%), “best energy savings for the cost premium” (8%), and “incentives from utilities” (9%) were much less likely to report the same.

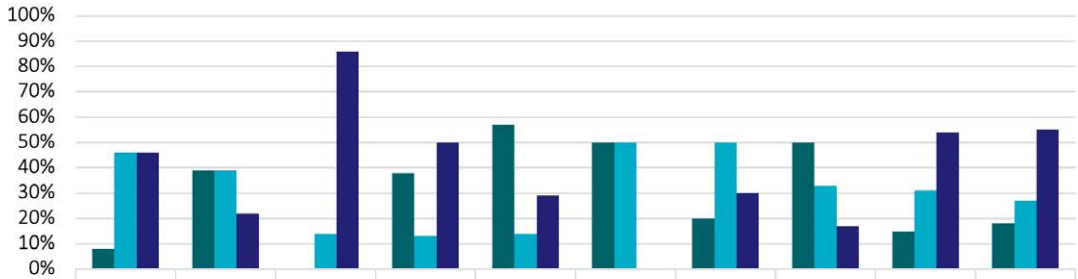
[10] Step 3 was selected for specific analysis as it had the highest proportion of respondents compared to other Steps at 27 respondents and is most aligned with the requirement to be 20% more efficient than the current BCBC by the end of 2022.

Figure 21: **Reported Cost Change by Step**



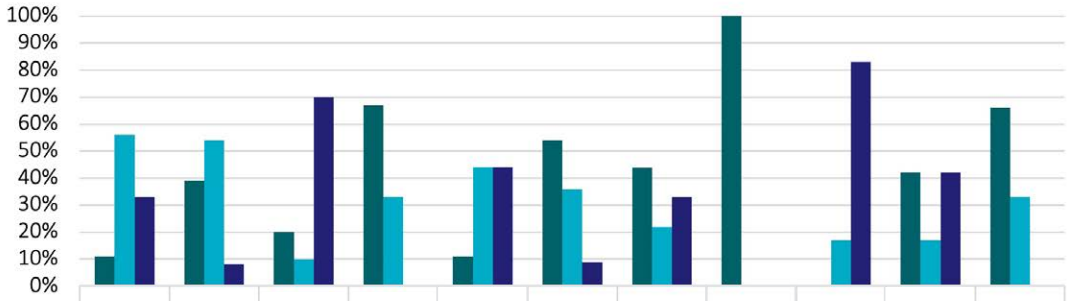
	Step 1	Step 2	Step 3	Step 4	Step 5
Between 0% and 3%	71%	47%	30%	27%	30%
Between 3% and 5%	29%	20%	30%	33%	20%
6% or more	0%	33%	41%	40%	50%

Figure 22: **Reported Cost Change at Step 3 by Building Envelope ESM Motivation**



	Best energy savings	Best energy savings for the cost premium	Client request/ preference	Easy to install	Familiarity	Incentives from utilities BC Hydro/ Fortis BC	Lowest operating cost	Lowest upfront cost	Part of the design	Recommend-ation from consultant/ trades
Between 0% and 3%	8%	39%	0%	38%	57%	50%	20%	50%	15%	18%
Between 3% and 5%	46%	39%	14%	13%	14%	50%	50%	33%	31%	27%
6% or more	46%	22%	86%	50%	29%	0%	30%	17%	54%	55%

Figure 23: **Reported Cost Change at Step 3 by Mechanical System ESM Motivation**



	Best energy savings	Best energy savings for the cost premium	Client request/ preference	Easy to install	Familiarity	Incentives from utilities BC Hydro/ Fortis BC	Lowest operating cost	Lowest upfront cost	Part of the design	Recom-mendation from consultant/ trades	Other*
Between 0% and 3%	11%	39%	20%	67%	11%	54%	44%	100%	0%	42%	66%
Between 3% and 5%	56%	54%	10%	33%	44%	36%	22%	0%	17%	17%	33%
6% or more	33%	8%	70%	0%	44%	9%	33%	0%	83%	42%	0%

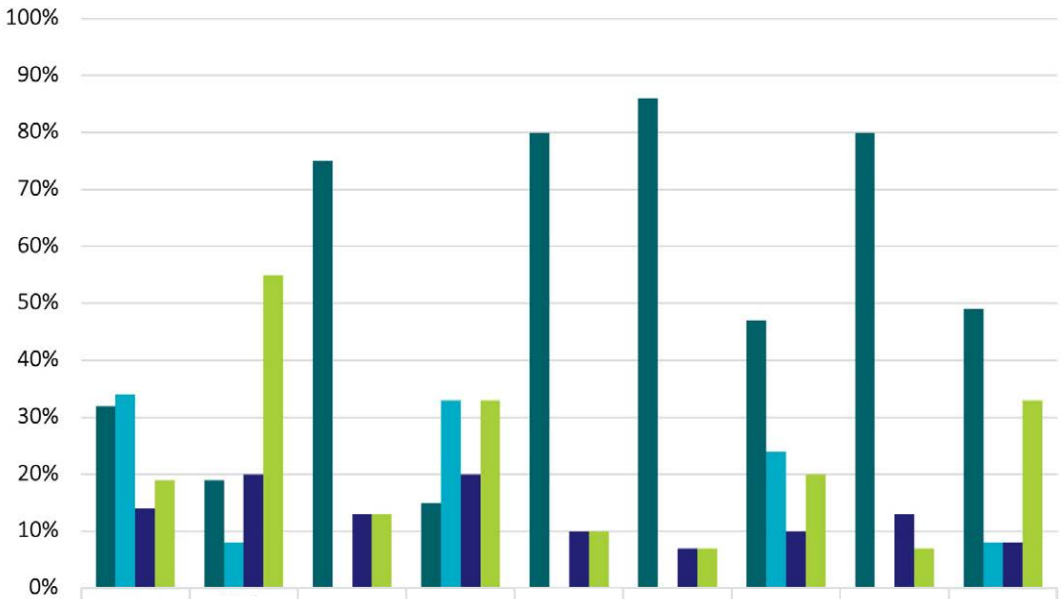
* Other refers to responses that were not feasible due to increased cost, lack of necessary skilled labour to implement, local government requirements, or necessary products/materials not available.

CONSTRUCTION COST CHANGES BY BUILDING ENVELOPE ESMS

When asked to estimate by how much a given implemented building envelope ESM changed the cost of the component (Figure 24), the results for many ESMs varied substantially across survey respondents. It is unclear if this reflected different approaches in construction between builders or differences in understanding the question. However, the most cost-effective ESMs appeared to be optimizing window location (86%), simplifying the building form (80%), less window area (80%), and improving the building orientation (75%). This is because over three-quarters of respondents reported either a decrease or no change in component cost. Cost increases of 6% or more in the component were most likely to be reported for high performance windows and doors (55%) at just over half.

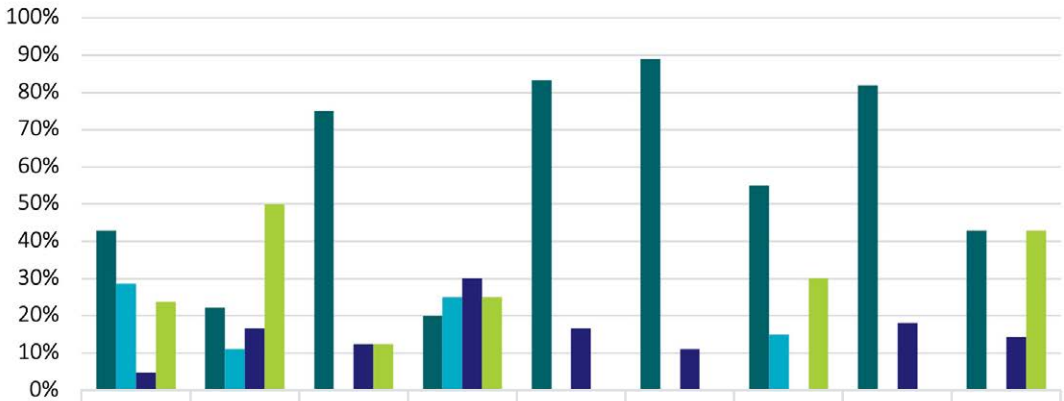
Use of IDP generally seemed to improve the cost impact of building envelope ESMs (Figure 25). The most pronounced impact was on better airtightness (43% cost decrease or no change) and reducing thermal bridging (55% cost decrease or no change).

Figure 24. **Reported Component Cost Changes by Building Envelope ESM**



	Better air tightness	High performance windows and doors	Improved building orientation	Improved insulation	Less window area	Optimizing window location	Reduced thermal bridging	Simplified building form	Sun-shading devices
Decrease or No Change	32%	19%	75%	15%	80%	86%	47%	80%	49%
Between 0% and 3%	34%	8%	0%	33%	0%	0%	24%	0%	8%
Between 3% and 5%	14%	20%	13%	20%	10%	7%	10%	13%	8%
6% or more	19%	55%	13%	33%	10%	7%	20%	7%	33%

Figure 25. **Reported Component Cost Changes by Building Envelope System ESM with IDP**



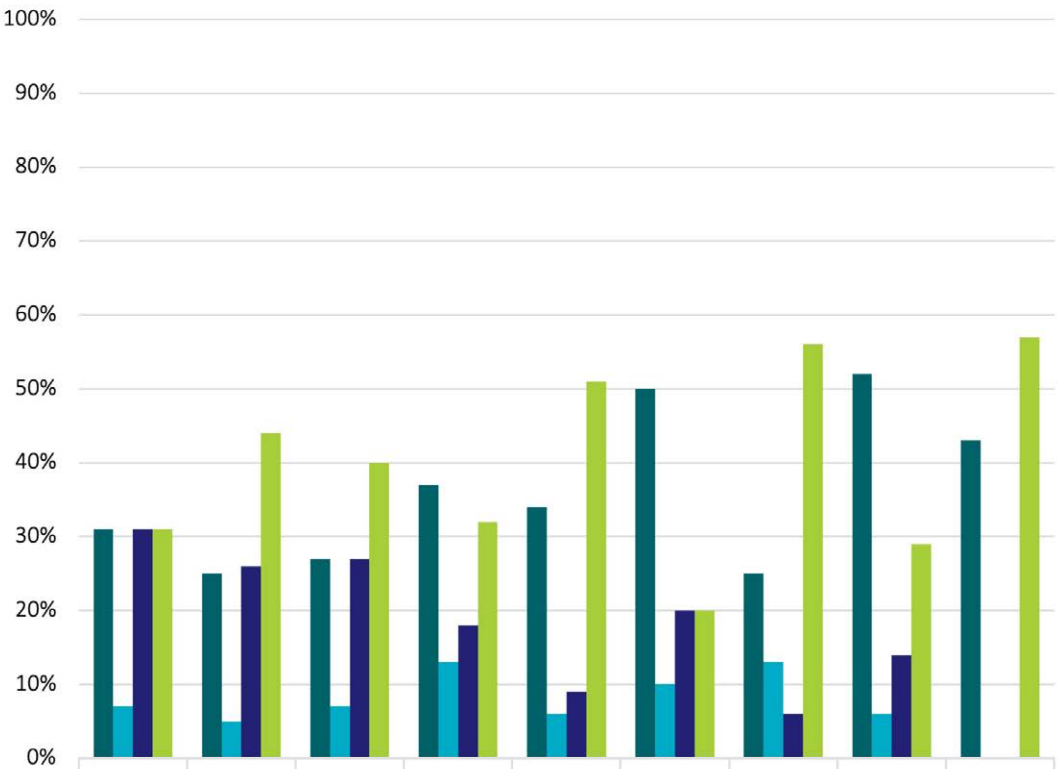
	Better air tightness	High performance windows and doors	Improved building orientation	Improved insulation	Less window area	Optimizing window location	Reduced thermal bridging	Simplified building form	Sun-shading devices
Decrease or No Change	43%	22%	75%	20%	83%	89%	55%	82%	43%
Between 0% and 3%	29%	11%	0%	25%	0%	0%	15%	0%	0%
Between 3% and 5%	5%	17%	13%	30%	17%	11%	0%	18%	14%
6% or more	24%	50%	13%	25%	0%	0%	30%	0%	43%

CONSTRUCTION COST CHANGES BY MECHANICAL SYSTEM ESMS

When asked to estimate by how much a given implemented mechanical ESM changed the cost of the component, the results for every ESM varied substantially (Figure 26). While the reason for the variation is unclear, the most cost-effective ESMs appeared to be right-sizing the mechanical system (52%) and individual metering (50%). This is because approximately half of respondents reported either a decrease or no change in the cost of the component. Cost increases of 6% or more were most likely to be reported for wastewater heat recovery (57%), on-demand/tankless hot water heating (56%), and HRVs/ERVs (51%).

