

# 2024 IECC Cost Analysis for Single-Family Homes

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## ACRONYMS, ABBREVIATIONS, AND DEFINITIONS

AC	Air Conditioner
ACH50	Air changes per hour at 50-pascal pressure differential
AFUE	Annual Fuel Utilization Efficiency
Btuh	British thermal units per hour
CFM	Cubic feet per minute
c.i.	Continuous Insulation
COP	Coefficient of Performance
CZ	Climate Zone
DOE	U.S. Department of Energy
EA	Each
EF	Bath exhaust fan
EIA	U.S. Energy Information Agency
ERV	Energy Recovery Ventilator
GF	Gas Furnace
HP	Heat Pump
HPWH	Heat Pump Water Heater
HRV	Heat Recovery Ventilator
HSPF	Heating Seasonal Performance Factor
IECC	International Energy Conservation Code
IRC	International Residential Code
kWh	Kilowatt-hours
LF	Linear Feet
PNNL	Pacific Northwest National Laboratory
SEER	Seasonal Energy Efficiency Ratio
SF	Square Feet
UEF	Uniform Energy Factor
WH	Water Heater

## BACKGROUND

The 2024 International Energy Conservation Code (IECC)<sup>1</sup> includes several changes which impact the cost of residential construction. The objective of this analysis was to estimate the added cost of compliance to build single-family homes in accordance with 2024 IECC relative to the 2018 IECC and 2021 IECC.

For the 2021 IECC, prescriptive compliance required compliance with section R408 using one of four prescribed additional efficiency package options. The 2024 IECC adopted a new format for R408 with a system of credits and a threshold with minimum credit number. The credits system enables a large number of compliance strategies depending on builder design choices and customer preferences. The cost comparison in this report accounts for the new R408 Additional Efficiency Requirements.

Home Innovation Research Labs estimated the incremental construction costs of key code changes using a single-family reference house with multiple configurations and in multiple locations.

Reported costs are representative of costs to the homebuyer. This analysis does not include any federal, state, or local incentives for energy efficiency.

Cost results are relative to the reference house characteristics, locations, and base codes used for this analysis. Results may vary substantially for other house designs and locations or in jurisdictions on an earlier version of the IECC or other locally adopted codes. Local market practices or consumer preferences may vary from the base code requirements and may impact cost in specific situations.

## METHODOLOGY

Costs were developed for the prescriptive provisions of the base code sections of the 2024 IECC (sections R102 through R404) and separately for the new additional efficiency requirements (section R408) based on the reference house, reference house configurations, and representative locations described below. Costs were also developed for Appendices RE Electric Vehicle Charging Infrastructure, RI On-Site Renewable Energy ready, RJ Demand Responsive Controls for water heating, and RK Electric-Ready Residential Building Provisions.

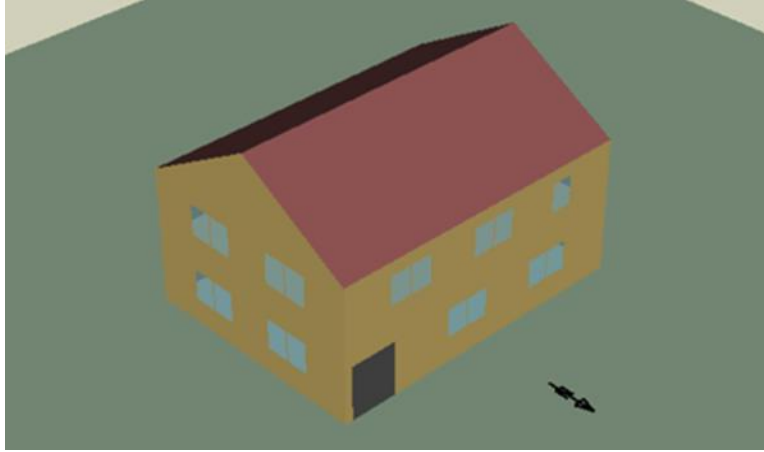
The reference house for this analysis was defined as a 2-story, 2,400 sq. ft., 4-bedroom, single-family detached home with a 40' x 30' footprint (Figure 1). This reference house was adapted from the single-family prototype building created by the Pacific Northwest National Laboratory (PNNL) for the U.S. Department of Energy (DOE).<sup>2</sup> The parameters represent typical values for building areas and features not dictated by the IECC. The characteristics of the reference house are shown in Table 1.

The representative locations and house configurations used for this study are shown in Table 2. The key design parameters used for the reference house are summarized in Table 3.

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<sup>1</sup> International Energy Conservation Code, International Code Council: <https://www.iccsafe.org/>

<sup>2</sup> DOE single-family prototype building: <https://www.energycodes.gov/methodology>



**Figure 1. Simulation Model of the Reference House**

**Table 1. Reference House Characteristics**

Component	Description
Conditioned floor area, slab house	2,400
Conditioned floor area, basement house	3,600
First floor area	1,200
Second floor area	1,200
Ceiling area, adjacent to vented attic	1,200
Ceiling height, ft.	8.5
Roof slope (2020 ABPS average)	7:12 (30.3°)
Foundation perimeter (40'x30' footprint), ft.	140
Gross Wall area, excluding rim areas	2,380
Window area, slab house (15% floor area)	360
Window area, add for basement house	24
Door area	42
Number of Bedrooms	4

**Table 2. Representative Locations and Configurations\***

CZ	Location	Foundation
2A	Houston, TX	Slab
3A	Atlanta, GA	Slab & Vented Crawlspace
4A	Baltimore, MD	Slab & Finished Basement
4C	Seattle, WA	Vented Crawlspace
5A	Chicago, IL	Slab & Finished Basement
6A	Minneapolis, MN	Finished Basement
7	Duluth, MN	Finished Basement
*Fuel for heating & hot water: all Gas & all Electric at each location		

**Table 3. Key Design Parameters**

Component	Description
Building thermal envelope	IECC Prescriptive (2024 v 2018 & 2021)
2021 IECC R408 efficiency option	Water Heater: 0.82 UEF Gas; 2.2 UEF Elec
Whole-house mechanical ventilation	Rate per IRC (61.5 cfm slab; 73.5 cfm bsmnt)
Duct location, slab house	75% attic, 25% cond space; air handler in attic
Duct location, basement house	25% attic, 75% cond space; air handler in basement
Duct location, crawlspace house	75% vented crawl, 25% cond space; air handler in crawlspace
Duct leakage, total	4 cfm25/100sfca
HVAC & Water Heater efficiency	Federal minimum (except R408)
Appliances, kitchen & laundry	Electric; Federal minimum efficiency

## COST DEVELOPMENT

Costs for building thermal envelope measures such as insulation and other measures including electrical wiring and mechanical piping were estimated using RSMeans 2024 Residential Data and national average costs for labor and materials.<sup>3</sup> For specific locations, the national average costs could be modified by applying the appropriate location adjustment factor from RSMeans; selected location adjustment factors from RSMeans are provided in Appendix B.

Costs for mechanical equipment, and in some cases costs for materials such as electrical components, were sourced from national distributor websites. Costs for windows were based on a 2021 report by the U.S. EPA for the ENERGY STAR program.<sup>4</sup> Costs associated with testing or fees provided by an energy rater, engineer, or other third party were estimated based on builder/rater feedback or an internet search of associated web sites.

Costs in the Results section are reported as cost to consumer. The cost to consumer is calculated by applying a markup to the builder cost to account for builder overhead and profit. For this analysis, the cost to consumer is calculated by applying a markup of 1.15 to the builder cost.<sup>5</sup> Note that cost details for individual measures provided in Appendix A show both cost to builder and cost to consumer.

The cost to builder represents the cost charged by the subcontractor: RSMeans provides a unit cost which represents builder cost and includes materials, labor, installation equipment (if needed to install materials, i.e., not permanently installed equipment), subcontractor overhead (overhead burden is applied to labor cost as a markup of approximately 1.5 although this markup varies by trade), and subcontractor profit (using a 10% markup applied to all costs). The base labor cost includes fringe benefits such as vacation pay and employer-paid healthcare. The overhead markup accounts for workers' compensation insurance, federal and state unemployment costs, social security taxes, insurance costs, and other subcontractor overhead costs. For this study, where material costs are sourced from national distributor websites (not RSMeans), a 10% subcontractor profit is added for consistency.

<sup>3</sup> RSMeans, <https://www.rsmeans.com/>

<sup>4</sup> ENERGY STAR Fenestration Version 7.0 Criteria Analysis Report, July 2021, EPA: [https://www.energystar.gov/sites/default/files/asset/document/ES\\_Residential\\_WDS\\_Draft%201\\_Criteria%20Analysis%20Report.pdf](https://www.energystar.gov/sites/default/files/asset/document/ES_Residential_WDS_Draft%201_Criteria%20Analysis%20Report.pdf)

<sup>5</sup> NAHB special study, Appendix I: [Government Regulation in the Price of a New Home](#)

## RESULTS

The estimated added costs of the 2024 IECC base code are summarized by climate zone and configuration in Table 4 for costs relative to 2018 IECC and Table 5 for costs relative to 2021 IECC. These results are broken down by individual measures in Table 6 and Table 7.

To account for the new R408 Additional Efficiency Requirements, example sets of measures were developed to meet R408 compliance (minimum two measures, minimum 10 credits). The associated costs of these packages represent costs relative to 2018 IECC. To compare with 2021 IECC, costs were first estimated for two 2021 IECC R408 options – HVAC and Water Heaters – and then deducted from the 2024 packages. Costs of 2024 R408 compliance are included in Table 4 through Table 7.

The estimated costs for each R408 measure are shown in Table 8. To estimate costs for Reduction in Total TC (R408.2.1.1), iterative modeling was performed to determine example sets of measures for three of the six prescribed improvement levels. The selection of measures was intended to show a representative range of practical and lowest-cost options a builder might consider to install, while taking into account the corresponding credits available. As of this writing, modeling software was not yet updated for 2024 IECC, so for this analysis, an assessment of total UA improvement was used.

Separately, added costs of selected measures in the appendices of the 2024 IECC are shown in Table 9.

Cost details of individual measures are provided in Appendix A.



**Table 4. Added Cost of 2024 IECC relative to 2018 IECC**

	CZ 2	CZ 3	CZ 3	CZ 4	CZ 4	CZ 4C	CZ 5	CZ 5	CZ 6	CZ 7
Config.	Slab	Slab	Crawl	Slab	Bsmnt	Crawl	Slab	Bsmnt	Bsmnt	Bsmnt
Gas	\$3,129	\$4,008	\$2,405	\$3,651	\$3,248	\$1,777	\$4,187	\$3,785	\$6,214	\$6,400
Elec	\$2,391	\$3,271	\$1,667	\$2,081	\$1,679	\$6,757	\$7,251	\$6,849	\$10,239	\$10,425

**Table 5. Added Cost of 2024 IECC relative to 2021 IECC**

	CZ 2	CZ 3	CZ 3	CZ 4	CZ 4	CZ 4C	CZ 5	CZ 5	CZ 6	CZ 7
Config.*	Slab	Slab	Crawl	Slab	Bsmnt	Crawl	Slab	Bsmnt	Bsmnt	Bsmnt
Gas, HVAC	\$1,176	\$277	\$277	(\$4,402)	(\$4,256)	(\$5,779)	(\$3,928)	(\$3,770)	\$4,025	\$2,018
Gas, WH	\$1,052	\$154	\$154	(\$4,526)	(\$4,380)	(\$5,666)	(\$3,815)	(\$3,657)	\$4,137	\$2,131
Elec, HVAC	(\$440)	(\$1,338)	(\$1,338)	(\$6,850)	(\$6,704)	(\$7,560)	(\$6,759)	(\$6,602)	\$2,155	\$148
Elec, WH	\$64	(\$835)	(\$835)	(\$6,609)	(\$6,462)	(\$2,065)	(\$1,264)	(\$1,106)	\$7,650	\$5,643
*Cost comparison based on 2021 IECC R408 option used for compliance: HVAC or Water Heater (WH)										

### Key observations

#### Cost of 2024 IECC relative to 2018 IECC:

- For gas houses, added costs ranged from \$2,405 (CZ 3 Crawlspace) to \$6,400 (CZ 7).
- For electric houses, added costs ranged from \$1,667 (CZ 3 Crawlspace) to \$10,425 (CZ 7).
- Requirements that contributed significantly to costs were continuous wall insulation (CZ 4-5), slab insulation (CZ 3), reduced air leakage (CZ 2, 6-7), and HRV mechanical ventilation (CZ 6-7); costs were also driven by more stringent requirements for fenestration (CZ 3-7), hot water pipe insulation, and controls for bath exhaust fans and interior lighting.
- R408 compliance increased total costs in CZ 2-3 and CZ 6-7 (particularly for electric houses in colder climates due to the cost of inverter heat pumps designed to operate more effectively in cold climates) but reduced total added costs in CZ 4-5 for gas houses and CZ 4 for electric houses (due to the optional opaque wall tradeoff of continuous insulation used for this analysis).

#### Cost of 2024 IECC relative to 2021 IECC:

- For gas houses, cost savings ranged \$3,657-\$5,779 in CZ 4-5, and cost increases ranged \$154-\$1,176 in CZ 2-3 and \$2,018-\$4,137 in CZ 6-7.
- For electric houses, cost savings ranged \$440-\$7,560 in CZ 2-5 (except for one cost increase of \$64 in CZ 2), and cost increases ranged \$148-\$7,650 in CZ 6-7.
- Total costs reflected the less stringent requirements in the 2024 IECC for ceiling insulation (CZ 2-7) and slab insulation (CZ 4-5).
- The costs for R408 compliance were also lower in the 2024 IECC because of the increased flexibility in R408 compliance compared to the 2021 IECC.

**Table 6. Added Cost of 2024 IECC vs 2018 IECC by Measure**

Code Section	2024 IECC Measure	CZ	Configuration	Cost	CZ 2	CZ 3	CZ 3	CZ 4	CZ 4
					Slab	Slab	Crawl	Slab	Bsmnt
R107.2.2/3	Inspections: air barrier; solar ready	All	All	\$242	\$242	\$242	\$242	\$242	\$242
Table R402.1.3	Windows, U-0.30 v .32 (2018)	3-4	Slab, Crawl	\$174		\$174	\$174	\$174	
			Basement	\$186				\$186	
	Windows, U-0.28 v .30 (2018 & 2021)	5-6	Slab, Crawl	\$174					
			Basement	\$186					
	Windows, U-0.27 v .30 (2018 & 2021)	7	Basement	\$372					
	Skylights	2-7	NA						
	Ceiling, R-38 v R-49 (2021)	2-3	All	(\$1,090)					
	Ceiling, R-60 v R-49 (2021)	4-7	All	(\$1,090)					
	Walls, R-20+5 v R-20+0 (2018)	4-5	Slab	\$5,098				\$5,098	
			Bsmnt, Crawl	\$5,366					\$5,366
Slab, R-10,2 v R-0 (2018)	3	Slab	\$1,604		\$1,604				
Slab, R-10,3 v R-10,2 (2018)	4-5	Slab	\$414				\$414		
Slab, R-10,3 v R-10,4 (2021)	4-5	Slab	(\$414)						
R402.5.1.3	Air leakage 4.0 ACH50 v 5 ACH50	2	Slab	\$898	\$898				
	Air leakage 2.5 ACH50 v 3 ACH50	6-7	Bsmnt, Crawl	\$1,198					
R402.5.1.2.1	Blower door test sampling: MF only	-	NA						
R403.3.8	Duct system leakage	All	All	(\$184)	(\$184)	(\$184)	(\$184)	(\$184)	(\$184)
R403.3.9	Duct leakage test sampling: MF only	-	NA						
R403.5.2	Hot water pipe insulation	All	All	\$127	\$127	\$127	\$127	\$127	\$127
R403.6.1	HRV or ERV: CZ 6-7 (2018); CZ 6 (2021)	6-7	All	\$2,193					
R403.6.4	Mech vent test sampling: MF only	-	NA						
R403.6.5	Bath exhaust fan control	All	All	\$87	\$87	\$87	\$87	\$87	\$87
R403.13	Gas fireplace, no pilot, min FE ratings	-	NA						
R404.1.1-5	Exterior lighting: MF only	-	NA						
R404.2	Interior lighting controls (2018/2021)	All	All	\$105/\$74	\$105	\$105	\$105	\$105	\$105
<b>Sub-Total before R408 compliance</b>					<b>\$1,275</b>	<b>\$2,154</b>	<b>\$550</b>	<b>\$6,062</b>	<b>\$5,928</b>
<b>Selected measures for 2024 R408 compliance, Gas Houses</b>									
R408.2.2(5)	95 AFUE Gas furnace Option 2	4-7		\$494				\$494	\$494
R408.2.3(2)(a)	0.92 UEF Gas water heater Option 1	All		\$1,767	\$1,767	\$1,767	\$1,767	\$1,767	\$1,767
R408.2.4(2)	100% ducts in conditioned space (4C vented to unvented crawl)	4C		\$7					
R408.2.8	Demand response thermostat	All		\$87	\$87	\$87	\$87	\$87	\$87
R408.2.2(2)	15.2 SEER2 AC Option 1	South		\$338				\$338	\$338
		North		\$574					
R408.2.6	Energy efficient appliances	All		\$300					
R408.2.9	Opaque walls, tradeoff c.i. for 3 additional credits in CZ 4-5	Slab		(\$5,098)				(\$5,098)	
		Bsmnt, Crawl		(\$5,366)					(\$5,366)
<b>Total for Gas houses with R408 compliance</b>					<b>\$3,129</b>	<b>\$4,008</b>	<b>\$2,405</b>	<b>\$3,651</b>	<b>\$3,248</b>
<b>Selected measures for 2024 R408 compliance, Electric Houses</b>									
R408.2.2(10)	7.8 HSPF2, 15.2 SEER2 HP Option 1	2-4		\$1,030	\$1,030	\$1,030	\$1,030	\$1,030	\$1,030
R408.2.2(14)	8.1 HSPF2, 15.2 SEER2, 70% heat at 5F HP Option 2	4C, 5-7		\$6,200					
R408.2.4(2)	100% ducts in conditioned space (4C vented to unvented crawl)	4C		\$7					
R408.2.8	Demand response thermostat	All		\$87	\$87	\$87	\$87	\$87	\$87
R408.2.9	Opaque walls, tradeoff c.i. for 3 additional credits in CZ 4-5	Slab		(\$5,098)				(\$5,098)	
		Bsmnt, Crawl		(\$5,366)					(\$5,366)
<b>Total for Electric houses with R408 compliance</b>					<b>\$2,391</b>	<b>\$3,271</b>	<b>\$1,667</b>	<b>\$2,081</b>	<b>\$1,679</b>

Table 6 continued. Added Cost of 2024 IECC vs 2018 IECC by Measure

Code Section	2024 IECC Measure	CZ	Configuration	Cost	CZ 4C	CZ 5	CZ 5	CZ 6	CZ 7
					Crawl	Slab	Bsmnt	Bsmnt	Bsmnt
R107.2.2/3	Inspections: air barrier; solar ready	All	All	\$242	\$242	\$242	\$242	\$242	\$242
Table R402.1.3	Windows, U-0.30 v .32 (2018)	3-4	Slab, Crawl	\$174					
			Basement	\$186					
	Windows, U-0.28 v .30 (2018 & 2021)	5-6	Slab, Crawl	\$174	\$174	\$174			
			Basement	\$186			\$186	\$186	
	Windows, U-0.27 v .30 (2018 & 2021)	7	Basement	\$372					\$372
	Skylights	2-7	NA						
	Ceiling, R-38 v R-49 (2021)	2-3	All	(\$1,090)					
	Ceiling, R-60 v R-49 (2021)	4-7	All	(\$1,090)					
	Walls, R-20+5 v R-20+0 (2018)	4-5	Slab	\$5,098		\$5,098			
			Bsmnt, Crawl	\$5,366	\$5,366		\$5,366		
Slab, R-10,2 v R-0 (2018)	3	Slab	\$1,604						
Slab, R-10,3 v R-10,2 (2018)	4-5	Slab	\$414		\$414				
Slab, R-10,3 v R-10,4 (2021)	4-5	Slab	(\$414)						
R402.5.1.3	Air leakage 4.0 ACH50 v 5 ACH50	2	Slab	\$898					
	Air leakage 2.5 ACH50 v 3 ACH50	6-7	Bsmnt, Crawl	\$1,198				\$1,198	\$1,198
R402.5.1.2.1	Blower door test sampling: MF only	-	NA						
R403.3.8	Duct system leakage	All	All	(\$184)	(\$184)	(\$184)	(\$184)	(\$184)	(\$184)
R403.3.9	Duct leakage test sampling: MF only	-	NA						
R403.5.2	Hot water pipe insulation	All	All	\$127	\$127	\$127	\$127	\$127	\$127
R403.6.1	HRV or ERV: CZ 6-7 (2018); CZ 6 (2021)	6-7	All	\$2,193				\$2,193	\$2,193
R403.6.4	Mech vent test sampling: MF only	-	NA						
R403.6.5	Bath exhaust fan control	All	All	\$87	\$87	\$87	\$87	\$87	\$87
R403.13	Gas fireplace, no pilot, min FE ratings	-	NA						
R404.1.1-5	Exterior lighting: MF only	-	NA						
R404.2	Interior lighting controls (2018/2021)	All	All	\$105/\$74	\$105	\$105	\$105	\$105	\$105
<b>Sub-Total before R408 compliance</b>					<b>\$5,916</b>	<b>\$6,062</b>	<b>\$5,928</b>	<b>\$3,953</b>	<b>\$4,138</b>
<b>Selected measures for 2024 R408 compliance, Gas Houses</b>									
R408.2.2(5)	95 AFUE Gas furnace Option 2	4-7		\$494	\$494	\$494	\$494	\$494	\$494
R408.2.3(2)(a)	0.92 UEF Gas water heater Option 1	All		\$1,767		\$1,767	\$1,767	\$1,767	\$1,767
R408.2.4(2)	100% ducts in conditioned space (4C vented to unvented crawl)	4C		\$7	\$7				
R408.2.8	Demand response thermostat	All		\$87	\$87	\$87	\$87		
R408.2.2(2)	15.2 SEER2 AC Option 1	South		\$338	\$338				
		North		\$574		\$574	\$574		
R408.2.6	Energy efficient appliances	All		\$300	\$300	\$300	\$300		
R408.2.9	Opaque walls, tradeoff c.i. for 3 additional credits in CZ 4-5	Slab		(\$5,098)		(\$5,098)			
		Bsmnt, Crawl		(\$5,366)	(\$5,366)		(\$5,366)		
<b>Total for Gas houses with R408 compliance</b>					<b>\$1,777</b>	<b>\$4,187</b>	<b>\$3,785</b>	<b>\$6,214</b>	<b>\$6,400</b>
<b>Selected measures for 2024 R408 compliance, Electric Houses</b>									
R408.2.2(10)	7.8 HSPF2, 15.2 SEER2 HP Option 1	2-4		\$1,030					
R408.2.2(14)	8.1 HSPF2, 15.2 SEER2, 70% heat at 5F HP Option 2	4C, 5-7		\$6,200	\$6,200	\$6,200	\$6,200	\$6,200	\$6,200
R408.2.4(2)	100% ducts in conditioned space (4C vented to unvented crawl)	4C		\$7	\$7				
R408.2.8	Demand response thermostat	All		\$87		\$87	\$87	\$87	\$87
R408.2.9	Opaque walls, tradeoff c.i. for 3 additional credits in CZ 4-5	Slab		(\$5,098)		(\$5,098)			
		Bsmnt, Crawl		(\$5,366)	(\$5,366)		(\$5,366)		
<b>Total for Electric houses with R408 compliance</b>					<b>\$6,757</b>	<b>\$7,251</b>	<b>\$6,849</b>	<b>\$10,239</b>	<b>\$10,425</b>

**Table 7. Added Cost of 2024 IECC vs 2021 IECC by Measure**

Code Section	2024 IECC Measure	CZ	Configuration	Cost	CZ 2	CZ 3	CZ 3	CZ 4	CZ 4	
					Slab	Slab	Crawl	Slab	Bsmnt	
R107.2.2/3	Inspections: air barrier; solar ready	All	All	\$242	\$242	\$242	\$242	\$242	\$242	
Table R402.1.3	Windows, U-0.30 v .32 (2018)	3-4	Slab, Crawl	\$174						
			Basement	\$186						
	Windows, U-0.28 v .30 (2018 & 2021)	5-6	Slab, Crawl	\$174						
			Basement	\$186						
	Windows, U-0.27 v .30 (2018 & 2021)	7	Basement	\$372						
	Skylights	2-7	NA							
	Ceiling, R-38 v R-49 (2021)	2-3	All	(\$1,090)	(\$1,090)	(\$1,090)	(\$1,090)			
	Ceiling, R-60 v R-49 (2021)	4-7	All	(\$1,090)				(\$1,090)	(\$1,090)	
	Walls, R-20+5 v R-20+0 (2018)	4-5	Slab	\$5,098						
			Bsmnt, Crawl	\$5,366						
Slab, R-10,2 v R-0 (2018)	3	Slab	\$1,604							
Slab, R-10,3 v R-10,2 (2018)	4-5	Slab	\$414							
Slab, R-10,3 v R-10,4 (2021)	4-5	Slab	(\$414)					(\$414)		
R402.5.1.3	Air leakage 4.0 ACH50 v 5 ACH50	2	Slab	\$898	\$898					
	Air leakage 2.5 ACH50 v 3 ACH50	6-7	Bsmnt, Crawl	\$1,198						
R402.5.1.2.1	Blower door test sampling: MF only	-	NA							
R403.3.8	Duct system leakage	All	All	(\$184)	(\$184)	(\$184)	(\$184)	(\$184)	(\$184)	
R403.3.9	Duct leakage test sampling: MF only	-	NA							
R403.5.2	Hot water pipe insulation	All	All	\$127	\$127	\$127	\$127	\$127	\$127	
R403.6.1	HRV or ERV: CZ 6-7 (2018); CZ 6 (2021)	6-7	All	\$2,193						
R403.6.4	Mech vent test sampling: MF only	-	NA							
R403.6.5	Bath exhaust fan control	All	All	\$87	\$87	\$87	\$87	\$87	\$87	
R403.13	Gas fireplace, no pilot, min FE ratings	-	NA							
R404.1.1 – 5	Exterior lighting: MF only	-	NA							
R404.2	Interior lighting controls (2018/2021)	All	All	\$105/\$74	\$74	\$74	\$74	\$74	\$74	
<b>Sub-Total before R408 compliance</b>					<b>\$154</b>	<b>(\$745)</b>	<b>(\$745)</b>	<b>(\$1,158)</b>	<b>(\$745)</b>	
<b>Selected measures for 2024 R408 compliance, Gas Houses</b>										
R408.2.2(5)	95 AFUE Gas furnace Option 2	4-7		\$494				\$494	\$494	
R408.2.3(2)(a)	0.92 UEF Gas water heater Option 1	All		\$1,767	\$1,767	\$1,767	\$1,767	\$1,767	\$1,767	
R408.2.4(2)	100% ducts in conditioned space (4C vented to unvented crawl)	4C		\$7						
R408.2.8	Demand response thermostat	All		\$87	\$87	\$87	\$87	\$87	\$87	
R408.2.2(2)	15.2 SEER2 AC Option 1	South		\$338				\$338	\$338	
		North		\$574						
R408.2.6	Energy efficient appliances	All		\$300						
R408.2.9	Opaque walls, tradeoff c.i. for 3 additional credits in CZ 4-5	Slab		(\$5,098)				(\$5,098)		
		Bsmnt, Crawl		(\$5,366)					(\$5,366)	
<b>Total for Gas houses with R408 compliance</b>					<b>\$2,008</b>	<b>\$1,109</b>	<b>\$1,109</b>	<b>(\$3,570)</b>	<b>(\$3,424)</b>	
<b>Selected measures for 2024 R408 compliance, Electric Houses</b>										
R408.2.2(10)	7.8 HSPF2, 15.2 SEER2 HP Option 1	2-4		\$1,030	\$1,030	\$1,030	\$1,030	\$1,030	\$1,030	
R408.2.2(14)	8.1 HSPF2, 15.2 SEER2, 70% heat at 5F HP Option 2	4C, 5-7		\$6,200						
R408.2.4(2)	100% ducts in conditioned space (4C vented to unvented crawl)	4C		\$7						
R408.2.8	Demand response thermostat	All		\$87	\$87	\$87	\$87	\$87	\$87	
R408.2.9	Opaque walls, tradeoff c.i. for 3 additional credits in CZ 4-5	Slab		(\$5,098)				(\$5,098)		
		Bsmnt, Crawl		(\$5,366)					(\$5,366)	
<b>Total for Electric houses with R408 compliance</b>					<b>\$1,270</b>	<b>\$372</b>	<b>\$372</b>	<b>(\$5,140)</b>	<b>(\$4,994)</b>	
<b>Selected 2021 R408 compliance options</b>										
2021 R408.2.2	HVAC, Gas: 95 AFUE GF/15.2 SEER2 AC	2-4	Gas house	\$832	(\$832)	(\$832)	(\$832)	(\$832)	(\$832)	
		4C, 5-7		\$1,069						
2021 R408.2.3	Water Heater, Gas: 0.82 UEF WH	All	Gas house	\$956	(\$956)	(\$956)	(\$956)	(\$956)	(\$956)	
2021 R408.2.2	HVAC, Elec: 8.5 HSPF2/15.2 SEER2 HP	2-4	Electric house	\$1,710	(\$1,710)	(\$1,710)	(\$1,710)	(\$1,710)	(\$1,710)	
		4C, 5-7		\$6,964						
2021 R408.2.3	Water Heater, Elec: 3.25 UEF HPWH	2-3	Electric house	\$1,207	(\$1,207)	(\$1,207)	(\$1,207)			
		4-7		\$1,469				(\$1,469)	(\$1,469)	
<b>Total for Gas houses with 2024 R408 compliance less 2021 R408 HVAC option</b>					<b>\$1,176</b>	<b>\$277</b>	<b>\$277</b>	<b>(\$4,402)</b>	<b>(\$4,256)</b>	
<b>Total for Gas houses with 2024 R408 compliance less 2021 R408 Water Heater option</b>					<b>\$1,052</b>	<b>\$154</b>	<b>\$154</b>	<b>(\$4,526)</b>	<b>(\$4,380)</b>	
<b>Total for Electric houses with 2024 R408 compliance less 2021 R408 HVAC option</b>					<b>(\$440)</b>	<b>(\$1,338)</b>	<b>(\$1,338)</b>	<b>(\$6,850)</b>	<b>(\$6,704)</b>	
<b>Total for Elec houses with 2024 R408 compliance less 2021 R408 Water Heater option</b>					<b>\$64</b>	<b>(\$835)</b>	<b>(\$835)</b>	<b>(\$6,609)</b>	<b>(\$6,462)</b>	