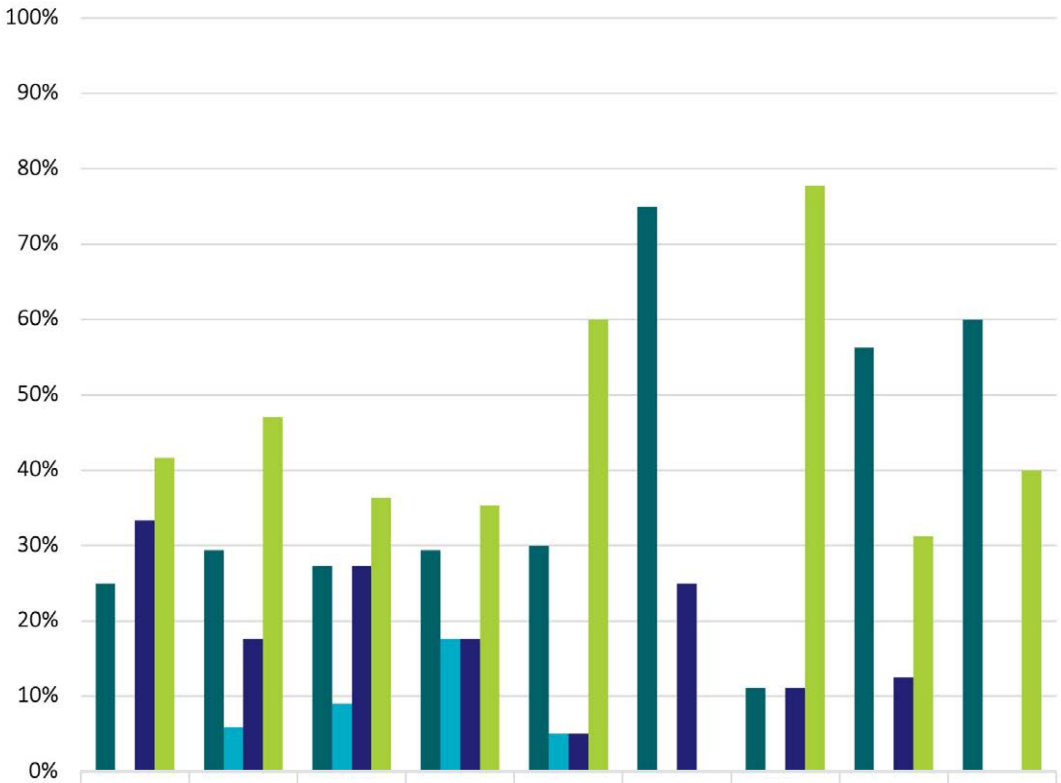
In contrast with the building envelope ESMs, use of IDP appeared to have an inconsistent impact on mechanical system ESM cost estimates (Figure 27). However, builders using IDP were slightly more likely to report a cost decrease or no change for right-sizing the mechanical systems (56%).

Figure 26. **Reported Component Cost Changes by Mechanical System ESM**



	Better mechanical control systems	Heat pumps for heating/ cooling	Heat pumps for domestic hot water heating	High efficiency appliances	HRVs/ ERVs	Individual unit metering	On-demand/ tankless hot water heating	Right-sizing mechanical systems	Wastewater heat recovery
Decrease or No Change	31%	25%	27%	37%	34%	50%	25%	52%	43%
Between 0% and 3%	7%	5%	7%	13%	6%	10%	13%	6%	0%
Between 3% and 5%	31%	26%	27%	18%	9%	20%	6%	14%	0%
6% or more	31%	44%	40%	32%	51%	20%	56%	29%	57%

Figure 27. **Reported Component Cost Changes by Mechanical System ESM with IDP**

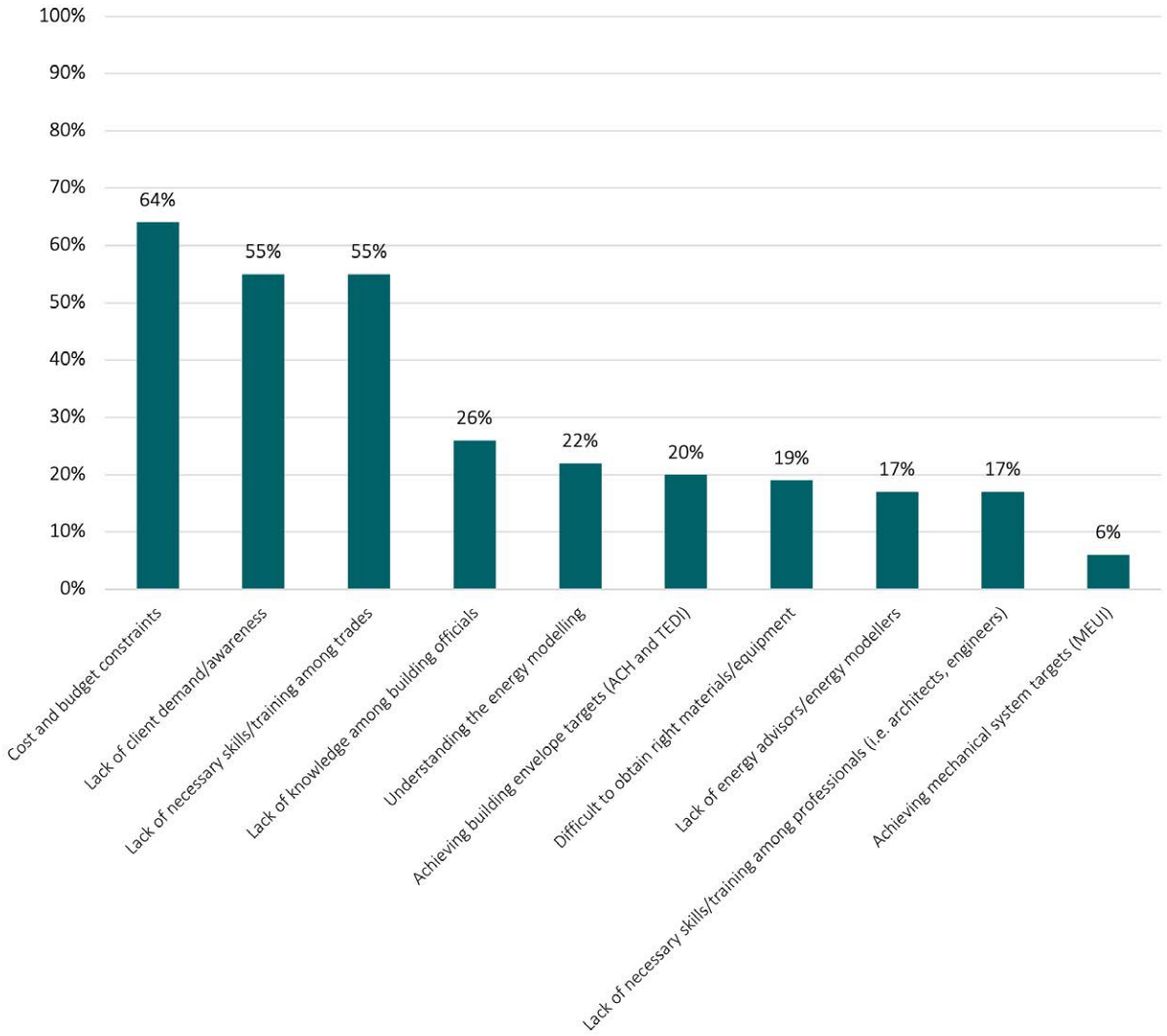


	Better mechanical control systems	Heat pumps for heating/ cooling	Heat pumps for domestic hot water heating	High efficiency appliances	HRVs/ ERVs	Individual unit metering	On-demand/ tankless hot water heating	Right-sizing mechanical systems	Wastewater heat recovery
Decrease or No Change	25%	29%	27%	29%	30%	75%	11%	56%	60%
Between 0% and 3%	0%	6%	9%	18%	5%	0%	0%	0%	0%
Between 3% and 5%	33%	18%	27%	18%	5%	25%	11%	13%	0%
6% or more	42%	47%	36%	35%	60%	0%	78%	31%	40%

3.0 Challenges and Opportunities

Of the 69 builders providing information on the most challenging aspects of building to the BC Energy Step Code, the most common issue identified was cost and budget constraints (64%). This was followed by lack of client demand/awareness (55%) and lack of necessary skills/training among trades (55%) (Figure 28). Between a quarter and one-fifth of respondents reported three other most challenging aspects of building to the BC Energy Step Code. These were a lack of knowledge among building officials (26%), understanding the energy modelling (22%) and achieving building envelope and energy targets (ACH and TEDI) (20%). Cost and budget constraints, lack of client demand/awareness, and lack of necessary skills/training among trades were consistently the top three issues respondents reported across different demographic groups.

Figure 28. **Most Challenging Aspects of Building to the BC Energy Step Code**



Of the 32 builders that provided feedback on how to address identified issues, 53% referred to the need for more industry training, particularly for the trades, but also for building officials and energy advisors (EAs). Another 19% made comments related to homebuyer and general public education around higher energy efficiency construction.

Other responses included:

- Modifications to the BC Energy Step Code metrics:
  - Allowing better insulation, windows and mechanical systems to compensate for higher air changes per hour.
  - Considering different air change per hour requirements for smaller homes.
  - Allowing BC Energy Step Code requirements for single family and duplexes to be done under the prescriptive path of the BCBC.
- Consistent adoption of BC Energy Step Code between neighbouring local governments.
- Increasing incentives for higher energy efficient homes.

4.0 Research Findings

Key findings of this study are as follows:

- The BC Energy Step Code is moving the residential construction industry towards greater energy performance, with 81% of monitoring survey respondents indicating they felt prepared for Step 3 or higher. The majority of builders working to the BC Energy Step Code (85%) confirmed they met their target Step on their last project. This was followed by 11% reporting they were unsure and 4% reporting the target was not met. For those that did not meet their target Step, two reasons were cited. Firstly, that there was a failure to meet the airtightness requirements (Step 3). Secondly, that there was a failure to meet the performance requirement of building equipment and systems (MEUI and ERS) (Step 5).
- While the BC Energy Step Code is likely increasing construction costs (particularly at the higher Steps), other factors have had a larger impact overall. These include general price inflation and client preferences. When asked to select the top three cost drivers in the last year, 21% of respondents selected the BC Energy Step Code (8th out of the 11 drivers provided). In comparison, the most cited cost driver was lumber and wood products, with 88% of respondents selecting this. Respondents achieving higher Steps were more likely to report higher overall cost increases of 6% or more (50% of Step 5 builders compared to 40% of Step 3 and 4 builders and 33% of Step 2 builders). However, the analysis also suggests that reported cost increases were more heavily influenced by ESM selection reasoning. For example, over 80% of respondents who selected "client request/preference" as a motivator for their building envelope ESMs reported a cost increase of 6% or more at Step 3. In contrast, 22% of builders who reported their ESM motivation for building envelope was "best energy savings for the cost premium" reported the same.
- The ESMs least associated with a cost increase appeared to be optimizing window location (86%), simplifying the building form (80%), less window area (80%), and improving the building orientation (75%). This is because over three-quarters of respondents reported either a decrease or no change in the cost of the component. However, the most cost-effective ESMs were not commonly reported as being used by respondents. This ranged from 27% (improved building orientation) to 18% (less window area). Right-sizing the mechanical systems, which should provide a cost saving for builders, also appeared under-utilized, with only half (52%) reporting its use. This means lower-cost opportunities are available to achieve the builder's BC Energy Step Code objectives. Yet their adoption may be hindered by a combination of factors. These might include local government planning requirements, a need for further education and training among industry and government officials, and the actual or perceived preferences of consumers.
- Overall, results indicate a strong need for more education on the BC Energy Step Code across a number of different areas:
  - Although respondents to the monitoring survey reported strong levels of preparedness for Step 3, results also indicate certain builder demographics may need more support. This could include builders in Northern B.C. and Lower Mainland/Southern Coast, as well as single-family speculative builders and multiplex builders. Due to the lack of respondents in the high-rise sector, it is not possible to assess their level of educational need. However, all demographic groups would likely benefit from focused training on certain areas. This includes training on the use of cost-effective ESMs, effective use of IDP, understanding energy modelling, and techniques for achieving building envelope targets (ACH and TEDI).
  - Over half of respondents identified a lack of necessary skills/training among trades as a key challenge to the BC Energy Step Code. On the other hand, results also showed that recommendations from trades/consultants is the top driver of ESM selection for mechanical systems. In particular, training for HVAC

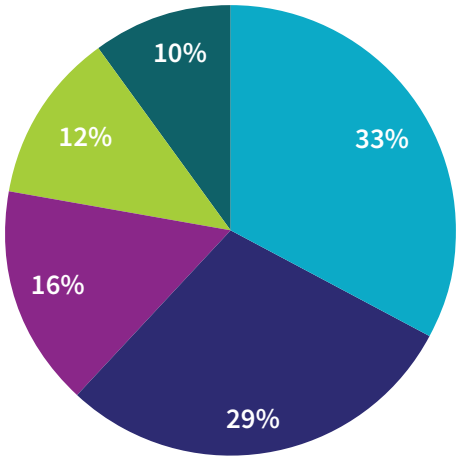
trades around right-sizing mechanical systems would help the industry realize important opportunities for cost-savings.