Table 7 continued. Added Cost of 2024 IECC vs 2021 IECC by Measure

Code Section	2024 IECC Measure	CZ	Configuration	Cost	CZ 4C	CZ 5	CZ 5	CZ 6	CZ 7
					Crawl	Slab	Bsmnt	Bsmnt	Bsmnt
R107.2.2/3	Inspections: air barrier; solar ready	All	All	\$242	\$242	\$242	\$242	\$242	\$242
Table R402.1.3	Windows, U-0.30 v .32 (2018)	3-4	Slab, Crawl	\$174					
			Basement	\$186					
	Windows, U-0.28 v .30 (2018 & 2021)	5-6	Slab, Crawl	\$174	\$174	\$174			
			Basement	\$186			\$186	\$186	
	Windows, U-0.27 v .30 (2018 & 2021)	7	Basement	\$372					\$372
	Skylights	2-7	NA						
	Ceiling, R-38 v R-49 (2021)	2-3	All	(\$1,090)					
	Ceiling, R-60 v R-49 (2021)	4-7	All	(\$1,090)	(\$1,090)	(\$1,090)	(\$1,090)	(\$1,090)	(\$1,090)
	Walls, R-20+5 v R-20+0 (2018)	4-5	Slab	\$5,098					
			Bsmnt, Crawl	\$5,366					
Slab, R-10,2 v R-0 (2018)	3	Slab	\$1,604						
Slab, R-10,3 v R-10,2 (2018)	4-5	Slab	\$414						
Slab, R-10,3 v R-10,4 (2021)	4-5	Slab	(\$414)		(\$414)				
R402.5.1.3	Air leakage 4.0 ACH50 v 5 ACH50	2	Slab	\$898					
	Air leakage 2.5 ACH50 v 3 ACH50	6-7	Bsmnt, Crawl	\$1,198				\$1,198	\$1,198
R402.5.1.2.1	Blower door test sampling: MF only	-	NA						
R403.3.8	Duct system leakage	All	All	(\$184)	(\$184)	(\$184)	(\$184)	(\$184)	(\$184)
R403.3.9	Duct leakage test sampling: MF only	-	NA						
R403.5.2	Hot water pipe insulation	All	All	\$127	\$127	\$127	\$127	\$127	\$127
R403.6.1	HRV or ERV: CZ 6-7 (2018); CZ 6 (2021)	6-7	All	\$2,193				\$2,193	
R403.6.4	Mech vent test sampling: MF only	-	NA						
R403.6.5	Bath exhaust fan control	All	All	\$87	\$87	\$87	\$87	\$87	\$87
R403.13	Gas fireplace, no pilot, min FE ratings	-	NA						
R404.1.1-5	Exterior lighting: MF only	-	NA						
R404.2	Interior lighting controls (2018/2021)	All	All	\$105/\$74	\$74	\$74	\$74	\$74	\$74
<b>Sub-Total before R408 compliance</b>					<b>(\$570)</b>	<b>(\$984)</b>	<b>(\$559)</b>	<b>\$2,832</b>	<b>\$825</b>
<b>Selected measures for 2024 R408 compliance, Gas Houses</b>									
R408.2.2(5)	95 AFUE Gas furnace Option 2	4-7		\$494	\$494	\$494	\$494	\$494	\$494
R408.2.3(2)(a)	0.92 UEF Gas water heater Option 1	All		\$1,767		\$1,767	\$1,767	\$1,767	\$1,767
R408.2.4(2)	100% ducts in conditioned space (4C vented to unvented crawl)	4C		\$7	\$7				
R408.2.8	Demand response thermostat	All		\$87	\$87	\$87	\$87		
R408.2.2(2)	15.2 SEER2 AC Option 1	South		\$338	\$338				
		North		\$574		\$574	\$574		
R408.2.6	Energy efficient appliances	All		\$300	\$300	\$300	\$300		
R408.2.9	Opaque walls, tradeoff c.i. for 3 additional credits in CZ 4-5	Slab		(\$5,098)		(\$5,098)			
		Bsmnt, Crawl		(\$5,366)	(\$5,366)	(\$5,366)			
<b>Total for Gas houses with R408 compliance</b>					<b>(\$4,710)</b>	<b>(\$2,859)</b>	<b>(\$2,702)</b>	<b>\$5,093</b>	<b>\$3,086</b>
<b>Selected measures for 2024 R408 compliance, Electric Houses</b>									
R408.2.2(10)	7.8 HSPF2, 15.2 SEER2 HP Option 1	2-4		\$1,030					
R408.2.2(14)	8.1 HSPF2, 15.2 SEER2, 70% heat at 5F HP Option 2	4C, 5-7		\$6,200	\$6,200	\$6,200	\$6,200	\$6,200	\$6,200
R408.2.4(2)	100% ducts in conditioned space (4C vented to unvented crawl)	4C		\$7	\$7				
R408.2.8	Demand response thermostat	All		\$87		\$87	\$87	\$87	\$87
R408.2.9	Opaque walls, tradeoff c.i. for 3 additional credits in CZ 4-5	Slab		(\$5,098)		(\$5,098)			
		Bsmnt, Crawl		(\$5,366)	(\$5,366)	(\$5,366)			
<b>Total for Electric houses with R408 compliance</b>					<b>\$271</b>	<b>\$204</b>	<b>\$362</b>	<b>\$9,118</b>	<b>\$7,112</b>
<b>Selected 2021 R408 compliance options</b>									
2021 R408.2.2	HVAC, Gas: 95 AFUE GF/15.2 SEER2 AC	2-4	Gas house	\$832					
		4C, 5-7		\$1,069	(\$1,069)	(\$1,069)	(\$1,069)	(\$1,069)	(\$1,069)
2021 R408.2.3	Water Heater, Gas: 0.82 UEF WH	All	Gas house	\$956	(\$956)	(\$956)	(\$956)	(\$956)	(\$956)
2021 R408.2.2	HVAC, Elec: 8.5 HSPF2/15.2 SEER2 HP	2-4	Electric house	\$1,710					
		4C, 5-7		\$6,964	(\$6,964)	(\$6,964)	(\$6,964)	(\$6,964)	(\$6,964)
2021 R408.2.3	Water Heater, Elec: 3.25 UEF HPWH	2-3	Electric house	\$1,207					
		4-7		\$1,469	(\$1,469)	(\$1,469)	(\$1,469)	(\$1,469)	(\$1,469)
<b>Total for Gas houses with 2024 R408 compliance less 2021 R408 HVAC option</b>					<b>(\$5,779)</b>	<b>(\$3,928)</b>	<b>(\$3,770)</b>	<b>\$4,025</b>	<b>\$2,018</b>
<b>Total for Gas houses with 2024 R408 compliance less 2021 R408 Water Heater option</b>					<b>(\$5,666)</b>	<b>(\$3,815)</b>	<b>(\$3,657)</b>	<b>\$4,137</b>	<b>\$2,131</b>
<b>Total for Electric houses with 2024 R408 compliance less 2021 R408 HVAC option</b>					<b>(\$6,693)</b>	<b>(\$6,759)</b>	<b>(\$6,602)</b>	<b>\$2,155</b>	<b>\$148</b>
<b>Total for Elec houses with 2024 R408 compliance less 2021 R408 Water Heater option</b>					<b>(\$1,198)</b>	<b>(\$1,264)</b>	<b>(\$1,106)</b>	<b>\$7,650</b>	<b>\$5,643</b>

**Table 8. Added Cost of R408 Options**

Code Section	Measure	CZ	Config.	Cost	Credits
R408.2.1.1	Reduction in total TC, by selected percentage reduction levels for example measures. Note: to estimate costs, iterative modeling was performed to determine example sets of measures for three of the six prescribed improvement levels with the intent to show a representative range of practical and lowest-cost options a builder might consider to install, while taking into account the corresponding credits available; as of this writing, modeling software was not yet updated for 2024 IECC, so for this analysis, an assessment of total UA improvement was used.				
	Cost for performing the TC analysis to determine compliance; this cost is not included in the R408.2.1.1 options below	All	All	\$242	NA
	> 7.5%: U-0.30 fenestration	2	Slab	\$174	1
	> 15%: U-0.30, R13+3ci walls			\$4,094	2
	> 20%: U-0.30, R13+5ci			\$5,272	4
	≥ 5%: U-0.25 fenestration	3	Slab	\$668	1
	> 10%: U-0.25, R20+3ci walls			\$4,588	2
	> 15%: U-0.25, R20+10ci, R49 ceiling			\$10,981	4
	≥ 5%: U-0.25 fenestration	3	Crawl	\$668	1
	>10%: U-0.25, R20+3ci walls			\$4,588	2
	> 20%: U-0.25, R20+7.5ci, R49 ceiling			\$9,346	4
	≥ 2.5%: U-0.28 fenestration	4	Slab	\$174	1
	≥ 5%: U-0.25 fenestration			\$668	2
	> 10%: U-0.25, R20+7.5ci walls, R60 ceiling			\$4,248	3
	≥ 2.5%: U-0.28 fenestration	4	Bsmnt	\$186	1
	≥ 5%: U-0.25 fenestration			\$712	2
	> 10%: U-0.25, R20+7.5ci walls, R60 ceiling			\$4,378	3
	≥ 2.5%: U-0.25 fenestration	4C	Crawl	\$668	1
	≥ 5%: U-0.25, R60 ceiling			\$1,758	2
	> 10%: U-0.25, R20+10ci walls			\$5,227	3
	≥ 2.5%: U-0.25 fenestration	5	Slab	\$668	1
	≥ 5%: U-0.25, R60 ceiling			\$1,758	2
	> 10%: U-0.25, R20+10ci walls			\$4,793	4
	≥ 2.5%: U-0.25 fenestration	5	Bsmnt	\$712	1
	≥ 5%: U-0.25, R20+7.5ci walls			\$3,287	2
	> 10% U-0.25, R20+10ci, R60 ceiling			\$5,005	4
	≥ 2.5%: U-0.25 fenestration	6	Bsmnt	\$712	1
	≥ 5%: U-0.25, R20+7.5ci walls			\$3,287	2
	> 10% U-0.25, R20+10ci, R60 ceiling			\$5,005	4
	≥ 2.5%: U-0.25 fenestration	7	Bsmnt	\$341	1
	≥ 5%: U-0.25 + R20+7.5 walls			\$2,916	2
	> 7.5% U-0.25 + R20+10 walls			\$4,633	3

R408.2.1.2	<b>Improved Fenestration, U-factor/SHGC</b>				
	.30/.23 v .40/.25	2	Slab	\$392	2
	.28/.23 v .30/.25	3	Slab	\$218	1
	.25/.40 v .30/.40	4	Slab	\$668	1
			Bsmnt	\$712	1
	.25/NR v .28/NR	5-6	Slab	\$668	1
Bsmnt			\$712	1	
.25/NR v .27/NR	7	Bsmnt	\$341	1	
R408.2.1.3	Roof SRI $\geq$ 75 "cool roof"	2		\$521	1
R408.2.1.4	Reduced Air Leakage, 2.0-2.5 ACH50 vs 4 (CZ 2) or 3 (CZ3-5)	2	Slab	\$1,724	1
		3-5	Slab	\$2,622	1-3
			Bsmnt	\$3,015	1-3
R408.2.2	<b>More efficient HVAC equipment</b>				
R408.2.2(1)	GSHP 16.1 EER/3.1 COP	2-3		\$11,288	14
		4-5		\$16,535	10-15
		6-7		\$21,997	17-18
R408.2.2(2)	AC Option 1: 15.2 SEER2	All	South	\$338	2-4
			North	\$574	1
R408.2.2(3)	AC Option 2: 16.0 SEER2	All	South	\$1,025	2-4
			North	\$1,261	1
R408.2.2(4)	GF Option 1: 97 AFUE	All		\$1,455	1-7
R408.2.2(5)	GF Option 2: 95 AFUE	All		\$494	1-7
R408.2.2(6)	GF Option 3: 90 AFUE	0-3		\$291	1
R408.2.2(7)	GF+AC Option 1: 90 AFUE + 15.2 SEER2	0-3		\$628	4-5
R408.2.2(8)	GF+AC Option 2: 95 AFUE + 16.0 SEER2	0-3		\$1,519	5
R408.2.2(9)	GF+HP Option 1: 90 AFUE + 7.8 HSPF2, 15.2 SEER2	0-3		\$1,288	11-13
R408.2.2(10)	HP Option 1: 7.8 HSPF2, 15.2 SEER2	0-3		\$1,030	11-12
R408.2.2(11)	GF+AC Option 3: 95 AFUE + 15.2 SEER2	4-8		\$1,069	4-7
R408.2.2(12)	GF+AC Option 4: 97 AFUE + 16.0 SEER2	4-8		\$2,716	5-8
R408.2.2(13)	GF+HP Option 2: 95 AFUE + 8.1 HSPF2, 15.2 SEER2, 70% heat at 5F	4-8		\$7,031	8-12
R408.2.2(14)	HP Option 2: 8.1 HSPF2, 15.2 SEER2, 70% heat at 5F	4-8		\$6,200	8-14
R408.2.2.1	GF+HP Option 3: 95 AFUE + 7.8 HSPF2, 15.2 SEER2	4		\$1,728	11
	HP Option 1: 7.8 HSPF2, 15.2 SEER2	4		\$1,030	12
R408.2.3	<b>Water Heating</b>				
R408.2.3(1)(a)	Gas storage WH, all V&DP, 0.81 UEF (Option 1)	All		\$3,749	3-7
R408.2.3(1)(b)	Gas storage WH, < 55g, H/M DP, 0.86/.81 UEF (Option 2)	All		\$3,749	4-8
	Gas storage WH, > 55g, M or H DP, 0.86 UEF (Option 2)	All		\$6,353	4-8
	Gas storage WH, >75 kBtuh, 0.86 UEF or 94% TE (Option 2)	All		\$3,749	4-8
R408.2.3(2)(a)	Gas instantaneous WH, 0.92 UEF, M or H DP (Option 1)	All		\$1,767	4-9
R408.2.3(2)(b)	Gas instantaneous WH, 0.95 UEF, M or H DP (Option 2)	All		\$2,085	4-10
R408.2.3(3)(a)	Elec integrated HPWH, 3.30 UEF all V & DP (Option 1)	All	50-gal	\$1,207	4-9
		All	65-gal	\$1,469	4-9

		All	80-gal	\$2,344	4-9
R408.2.3(4)	Elec integrated HPWH, 120-volt, 15-amp, 2.20 UEF (Option 2)	All	50-gal	\$1,584	3-8
		All	65-gal	\$2,038	3-8
		All	80-gal	\$2,472	3-8
R408.2.3(5)(a)	Elec split-system HPWH, 2.20 UEF (Option 3)	All		\$6,303	3-8
R408.2.3(5)(b)	Elec split-system HPWH, 3.75 UEF (Option 4)	All		\$6,787	4-10
R408.2.3(6)	Elec WH, input capacity > 12 kW, 3.0 COP (Option 5)	All		\$1,558	3-9
R408.2.3(7)(a)	Solar WH, all Vol, all DP, Elec backup, 3.00 SUEF (Option 1)	All		\$15,649	4-13
R408.2.3(7)(b)	Solar WH, all Vol, all DP, Gas backup: 1.80 SUEF (Option 2)	All		\$15,649	4-9
R408.2.3(8)	Compact Hot Water Distribution: recirculation loop system	All		\$1,034	2
R408.2.4	<b>Distribution systems</b>				
R408.2.4(1)	Ductless heat pumps	1-3		\$6,140	4-5
	Ductless, cold-climate heat pumps	4-8		\$9,049	7-10
R408.2.4(2)	100% ducts & air handler in cond space: encapsulated attic using closed-cell spray foam insulation	2-3		\$9,025	3
		4-8		\$10,944	6-9
	100% ducts & air handler in conditioned space: buried ducts considered inside conditioned space (R403.3.4)	4-8	Slab	\$2,042	6-9
		4-8	Bsmnt	\$921	6-9
		2A-3A	Slab	\$4,665	3
		2B-3B	Slab	\$1,769	3
	100% ducts & air handler in cond space: converting crawlspace from vented to unvented/conditioned	4C	Crawl	\$7	7
3		Crawl	\$2	4	
R408.2.4(3)	80% ducts & air handler in conditioned space: buried ducts considered inside conditioned space (R403.3.4)	4-8	Slab	\$1,806	5-7
			Bsmnt	\$685	5-7
		2A-3A	Slab	\$3,730	3
		2B-3B	Slab	\$1,614	3
R408.2.4(4)	Total duct leakage max 2.0 cfm25/100sfca			\$453	1-2
R408.2.5	<b>Improved air sealing &amp; ventilation</b>				
R408.2.5(1)	ERV/HRV: 75 SRE, 50 LRMT: adder for CZ 6-8; option for other CZ	4C-5		\$2,417	1-3
		6-8		\$224	5
R408.2.5(2)	≤ 2.0 ACH50 + HRV/ERV, CZ 4-8	4-5	Slab	\$5,039	4-8
			Bsmnt	\$5,432	4-8
		6-8	Bsmnt	\$2,041	5
R408.2.5(3)	≤ 2.0 ACH50 + balanced ventilation, CZ 6-8	6-8	Bsmnt	\$580	4
R408.2.5(4)	≤ 1.5 ACH50 + HRV/ERV, CZ 4-8	4-5	Slab	\$5,432	5-10
			Bsmnt	\$5,884	5-10
		6-8	Bsmnt	\$2,493	9-10
R408.2.5(5)	≤ 1.0 ACH50 + HRV/ERV, CZ 3-8	2	Slab	\$4,986	0
		3-5	Slab	\$5,884	1-12
		4-5	Bsmnt	\$6,180	7-12
		6-8	Bsmnt	\$3,014	12
R408.2.6	<b>Energy Efficient Appliances</b>	1-5		\$300	1



		6-8		\$300	0
R408.2.7	Renewable energy, on-site, min 1.0 W/SFcf	All	Slab	\$10,638	7-16
		All	Bsmnt	\$12,234	7-16
R408.2.8	Demand response thermostat			\$87	1
R408.2.9	<p><b>Opaque walls.</b> For CZ 4-5, maximum U-factor of 0.60 (i.e., R-20+0ci) is permitted for wood-framed walls where using one of four prescribed alternatives. Cost is net cost of tradeoffs.</p> <p>1. Heat Pump, Elec house, Option 1 \$1,030 (CZ 4) or Option 2 \$6,200 (CZ 4C-5) less wall c.i. \$5,098 (Slab) or \$5,366 (Basement or Crawlspace)</p> <p>2. Heat Pump Water Heater, Elec house, 65-gal \$1,469 less wall c.i. \$5,098 (Slab) or \$5,366 (Basement or Crawlspace)</p> <p>3. Three additional credits, Gas house, example 1: Demand response thermostat \$87 (1 credit), 15.2 SEER2 AC \$338 (2 credits in CZ 4) or \$574 (1 credit in CZ 4C-5), and Energy efficient appliances \$300 (1 credit in CZ 4-5) less wall c.i. \$5,098 (Slab) or \$5,366 (Basement or Crawlspace)</p> <p>3. Three additional credits, Gas house, example 2, 100% ducts &amp; air handler in conditioned space: \$1,553 (Slab) or \$341 (Basement) or \$7 (CZ 4C Crawlspace) less wall c.i. (see above)</p> <p>4. Renewable energy, Gas or Elec house: PV \$10,638 (Slab or Crawlspace) or \$12,234 (Basement) less wall c.i. \$5,098 (Slab) or \$5,366 (Basement or Crawlspace)</p>	4-5			
		4	Slab	(\$4,068)	
			Bsmnt, Crawl	(\$4,336)	
		4C-5	Slab	\$1,102	
			Bsmnt, Crawl	\$834	
		4-5	Slab	(\$3,629)	
			Bsmnt, Crawl	(\$3,897)	
		4	Slab	(\$4,673)	
			Bsmnt	(\$4,941)	
		4C	Crawl	(\$4,405)	
		5	Slab	(\$4,137)	
			Bsmnt	(\$4,405)	
4&5	Slab	(\$3,056)			
	Bsmnt	(\$4,445)			
4C	Crawl	(\$5,359)			
4-5	Slab	\$5,540			
	Crawl	\$5,272			
	Bsmnt	\$6,868			
R408.2.10	Whole Home Lighting Control			\$418	0-1
R408.2.11	Higher Efficacy Lighting, lamp 90 lm/w			\$19	0

**Table 9. Added Cost of Selected Measures in the Appendices\***

Appendix	Measure	CZ	Configuration	Cost
RE101.2.2	EV capable spaces	All	Any	\$291
RE101.2.3	EV ready spaces	All	Any	\$616
RE101.2.4	EVSE spaces	All	Any	\$944
RI103	On-site renewable energy ready	All	Any	\$742
RJ101	Demand responsive electric water heater	All	Elec house	\$148
RK101.1.1	Electric ready for range	All	Gas house	\$377
RK101.1.2	Electric ready for dryer	All	Gas house	\$314
RK101.1.3	Electric ready for water heater	All	Gas house	\$255
*Costs do not include the cost of an electrical service upgrade if required.				

## APPENDIX A: COST DETAILS FOR INDIVIDUAL MEASURES

The cost results for this analysis are based on the estimated cost of individual measures provided in the tables below. Costs are reported as both “Cost to Builder” and the marked-up “Cost to Consumer”.

### 2024 IECC Prescriptive Requirements (non-R408 measures)

R107.2.2/3 Inspections				
Component	Unit	Unit Cost	Quantity	Cost
Rater fee to inspect & document the air barrier	HR	105.00	2.0	210
Total to Builder				210
<b>Total to Consumer</b>				<b>242</b>

R402.1.3 Windows (costs relative to 2018 IECC and 2021 IECC)*				
Window	Unit	Unit Cost	Quantity	Cost*
U-0.30 v .32 (CZ 3-4), slab house (2018 only)	SF	0.40	360	174
U-0.30 v .32 (CZ 3-4), basement house (2018 only)	SF	0.40	384	186
U-0.28 v .30 (CZ 5-6), slab house	SF	0.40	360	174
U-0.28 v .30 (CZ 5-6), basement house	SF	0.40	384	186
U-0.27 v .30 (CZ 7-8), slab house	SF	0.80	360	348
U-0.27 v .30 (CZ 7-8), basement house	SF	0.80	384	372

\*RSM means does not provide the granularity to estimate the cost difference for fenestration with different SHGC and U-factors. For this analysis, added window costs were estimated based on an EPA study that reported incremental cost to consumer for a 15 sq. ft. window, adjusted for inflation (1.21 factor for Aug 2020 to Jun 2024). Separately for this analysis, entry doors were assumed to be opaque: a survey of market pricing indicated that even inexpensive doors typically meet or exceed U-0.17, the requirement for the ENERGY STAR Reference Design Home, therefore no additional cost was assumed for doors.

[https://www.energystar.gov/sites/default/files/asset/document/ES\\_Residential\\_WDS\\_Draft%201\\_Criteria%20Analysis%20Report.pdf](https://www.energystar.gov/sites/default/files/asset/document/ES_Residential_WDS_Draft%201_Criteria%20Analysis%20Report.pdf)

R402.1.3 Ceiling insulation, R-49 vs R-38, or R-60 vs R-49*				
Component	Unit	Unit Cost	Quantity	Cost
R-49 ceiling insulation, blown fiberglass**	SF	3.65	1,200	4,380
R-38 ceiling insulation, blown fiberglass**	SF	2.86	(1,200)	(3,432)
Total to Builder				948
<b>Total to Consumer</b>				<b>1,090</b>

\*RSM means does not provide R-60 data; assumed same incremental cost as R-49 vs R-38

\*\*Cost based on full coverage, i.e., not reduced coverage at truss heels; cost does not include any additional cost for raised heel trusses to accommodate additional ceiling insulation.

<b>R402.1.3. Wall continuous insulation, R-5 vs R-0, slab house</b>				
<b>Component</b>	<b>Unit</b>	<b>Unit Cost</b>	<b>Quantity</b>	<b>Cost</b>
R-5 XPS, 1" thick	SF	1.64	2,520	4,144
Fasteners, vinyl siding, 2.5" galv roof nail	LB	5.65	22	124
Fasteners, vinyl siding, 1.5" galv roof nail	LB	5.65	(14)	(79)
Interior drywall to fill gap at windows/doors	SF	1.86	35	65
Window sill/stool cap, add 1" depth	LF	1.95	72	140
Paint, 2 coats	SF	1.11	35	39
Total to Builder				4,433
<b>Total to Consumer</b>				<b>5,098</b>

<b>R402.1.3. Wall continuous insulation, R-5 vs R-0, basement house</b>				
<b>Component</b>	<b>Unit</b>	<b>Unit Cost</b>	<b>Quantity</b>	<b>Cost</b>
R-5 XPS, 1" thick	SF	1.64	2,660	4,374
Fasteners, vinyl siding, 2.5" galv roof nail	LB	5.65	24	136
Fasteners, vinyl siding, 1.5" galv roof nail	LB	5.65	(14)	(79)
Interior drywall to fill gap at windows/doors	SF	1.86	32	60
Window sill/stool cap, add 1" depth	LF	1.95	72	140
Paint, 2 coats	SF	1.11	32	36
Total to Builder				4,666
<b>Total to Consumer</b>				<b>5,366</b>

<b>R402.1.3 Slab insulation, R-10, 3-ft deep vs R-10, 2-ft deep</b>				
<b>Component</b>	<b>Unit</b>	<b>Unit Cost</b>	<b>Quantity</b>	<b>Cost</b>
R-10 XPS, 2" thick, 25 psi	SF	2.57	140	360
Total to Builder				360
<b>Total to Consumer</b>				<b>414</b>

<b>R402.1.3. Slab insulation, R-10, 4-ft deep vs R-10, 2-ft deep</b>				
<b>Component</b>	<b>Unit</b>	<b>Unit Cost</b>	<b>Quantity</b>	<b>Cost</b>
R-10 XPS, 2" thick, 25 psi	SF	2.57	280	720
Total to Builder				720
<b>Total to Consumer</b>				<b>828</b>

<b>R402.1.3 Slab insulation, R-10, 2-ft deep vs R-0</b>				
<b>Component</b>	<b>Unit</b>	<b>Unit Cost</b>	<b>Quantity</b>	<b>Cost</b>
R-10 XPS, 2" thick, 25 psi	SF	2.57	280	720
Flashing at XPS, vinyl coated aluminum sheet metal	SF	4.82	140	675
Total to Builder				1,394
<b>Total to Consumer</b>				<b>1,604</b>

<b>R402.5.1.3 Air leakage 4 ACH50 vs 5 (CZ2) or 2.5 ACH50 vs 3 (CZ 6-8), slab house*</b>				
<b>Component</b>	<b>Unit</b>	<b>Unit Cost</b>	<b>Quantity</b>	<b>Cost</b>
Sealant, latex acrylic, ¼"x ¼" bead	LF	1.86	420	781
Total to Builder				781
<b>Total to Consumer</b>				<b>898</b>

<b>R402.5.1.3 Air leakage 4 ACH50 vs 5 (CZ2) or 2.5 ACH50 vs 3 (CZ 6-8), basement house*</b>				
<b>Component</b>	<b>Unit</b>	<b>Unit Cost</b>	<b>Quantity</b>	<b>Cost</b>
Sealant, latex acrylic, ¼"x ¼" bead	LF	1.86	560	1,042
Total to Builder		7.00		1,042
<b>Total to Consumer</b>				<b>1,198</b>

\*RSM means does not provide a direct cost for improved building tightness. It is acknowledged that there are numerous methods for a builder to improve building tightness with wide ranging costs. For this analysis, it was assumed that a builder would install additional sealant at ceilings, rim areas, and walls; this cost was estimated using linear foot costs from RSM means (translates to approximately \$0.33/sf floor area builder cost for the slab house). This approach was selected based on judgement but was not based on any field cost data. The magnitude of the improved building tightness using this method was estimated to be 2.5 ACH50 where 3 ACH is the prescriptive requirement and 4 ACH50 where 5 ACH50 is the prescriptive requirement; these values correlate well with updated criteria provided by a production builder's evaluation of achieving building tightness targets of 2.5 ACH50 and 2.0 ACH50 where 3 ACH50 is the prescriptive requirement.

<b>R403.3.8 Duct system leakage: 4 to 6 cfm25/100sfca If ≥ 3 returns</b>				
<b>Component</b>	<b>Unit</b>	<b>Unit Cost</b>	<b>Quantity</b>	<b>Cost</b>
Duct sealing using mastic, assume 3 returns,	LF	1.14	(140)	(160)
Total to Builder				(160)
<b>Total to Consumer</b>				<b>(184)</b>

<b>R403.5.2 Hot Water Pipe Insulation, min 1" thick vs min R-3</b>				
<b>Component</b>	<b>Unit</b>	<b>Unit Cost</b>	<b>Quantity</b>	<b>Cost</b>
Foam pipe insulation, ½" wall (R-3) for ¾ pipe	LF	7.47	(40)	(299)
Foam pipe insulation, 1" wall (R-7) for ¾ pipe	LF	10.22	40	409
Total to Builder				110
<b>Total to Consumer</b>				<b>127</b>

<b>R403.6.1 HRV or ERV ventilation: HRV or ERV: CZ 6-8 (2018); CZ 6 (2021)</b>				
<b>Component</b>	<b>Unit</b>	<b>Unit Cost</b>	<b>Quantity</b>	<b>Cost</b>
HRV/ERV	EA	946.00	1	946
Control	EA	72.05	1	72
Bath EF, ES, 80 cfm	EA	141.90	(1)	(142)
Bath EF control	EA	72.05	(1)	(72)
Bath EF, standard economy, 70 cfm	EA	31.90	1	32
HRV/ERV install labor, est., crew (skilled, helper)	HR	116.80	1	117
15A circuit, outlet, 20' 14/2 NM	EA	54.05	1	54
Wire, 14/2, add 20'	LF	2.81	20	56
GFCI 15-amp 1-pole breaker	EA	58.15	1	58
Grille, exhaust (from house)	EA	68.00	1	68
Duct, flexible insulated, 6" dia.	LF	9.33	50	467
Wall cap, 6" dia. Duct	EA	125.50	2	251
Total to Builder				1,907
<b>Total to Consumer</b>				<b>2,193</b>

<b>R403.6.5 Intermittent exhaust control for bath fan</b>				
<b>Component</b>	<b>Unit</b>	<b>Unit Cost</b>	<b>Quantity</b>	<b>Cost</b>
Countdown timer, 20/40/60 mins	EA	38.50	2	77
Wall plate for timer switch	EA	0.66	2	1
Standard toggle switch	EA	0.94	(2)	(2)
Wall plate for toggle switch	EA	0.40	(2)	(1)
Total to Builder				76
<b>Total to Consumer</b>				<b>87</b>

<b>R404.2 Interior Lighting Controls vs 2021 IECC requirements</b>				
<b>Component</b>	<b>Unit</b>	<b>Unit Cost</b>	<b>Quantity</b>	<b>Cost</b>
Dimmer switch, toggle style (2 hall, 2 baths)	EA	14.29	4	57
Standard toggle switch	EA	0.94	(4)	(4)
Motion sensor light switch (laundry)	EA	25.23	1	25
Dimmer switch (laundry)	EA	14.29	(1)	(14)
Total to Builder				64
<b>Total to Consumer</b>				<b>74</b>

<b>R404.2 Interior Lighting Controls vs 2018 IECC requirements</b>				
<b>Component</b>	<b>Unit</b>	<b>Unit Cost</b>	<b>Quantity</b>	<b>Cost</b>
Dimmer switch, toggle style (2 hall, 2 baths, kitchen, dining room)	EA	14.29	6	86
Standard toggle switch	EA	0.94	(6)	(6)
Motion sensor light switch (laundry)	EA	25.23	1	25
Dimmer switch (laundry)	EA	14.29	(1)	(14)
Total to Builder				91
<b>Total to Consumer</b>				<b>105</b>

## R408 Additional Efficiency Requirements: Options

Note: R408.2.1.1 options for continuous insulation, slab insulation, and improved fenestration were utilized for Reduction in Total TC packages and not explicit items for R408.