- Lack of client awareness and demand was also identified as a challenge by over half of respondents. This is consistent with findings that "client request/preference" is also a key motivator for ESM selection but appears to have a negative impact on construction costs. As industry has been the primary focus of communication around the BC Energy Step Code, there is scope to refocus attention on home buyer education moving forward.
- Approximately a quarter of respondents identified a lack of awareness and education of building officials as a challenge. More training for this stakeholder group would be helpful. This is because building officials have the potential to influence ESM selection, as well as to identify and influence potential barriers at the local level to certain ESMs (e.g. lot size).

APPENDIX

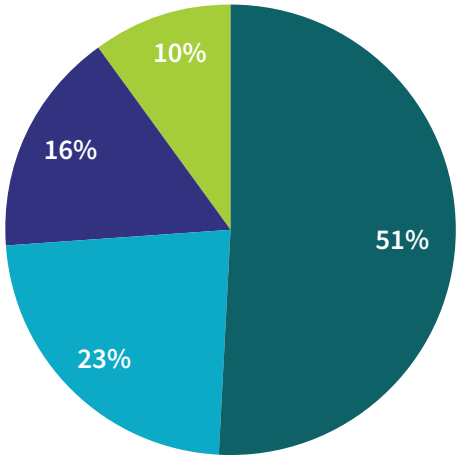
Survey Questions and Results

Q1. **How long have you worked in new home construction (in years)?**



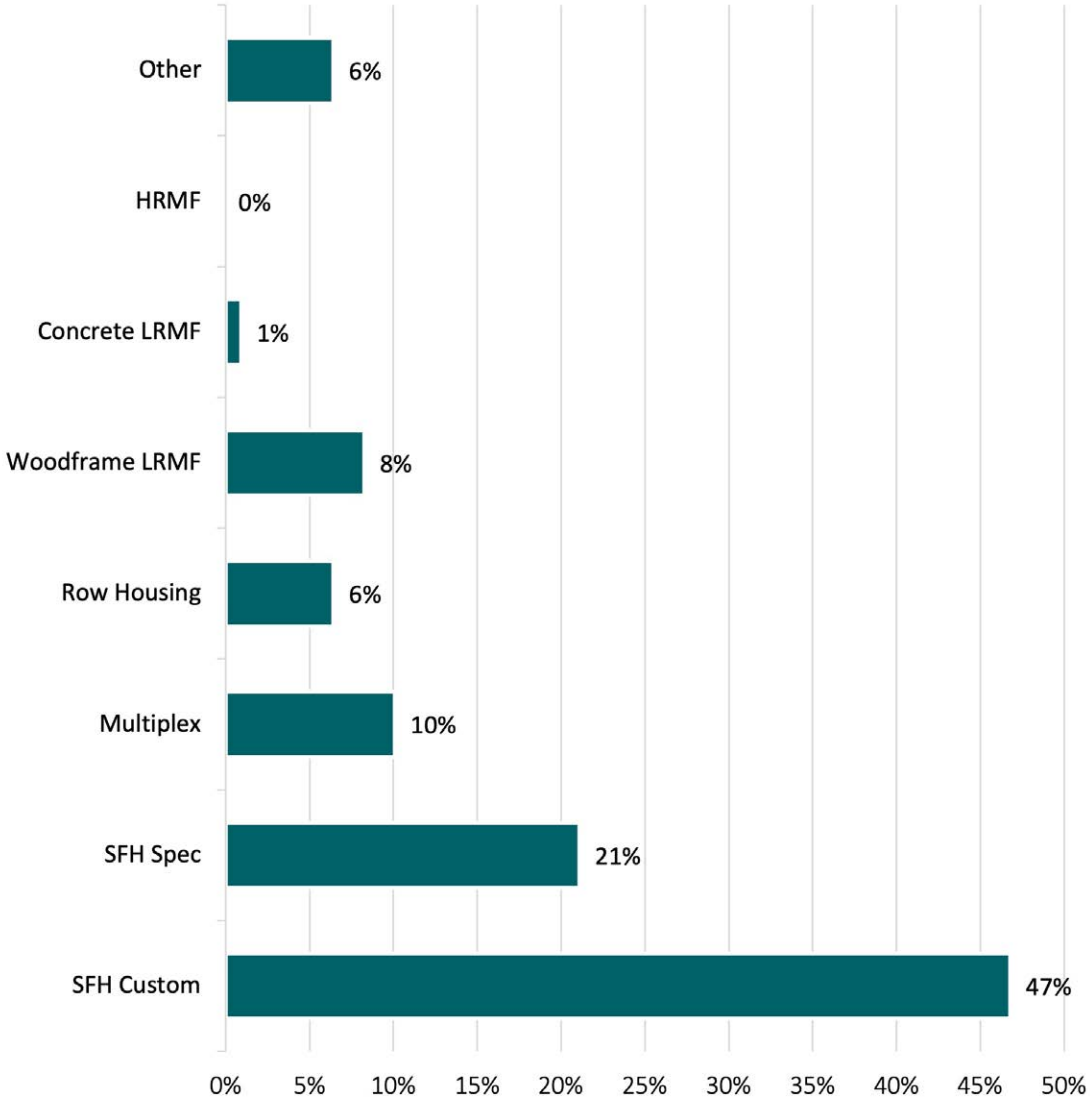
69
respondents

Q2. **In British Columbia, which regions does your company work in?**



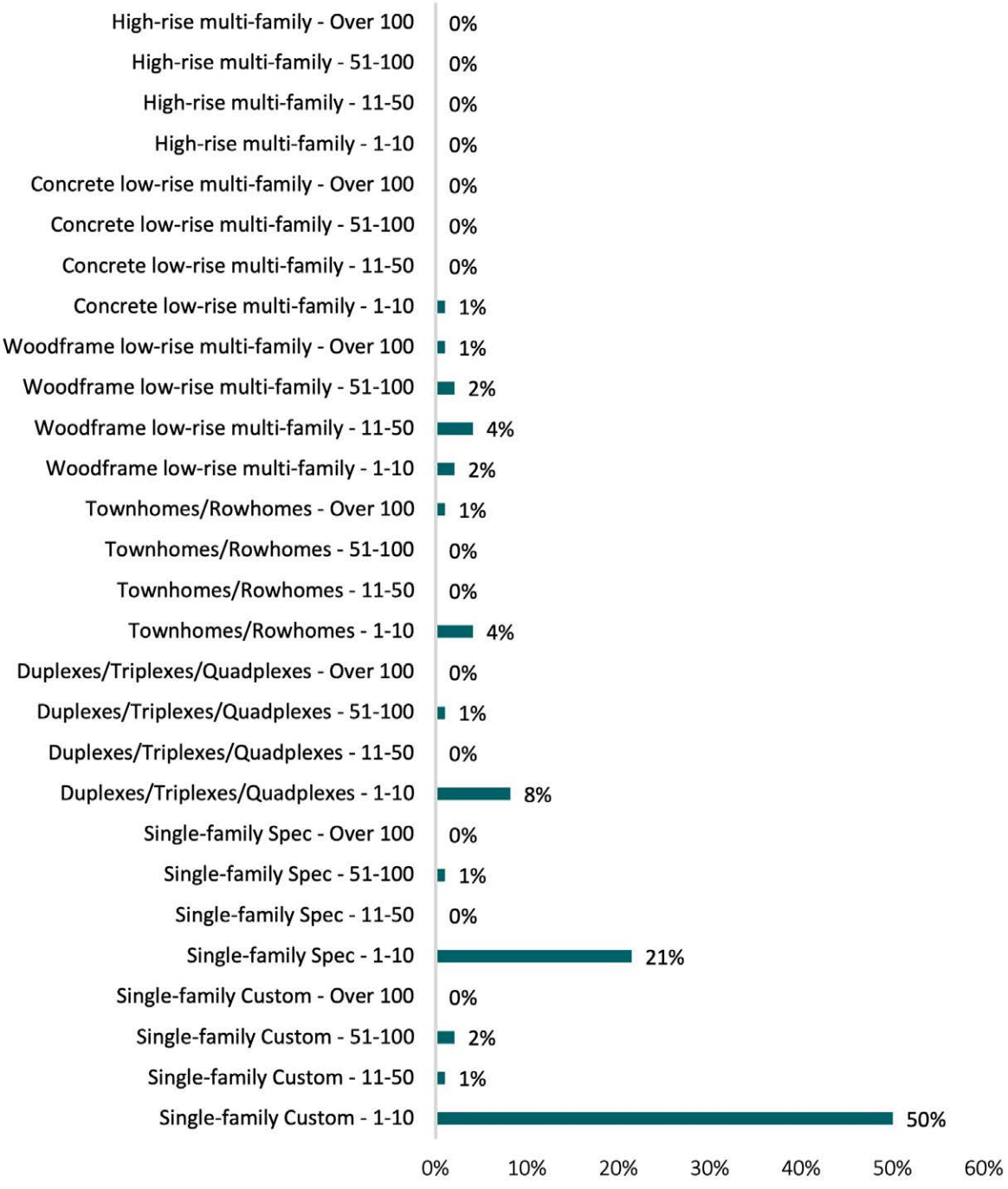
69
respondents

Q3. **What types of housing did your company build in B.C. between November 1, 2020, and October 31, 2021?**



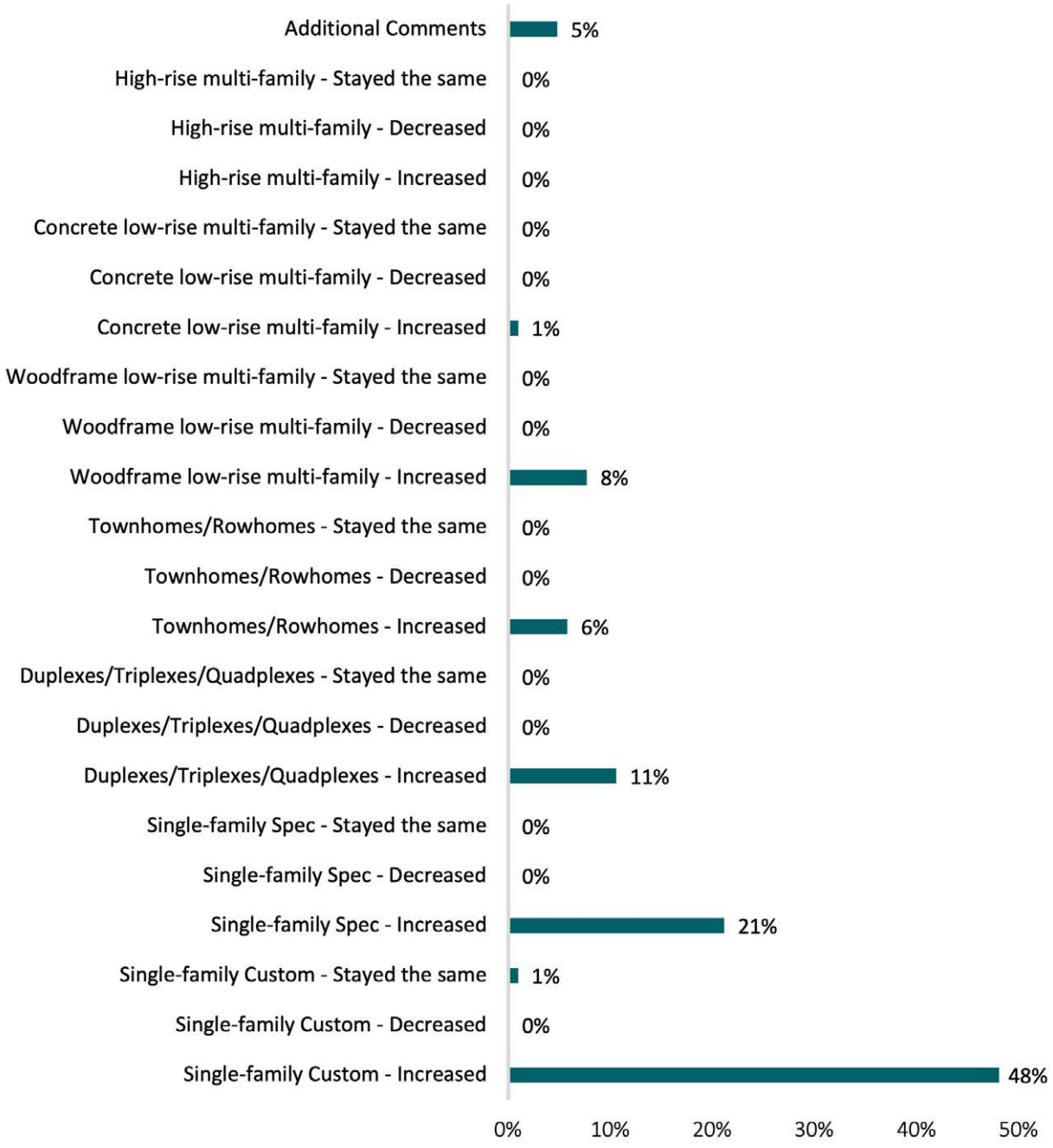
69
respondents

Q4. **Approximately how many housing units/homes did your company build between November 1, 2020, and October 31, 2021?**



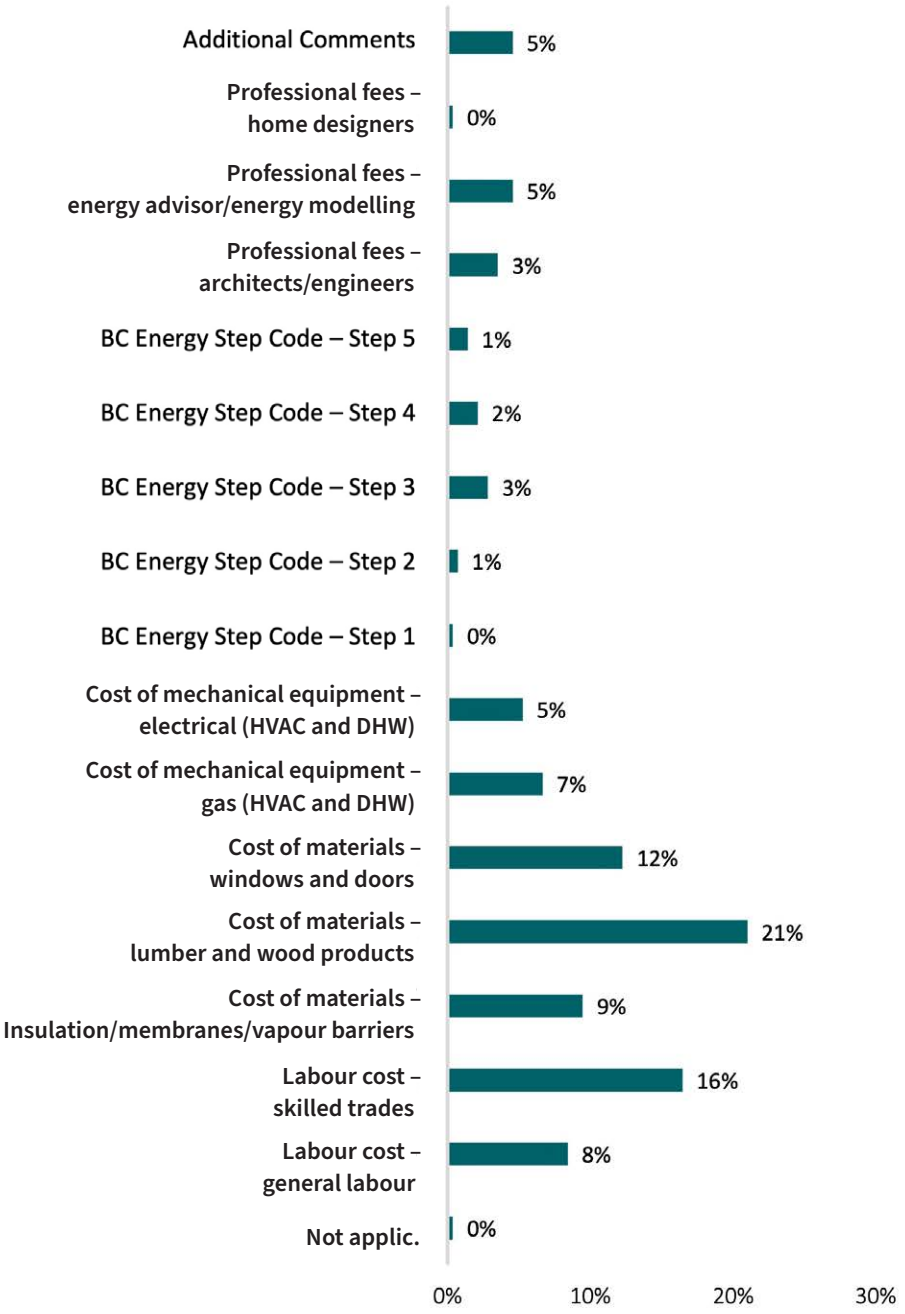
67
respondents

Q5. **For each housing type completed over that period, how have your overall construction costs changed between November 1, 2020, and October 31, 2021?**



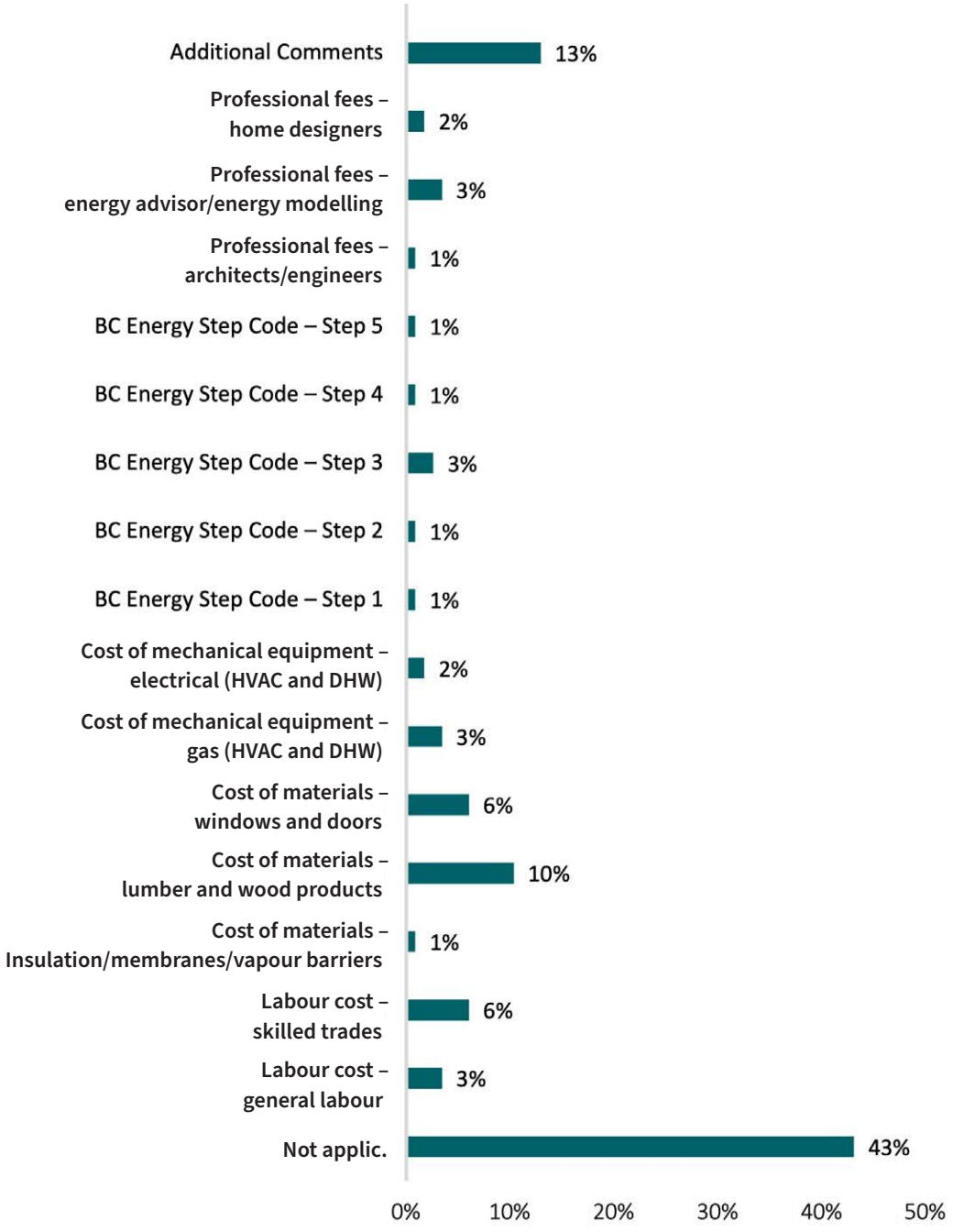
65
respondents

Q6. **What are the most important factors driving cost increases? Select up to three of the most important.**



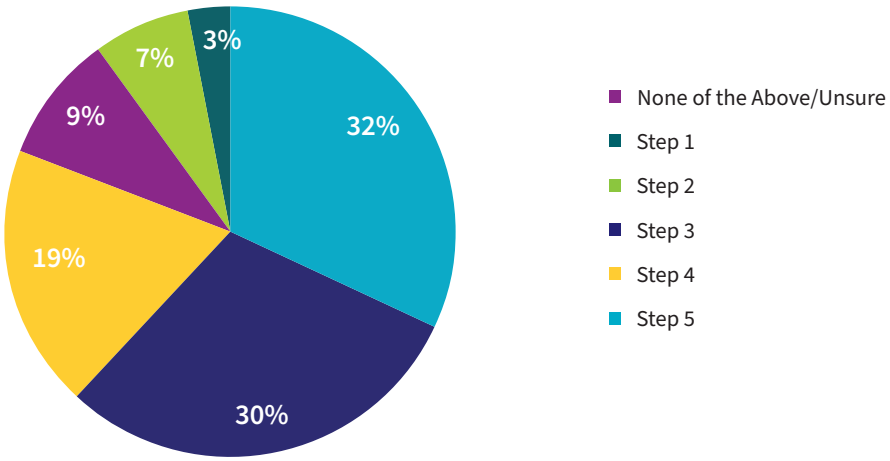
69
respondents

Q7. **What are the most important factors driving cost decreases? Select up to three of the most important.**



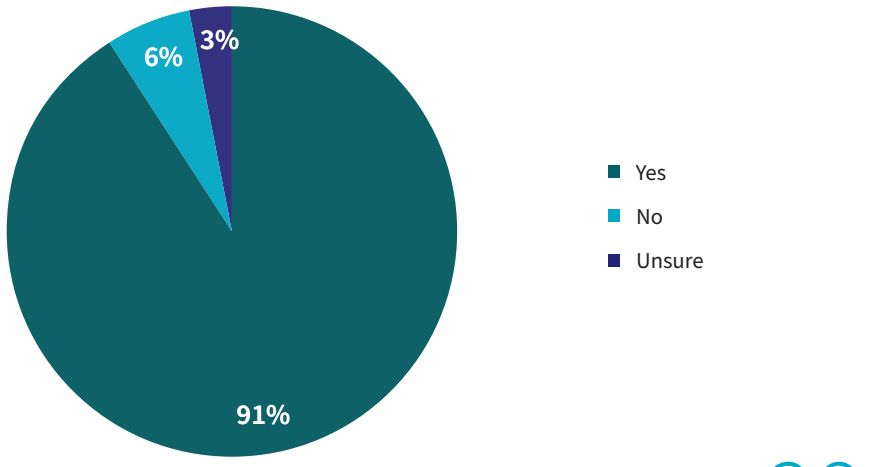
69
respondents

Q8. **Which Steps of the BC Energy Step Code do you or your company feel prepared to meet?**