R408.2.1.1 Wall continuous insulation, R-3 vs R-0, slab house				
Component	Unit	Unit Cost	Quantity	Cost
R-3 PIC, 1/2" thick	SF	1.29	2,520	3,251
Fasteners, vinyl siding, 2" galv roof nail	LB	5.65	20	113
Fasteners, vinyl siding, 1.5" galv roof nail	LB	5.65	(14)	(79)
Interior drywall to fill gap at windows/doors	SF	1.86	18	33
Window sill/stool cap, add 1/2" depth	LF	1.95	36	70
Paint, 2 coats	SF	1.11	18	20
Total to Builder				3,408
<b>Total to Consumer</b>				<b>3,920</b>

R408.2.1.1 Wall continuous insulation, R-7.5 vs R-0, slab house, vinyl siding				
Component	Unit	Unit Cost	Quantity	Cost
R-7.5 XPS, 1.5" thick	SF	2.11	2,520	5,317
Solid backing at windows & doors, 2x4 nailer	LF	2.07	410	849
Fasteners, vinyl siding, 3" galv roof nail	LB	5.65	28	158
Fasteners, vinyl siding, 1.5" galv roof nail	LB	5.65	(14)	(79)
Interior drywall to fill gap at windows/doors	SF	1.86	48	89
Window sill/stool cap, add 1.5" depth	LF	1.95	108	211
Paint, 2 coats	SF	1.11	48	53
Total to Builder				6,598
<b>Total to Consumer</b>				<b>7,588</b>

R408.2.1.1 Wall continuous insulation, R-7.5 vs R-0, slab house, fiber cement siding				
Component	Unit	Unit Cost	Quantity	Cost
R-7.5 XPS, 1.5" thick	SF	2.11	2,520	5,317
Solid backing at windows & doors, 2x4 nailer	LF	2.07	410	849
Furring for siding, 1x3, 24" o.c.	LF	1.30	1,260	1,638
Fastener, furring, 3.5" com galv nail	LB	5.95	101	601
Fastener, furring, 2" com galv nail	LB	5.95	(31)	(184)
Interior drywall to fill gap at windows/doors	SF	1.86	48	89
Window sill/stool cap, add 1.5" depth	LF	1.95	108	211
Paint, 2 coats	SF	1.11	48	53
Total to Builder				8,574
<b>Total to Consumer</b>				<b>9,860</b>

<b>R408.2.1.1 Wall continuous insulation, R-7.5 vs R-0, basement house, vinyl siding</b>				
<b>Component</b>	<b>Unit</b>	<b>Unit Cost</b>	<b>Quantity</b>	<b>Cost</b>
R-7.5 XPS, 1.5" thick	SF	2.11	2,660	5,613
Solid backing at windows & doors, 2x4 nailer	LF	2.07	410	849
Fasteners, vinyl siding, 3" galv roof nail	LB	5.65	30	170
Fasteners, vinyl siding, 1.5" galv roof nail	LB	5.65	(14)	(79)
Interior drywall to fill gap at windows/doors	SF	1.86	48	89
Window sill/stool cap, add 1.5" depth	LF	1.95	108	211
Paint, 2 coats	SF	1.11	48	53
Total to Builder				6,905
<b>Total to Consumer</b>				<b>7,941</b>

<b>R408.2.1.1 Wall continuous insulation, R-7.5 vs R-0, basement house, fiber cement siding</b>				
<b>Component</b>	<b>Unit</b>	<b>Unit Cost</b>	<b>Quantity</b>	<b>Cost</b>
R-7.5 XPS, 1.5" thick	SF	2.11	2,660	5,613
Solid backing at windows & doors, 2x4 nailer	LF	2.07	410	849
Furring for siding, 1x3, 24" o.c.	LF	1.30	1,330	1,729
Fastener, furring, 3.5" com galv nail	LB	5.95	107	637
Fastener, furring, 2" com galv nail	LB	5.95	(33)	(196)
Interior drywall to fill gap at windows/doors	SF	1.86	48	89
Window sill/stool cap, add 1.5" depth	LF	1.95	108	211
Paint, 2 coats	SF	1.11	48	53
Total to Builder				8,984
<b>Total to Consumer</b>				<b>10,331</b>

<b>R408.2.1.1 Wall continuous insulation, R-10 vs R-0, slab house, vinyl siding</b>				
<b>Component</b>	<b>Unit</b>	<b>Unit Cost</b>	<b>Quantity</b>	<b>Cost</b>
R-10 XPS, 2" thick	SF	2.57	2,520	6,476
Solid backing at windows & doors, 2x4 nailer	LF	2.07	410	849
Fasteners, vinyl siding, 3.5" galv com nail	LB	5.95	51	303
Fasteners, vinyl siding, 1.5" galv roof nail	LB	5.65	(14)	(79)
Interior drywall to fill gap at windows/doors	SF	1.86	64	119
Window sill/stool cap, add 1.5" depth	LF	1.95	144	281
Paint, 2 coats	SF	1.11	64	71
Total to Builder				8,020
<b>Total to Consumer</b>				<b>9,223</b>

<b>R408.2.1.1 Wall continuous insulation, R-10 vs R-0, slab house, fiber cement siding</b>				
<b>Component</b>	<b>Unit</b>	<b>Unit Cost</b>	<b>Quantity</b>	<b>Cost</b>
R-10 XPS, 2" thick	SF	2.57	2,520	6,476
Solid backing at windows & doors, 2x4 nailer	LF	2.07	410	849
Furring for siding, 1x3, 24" o.c.	LF	1.30	1,260	1,638
Fastener, furring, 4" com galv nail	LB	5.95	153	910
Fastener, furring, 2" com galv nail	LB	5.95	(31)	(184)
Interior drywall to fill gap at windows/doors	SF	1.86	64	119
Window sill/stool cap, add 1.5" depth	LF	1.95	144	281
Paint, 2 coats	SF	1.11	64	71
Total to Builder				10,160
<b>Total to Consumer</b>				<b>11,684</b>

<b>R408.2.1.1 Wall continuous insulation, R-10 vs R-0, basement house, vinyl siding</b>				
<b>Component</b>	<b>Unit</b>	<b>Unit Cost</b>	<b>Quantity</b>	<b>Cost</b>
R-10 XPS, 2" thick	SF	2.57	2,660	6,836
Solid backing at windows & doors, 2x4 nailer	LF	2.07	410	849
Fasteners, vinyl siding, 3.5" galv com nail	LB	5.95	54	321
Fasteners, vinyl siding, 1.5" galv roof nail	LB	5.65	(14)	(79)
Interior drywall to fill gap at windows/doors	SF	1.86	64	119
Window sill/stool cap, add 1.5" depth	LF	1.95	144	281
Paint, 2 coats	SF	1.11	64	71
Total to Builder				8,398
<b>Total to Consumer</b>				<b>9,658</b>

<b>R408.2.1.1 Wall continuous insulation, R-10 vs R-0, basement house, fiber cement siding</b>				
<b>Component</b>	<b>Unit</b>	<b>Unit Cost</b>	<b>Quantity</b>	<b>Cost</b>
R-10 XPS, 2" thick	SF	2.57	2,660	6,836
Solid backing at windows & doors, 2x4 nailer	LF	2.07	410	849
Furring for siding, 1x3, 24" o.c.	LF	1.30	1,330	1,729
Fastener, furring, 4" com galv nail	LB	5.95	162	964
Fastener, furring, 2" com galv nail	LB	5.95	(33)	(196)
Interior drywall to fill gap at windows/doors	SF	1.86	64	119
Window sill/stool cap, add 1.5" depth	LF	1.95	144	281
Paint, 2 coats	SF	1.11	64	71
Total to Builder				10,652
<b>Total to Consumer</b>				<b>12,250</b>

<b>R408.2.1.1 Basement Wall continuous insulation, R-5 vs R-0 for R-13 or R-19 frame walls</b>				
<b>Component</b>	<b>Unit</b>	<b>Unit Cost</b>	<b>Quantity</b>	<b>Cost</b>
R-5 XPS, 1" thick	SF	1.64	1,120	1,837
Total to Builder				1,837
<b>Total to Consumer</b>				<b>2,112</b>



<b>R408.2.1.1 Slab insulation, R-20, 3-ft deep vs R-10, 3-ft deep</b>				
<b>Component</b>	<b>Unit</b>	<b>Unit Cost</b>	<b>Quantity</b>	<b>Cost</b>
R-10 XPS, 2" thick, 25 psi	SF	2.45	(420)	(1,030)
R-20 XPS, 4" thick, 25 psi	SF	4.23	420	1,777
Total to Builder				747
<b>Total to Consumer</b>				<b>859</b>

<b>R408.2.1.2 Improved Fenestration*</b>				
<b>Window, U-factor/SHGC</b>	<b>Unit</b>	<b>Unit Cost</b>	<b>Quantity</b>	<b>Cost*</b>
CZ2 .30/.23 v .40/.25, slab	SF	0.90	360	392
CZ3 .28/.23 v .30/.25, slab	SF	0.50	360	218
CZ4 .25/.40 v .30/.40, slab	SF	1.53	360	668
CZ4 .25/.40 v .30/.40, basement	SF	1.53	384	712
CZ5 .25/NR v .28/NR, slab	SF	1.53	360	668
CZ5-6 .25/NR v .28/NR, basement	SF	1.53	384	712
CZ7 .25/NR v .27/NR, basement	SF	0.73	384	341
<p>*RSM means does not provide the granularity to estimate the cost difference for fenestration with different SHGC and U-factors. For this analysis, added window costs were estimated based on an EPA study that reported incremental cost to consumer for a 15 sq. ft. window, adjusted for inflation (1.21 factor for Aug 2020 to Jun 2024). Separately for this analysis, entry doors were assumed to be opaque: a survey of market pricing indicated that even inexpensive doors typically meet or exceed U-0.17, the requirement for the ENERGY STAR Reference Design Home, therefore no additional cost was assumed for doors.</p> <p><a href="https://www.energystar.gov/sites/default/files/asset/document/ES_Residential_WDS_Draft%201_Criteria%20Analysis%20Report.pdf">https://www.energystar.gov/sites/default/files/asset/document/ES_Residential_WDS_Draft%201_Criteria%20Analysis%20Report.pdf</a></p>				

<b>R408.2.1.3 Roof Reflectance: 3-yr aged min 75 Solar Reflectance Index (SRI)</b>				
<b>Component</b>	<b>Unit</b>	<b>Unit Cost</b>	<b>Quantity</b>	<b>Cost</b>
"Cool roof" architectural shingles	SF	1.50	1,392	2,089
Architectural shingles	SF	1.18	(1,392)	(1,649)
Total to Builder				441
<b>Total to Consumer</b>				<b>507</b>

<b>R408.2.1.4 Reduced air leakage 2.0-2.5 ACH50 vs 4 ACH50 in CZ 2</b>				
<b>Component</b>	<b>Unit</b>	<b>Unit Cost</b>	<b>Quantity</b>	<b>Cost</b>
Aeroseal, installed*	SF	0.95	2,400	2,280
4 ACH50 vs 5 in CZ2 slab house (costed separately)				(781)
Total to Builder				1,499
<b>Total to Consumer, slab house</b>				<b>1,724</b>
<p>*It was assumed that a builder would use Aeroseal to achieve these house tightness levels. This cost was based on pricing from Aeroseal, using a flat rate to achieve 2 ACH50. No cost savings was taken for reduced conventional air sealing which may be required by code.</p>				

<b>R408.2.1.4 Reduced air leakage 2.0-2.5 ACH50 vs 3 ACH50 in CZ 3-5</b>				
<b>Component</b>	<b>Unit</b>	<b>Unit Cost</b>	<b>Quantity</b>	<b>Cost</b>
Aeroseal, installed*	SF	0.95	2,400	2,280
Total to Builder				2,280
<b>Total to Consumer, slab house</b>				<b>2,622</b>
<b>Total to Consumer, basement, est. 15% add</b>				<b>3,015</b>
*It was assumed that a builder would use Aeroseal to achieve these house tightness levels. This cost was based on pricing from Aeroseal, using a flat rate to achieve 2 ACH50. No cost savings was taken for reduced conventional air sealing which may be required by code.				