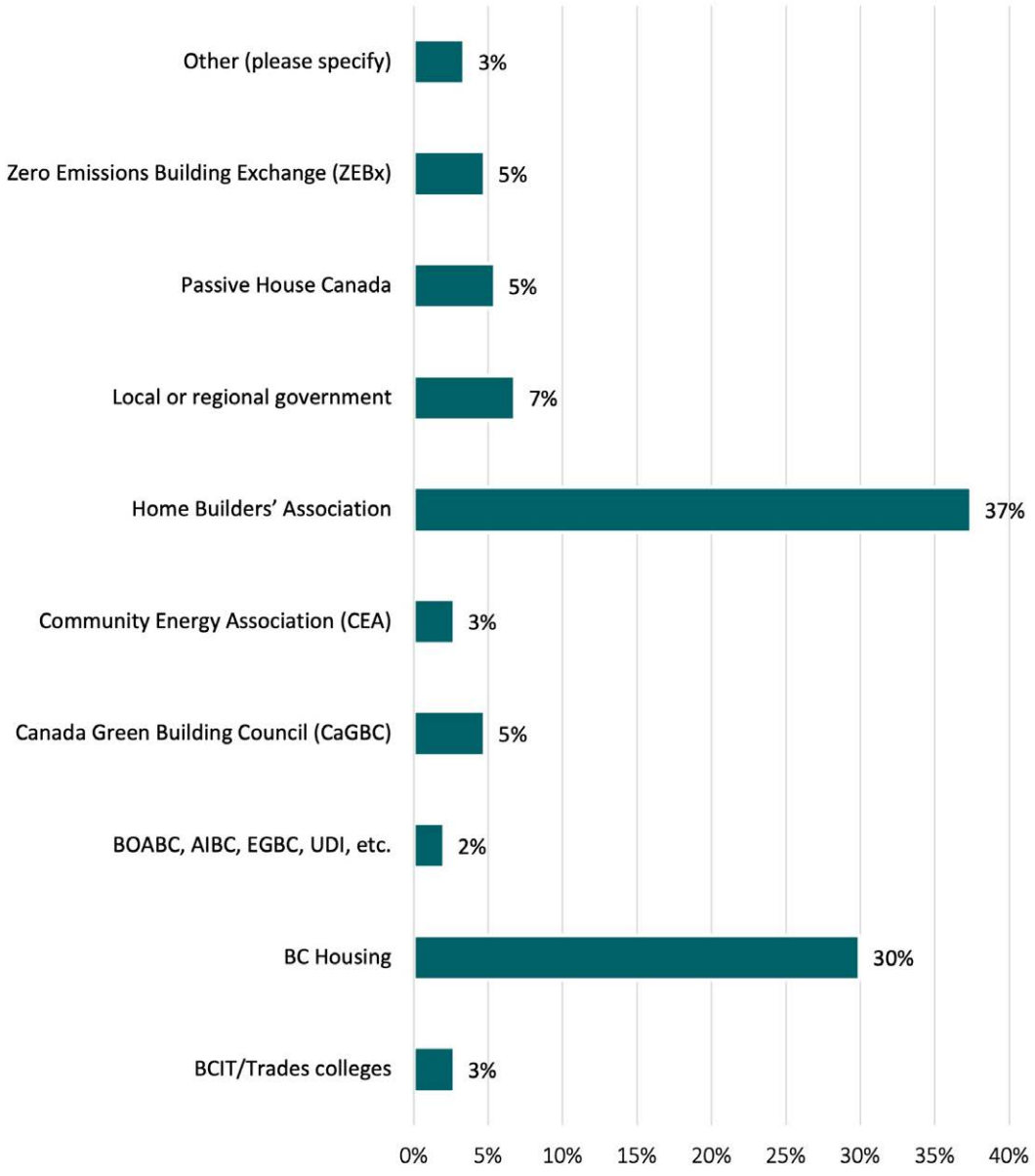
69
respondents

Q9. **Have you or other members of your company undertaken any training or accessed other resources in preparation for the BC Energy Step Code?**



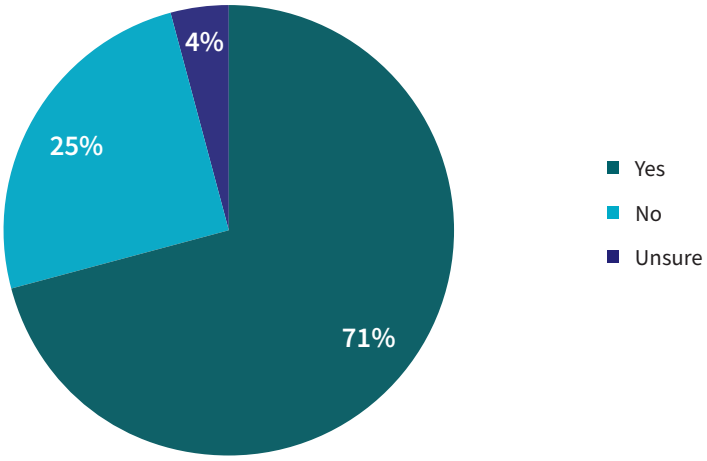
69
respondents

Q10. **What were the sources of the BC Energy Step Code training that you or your company participated in?** Check all that apply.



63
respondents

Q11. **Have you or your company built, or are you currently building to BC Energy Step Code (as confirmed by an energy advisor for a specific step)?**



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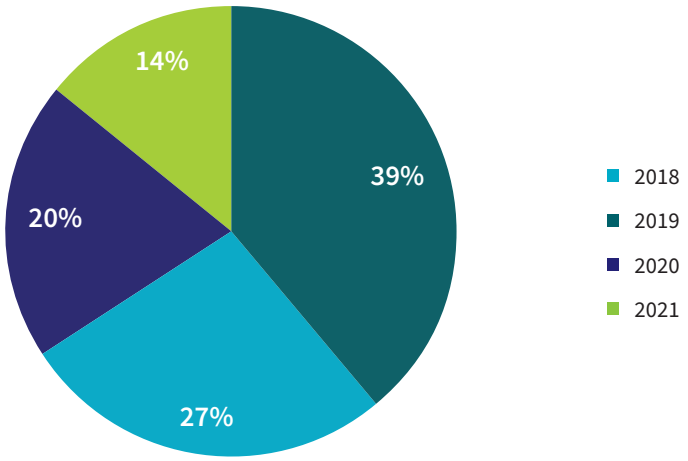
respondents

Q12. **When did you or your company first start building to the BC Energy Step Code?**



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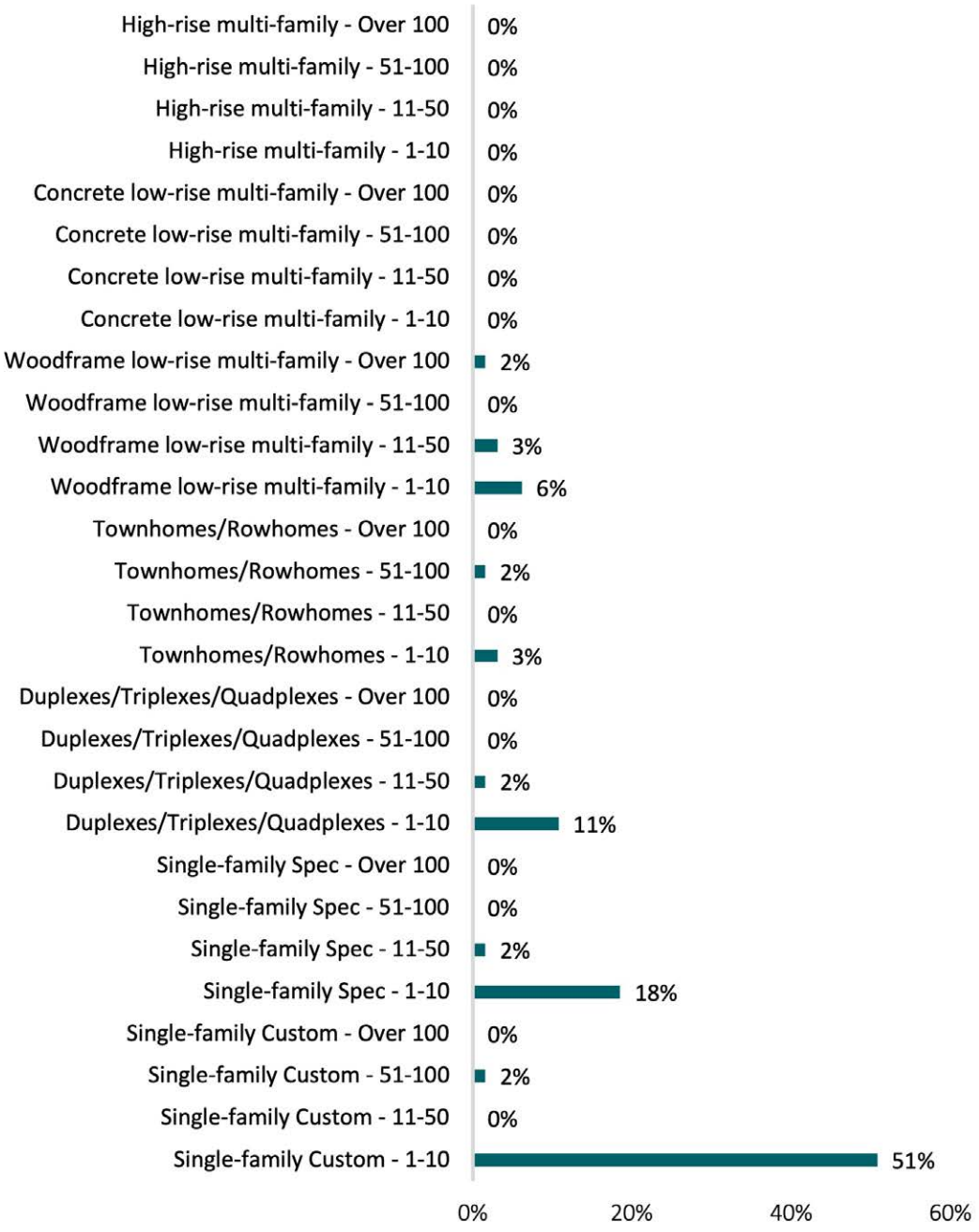
respondents

Q13. **Approximately how many residential units/homes have you or your company completed in the period November 1, 2020 to October 31, 2021 to a step of the BC Energy Step Code?**



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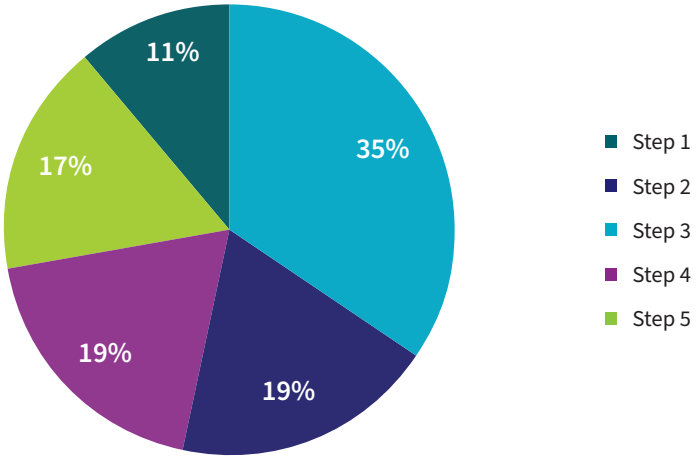
respondents

Q14. **What Steps of the BC Energy Step Code have you or your company built to between November 1, 2020 and October 31, 2021?** Check all that apply.



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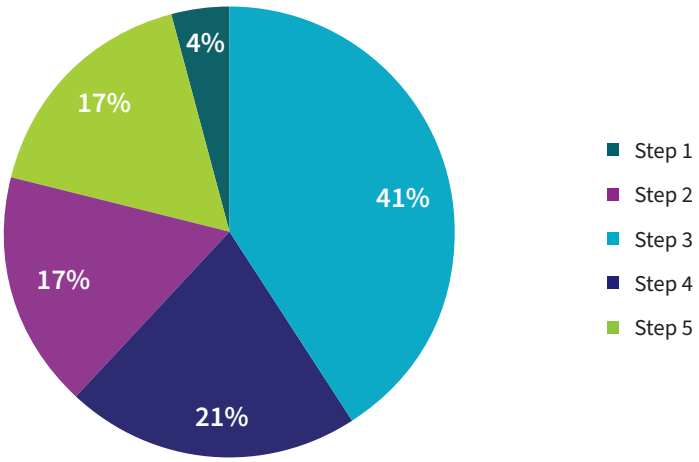
respondents

Q15. **For your most recently completed BC Energy Step Code project, what was your targeted Step?**



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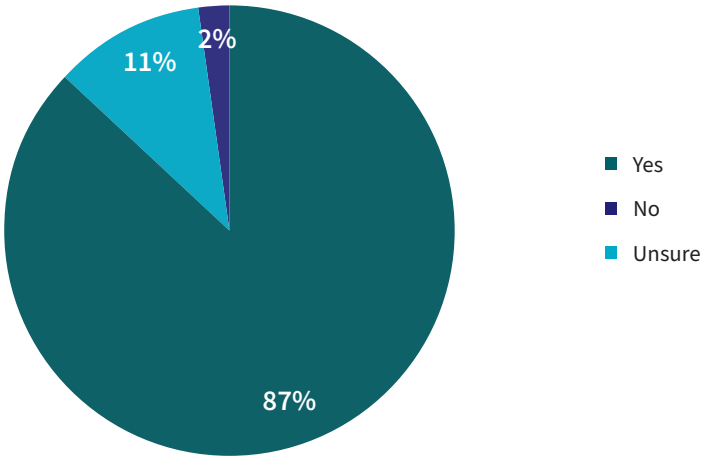
respondents

Q16. **For your most recently completed BC Energy Step Code project, did you attain the targeted Step?**



47
respondents

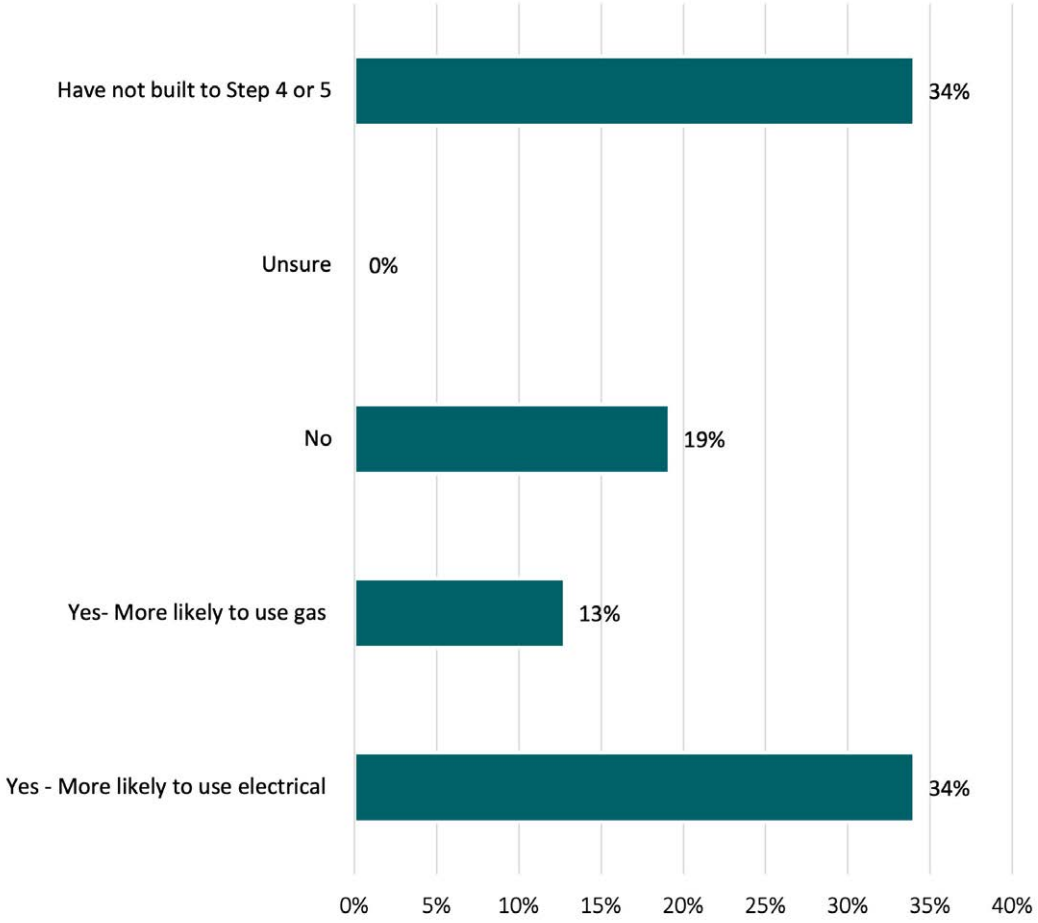
Q17. **Which metric(s) of the targeted Step was missed? Check all that apply.**

There were 2 responses received for this question, one indicating “Airtightness Requirements” and one “Performance Requirement of Building Equipment and Systems (MEUI and ERS)”.

Q18. **Can you explain why you are unsure as to why you did not achieve the targeted Step?**

There were 5 open-ended responses received for this question.

Q19. **In your experience building to Step 4 or Step 5 of the BC Energy Step Code, has this affected your decision making with respect to the energy source for space heating and/or domestic hot water heating?**



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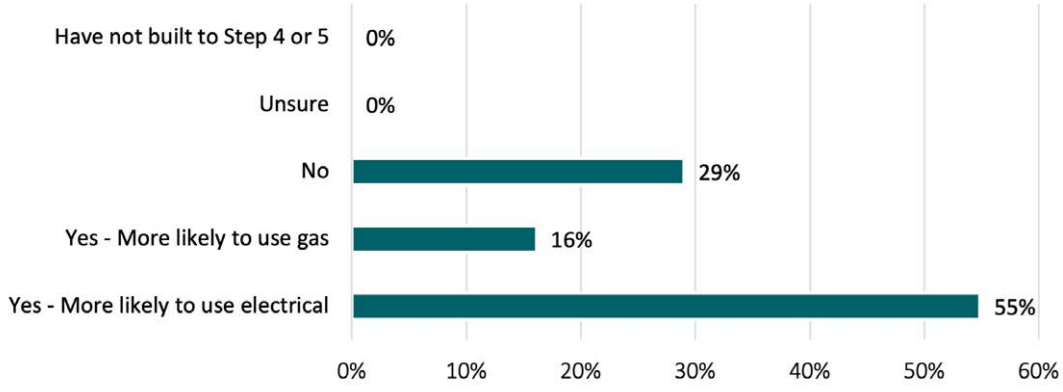
respondents

Q20. **In your experience building to Step 4 or Step 5 of the BC Energy Step Code, has it affected your decision making with respect to electrical or gas home appliances?**



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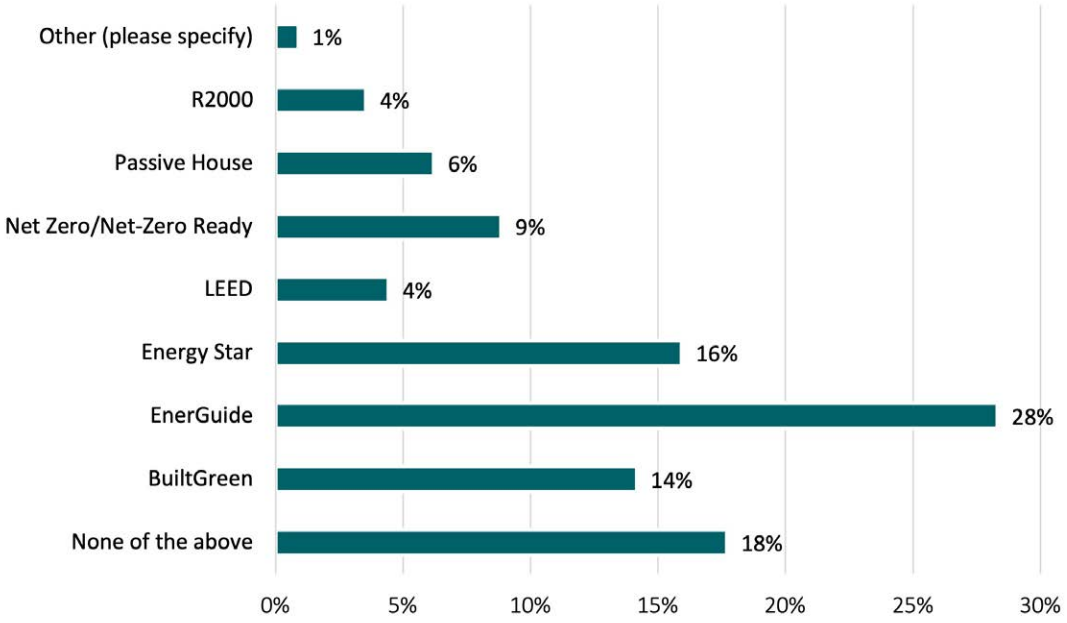
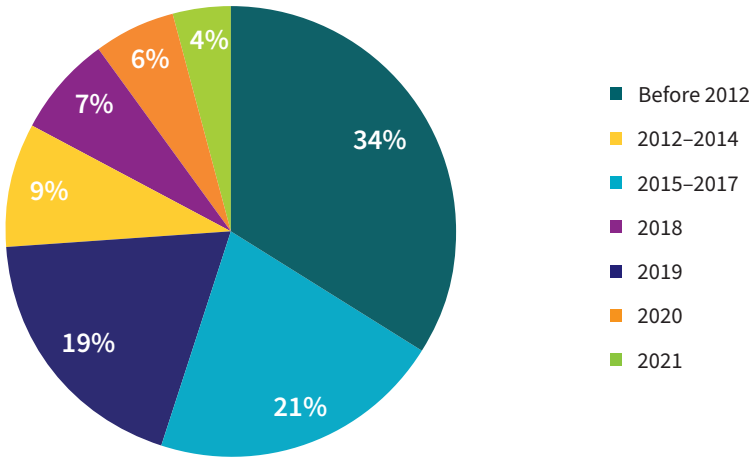
respondents

Q21. **What energy performance programs, other than the BC Energy Step Code, have you or your company used in building projects in the past?** Check all that apply.



67
respondents

Q22. **When did you or your company first start building using these energy performance programs?**