<b>R408.2.2(1) Ground Source Heat Pump, 16.1 EER, 3.1 COP for CZ 2-3</b>				
<b>Component</b>	<b>Unit</b>	<b>Unit Cost</b>	<b>Quantity</b>	<b>Cost</b>
Air Source HP system, 7.5 HSPF2, 14.3 SEER2	EA	3,461.70	(1)	(3,462)
Ground Source HP system, 2-ton	EA	4,944.50	1	4,945
Ground loop: vertical, 200' well depth, 200 LF/ton, grout	EA	8,332.80	1	8,333
Total to Builder				9,816
<b>Total to Consumer</b>				<b>11,288</b>

<b>R408.2.2(1) Ground Source Heat Pump, 16.1 EER, 3.1 COP for CZ 4-5</b>				
<b>Component</b>	<b>Unit</b>	<b>Unit Cost</b>	<b>Quantity</b>	<b>Cost</b>
Air Source HP system, 7.5 HSPF2, 14.3 SEER2	EA	3,461.70	(1)	(3,462)
Ground Source HP system, 3-ton	EA	5,340.50	1	5,341
Ground loop: vertical, 200' well depth, 200 LF/ton, grout	EA	8,332.80	1.5	12,499
Total to Builder				14,378
<b>Total to Consumer</b>				<b>16,535</b>

<b>R408.2.2(1) Ground Source Heat Pump, 16.1 EER, 3.1 COP for CZ 7-8</b>				
<b>Component</b>	<b>Unit</b>	<b>Unit Cost</b>	<b>Quantity</b>	<b>Cost</b>
Air Source HP system, 7.5 HSPF2, 14.3 SEER2	EA	3,461.70	(1)	(3,462)
Ground Source HP system, 4-ton	EA	5,923.50	1	5,924
Ground loop: vertical, 200' well depth, 200 LF/ton, grout	EA	8,332.80	2	16,666
Total to Builder				19,127
<b>Total to Consumer</b>				<b>21,997</b>

<b>R408.2.2(2) AC Option 1: 15.2 SEER2 - north region</b>				
<b>Component</b>	<b>Unit</b>	<b>Unit Cost</b>	<b>Quantity</b>	<b>Cost</b>
Air Conditioner, 13.4 SEER2	EA	1,596.10	(1)	(1,596)
Air Conditioner, 15.2 SEER2	EA	2,095.50	1	2,096
Total to Builder				499
<b>Total to Consumer</b>				<b>574</b>

R408.2.2(2) AC Option 1: 15.2 SEER2 - south regions				
Component	Unit	Unit Cost	Quantity	Cost
Air Conditioner, 14.3 SEER2	EA	1,801.80	(1)	(1,802)
Air Conditioner, 15.2 SEER2	EA	2,095.50	1	2,096
Total to Builder				294
<b>Total to Consumer</b>				<b>338</b>

R408.2.2(3) AC Option 2: 16.0 SEER2 - north region				
Component	Unit	Unit Cost	Quantity	Cost
Air Conditioner, 13.4 SEER2	EA	1,596.10	(1)	(1,596)
Air Conditioner, 16.0 SEER2	EA	2,692.80	1	2,693
Total to Builder				1,097
<b>Total to Consumer</b>				<b>1,261</b>

R408.2.2(3) AC Option 2: 16.0 SEER2 - south regions				
Component	Unit	Unit Cost	Quantity	Cost
Air Conditioner, 14.3 SEER2	EA	1,801.80	(1)	(1,802)
Air Conditioner, 16.0 SEER2	EA	2,692.80	1	2,693
Total to Builder				891
<b>Total to Consumer</b>				<b>1,025</b>

R408.2.2(4) Gas Furnace Option 1: 97 AFUE (all CZ)				
Component	Unit	Unit Cost	Quantity	Cost
Gas furnace, 80 AFUE*	EA	1,081.30	(1)	(1,081)
Gas chimney vent, 4" dia.	LF	33.40	(30)	(1,002)
Gas furnace, 97 AFUE*	EA	2,548.70	1	2,549
Vent piping, PVC, 2" dia.	LF	11.60	60	696
2" concentric vent kit	EA	103.40	1	103
Total to Builder				1,265
<b>Total to Consumer</b>				<b>1,455</b>
*80 AFUE model with multi-speed ECM airdrive (not variable-speed ECM) and 1-stage burner; 97 AFUE model with variable-speed ECM and 2-stage burner				

R408.2.2(5) Gas Furnace Option 2: 95 AFUE (all CZ)				
Component	Unit	Unit Cost	Quantity	Cost
Gas furnace, 80 AFUE*	EA	1,081.30	(1)	(1,081)
Gas chimney vent, 4" dia.	LF	33.40	(30)	(1,002)
Gas furnace, 95 AFUE*	EA	1,713.80	1	1,714
Vent piping, PVC, 2" dia.	LF	11.60	60	696
2" concentric vent kit	EA	103.40	1	103
Total to Builder				430
<b>Total to Consumer</b>				<b>494</b>
*Furnaces with multi-speed ECM airdrive (not variable-speed ECM) and 1-stage burner				

<b>R408.2.2(6) Gas Furnace Option 3: 90 AFUE (CZ 0-3)</b>				
<b>Component</b>	<b>Unit</b>	<b>Unit Cost</b>	<b>Quantity</b>	<b>Cost</b>
Gas furnace, 80 AFUE*	EA	1,081.30	(1)	(1,081)
Gas chimney vent, 4" dia.	LF	33.40	(30)	(1,002)
Gas furnace, 90 AFUE*	EA	1,536.70	1	1,537
Vent piping, PVC, 2" dia.	LF	11.60	60	696
2" concentric vent kit	EA	103.40	1	103
Total to Builder				253
<b>Total to Consumer</b>				<b>291</b>
*Furnaces with multi-speed ECM airdrive (not variable-speed ECM) and 1-stage burner				

<b>R408.2.2(7) GF+AC Option 1: 90 AFUE + 15.2 SEER2 (CZ 0-3)</b>				
<b>Component</b>	<b>Unit</b>	<b>Unit Cost</b>	<b>Quantity</b>	<b>Cost</b>
90 AFUE GF (costed separately)				253
15.2 SEER2 AC (costed separately)				294
Total to Builder				547
<b>Total to Consumer</b>				<b>628</b>

<b>R408.2.2(8) GF+AC Option 2: 95 AFUE + 16.0 SEER2 (CZ 0-3)</b>				
<b>Component</b>	<b>Unit</b>	<b>Unit Cost</b>	<b>Quantity</b>	<b>Cost</b>
95 AFUE GF (costed separately)				430
16.0 SEER2 AC (costed separately)				891
Total to Builder				1,321
<b>Total to Consumer</b>				<b>1,519</b>

<b>R408.2.2(9) GF+HP Option 1: 90 AFUE + 7.8 HSPF2, 15.2 SEER2 (CZ 0-3)</b>				
<b>Component</b>	<b>Unit</b>	<b>Unit Cost</b>	<b>Quantity</b>	<b>Cost</b>
90 AFUE GF (costed separately)				253
Air Conditioner, 14.3 SEER2	EA	1,801.80	(1)	(1,802)
Heat Pump, 7.8 HSPF2, 15.2 SEER2	EA	2,668.60	1	2,669
Total to Builder				1,120
<b>Total to Consumer</b>				<b>1,288</b>

<b>R408.2.2(10) HP Option 1: 7.8 HSPF2, 15.2 SEER2 (CZ 0-3)</b>				
<b>Component</b>	<b>Unit</b>	<b>Unit Cost</b>	<b>Quantity</b>	<b>Cost</b>
HP 7.5 HSPF2, 14.3 SEER2	EA	3,461.70	(1)	(3,462)
HP 7.8 HSPF2, 15.2 SEER2	EA	4,061.20	1	4,357
Total to Builder				895
<b>Total to Consumer</b>				<b>1,030</b>

<b>R408.2.2(11) GF+AC Option 3: 95 AFUE + 15.2 SEER2 (CZ 4-8)</b>				
<b>Component</b>	<b>Unit</b>	<b>Unit Cost</b>	<b>Quantity</b>	<b>Cost</b>
95 AFUE GF (costed separately)				430
15.2 SEER2 AC (costed separately)				499
Total to Builder				929
<b>Total to Consumer</b>				<b>1,069</b>

<b>R408.2.2(12) GF+AC Option 4: 97 AFUE + 16.0 SEER2 (CZ 4-8)</b>				
<b>Component</b>	<b>Unit</b>	<b>Unit Cost</b>	<b>Quantity</b>	<b>Cost</b>
97 AFUE GF (costed separately)				1,265
16.0 SEER2 AC (costed separately)				1,097
Total to Builder				2,362
<b>Total to Consumer</b>				<b>2,716</b>

<b>R408.2.2(13) GF+HP Option 2: 95 AFUE + 8.1 HSPF2, 15.2 SEER2, 70% heat at 5F (CZ 4-8)</b>				
<b>Component</b>	<b>Unit</b>	<b>Unit Cost</b>	<b>Quantity</b>	<b>Cost</b>
95 AFUE GF (costed separately)				430
95 AFUE GF multi-speed	EA	1,713.80	(1)	(1,714)
95 AFUE GF variable-speed	EA	2,192.30	1	2,192
14.3 SEER2 AC	EA	1,596.10	(1)	(1,596)
HP, inverter, provides 70% heating capacity at 5F	EA	6,801.30	1	6,801
Total to Builder				6,114
<b>Total to Consumer</b>				<b>7,031</b>

<b>R408.2.2(14) HP Option 2: 8.1 HSPF2, 15.2 SEER2, 70% heat at 5F (CZ 4-8)</b>				
<b>Component</b>	<b>Unit</b>	<b>Unit Cost</b>	<b>Quantity</b>	<b>Cost</b>
HP system, 7.5 HSPF2, 14.3 SEER2	EA	3,461.70	(1)	(3,462)
HP system, inverter, provides 70% heating capacity at 5F, 8.2 HSPF, 18.5 SEER2	EA	8,852.80	1	8,853
Total to Builder				5,391
<b>Total to Consumer</b>				<b>6,200</b>

<b>R408.2.2.1 HP (Option 1) for CZ 4: 7.8 HSPF2, 15.2 SEER2</b>				
<b>Component</b>	<b>Unit</b>	<b>Unit Cost</b>	<b>Quantity</b>	<b>Cost</b>
HP system (costed separately)				1,030

<b>R408.2.2.1 GF+HP (Option 3) for CZ 4: 95 AFUE + 7.8 HSPF, 15.2 SEER2</b>				
<b>Component</b>	<b>Unit</b>	<b>Unit Cost</b>	<b>Quantity</b>	<b>Cost</b>
95 AFUE GF (costed separately)				430
14.3 SEER2 AC	EA	1,596.10	(1)	(1,596)
7.8 HSPF, 15.2 SEER HP	EA	2,668.60	1	2,669
Total to Builder				1,502
<b>Total to Consumer</b>				<b>1,728</b>

2021 IECC R408 HP: 10 HSPF/16 SEER (CZ 0-3)				
Component	Unit	Unit Cost	Quantity	Cost
HP system, 7.5 HSPF2, 14.3 SEER2	EA	3,461.70	(1)	(3,462)
HP system, 8.5 HSPF2, 15.2 SEER2	EA	4,948.90	1	4,949
Total to Builder				1,487
<b>Total to Consumer</b>				<b>1,710</b>

2021 IECC R408 HP: 10 HSPF/16 SEER (CZ 4-8)				
Component	Unit	Unit Cost	Quantity	Cost
HP system, 7.5 HSPF2, 14.3 SEER2	EA	3,461.70	(1)	(3,462)
HP system, 8.5 HSPF2, 15.2 SEER2	EA	9,517.20	1	9,517
Total to Builder				6,056
<b>Total to Consumer</b>				<b>6,964</b>

R408.2.3(1)(a) Gas Storage Water Heater, any volume, any draw pattern ≥0.81 UEF (Option 1)				
Component	Unit	Unit Cost	Quantity	Cost
Same as R408.2.3(1)(b) costed separately, total to consumer				3,749

R408.2.3(1)(b) Gas Storage Water Heater: ≤55 gal and high/medium draw ≥0.86/0.81 UEF (Option 2)				
Component	Unit	Unit Cost	Quantity	Cost
50-gal gas, natural draft, 0.56 UEF	EA	632.50	(1)	(633)
50-gal gas power vent, 76 kBtu/h input, 0.88 UEF, 94%TE	EA	3,455.10	1	3,455
Vent piping, 2" PVC	EA	11.60	20	232
Vent termination kit, 2" PVC	EA	103.40	0	0
Gas Chimney Vent (metal B-vent), 3" dia.	LF	29.05	(6)	(174)
Gas piping, 1/2" black iron	LF	16.30	(10)	(163)
Gas piping, 1" black iron	LF	22.95	10	230
15-amp circuit, toggle, 40' #14/2 NM	EA	240.50	1	241
GFCI 15-amp, 1-pole breaker	EA	72.58	1	73
Total to Builder				3,260
<b>Total to Consumer</b>				<b>3,749</b>

R408.2.3(1)(b) Gas Storage Water Heater >55-gal and medium or high draw ≥0.86 UEF (Option 2)				
Component	Unit	Unit Cost	Quantity	Cost
50-gal gas, natural draft, 0.56 UEF	EA	632.50	(1)	(633)
75-gal gas power direct vent	EA	5,500.00	1	5,500
Vent piping, 2" PVC	EA	11.60	30	348
Vent termination kit, 2" PVC	EA	103.40	1	103
Gas Chimney Vent (metal B-vent), 3" dia.	LF	29.05	(6)	(174)
Gas piping, 1/2" black iron	LF	16.30	(10)	(163)
Gas piping, 1" black iron	LF	22.95	10	230
15-amp circuit, toggle, 40' #14/2 NM	EA	240.50	1	241
GFCI 15-amp, 1-pole breaker	EA	72.58	1	73
Total to Builder				5,524
<b>Total to Consumer</b>				<b>6,353</b>

<b>R408.2.3(1)(b) Gas Storage Water Heater &gt;75 kBtu/h input and ≥0.86 UEF or 94% TE (Option 2)</b>				
<b>Component</b>	<b>Unit</b>	<b>Unit Cost</b>	<b>Quantity</b>	<b>Cost</b>
50-gal gas, natural draft, 0.56 UEF	EA	632.50	(1)	(633)
50-gal gas power vent, 94% TE	EA	3,455.10	1	3,455
Vent piping, 2" PVC	EA	11.60	20	232
Vent termination kit, 2" PVC	EA	103.40	0	0
Gas Chimney Vent (metal B-vent), 3" dia.	LF	29.05	(6)	(174)
Gas piping, 1/2" black iron	LF	16.30	(10)	(163)
Gas piping, 1" black iron	LF	22.95	10	230
15-amp circuit, toggle, 40' #14/2 NM	EA	240.50	1	241
GFCI 15-amp, 1-pole breaker	EA	72.58	1	73
Total to Builder				3,260
<b>Total to Consumer</b>				<b>3,749</b>

<b>R408.2.3(2)(a) Gas Instantaneous Water Heater, 0.92 UEF (Option 1)</b>				
<b>Component</b>	<b>Unit</b>	<b>Unit Cost</b>	<b>Quantity</b>	<b>Cost</b>
50-gal gas, natural draft, 0.56 UEF	EA	632.50	(1)	(633)
Tankless, direct vent, condensing, min 0.92 UEF	EA	1,512.50	1	1,513
Vent piping, 2" PVC	EA	11.60	30	348
Vent termination kit, 2" PVC	EA	103.40	1	103
Gas Chimney Vent (metal B-vent), 3" dia.	LF	29.05	(6)	(174)
Gas piping, 1/2" black iron	LF	16.30	(10)	(163)
Gas piping, 1" black iron	LF	22.95	10	230
15-amp circuit, toggle, 40' #14/2 NM	EA	240.50	1	241
GFCI 15-amp, 1-pole breaker	EA	72.58	1	73
Total to Builder				1,537
<b>Total to Consumer</b>				<b>1,767</b>

<b>R408.2.3(2)(b) Gas Instantaneous Water Heater, 0.95 UEF (Option 2)</b>				
<b>Component</b>	<b>Unit</b>	<b>Unit Cost</b>	<b>Quantity</b>	<b>Cost</b>
50-gal gas, natural draft, 0.56 UEF	EA	632.50	(1)	(633)
Tankless, direct vent, condensing, min 0.95 UEF	EA	1,788.60	1	1,789
Vent piping, 2" PVC	EA	11.60	30	348
Vent termination kit, 2" PVC	EA	103.40	1	103
Gas Chimney Vent (metal B-vent), 3" dia.	LF	29.05	(6)	(174)
Gas piping, 1/2" black iron	LF	16.30	(10)	(163)
Gas piping, 1" black iron	LF	22.95	10	230
15-amp circuit, toggle, 40' #14/2 NM	EA	240.50	1	241
GFCI 15-amp, 1-pole breaker	EA	72.58	1	73
Total to Builder				1,813
<b>Total to Consumer</b>				<b>2,085</b>

<b>R408.2.3(3)(a) Electric integrated HPWH, 3.30 UEF (Option 1): 50-gallon</b>				
<b>Component</b>	<b>Unit</b>	<b>Unit Cost</b>	<b>Quantity</b>	<b>Cost</b>
50-gal electric water heater, 0.92 UEF	EA	632.50	(1)	(633)
50-gal HPWH, min 3.30 UEF	EA	1,681.90	1	1,682
Total to Builder				1,049
<b>Total to Consumer</b>				<b>1,207</b>

<b>R408.2.3(3)(a) Electric integrated HPWH, 3.30 UEF (Option 1): 65-gallon</b>				
<b>Component</b>	<b>Unit</b>	<b>Unit Cost</b>	<b>Quantity</b>	<b>Cost</b>
50-gal electric water heater, 0.92 UEF	EA	632.50	(1)	(633)
65-gal HPWH, min 3.30 UEF	EA	1,909.60	1	1,910
Total to Builder				1,277
<b>Total to Consumer</b>				<b>1,469</b>

<b>R408.2.3(3)(a) Electric integrated HPWH, 3.30 UEF (Option 1): 80-gallon</b>				
<b>Component</b>	<b>Unit</b>	<b>Unit Cost</b>	<b>Quantity</b>	<b>Cost</b>
50-gal electric water heater, 0.92 UEF	EA	632.50	(1)	(633)
80-gal HPWH, min 3.30 UEF	EA	2,670.80	1	2,671
Total to Builder				2,038
<b>Total to Consumer</b>				<b>2,344</b>

<b>R408.2.3(4) Electric integrated HPWH, 115V/15A plug-in, 2.20 UEF (Option 2): 50-gal</b>				
<b>Component</b>	<b>Unit</b>	<b>Unit Cost</b>	<b>Quantity</b>	<b>Cost</b>
50-gal electric water heater, 0.92 UEF	EA	632.50	(1)	(633)
50-gal HPWH plug-in, min 2.20 UEF	EA	2,176.90	1	2,177
30-amp, 240-volt circuit vs 120-volt circuit	EA	167.00	(1)	(167)
Total to Builder				1,377
<b>Total to Consumer</b>				<b>1,584</b>

<b>R408.2.3(4) Electric integrated HPWH, 115V/15A plug-in, 2.20 UEF (Option 2): 65-gal</b>				
<b>Component</b>	<b>Unit</b>	<b>Unit Cost</b>	<b>Quantity</b>	<b>Cost</b>
50-gal electric water heater, 0.92 UEF	EA	632.50	(1)	(633)
65-gal HPWH plug-in, min 2.20 UEF	EA	2,571.80	1	2,572
30-amp, 240-volt circuit vs 120-volt circuit	EA	167.00	(1)	(167)
Total to Builder				1,772
<b>Total to Consumer</b>				<b>2,038</b>

<b>R408.2.3(4) Electric integrated HPWH, 115V/15A plug-in, 2.20 UEF (Option 2): 80-gal</b>				
<b>Component</b>	<b>Unit</b>	<b>Unit Cost</b>	<b>Quantity</b>	<b>Cost</b>
50-gal electric water heater, 0.92 UEF	EA	632.50	(1)	(633)
80-gal HPWH plug-in, min 2.20 UEF	EA	2,949.10	1	2,949
30-amp, 240-volt circuit vs 120-volt circuit	EA	167.00	(1)	(167)
Total to Builder				2,150
<b>Total to Consumer</b>				<b>2,472</b>



<b>R408.2.3(5)(a) Electric Split-System HPWH, 2.20 UEF (Option 3)</b>				
<b>Component</b>	<b>Unit</b>	<b>Unit Cost</b>	<b>Quantity</b>	<b>Cost</b>
50-gal electric water heater, 0.92 UEF	EA	632.50	(1)	(633)
Outdoor HP & indoor 43-gal tank system, UEF 3.66	EA	6,001.60	1	6,002
Water heater circuit, 30-amp, breaker, box, 20' #10/2 NM	EA	179.00	(1)	(179)
Additional wire, #10/2 NM	LF	4.31	(20)	(86)
HP circuit, 40-amp, 3' sealtite, breaker, disc, 40' #8/2 NM	EA	417.00	1	417
Wire, #8/2	LF	6.96	(40)	(278)
Wire, #12/2	LF	3.29	40	132
Standard breaker	EA	17.58	(1)	(18)
GFCI breaker	EA	129.80	(1)	(130)
Piping between HP & tank, 1/2 PEX, material	LF	0.55	40	22
PEX adapter, 1/2	EA	28.70	4	115
PEX pipe labor	EA	23.60	1	24
Condenser pad	EA	93.50	1	94
Total to Builder				5,481
<b>Total to Consumer</b>				<b>6,303</b>

<b>R408.2.3(5)(b) Electric Split-System HPWH, 3.75 UEF (Option 4)</b>				
<b>Component</b>	<b>Unit</b>	<b>Unit Cost</b>	<b>Quantity</b>	<b>Cost</b>
Outdoor HP & indoor 83-gal tank system, UEF 3.80		6,422.90	1	6,423
Outdoor HP & indoor 43-gal tank system, UEF 3.66		6,001.60	(1)	(6,002)
Total to Builder				421
<b>Incremental cost to consumer vs R408.2.3(5)(a)</b>				<b>484</b>
<b>Total to Consumer</b>				<b>6,787</b>

<b>R408.2.3(7)(a) Solar water heater system, electric backup (Option 1)</b>				
<b>Component</b>	<b>Unit</b>	<b>Unit Cost</b>	<b>Quantity</b>	<b>Cost</b>
Medium temperature package: 120 gal tank with closed loop heat exchanger; (2) 4'x8' collector panels; circulator pumps; valves; controls; connect to backup WH	EA	12,175	1	12,175
Pipe, 3/4 copper	LF	13.25	50	663
Pipe insulation, closed cell rubber, 1" wall	LF	9.44	50	472
Electrical circuit	EA	240.50	1	241
GFCI breaker, 1-pole, 20-amp	EA	58.15	1	58
Total to Builder				13,608
<b>Total to Consumer</b>				<b>15,649</b>

<b>R408.2.3(7)(b) Solar water heater system, gas backup (Option 2)</b>				
Same as R408.2.3(7)(a)				<b>15,649</b>

<b>R408.2.3.1 Compact Hot Water Distribution: Recirculation Loop System</b>				
<b>Component</b>	<b>Unit</b>	<b>Unit Cost</b>	<b>Quantity</b>	<b>Cost</b>
Recirculation pump kit	EA	358.60	1	359
Plumbing labor for pump kit	EA	179.85	1	180
Electric circuit for pump kit	EA	54.05	1	54
GFCI breaker, 15-amp	EA	58.15	1	58
Dedicated hot water return pipe, 3/4 PEX, material	LF	1.01	40	40
PEX pipe labor	EA	13.28	1	13
PEX adapter, 3/4	EA	35.15	2	70
On-demand low-voltage control circuit	EA	41.50	3	125
Total to Builder				899
<b>Total to Consumer</b>				<b>1,034</b>

<b>R408.2.4(1) Ductless Heat Pump, CZ 2-3</b>				
<b>Component</b>	<b>Unit</b>	<b>Unit Cost</b>	<b>Quantity</b>	<b>Cost</b>
Central HP, 7.5 HSPF2, 14.3 SEER2	EA	3,461.70	(1)	(3,462)
HP labor	EA	569.25	(1)	(569)
Condenser pad with 6" risers	EA	115.50	(1)	(116)
Refrigerant piping, 3/8 x 3/4 x 50'	EA	755.50	(1)	(756)
Condensate pan with safety switch & 6" risers	EA	135.30	(1)	(135)
Condensate piping, 3/4 PVC	LF	8.87	(40)	(355)
Electrical wiring	EA	1165.00	(1)	(1,165)
GFCI breaker	EA	129.80	(2)	(260)
Ducts, metal	LBS	7.30	(700)	(5,110)
Duct insulation	SF	4.56	(672)	(3,064)
<b>Sub-Total</b>				<b>(14,991)</b>
Ductless HP system, 4-zone (6+6+6+9), 19 SEER, 11 HSPF	EA	6154.50	2	12,309
HP labor	EA	952.88	2	1,906
Condenser pad & riser kit	EA	119.90	2	240
Refrigerant piping/wiring kit, 35'	EA	417.00	8	3,336
Condensate piping, 3/4 PVC	LF	8.87	200	1,774
HP circuit, 40-amp, 3' sealtite, breaker, disc, 40' #8/2	EA	417.00	2	834
Wire, #8/2	LF	6.96	(80)	(557)
Wire, #12/2	LF	3.29	80	263
Standard breaker	EA	17.58	(2)	(35)
GFCI breaker	EA	129.80	2	260
<b>Sub-Total</b>				<b>20,329</b>
Total to Builder				5,339
<b>Total to Consumer</b>				<b>6,140</b>
<b>R408.2.4(1) Ductless "cold-climate" Heat Pump CZ 4-8</b>				
Standard ductless HP system, 4-zone	EA	6154.50	(2)	(12,309)
High-heat ductless HP system, 4-Zone (6+6+6+12)	EA	7,419.50	2	14,839
<b>Sub-Total adder to Builder</b>				<b>2,530</b>
Total to Builder from above				5,339
Total to Builder				7,869
<b>Total to Consumer</b>				<b>9,049</b>

<b>R408.2.4(3) 100% Ducts &amp; AH in cond space: Encapsulated Attic, CZ 2-3</b>				
<b>Component</b>	<b>Unit</b>	<b>Unit Cost</b>	<b>Quantity</b>	<b>Cost</b>
Ceiling insulation, R-38 blown f.g.	SF	2.86	(1,200)	(3,432)
Closed-cell spray foam at roof deck, 4.5" thick, R-29	SF	7.20	1392	10,022
Closed-cell spray foam at gable walls, 3" thick, R-20	SF	4.79	263	1,257
Total to Builder				7,848
<b>Total to Consumer</b>				<b>9,025</b>

<b>R408.2.4(2) 100% Ducts &amp; AH in cond space: Encapsulated Attic, CZ 4-7</b>				
<b>Component</b>	<b>Unit</b>	<b>Unit Cost</b>	<b>Quantity</b>	<b>Cost</b>
Ceiling insulation, R-49 blown f.g.	SF	3.65	(1,200)	(4,380)
Closed-cell spray foam at roof deck, 5.5" thick, R-36	SF	8.78	1392	12,222
Closed-cell spray foam at gable walls, 4" thick, R-26	SF	6.38	263	1,675
Total to Builder				9,517
<b>Total to Consumer</b>				<b>10,944</b>

<b>R408.2.4(2) 100% Ducts &amp; AH in cond space: Buried Ducts CZ 4-8 Slab House</b>				
<b>Component</b>	<b>Unit</b>	<b>Unit Cost</b>	<b>Quantity</b>	<b>Cost</b>
Additional ceiling insulation, blown f.g.	SF	2.29	336	769
Additional duct sealing using mastic	LF	2.10	188	394
Additional trip to test duct leakage at rough stage	EA	150.00	1	150
Relocate air handler from attic (costed separately)				462
Total to Builder				1,775
<b>Total to Consumer</b>				<b>2,042</b>

<b>R408.2.4(2) 100% Ducts &amp; AH in cond space: Buried Ducts, CZ 4-8, Basement House</b>				
<b>Component</b>	<b>Unit</b>	<b>Unit Cost</b>	<b>Quantity</b>	<b>Cost</b>
Additional ceiling insulation, blown f.g.	SF	2.29	112	256
Additional duct sealing using mastic	LF	2.10	188	394
Additional trip to test duct leakage at rough stage	EA	150.00	1	150
Total to Builder				801
<b>Total to Consumer</b>				<b>921</b>

<b>R408.2.4(2) 100% Ducts &amp; AH in cond space: Buried Ducts, CZ 1A-3A (R-13 ducts) Slab House</b>				
<b>Component</b>	<b>Unit</b>	<b>Unit Cost</b>	<b>Quantity</b>	<b>Cost</b>
Additional ceiling insulation, blown f.g.	SF	1.46	336	491
Additional duct sealing using mastic	LF	2.10	188	394
Add R-6 fsk duct wrap over R-8 ducts	SF	3.81	672	2,560
Additional trip to test duct leakage at rough stage	EA	150.00	1	150
Relocate air handler from attic (costed separately)				462
Total to Builder				4,057
<b>Total to Consumer</b>				<b>4,665</b>

<b>R408.2.4(2) 100% Ducts &amp; AH in cond space: Buried Ducts, CZ 2B-3B (R-8 ducts) Slab House</b>				
<b>Component</b>	<b>Unit</b>	<b>Unit Cost</b>	<b>Quantity</b>	<b>Cost</b>
Additional ceiling insulation, blown f.g.	SF	1.46	336	491
Additional duct sealing using mastic	LF	2.10	188	394
Additional trip to test duct leakage at rough stage	EA	150.00	1	150
Relocate air handler from attic (costed separately)				462
Total to Builder				1,496
<b>Total to Consumer</b>				<b>1,769</b>

<b>R408.2.4(3) 80% Ducts &amp; AH in cond space: Buried Ducts CZ 4-8 Slab House</b>				
<b>Component</b>	<b>Unit</b>	<b>Unit Cost</b>	<b>Quantity</b>	<b>Cost</b>
Additional ceiling insulation, blown f.g.	SF	2.29	246.4	564
Additional duct sealing using mastic	LF	2.10	188	394
Additional trip to test duct leakage at rough stage	EA	150.00	1	150
Relocate air handler from attic (costed separately)				462
Total to Builder				1,570
<b>Total to Consumer</b>				<b>1,806</b>

<b>R408.2.4(3) 80% Ducts &amp; AH in cond space: Buried Ducts, CZ 4-8, Basement House</b>				
<b>Component</b>	<b>Unit</b>	<b>Unit Cost</b>	<b>Quantity</b>	<b>Cost</b>
Additional ceiling insulation, blown f.g.	SF	2.29	22.4	51
Additional duct sealing using mastic	LF	2.10	188	394
Additional trip to test duct leakage at rough stage	EA	150.00	1	150
Total to Builder				596
<b>Total to Consumer</b>				<b>685</b>

<b>R408.2.4(3) 80% Ducts &amp; AH in cond space: Buried Ducts, CZ 1A-3A (R-13 ducts) Slab House</b>				
<b>Component</b>	<b>Unit</b>	<b>Unit Cost</b>	<b>Quantity</b>	<b>Cost</b>
Additional ceiling insulation, blown f.g.	SF	1.46	246.4	360
Additional duct sealing using mastic	LF	2.10	188	394
Add R-6 fsk duct wrap over R-8 ducts	SF	3.81	492.8	1,878
Additional trip to test duct leakage at rough stage	EA	150.00	1	150
Relocate air handler from attic (costed separately)				462
Total to Builder				3,243
<b>Total to Consumer</b>				<b>3,730</b>

<b>R408.2.4(3) 80% Ducts &amp; AH in cond space: Buried Ducts, CZ 2B-3B (R-8 ducts) Slab House</b>				
<b>Component</b>	<b>Unit</b>	<b>Unit Cost</b>	<b>Quantity</b>	<b>Cost</b>
Additional ceiling insulation, blown f.g.	SF	1.46	246.4	360
Additional duct sealing using mastic	LF	2.10	188	394
Additional trip to test duct leakage at rough stage	EA	150.00	1	150
Relocate air handler from attic (costed separately)				462
Total to Builder				1,366
<b>Total to Consumer</b>				<b>1,614</b>