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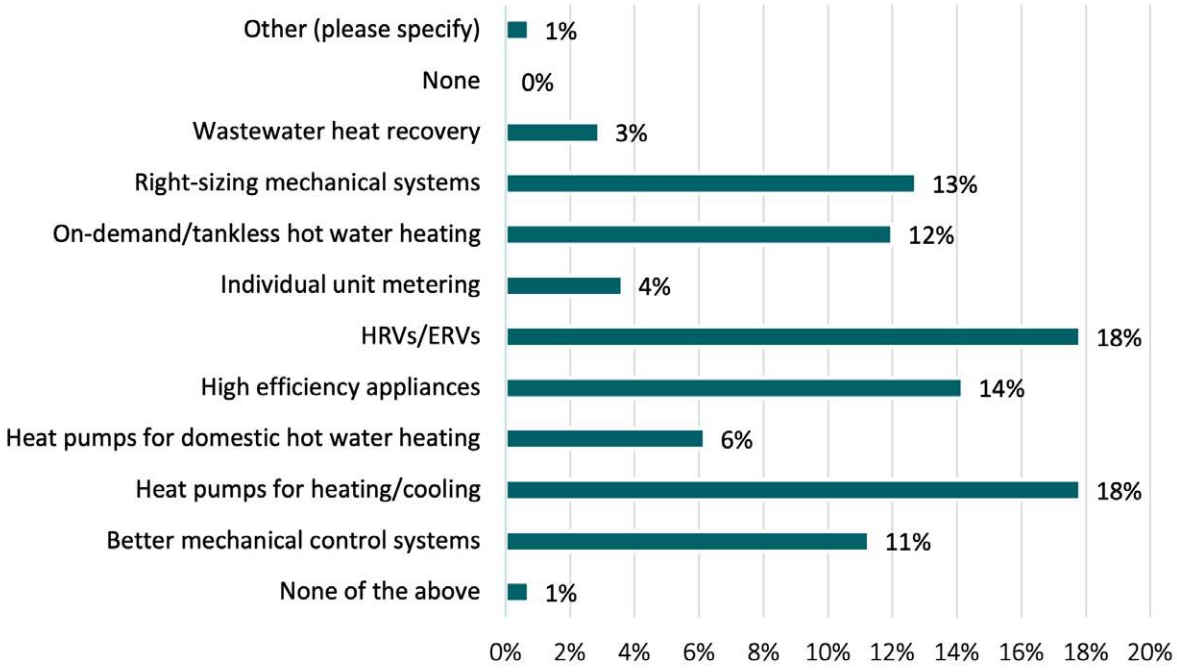
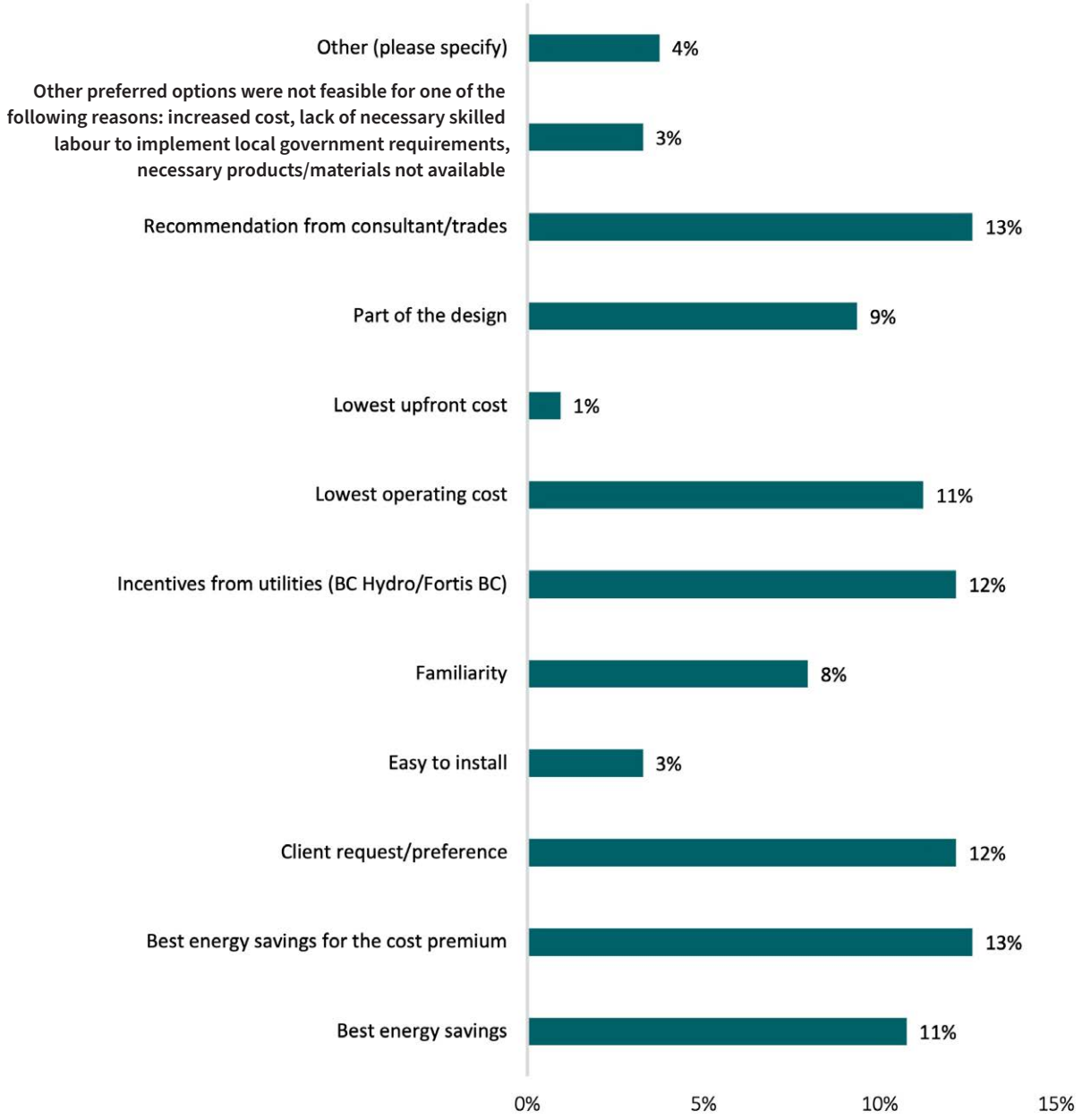
respondents

Q23. **Which of the following mechanical equipment and control systems measures have you or your company used between November 1, 2020 and October 31, 2021, to improve the energy performance of your projects?** Check all that apply.



67
respondents

Q24. **For the measures selected in the previous question, why did you or your company choose these ones to implement?** Check all that apply.



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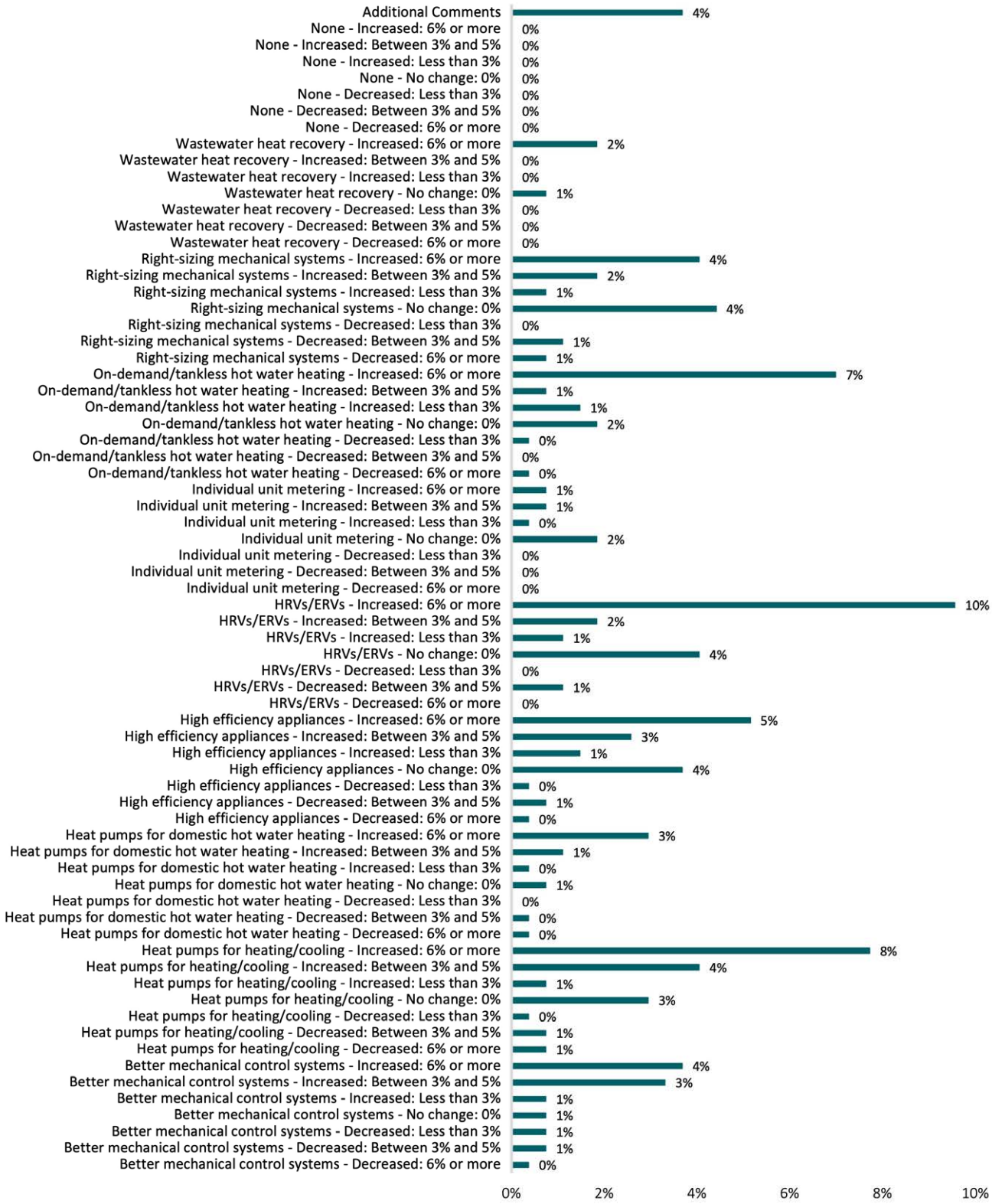
respondents

Q25. **For the measures previously selected, can you estimate by how much (%) the cost of that component changed?**



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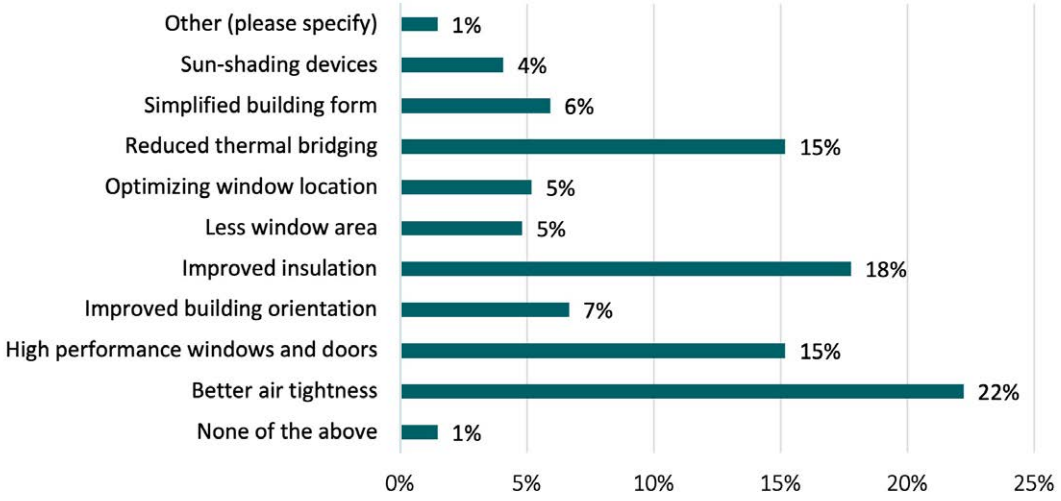
respondents

Q26. **Which of the following building envelope measures have you or your company used between October 1, 2020 and November 31, 2021, to improve the energy performance of your projects?** Check all that apply.



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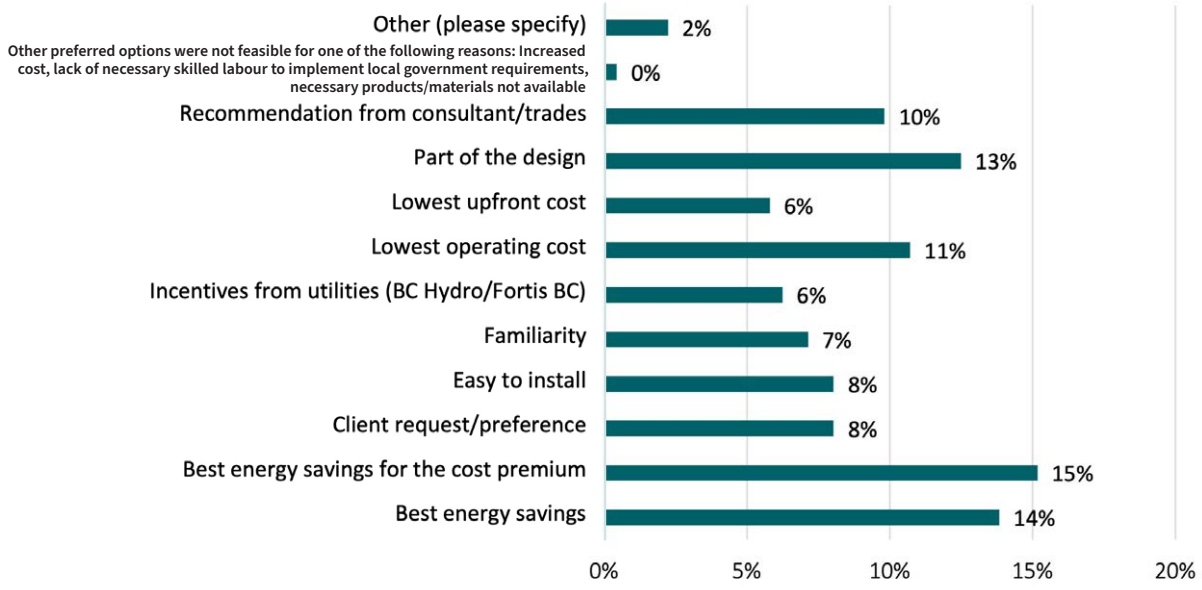
respondents

Q27. **For the measures selected in the previous question, why did you or your company choose these ones to implement?** Check all that apply.



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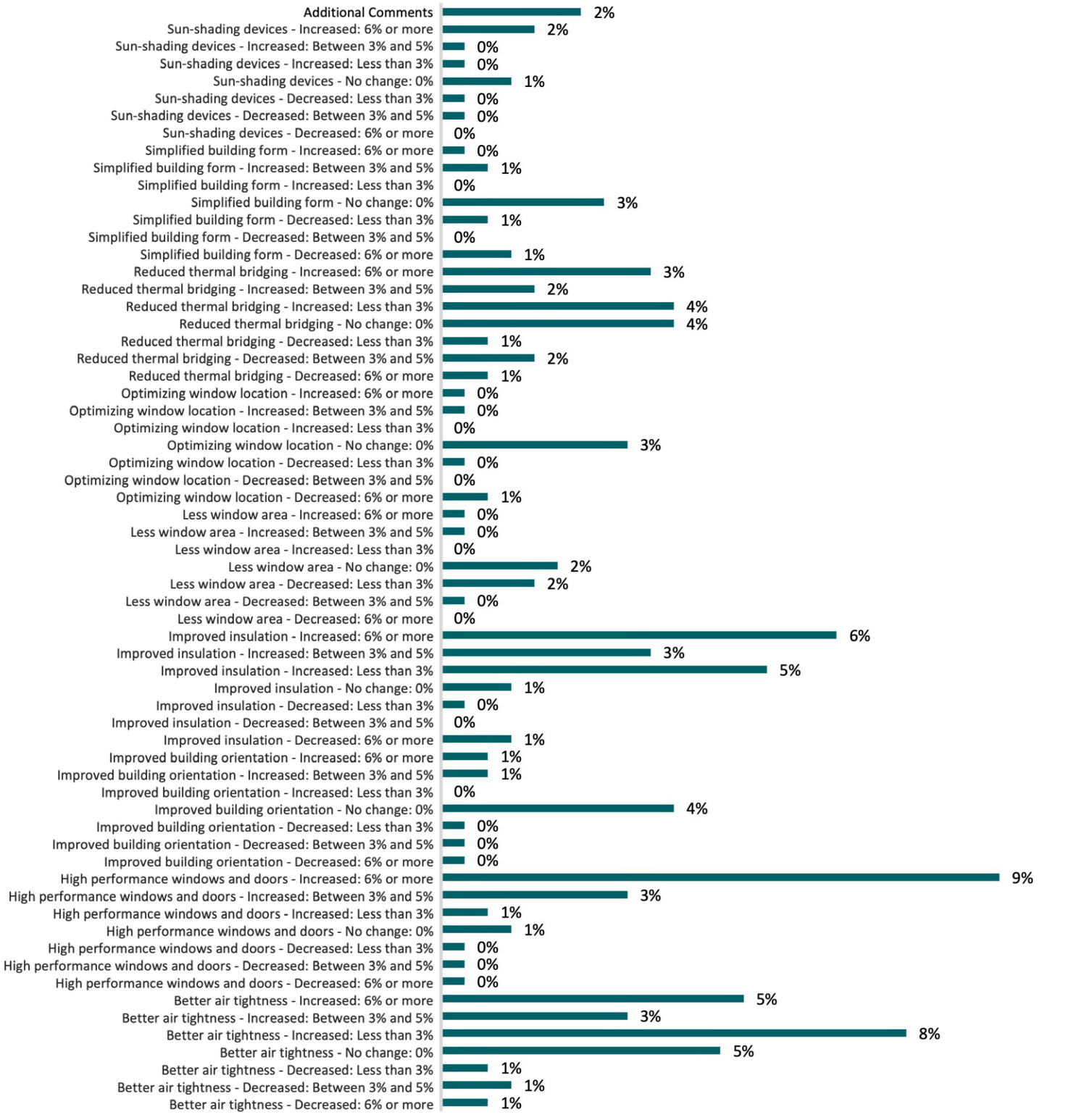
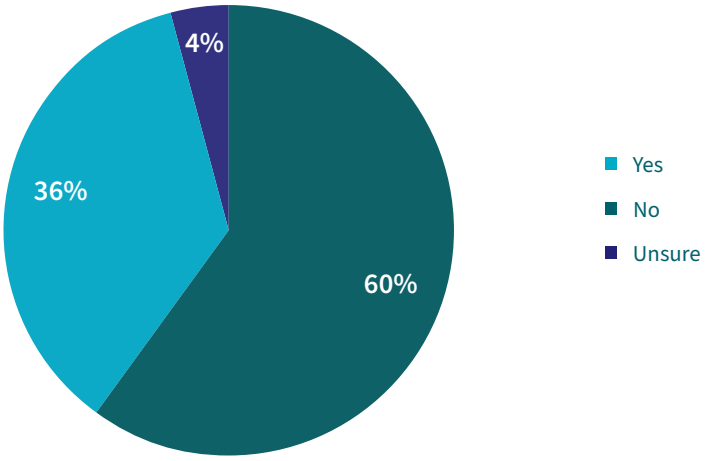
respondents

Q28. **For the measures previously selected, can you estimate by how much (%) the cost of that component changed?**



62
respondents

Q29. **Did you or your company use an Integrated Design Process (IDP)* between November 1, 2020 and October 31, 2021, to improve the energy performance of your projects?**



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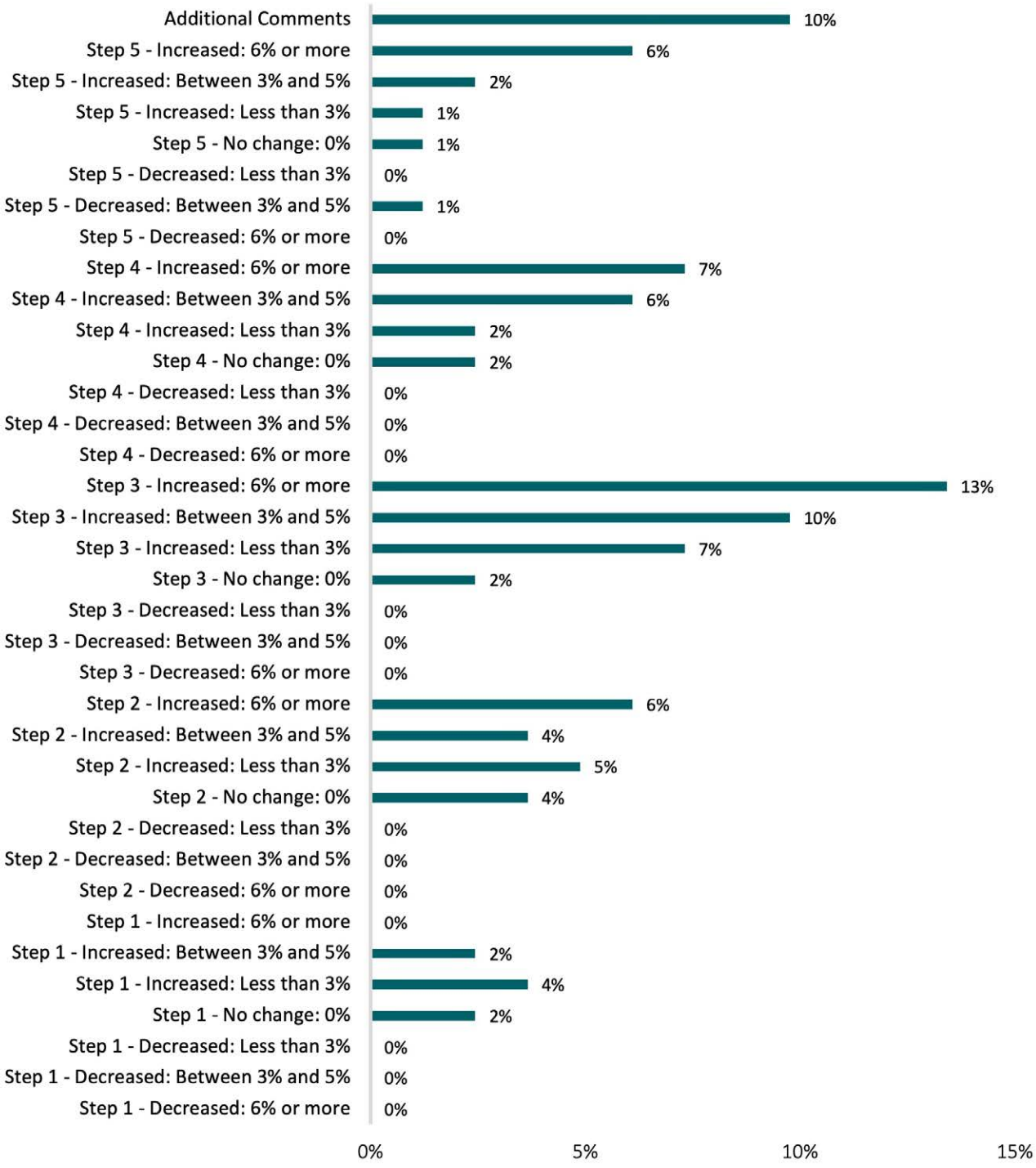
respondents

* Integrated Design Process (IDP) is a collaborative design approach that is intended to optimize performance, cost, occupant comfort and resilience of a residential building. It involves engaging the builder and their team of designers, mechanical contractor, and energy advisor at the conceptual design stage. The goal IDP is to ensure all objectives of are met. More information on IDP can be found here.

Q30. **For respondents who have previously built or are currently building to the BC Energy Step Code: On average, how much would you estimate building to the BC Energy Step Code has impacted your construction and design costs compared to base BC Building Code and did it mainly impact labour or material costs?**



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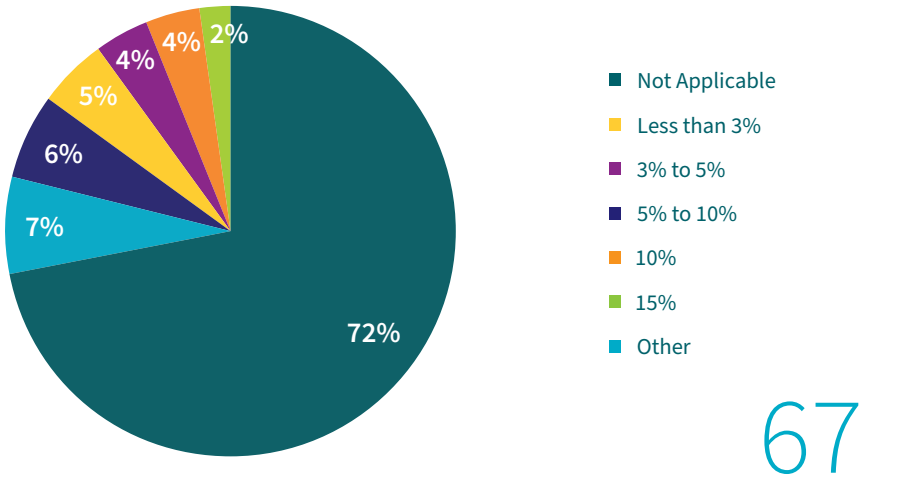
respondents

Q31. **For respondents who have NOT previously built or are NOT currently building to the BC Energy Step Code: On average, how much would you estimate Step 3 of the BC Energy Step Code would impact your construction and design costs compared to the base BC Building Code?**



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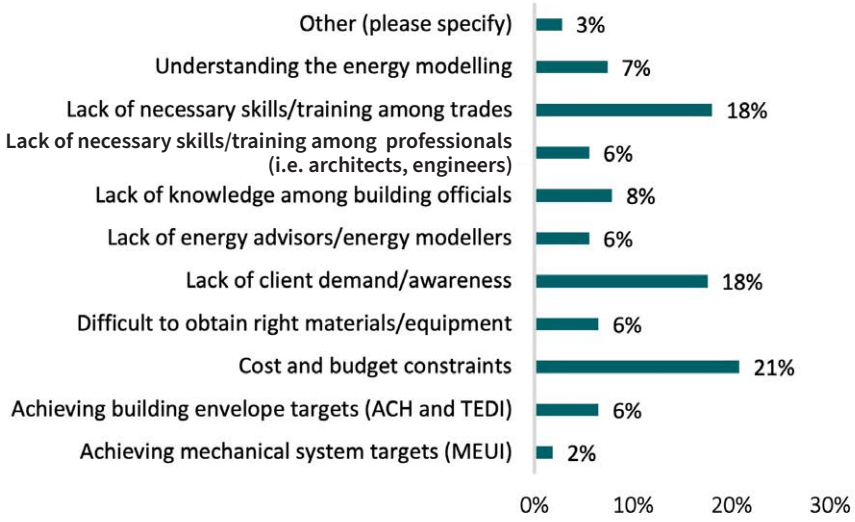
respondents

Q32. **What aspects of building to the BC Energy Step Code do you or your company find the most challenging?** Check all that apply.



67
respondents

Q33. **Do you have any suggestions as to how these issues could be addressed?**

There were 32 open-ended responses to this question.

Q34. **Is there anything we didn't cover that you would like to add?**

There were 16 open-ended responses to this question.

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