<b>R408.2.4(2) 100% Ducts &amp; AH in cond space: Unvented Crawlspace* in CZ 4C</b>				
<b>Component</b>	<b>Unit</b>	<b>Unit Cost</b>	<b>Quantity</b>	<b>Cost</b>
Floor insulation, R-30	SF	2.71	(1,200)	(3,252)
Crawlspace wall insulation, R-15 c.i., 3" PIC**	SF	3.21	700	2,247
Seam tape for c.i. at top & bottom edges and joints	LF	0.71	350	249
Additional Class I vapor retarder, 10-mil polyethylene	SF	0.31	140	43
Sealing tape for vapor retarder at walls and seams	LF	0.86	290	249
Conditioned air, supply & return ducts	LF	8.81	30	264
Supply register, boot, and damper	EA	136.50	1	137
Return grill and boot	EA	68.00	1	68
Total to Builder				6
<b>Total to Consumer</b>				<b>7</b>
*In accordance with 2024 IRC R408.3 Unvented crawl space				
**Quantity based on 4-ft. high crawlspace, plus rim area, and 140-ft. building perimeter				

<b>R408.2.4(2) 100% Ducts &amp; AH in cond space: Unvented Crawlspace* in CZ 3</b>				
<b>Component</b>	<b>Unit</b>	<b>Unit Cost</b>	<b>Quantity</b>	<b>Cost</b>
Floor insulation, R-19	SF	2.13	(1,200)	(2,556)
Crawlspace wall insulation, R-5 c.i., 1" PIC**	SF	1.96	560	1,098
R-15 c.i. at rim area		3.21	140	449
Seam tape for c.i. at top & bottom edges and joints	LF	0.71	350	249
Additional Class I vapor retarder, 10-mil polyethylene	SF	0.31	140	43
Sealing tape for vapor retarder at walls and seams	LF	0.86	290	249
Conditioned air, supply & return ducts	LF	8.81	30	264
Supply register, boot, and damper	EA	136.50	1	137
Return grill and boot	EA	68.00	1	68
Total to Builder				1
<b>Total to Consumer</b>				<b>2</b>
*In accordance with 2024 IRC R408.3 Unvented crawl space				
**Quantity based on 4-ft. high crawlspace, plus rim area (2 layers), and 140-ft. building perimeter				

<b>R408.2.4(4) Total duct leakage: reduce from 4 to 2 cfm25/100sfca</b>				
<b>Component</b>	<b>Unit</b>	<b>Unit Cost</b>	<b>Quantity</b>	<b>Cost</b>
Add duct sealing using mastic	LF	2.10	188	394
Total to Builder				394
<b>Total to Consumer</b>				<b>453</b>

<b>R408.2.5(1) HRV/ERV, 75 SRE, 50 LMRT, CZ 4C-8</b>				
<b>Component</b>	<b>Unit</b>	<b>Unit Cost</b>	<b>Quantity</b>	<b>Cost</b>
HRV/ERV, 75 SRE, 50 LMRT, unit only	EA	1,140.69	1	1,141
HRV/ERV, 65 SRE, unit only	EA	946.00	(1)	(946)
Total to Builder				195
<b>Total to Consumer, CZ 6-8 adder</b>				<b>224</b>
HRV/ERV, 65 SRE (costed separately)				2,193
<b>Total to Consumer, all except CZ 6-8</b>				<b>2,417</b>

<b>For R408.2.5: House tightness using Aeroseal*</b>				
<b>Component</b>	<b>Unit</b>	<b>Unit Cost</b>	<b>Quantity</b>	<b>Cost</b>
Aeroseal, slab house	SF	0.95	2,400	2,280
Total to Consumer, slab house, 2 ACH50				<b>2,622</b>
<b>≤ 2.0ACH50</b>				
Slab house				<b>2,622</b>
Basement house (est. 15% add)				<b>3,015</b>
Basement in CZ 6-8: \$1,198 credit for 2.5 ACH50 cost				<b>1,817</b>
<b>≤ 1.5 ACH50</b>				
Slab house (est. 15% add)				<b>3,015</b>
Basement house (est. 15% add)				<b>3,468</b>
Basement in CZ 6-8: \$1,198 credit for 2.5 ACH50 cost				<b>2,270</b>
<b>≤ 1.0 ACH50</b>				
Slab house (est. 15% add)				<b>3,468</b>
Basement house (est. 15% add)				<b>3,988</b>
Basement in CZ 6-8: \$1,198 credit for 2.5 ACH50 cost				<b>2,790</b>

\*It was assumed that a builder would use Aeroseal to achieve these house tightness levels. This cost was based on pricing from Aeroseal, using a flat rate to achieve 2 ACH50. Additional costs are estimated for house tightness of 1.5 ACH50 and 1.0 ACH50. No cost savings was taken for reduced conventional air sealing which may be required by code.

<b>For R408.2.5(3) Balanced Ventilation: add supply ventilation to bath exhaust ventilation</b>				
<b>Component</b>	<b>Unit</b>	<b>Unit Cost</b>	<b>Quantity</b>	<b>Cost</b>
Supply ventilation system, control & damper	EA	301.40	1	301
Installation labor, crew (skilled, helper), est.	HR	116.80	1	117
Electrical circuit	EA	54.05	1	54
Duct, flexible insulated, 6", from outdoors	LF	9.33	25	233
Wall cap, 6" dia duct	EA	125.50	1	126
Total to Builder				831
<b>Total to Consumer</b>				<b>956</b>

R408.2.5(2): ≤ 2.0 ACH50 + HE HRV/ERV, CZ 4-8*				
Component	Unit	Unit Cost	Quantity	Cost
Slab house, CZ 4-5				5,039
Basement house, CZ 4-5				5,432
Basement house, CZ 6-8				2,041
*Costs here are cost to consumer, for ventilation & air sealing costed separately above				

R408.2.5(3) ≤ 2.0 ACH50 + balanced ventilation, CZ 6-8*				
Component	Unit	Unit Cost	Quantity	Cost
HRV/ERV				(2,193)
Balanced ventilation				956
Air sealing				1,817
<b>Total to Consumer</b>				<b>580</b>
*Costs here are cost to consumer, for ventilation & air sealing costed separately above				

R408.2.5(4) ≤ 1.5 ACH50 + HE HRV/ERV, CZ 4-8*				
Component	Unit	Unit Cost	Quantity	Cost
Slab house, CZ 4-5				5,432
Basement house, CZ 4-5				5,884
Basement house, CZ 6-8				2,493
*Costs here are cost to consumer, for ventilation & air sealing costed separately above				

R408.2.5(5) ≤ 1.0 ACH50 + HE HRV/ERV, CZ 2-8*				
Component	Unit	Unit Cost	Quantity	Cost
Slab house, CZ 2, with \$898 credit for 4 ACH50 cost				4,986
Slab house, CZ 3-5				5,884
Basement house, CZ 4-5				6,180
Basement house, CZ 6-8				3,014
*Costs here are cost to consumer, for ventilation & air sealing costed separately above				

R408.2.7 Renewable energy on-site, min 1.0 W/SFcf: Photovoltaic (PV)				
Component	Unit	Unit Cost	Quantity	Cost
PV, installed cost*, slab house	Watt	3.60	2,500	9,000
PV, installed cost*, basement house	Watt	3.60	3,600	12,960
<b>Total to Consumer, slab house</b>				<b>10,638</b>
<b>Total to Consumer, basement house</b>				<b>12,234</b>
*LBNL, 2022 cost of PV:	<a href="https://emp.lbl.gov/tracking-the-sun/">https://emp.lbl.gov/tracking-the-sun/</a>			

R408.2.8 Demand Response Thermostat				
Component	Unit	Unit Cost	Quantity	Cost
Programmable thermostat, Smart Wi-Fi	EA	162.40	1	162
Programmable thermostat, conventional	EA	87.03	(1)	(87)
Total to Builder				75
<b>Total to Consumer</b>				<b>87</b>



R408.2.10 Whole-home lighting control*				
Component	Unit	Unit Cost	Quantity	Cost
Light switch, wi-fi smart dimmer	EA	28.91	13	376
Light switch, standard	EA	0.94	(13)	(12)
Total to Builder				364
<b>Total to Consumer</b>				<b>418</b>
*Based on a control system with wi-fi control and Bluetooth remote switches (versus hard-wired option); quantity assumed 3 bathrooms, 1 kitchen, 1 dining room, 2 hall, 2 stairwell, 1 laundry, 2 outdoor, and 1 basement, crawlspace, or attic				

R408.2.11 Higher Efficacy Lighting				
Component	Unit	Unit Cost	Quantity	Cost
Standard dimmable LED lamp, 8-+ lm/w	EA	2.75	(20)	(55)
Higher efficacy dimmable LED lamp, 90 lm/w	EA	3.58	20	72
Total to Builder				17
<b>Total to Consumer</b>				<b>19</b>

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Appendix RE101.2.2 EV capable*				
Component	Unit	Unit Cost	Quantity	Cost
Electric metallic tubing (EMT) conduit, 3/4 dia.	LF	6.79	30	204
Electrical junction box	EA	38.00	1	38
Blank cover for junction box	EA	11.37	1	11
Total to Builder				253
<b>Total to Consumer</b>				<b>291</b>
*Cost does not include cost of electrical service upgrade if required.				

Appendix RE101.2.3 EV ready*				
Component	Unit	Unit Cost	Quantity	Cost
40-amp circuit, breaker, disconnect, 40' #8/2 NM	EA	417.00	1	417
Wire, #8/2 NM	LF	6.96	(10)	(70)
GFCI breaker, 40-amp, 2-pole	EA	130.90	1	131
Standard breaker, 40-amp, 2-pole	EA	17.58	(1)	(18)
Electrical junction box	EA	38.00	1	38
Receptacle, NEMA 14-50	EA	12.56	1	13
Weatherproof while-in-use cover	EA	24.40	1	24
Total to Builder				536
<b>Total to Consumer</b>				<b>616</b>
*Cost does not include cost of electrical service upgrade if required.				

Appendix RE101.2.4 EVSE*				
Component	Unit	Unit Cost	Quantity	Cost
40-amp circuit, breaker, disconnect, 40' #8/2 NM	EA	417.00	1	417
Wire, #8/2 NM	LF	6.96	(10)	(70)
GFCI breaker, 40-amp, 2-pole	EA	130.90	1	131
Standard breaker, 40-amp, 2-pole	EA	17.58	(1)	(18)
Electrical junction box	EA	38.00	1	38
Receptacle, NEMA 14-50	EA	12.56	1	13
Weatherproof while-in-use cover	EA	24.40	1	24
Level 2 NACS charging connector	EA	284.90	1	285
Total to Builder				821
<b>Total to Consumer</b>				<b>944</b>
*Cost does not include cost of electrical service upgrade if required.				

Appendix RI103 On-site renewable energy (ready)				
Component	Unit	Unit Cost	Quantity	Cost
Conduit, EMT, 1", from attic to electric panel	LF	8.83	50	442
Electrical junction box	EA	38.00	2	76
Junction box blank cover	EA	11.37	2	23
Reserved space for 2-pole breaker in elec panel	EA	0.00	1	0
R103.2.2/R105.2.2 Solar-ready system: construction documents to indicate dedicated roof area for a solar-ready zone, roof dead load, roof live load, ground snow load, and routing of conduit to electrical service panel (or service water heating system) prepared by Rater.	HR	105.00	1	105
Total to Builder				645
<b>Total to Consumer</b>				<b>742</b>

Appendix RJ101 Demand responsive water heating: electric 40-120 gal				
Component	Unit	Unit Cost	Quantity	Cost
50-gal elec, 0.92 UEF, 6 yr, not demand response ready	EA	543.40	(1)	(543)
50-gal elec, 0.92 UEF, 6 yr, with CTA-2045 port	EA	672.10	1	672
Total to Builder				129
<b>Total to Consumer</b>				<b>148</b>

Appendix RK101.1.3 Electric Ready for Water Heater				
Component	Unit	Unit Cost	Quantity	Cost
Wire, #10/2 NM	LF	4.31	40	172
Electrical junction box	EA	38.00	1	38
Junction box blank cover	EA	11.37	1	11
Total to Builder				222
<b>Total to Consumer</b>				<b>255</b>

<b>Appendix RK101.1.2 Electric Ready for Dryer</b>				
<b>Component</b>	<b>Unit</b>	<b>Unit Cost</b>	<b>Quantity</b>	<b>Cost</b>
Wire, #10/3 NM	LF	5.59	40	224
Electrical junction box	EA	38.00	1	38
Junction box blank cover	EA	11.37	1	11
Total to Builder				273
<b>Total to Consumer</b>				<b>314</b>

<b>Appendix RK101.1.1 Electric Ready for Range</b>				
<b>Component</b>	<b>Unit</b>	<b>Unit Cost</b>	<b>Quantity</b>	<b>Cost</b>
Wire, #8/3 NM	LF	6.96	40	278
Electrical junction box	EA	38.00	1	38
Junction box blank cover	EA	11.37	1	11
Total to Builder				328
<b>Total to Consumer</b>				<b>377</b>

## APPENDIX B: COST ADJUSTMENT FACTORS BY LOCATION

**Table B-1. Cost Adjustment Factors by Location\***

State	City	Cost Factor	State	City	Cost Factor
Alabama	Birmingham	0.892	Montana	Billings	0.919
Alabama	Mobile	0.871	Nebraska	Omaha	0.922
Alaska	Fairbanks	1.163	Nevada	Las Vegas	1.067
Arizona	Phoenix	0.908	New Hampshire	Portsmouth	0.947
Arizona	Tucson	0.883	New Jersey	Jersey City	1.110
Arkansas	Little Rock	0.846	New Mexico	Albuquerque	0.898
California	San Diego	1.096	New York	Long Island City	1.279
California	Los Angeles	1.125	New York	Syracuse	0.993
California	Riverside	1.101	North Carolina	Charlotte	0.886
California	San Francisco	1.260	North Carolina	Hickory	0.853
Colorado	Boulder	0.873	North Carolina	Raleigh	0.850
Colorado	Colorado Springs	0.876	North Dakota	Fargo	0.896
Colorado	Denver	0.918	Ohio	Columbus	0.931
Connecticut	New Haven	1.062	Oklahoma	Oklahoma City	0.881
Delaware	Dover	1.051	Oklahoma	Tulsa	0.852
District of Columbia	Washington, D.C.	0.980	Oregon	Bend	0.984
Florida	Fort Meyers	0.866	Pennsylvania	Norristown	1.038
Florida	Miami	0.887	Pennsylvania	State College	0.959
Florida	Orlando	0.888	Rhode Island	Providence	1.058
Florida	Tampa	0.880	South Carolina	Greenville	0.878
Georgia	Atlanta	0.912	South Dakota	Sioux Falls	0.925
Hawaii	Honolulu	1.220	Tennessee	Memphis	0.896
Idaho	Boise	0.935	Texas	Austin	0.863
Illinois	Chicago	1.172	Texas	Dallas	0.852
Indiana	Indianapolis	0.920	Texas	Houston	0.866
Iowa	Des Moines	0.960	Texas	San Antonio	0.854
Kansas	Wichita	0.874	Utah	Ogden	0.886
Kentucky	Louisville	0.913	Utah	Provo	0.899
Louisiana	Baton Rouge	0.879	Utah	Salt Lake City	0.914
Maine	Portland	0.971	Vermont	Burlington	0.947
Maryland	Baltimore	0.959	Virginia	Fairfax	0.926
Massachusetts	Boston	1.124	Virginia	Winchester	0.883
Michigan	Ann Arbor	0.971	Washington	Tacoma	1.040
Minnesota	Minneapolis	1.067	West Virginia	Charleston	0.949
Mississippi	Biloxi	0.848	Wisconsin	La Crosse	0.950
Missouri	Springfield	0.895	Wyoming	Casper	0.905

\*Source: RSMean Residential Cost Data 2024. Sample cities are listed in this table; check RSMean for additional locations.



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